Title: **Smart meter rollout for the small and medium non-domestic sector[1] (GB)** **Lead department or agency:** DECC **Other departments or agencies:**	**Impact Assessment (IA)** **IA No:** DECC0010 **Date:** 18/08/2011 **Stage: Consultation** **Source of intervention:** Domestic **Type of measure:** Other **Contact for enquiries:** Ferry Lienert/Pau Castells (0300 068 6325/6541)

Summary: Intervention and Options

What is the problem under consideration? Why is government intervention necessary?

The policy for smart meters addresses market failures in the energy markets - information asymmetries, lack of coordination and negative externalities from energy consumption. Lack of sufficiently accurate and timely information on energy use may prevent customers from taking informed decisions to reduce consumption and thereby bills and CO2 emissions. This information failure also increases suppliers' accounts management and switching costs. Better information on patterns of use across networks will aid in network planning and development, including future smart grids. Smart metering is a key enabling technology for managing energy systems more efficiently in the future, and providing new information and services to consumers which reduce costs and carbon emissions. In the absence of intervention by Government, suppliers would roll out only limited numbers of smart meters. Government intervention is needed to ensure commercial interoperability and full market coverage of smart meters. This will facilitate the capture of wider benefits to consumers, the environment, network operators and new businesses.

What are the policy objectives and the intended effects?

The objective of the Government intervention is to provide smart metering to non-domestic gas and electricity customers in a cost-effective way, which optimises the benefits to consumers, energy suppliers, network operators and other energy market participants and delivers environmental and other policy goals.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

This policy focuses on the mandated replacement of non residential gas and electricity meters in GB through a supplier-led rollout in the domestic sector with a voluntary Data and Communications Company (DCC), where suppliers can choose not to use the DCC. In this IA options for the configuration of the Communications Hub within the premise are considered. Five options are identified and assessed against a number of criteria, both quantitative and qualitative. The preferred option is a <u>Separate Communications Hub with fixed WAN</u>.
This IA also updates cost and benefit estimates in areas where additional evidence has been received or developed.
The consultation that this IA accompanies seeks views on the impacts of specifying a completion date that is in the earlier part of 2019, but no further evidence regarding the completion date has come to light and the analysis in this IA remains unchanged from the March 2011 version.

When will the policy be reviewed to establish the actual cost and benefits and the achievements of the policy objectives?	An early review of requirements for the rollout to ensure delivery of benefits is expected to be carried out before 2014. Further evaluation of the policy will also be conducted (provisionally by 2018). (See Annex 1 – Post Implementation Review Plan)
Are there arrangements in place that will allow a systematic collection of monitoring information for future policy review?	The requirements for the collection of monitoring information that will contribute to the benefits realisation will be developed in the next phase of the programme.

<u>Ministerial Sign-off: *I have read the Impact Assessment and I am satisfied that (a) it represents a fair and reasonable view of the expected costs, benefits and impact of the policy, and (b) the benefits justify the costs.*</u>

Signed by the responsible Minister. Date: 18/08/2011

[1] The present document focuses on smaller non-domestic sites – those in electricity profile classes 3 and 4, and those with gas consumption below 732 MWh per annum.

Summary: Analysis and Evidence - Policy Option 1

Description: Fully integrated Communications Hub

Price Base Year 2009	PV Base Year 2011	Time Period Years 20	Net Benefit (Present Value (PV)) (£m)		
			Low: 1,387	High: 2,944	Best Estimate: 2,166

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	n/a		n/a	**n/a**
High	n/a		n/a	**n/a**
Best Estimate	-5		41	**592**

Description and scale of key monetised costs by 'main affected groups'

Capital costs and installation costs amount to £358m; O&M costs amount to £39m. Communications costs amount to £172m and energy, disposal and pavement inefficiency reading costs are £23m.

Other key non-monetised costs by 'main affected groups'

n/a

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	n/a		135	**1,980**
High	n/a		188	**3,535**
Best Estimate	n/a		241	**2,759**

Description and scale of key monetised benefits by 'main affected groups'

Total consumer benefits amount to £1.63bn and consist mainly of savings due to a reduction in energy consumption.
Total supplier benefits amount to £446m and include avoided site visits (£248m), and reduced inquiries and customer overheads (£60m). Total network benefits amount to £101m and generation benefits to £47m. UK wide benefits from reduced carbon are £535m.

Other key non-monetised benefits by 'main affected groups'

Advanced/smart meters are a strong enabling tool for many energy efficiency policies, facilitating improved competition, wider network benefits and demand side shifting.

Key assumptions/sensitivities/risks — **Discount rate (%)** 3.5

All numbers adjusted for risk optimism bias and under central scenario unless stated otherwise. Sensitivity analysis has been applied to the benefits as energy savings depend on consumers' behavioural response to information and changes to them affect the benefits substantially.

The numbers presented are based on the assumption that a scope of the DCC including data aggregation will eventually be achieved.

Direct impact on business (Equivalent Annual) £m)[2]:			In scope of OIOO?	Measure qualifies as
Costs: 789	Benefits: 839	Net: 50	Yes	IN (£0 IN)

[2] Aggregates domestic and smaller non-domestic rollout. This approach has been agreed with the Better Regulation Executive.

Enforcement, Implementation and Wider Impacts

<table>
<tr><td colspan="3">What is the geographic coverage of the policy/option?</td><td colspan="3">Great Britain</td></tr>
<tr><td colspan="3">From what date will the policy be implemented?</td><td colspan="3">The start date will be confirmed in accordance with the rollout plans for the preferred Option.</td></tr>
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<tr><td colspan="3">Does enforcement comply with Hampton principles?</td><td colspan="3">N/A</td></tr>
<tr><td colspan="3">Does implementation go beyond minimum EU requirements?</td><td colspan="3">Yes</td></tr>
<tr><td colspan="3">What is the CO_2 equivalent change in greenhouse gas emissions?
(Million tonnes CO_2 equivalent)</td><td colspan="2">Traded:
4.1</td><td>Non-traded:
10.3</td></tr>
<tr><td colspan="3">Does the proposal have an impact on competition?</td><td colspan="3">Yes</td></tr>
<tr><td>Distribution of annual cost (%) by organisation size
(excl. Transition) (Constant Price)</td><td>Micro</td><td>< 20</td><td>Small</td><td>Medium</td><td>Large</td></tr>
<tr><td>Are any of these organisations exempt?</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
</table>

Annual profile of monetised costs and benefits* - (£) constant prices

	2010	2011	2012	2013	2014	2015	2016
Transition costs	0	0	217,447	378,487	1,661,291	3,507,471	4,571,175
Annual recurring cost	0	0	-430,457	-1,575,763	6,713,611	24,605,331	44,455,354
Total annual costs	0	0	-213,010	-1,197,276	8,374,902	28,112,803	49,026,529
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	0	0	0	0	5,793,084	11,330,812	40,279,398
Total annual benefits	0	0	0	0	5,793,084	11,330,812	40,279,398

	2017	2018	2019	2020	2021	2022	2023
Transition costs	4,767,695	2,402,722	-993,354	-2,479,066	-2,903,910	-3,115,065	-3,261,714
Annual recurring cost	64,284,406	77,122,509	79,752,613	77,378,202	72,280,854	66,846,669	61,407,893
Total annual costs	69,052,102	79,525,231	78,759,259	74,899,136	69,376,944	63,731,604	58,146,179
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	92,925,788	147,409,625	202,433,086	243,931,364	262,365,013	267,976,524	270,421,045
Total annual benefits	92,925,788	147,409,625	202,433,086	243,931,364	262,365,013	267,976,524	270,421,045

	2024	2025	2026	2027	2028	2029	2030
Transition costs	-3,370,216	-3,435,500	-3,447,138	-3,209,206	-3,060,035	-1,861,702	-436,944
Annual recurring cost	55,997,447	51,114,854	46,069,712	40,677,304	35,252,525	29,757,348	24,223,317
Total annual costs	52,627,232	47,679,354	42,622,574	37,468,098	32,192,490	27,895,646	23,786,373
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	270,540,126	271,971,018	273,766,059	292,475,393	300,111,058	300,101,876	300,296,590
Total annual benefits	270,540,126	271,971,018	273,766,059	292,475,393	300,111,058	300,101,876	300,296,590

Emission savings by carbon budget period (MtCO2e)

Sector		Emission Savings (MtCO2e) - By Budget Period		
		CB I; 2008-2012	CB II; 2013-2017	CB III; 2018-2022
Power sector	Traded	0	0	0
	Non-traded	0	0	0
Transport	Traded	0	0	0
	Non-traded	0	0	0
Workplaces & Industry	Traded	0.01	0.61	1.54
	Non-traded	0.02	1.44	3.64
Homes	Traded	0	0	0
	Non-traded	0	0	0
Waste	Traded	0	0	0
	Non-traded	0	0	0
Agriculture	Traded	0	0	0
	Non-traded	0	0	0
Public	Traded	0	0	0
	Non-traded	0	0	0
Total	Traded	0.01	0.61	1.54
	Non-traded	0.02	1.44	3.64
Cost effectiveness	% of lifetime emissions below traded cost comparator	100%		

	% of lifetime emissions below non-traded cost comparator	100%

Summary: Analysis and Evidence - Policy Option 2

Description: Integrated Communications Hub with replaceable WAN

Price Base Year 2009	PV Base Year 2011	Time Period Years 20	Net Benefit (Present Value (PV) (£m)		
			Low: 1,376	**High:** 2,932	**Best Estimate: 2,155**

COSTS (£m)	**Total Transition** (Constant Price) Years		**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	n/a		n/a	**n/a**
High	n/a		n/a	**n/a**
Best Estimate	-5		41	**604**

Description and scale of key monetised costs by 'main affected groups'

Capital costs and installation costs amount to £358m; O&M costs amount to £39m. Communications costs amount to £184m and energy, disposal and pavement inefficiency reading costs are £23m.

Other key non-monetised costs by 'main affected groups'

n/a

BENEFITS (£m)	**Total Transition** (Constant Price) Years		**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	n/a		135	**1,980**
High	n/a		188	**3,535**
Best Estimate	n/a		241	**2,759**

Description and scale of key monetised benefits by 'main affected groups'

Total consumer benefits amount to £1.63bn and consist mainly of savings due to a reduction in energy consumption.
Total supplier benefits amount to £446m and include avoided site visits (£248m), and reduced inquiries and customer overheads (£60m). Total network benefits amount to £101m and generation benefits to £47m. UK wide benefits from reduced carbon are £535m.

Other key non-monetised benefits by 'main affected groups'

Advanced/smart meters are a strong enabling tool for many energy efficiency policies, facilitating improved competition, wider network benefits and demand side shifting.

Key assumptions/sensitivities/risks — **Discount rate (%)** 3.5

All numbers adjusted for risk optimism bias and under central scenario unless stated otherwise. Sensitivity analysis has been applied to the benefits as energy savings depend on consumers' behavioural response to information and changes to them affect the benefits substantially.

The numbers presented are based on the assumption that a scope of the DCC including data aggregation will eventually be achieved.

Direct impact on business (Equivalent Annual) £m)[3]:			**In scope of OIOO?**	**Measure qualifies as**
Costs: 800	**Benefits: 849**	**Net: 49**	Yes	IN (£0 IN)

[3] Aggregates domestic and smaller non-domestic rollout. This approach has been agreed with the Better Regulation Executive.

Enforcement, Implementation and Wider Impacts

What is the geographic coverage of the policy/option?			Great Britain		
From what date will the policy be implemented?			The start date will be confirmed in accordance with the rollout plans for the preferred Option.		
Which organisation(s) will enforce the policy?			DECC / Ofgem		
What is the annual change in enforcement cost (£m)?			N/A		
Does enforcement comply with Hampton principles?			N/A		
Does implementation go beyond minimum EU requirements?			Yes		
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:** 4.1	**Non-traded:** 10.3	
Does the proposal have an impact on competition?			Yes		
Distribution of annual cost (%) by organisation size (excl. Transition) (Constant Price)	**Micro**	**< 20**	**Small**	**Medium**	**Large**
Are any of these organisations exempt?	N/A	N/A	N/A	N/A	N/A

Annual profile of monetised costs and benefits* - (£) constant prices

	2010	2011	2012	2013	2014	2015	2016
Transition costs	0	0	217,447	378,487	1,661,291	3,507,471	4,571,175
Annual recurring cost	0	0	-412,099	-1,539,755	6,873,421	24,998,711	45,164,258
Total annual costs	0	0	-194,652	-1,161,269	8,534,713	28,506,183	49,735,433
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	0	0	0	0	5,793,084	11,330,812	40,279,398
Total annual benefits	0	0	0	0	5,793,084	11,330,812	40,279,398
	2017	2018	2019	2020	2021	2022	2023
Transition costs	4,767,695	2,402,722	-993,354	-2,479,066	-2,903,910	-3,115,065	-3,261,714
Annual recurring cost	65,304,017	78,355,937	81,057,242	78,682,079	73,550,678	68,081,428	62,610,441
Total annual costs	70,071,712	80,758,659	80,063,888	76,203,013	70,646,768	64,966,363	59,348,727
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	92,925,788	147,409,625	202,433,086	243,931,364	262,365,013	267,976,524	270,421,045
Total annual benefits	92,925,788	147,409,625	202,433,086	243,931,364	262,365,013	267,976,524	270,421,045
	2024	2025	2026	2027	2028	2029	2030
Transition costs	-3,370,216	-3,435,500	-3,447,138	-3,209,206	-3,060,035	-1,861,702	-436,944
Annual recurring cost	57,169,544	52,257,385	47,183,073	41,752,973	36,291,893	30,759,817	25,185,827
Total annual costs	53,799,329	48,821,884	43,735,934	38,543,767	33,231,858	28,898,116	24,748,883
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	270,540,126	271,971,018	273,766,059	292,475,393	300,111,058	300,101,876	300,296,590
Total annual benefits	270,540,126	271,971,018	273,766,059	292,475,393	300,111,058	300,101,876	300,296,590

Emission savings by carbon budget period (MtCO2e)

Sector		Emission Savings (MtCO2e) - By Budget Period		
		CB I; 2008-2012	CB II; 2013-2017	CB III; 2018-2022
Power sector	Traded	0	0	0
	Non-traded	0	0	0
Transport	Traded	0	0	0
	Non-traded	0	0	0
Workplaces & Industry	Traded	0.01	0.61	1.54
	Non-traded	0.02	1.44	3.64
Homes	Traded	0	0	0
	Non-traded	0	0	0
Waste	Traded	0	0	0
	Non-traded	0	0	0
Agriculture	Traded	0	0	0
	Non-traded	0	0	0
Public	Traded	0	0	0
	Non-traded	0	0	0
Total	Traded	0.01	0.61	1.54
	Non-traded	0.02	1.44	3.64
Cost effectiveness	% of lifetime emissions below traded cost comparator	100%		

	% of lifetime emissions below non-traded cost comparator	100%

Summary: Analysis and Evidence - Policy Option 3a (preferred option)

Description: Communications Hub with fixed WAN

Price Base Year 2009	PV Base Year 2011	Time Period Years 20	Net Benefit (Present Value (PV)) (£m)		
			Low: 1,375	High: 2,932	Best Estimate: 2,154

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	n/a		n/a	**n/a**
High	n/a		n/a	**n/a**
Best Estimate	-5		41	**604**

Description and scale of key monetised costs by 'main affected groups'

Capital costs and installation costs amount to £358m; O&M costs amount to £39m. Communication costs amount to £184m and energy, disposal and pavement inefficiency reading costs are £23m.

Other key non-monetised costs by 'main affected groups'

n/a

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	n/a		135	**1,980**
High	n/a		188	**3,535**
Best Estimate	n/a		241	**2,759**

Description and scale of key monetised benefits by 'main affected groups'

Total consumer benefits amount to £1.63bn and consist mainly of savings due to a reduction in energy consumption.
Total supplier benefits amount to £446m and include avoided site visits (£248m), and reduced inquiries and customer overheads (£60m). Total network benefits amount to £101m and generation benefits to £47m.
UK wide benefits from reduced carbon are £535m.

Other key non-monetised benefits by 'main affected groups'

Advanced/smart meters are a strong enabling tool for many energy efficiency policies, facilitating improved competition, wider network benefits and demand side shifting.

Key assumptions/sensitivities/risks — **Discount rate (%)** 3.5

All numbers adjusted for risk optimism bias and under central scenario unless stated otherwise. Sensitivity analysis has been applied to the benefits as energy savings depend on consumers' behavioural response to information and changes to them affect the benefits substantially.

The numbers presented are based on the assumption that a scope of the DCC including data aggregation will eventually be achieved.

Direct impact on business (Equivalent Annual) £m)[4]:			In scope of OIOO?	Measure qualifies as
Costs: 800	**Benefits: 849**	**Net: 49**	Yes	IN (£0 IN)

[4] Aggregates domestic and smaller non-domestic rollout. This approach has been agreed with the Better Regulation Executive.

Enforcement, Implementation and Wider Impacts

<table>
<tr><td colspan="3">What is the geographic coverage of the policy/option?</td><td colspan="3">Great Britain</td></tr>
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10.3</td></tr>
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<tr><td>Distribution of annual cost (%) by organisation size
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N/A</td><td>< 20
N/A</td><td>Small
N/A</td><td>Medium
N/A</td><td>Large
N/A</td></tr>
<tr><td>Are any of these organisations exempt?</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
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Annual profile of monetised costs and benefits - (£) constant prices

	2010	2011	2012	2013	2014	2015	2016
Transition costs	0	0	217,447	378,487	1,661,291	3,507,471	4,571,175
Annual recurring cost	0	0	-411,575	-1,538,727	6,877,987	25,009,951	45,184,512
Total annual costs	0	0	-194,128	-1,160,240	8,539,279	28,517,422	49,755,688
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	0	0	0	0	5,793,084	11,330,812	40,279,398
Total annual benefits	0	0	0	0	5,793,084	11,330,812	40,279,398
	2017	2018	2019	2020	2021	2022	2023
Transition costs	4,767,695	2,402,722	-993,354	-2,479,066	-2,903,910	-3,115,065	-3,261,714
Annual recurring cost	65,333,148	78,391,178	81,094,517	78,719,333	73,586,959	68,116,707	62,644,799
Total annual costs	70,100,844	80,793,899	80,101,163	76,240,267	70,683,049	65,001,642	59,383,085
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	92,925,788	147,409,625	202,433,086	243,931,364	262,365,013	267,976,524	270,421,045
Total annual benefits	92,925,788	147,409,625	202,433,086	243,931,364	262,365,013	267,976,524	270,421,045
	2024	2025	2026	2027	2028	2029	2030
Transition costs	-3,370,216	-3,435,500	-3,447,138	-3,209,206	-3,060,035	-1,861,702	-436,944
Annual recurring cost	57,203,033	52,290,028	47,214,883	41,783,706	36,321,589	30,788,459	25,213,327
Total annual costs	53,832,817	48,854,528	43,767,745	38,574,500	33,261,554	28,926,758	24,776,383
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	270,540,126	271,971,018	273,766,059	292,475,393	300,111,058	300,101,876	300,296,590
Total annual benefits	270,540,126	271,971,018	273,766,059	292,475,393	300,111,058	300,101,876	300,296,590

Emission savings by carbon budget period (MtCO2e)

Sector		**Emission Savings (MtCO2e) - By Budget Period**		
		CB I; 2008-2012	CB II; 2013-2017	CB III; 2018-2022
Power sector	Traded	0	0	0
	Non-traded	0	0	0
Transport	Traded	0	0	0
	Non-traded	0	0	0
Workplaces & Industry	Traded	0.01	0.61	1.54
	Non-traded	0.02	1.44	3.64
Homes	Traded	0	0	0
	Non-traded	0	0	0
Waste	Traded	0	0	0
	Non-traded	0	0	0
Agriculture	Traded	0	0	0
	Non-traded	0	0	0
Public	Traded	0	0	0
	Non-traded	0	0	0
Total	Traded	0.01	0.61	1.54
	Non-traded	0.02	1.44	3.64
Cost effectiveness	% of lifetime emissions below traded cost comparator	100%		

	% of lifetime emissions below non-traded cost comparator	100%

Summary: Analysis and Evidence - Policy Option 3b

Description: Intimate Communications Hub with fixed WAN

Price Base Year 2009	PV Base Year 2011	Time Period Years 20	Net Benefit (Present Value (PV)) (£m)		
			Low: 1,384	**High: 2,940**	**Best Estimate: 2,163**

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	n/a		n/a	**n/a**
High	n/a		n/a	**n/a**
Best Estimate	-5		41	**596**

Description and scale of key monetised costs by 'main affected groups'

Capital costs and installation costs amount to £358m; O&M costs amount to £39m. Communications costs amount to £176m and energy, disposal and pavement inefficiency reading costs are £23m.

Other key non-monetised costs by 'main affected groups'

n/a

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	n/a		135	**1,980**
High	n/a		188	**3,535**
Best Estimate	n/a		241	**2,759**

Description and scale of key monetised benefits by 'main affected groups'

Total consumer benefits amount to £1.63bn and consist mainly of savings due to a reduction in energy consumption.
Total supplier benefits amount to £446m and include avoided site visits (£248m), and reduced inquiries and customer overheads (£60m). Total network benefits amount to £101m and generation benefits to £47m. UK wide benefits from reduced carbon are £535m.

Other key non-monetised benefits by 'main affected groups'

Advanced/smart meters are a strong enabling tool for many energy efficiency policies, facilitating improved competition, wider network benefits and demand side shifting.

Key assumptions/sensitivities/risks — **Discount rate (%)** 3.5

All numbers adjusted for risk optimism bias and under central scenario unless stated otherwise. Sensitivity analysis has been applied to the benefits as energy savings depend on consumers' behavioural response to information and changes to them affect the benefits substantially.

The numbers presented are based on the assumption that a scope of the DCC including data aggregation will eventually be achieved.

Direct impact on business (Equivalent Annual) £m)[5]**:**			**In scope of OIOO?**	**Measure qualifies as**
Costs: 793	**Benefits: 849**	**Net: 56**	Yes	IN (£0 IN)

[5] Aggregates domestic and smaller non-domestic rollout. This approach has been agreed with the Better Regulation Executive.

Enforcement, Implementation and Wider Impacts

What is the geographic coverage of the policy/option?			Great Britain		
From what date will the policy be implemented?			The start date will be confirmed in accordance with the rollout plans for the preferred Option.		
Which organisation(s) will enforce the policy?			DECC / Ofgem		
What is the annual change in enforcement cost (£m)?			N/A		
Does enforcement comply with Hampton principles?			N/A		
Does implementation go beyond minimum EU requirements?			Yes		
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:** 4.1	**Non-traded:** 10.3	
Does the proposal have an impact on competition?			Yes		
What proportion (%) of Total PV costs/benefits is directly attributable to primary legislation, if applicable?			**Costs:** N/A	**Benefits:** N/A	
Distribution of annual cost (%) by organisation size (excl. Transition) (Constant Price)	**Micro**	**< 20**	**Small**	**Medium**	**Large**
Are any of these organisations exempt?	N/A	N/A	N/A	N/A	N/A

Annual profile of monetised costs and benefits* - (£) constant prices

	2010	2011	2012	2013	2014	2015	2016
Transition costs	0	0	217,447	378,487	1,661,291	3,507,471	4,571,175
Annual recurring cost	0	0	-424,688	-1,564,446	6,763,837	24,728,965	44,678,152
Total annual costs	0	0	-207,241	-1,185,960	8,425,128	28,236,436	49,249,328
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	0	0	0	0	5,793,084	11,330,812	40,279,398
Total annual benefits	0	0	0	0	5,793,084	11,330,812	40,279,398

	2017	2018	2019	2020	2021	2022	2023
Transition costs	4,767,695	2,402,722	-993,354	-2,479,066	-2,903,910	-3,115,065	-3,261,714
Annual recurring cost	64,604,855	77,510,158	80,162,639	77,787,992	72,679,941	67,234,736	61,785,837
Total annual costs	69,372,551	79,912,880	79,169,286	75,308,926	69,776,031	64,119,671	58,524,122
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	92,925,788	147,409,625	202,433,086	243,931,364	262,365,013	267,976,524	270,421,045
Total annual benefits	92,925,788	147,409,625	202,433,086	243,931,364	262,365,013	267,976,524	270,421,045

	2024	2025	2026	2027	2028	2029	2030
Transition costs	-3,370,216	-3,435,500	-3,447,138	-3,209,206	-3,060,035	-1,861,702	-436,944
Annual recurring cost	56,365,820	51,473,935	46,419,625	41,015,372	35,579,183	30,072,409	24,525,820
Total annual costs	52,995,605	48,038,435	42,972,487	37,806,166	32,519,148	28,210,708	24,088,876
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	270,540,126	271,971,018	273,766,059	292,475,393	300,111,058	300,101,876	300,296,590
Total annual benefits	270,540,126	271,971,018	273,766,059	292,475,393	300,111,058	300,101,876	300,296,590

Emission savings by carbon budget period (MtCO2e)

Sector		Emission Savings (MtCO2e) - By Budget Period		
		CB I; 2008-2012	CB II; 2013-2017	CB III; 2018-2022
Power sector	Traded	0	0	0
	Non-traded	0	0	0
Transport	Traded	0	0	0
	Non-traded	0	0	0
Workplaces & Industry	Traded	0.01	0.61	1.54
	Non-traded	0.02	1.44	3.64
Homes	Traded	0	0	0
	Non-traded	0	0	0
Waste	Traded	0	0	0
	Non-traded	0	0	0
Agriculture	Traded	0	0	0
	Non-traded	0	0	0
Public	Traded	0	0	0
	Non-traded	0	0	0
Total	Traded	0.01	0.61	1.54
	Non-traded	0.02	1.44	3.64
Cost effectiveness	% of lifetime emissions below traded cost comparator	100%		

	% of lifetime emissions below non-traded cost comparator	100%

Summary: Analysis and Evidence - Policy Option 4

Description: Communications Hub with replaceable WAN

Price Base Year 2009	PV Base Year 2011	Time Period Years 20	Net Benefit (Present Value (PV)) (£m)		
			Low: 1,363	**High: 2,920**	**Best Estimate: 2,146**

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	n/a		n/a	**n/a**
High	n/a		n/a	**n/a**
Best Estimate	-5		42	**616**

Description and scale of key monetised costs by 'main affected groups'

Capital costs and installation costs amount to £358m; O&M costs amount to £39m. Communications costs amount to £196m and energy, disposal and pavement inefficiency reading costs are £23m.

Other key non-monetised costs by 'main affected groups'

n/a

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	n/a		135	**1,980**
High	n/a		188	**3,535**
Best Estimate	n/a		241	**2,759**

Description and scale of key monetised benefits by 'main affected groups'

Total consumer benefits amount to £1.63bn and consist mainly of savings due to a reduction in energy consumption.
Total supplier benefits amount to £446m and include avoided site visits (£248m), and reduced inquiries and customer overheads (£60m). Total network benefits amount to £101m and generation benefits to £47m. UK wide benefits from reduced carbon are £535m.

Other key non-monetised benefits by 'main affected groups'

Advanced/smart meters are a strong enabling tool for many energy efficiency policies, facilitating improved competition, wider network benefits and demand side shifting.

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5

All numbers adjusted for risk optimism bias and under central scenario unless stated otherwise. Sensitivity analysis has been applied to the benefits as energy savings depend on consumers' behavioural response to information and changes to them affect the benefits substantially.

The numbers presented are based on the assumption that a scope of the DCC including data aggregation will eventually be achieved.

Direct impact on business (Equivalent Annual) £m)[6]**:**			**In scope of OIOO?**	**Measure qualifies as**
Costs: 812	**Benefits: 849**	**Net: 37**	Yes	IN (£0 IN)

[6] Aggregates domestic and smaller non-domestic rollout. This approach has been agreed with the Better Regulation Executive.

Enforcement, Implementation and Wider Impacts

<table>
<tr><td colspan="3">What is the geographic coverage of the policy/option?</td><td colspan="3">Great Britain</td></tr>
<tr><td colspan="3">From what date will the policy be implemented?</td><td colspan="3">The start date will be confirmed in accordance with the rollout plans for the preferred Option.</td></tr>
<tr><td colspan="3">Which organisation(s) will enforce the policy?</td><td colspan="3">DECC / Ofgem</td></tr>
<tr><td colspan="3">What is the annual change in enforcement cost (£m)?</td><td colspan="3">N/A</td></tr>
<tr><td colspan="3">Does enforcement comply with Hampton principles?</td><td colspan="3">N/A</td></tr>
<tr><td colspan="3">Does implementation go beyond minimum EU requirements?</td><td colspan="3">Yes</td></tr>
<tr><td colspan="3">What is the CO_2 equivalent change in greenhouse gas emissions?
(Million tonnes CO_2 equivalent)</td><td>Traded:
4.1</td><td colspan="2">Non-traded:
10.3</td></tr>
<tr><td colspan="3">Does the proposal have an impact on competition?</td><td colspan="3">Yes</td></tr>
<tr><td colspan="3">What proportion (%) of Total PV costs/benefits is directly attributable to primary legislation, if applicable?</td><td>Costs:
N/A</td><td colspan="2">Benefits:
N/A</td></tr>
<tr><td>Distribution of annual cost (%) by organisation size
(excl. Transition) (Constant Price)</td><td>Micro</td><td>< 20</td><td>Small</td><td>Medium</td><td>Large</td></tr>
<tr><td>Are any of these organisations exempt?</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
</table>

Annual profile of monetised costs and benefits* - (£) constant prices

	2010	2011	2012	2013	2014	2015	2016
Transition costs	0	0	217,447	378,487	1,661,291	3,507,471	4,571,175
Annual recurring cost	0	0	-393,216	-1,502,719	7,037,798	25,403,331	45,893,416
Total annual costs	0	0	-175,770	-1,124,232	8,699,089	28,910,802	50,464,592
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	0	0	0	0	5,793,084	11,330,812	40,279,398
Total annual benefits	0	0	0	0	5,793,084	11,330,812	40,279,398
	2017	2018	2019	2020	2021	2022	2023
Transition costs	4,767,695	2,402,722	-993,354	-2,479,066	-2,903,910	-3,115,065	-3,261,714
Annual recurring cost	66,352,759	79,624,605	82,399,146	80,023,210	74,856,784	69,351,465	63,847,347
Total annual costs	71,120,454	82,027,327	81,405,792	77,544,144	71,952,874	66,236,400	60,585,633
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	92,925,788	147,409,625	202,433,086	243,931,364	262,365,013	267,976,524	270,421,045
Total annual benefits	92,925,788	147,409,625	202,433,086	243,931,364	262,365,013	267,976,524	270,421,045
	2024	2025	2026	2027	2028	2029	2030
Transition costs	-3,370,216	-3,435,500	-3,447,138	-3,209,206	-3,060,035	-1,861,702	-436,944
Annual recurring cost	58,375,130	53,432,559	48,328,244	42,859,374	37,360,957	31,790,929	26,175,837
Total annual costs	55,004,915	49,997,058	44,881,105	39,650,168	34,300,922	29,929,227	25,738,893
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	270,540,126	271,971,018	273,766,059	292,475,393	300,111,058	300,101,876	300,296,590
Total annual benefits	270,540,126	271,971,018	273,766,059	292,475,393	300,111,058	300,101,876	300,296,590

Emission savings by carbon budget period (MtCO2e)

Sector		Emission Savings (MtCO2e) - By Budget Period		
		CB I; 2008-2012	CB II; 2013-2017	CB III; 2018-2022
Power sector	Traded	0	0	0
	Non-traded	0	0	0
Transport	Traded	0	0	0
	Non-traded	0	0	0
Workplaces & Industry	Traded	0.01	0.61	1.54
	Non-traded	0.02	1.44	3.64
Homes	Traded	0	0	0
	Non-traded	0	0	0
Waste	Traded	0	0	0
	Non-traded	0	0	0
Agriculture	Traded	0	0	0
	Non-traded	0	0	0
Public	Traded	0	0	0
	Non-traded	0	0	0
Total	Traded	0.01	0.61	1.54
	Non-traded	0.02	1.44	3.64
Cost effectiveness	% of lifetime emissions below traded cost comparator	100%		

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A. Glossary of Terms

CAPEX – Capital Expenditure
DCC – Data Communications Company
DNO – Distribution Network Operators
ESCO – Energy Service Company
GHG – Greenhouse Gas
GPRS – General Packetised Radio Service
GSM – Global System for Mobile Communication
HAN – Home Area Network
IHD– In-Home Display
IT – Information Technology
LAN – Local Area Network
NPV – Net Present Value
O & M – Operation & Maintenance
OPEX – Operational Expenditure
PPM – Prepayment Meter
PV – Present Value
RTD – Real Time Display
SPC – Shadow Price of Carbon
ToU – Time of Use (tariff)
WAN – Wide Area Network

B. Introduction and Strategic Overview

The Government set out its commitment to the rollout of smart meters in its coalition programme[7] - the Programme for Government.

The Programme for Government sets out the strategic context for the rollout of smart metering alongside the establishment of a smart grid. The smart meter policy sits within the broader Government policy of an increase in the EU carbon emission reduction target by 2020, through encouraging investment in renewable energy both locally and for large scale offshore wind developments; feed-in tariffs; and increased home and business energy efficiency via the Green Deal.

Smart metering will play an important part in supporting these policies and objectives, by directly helping consumers to understand their energy consumption and make savings; reducing supplier costs; enabling new services; facilitating demand-side management to help reduce security of supply risks; and aiding broad sustainability and affordability objectives. As well as facilitating the deployment of renewables and electric vehicles, smart metering is a key enabler of the future Smart Grid.

The rollout of smart metering therefore needs to happen on a timescale appropriate to supporting these various objectives and policies.

In the non-domestic market, energy suppliers are already required to ensure that, by April 2014, energy supplied to larger electricity sites (defined as those within profile classes 5-8[8]) and larger gas sites (defined as those with consumption above 732MWh per annum) is measured by an advanced meter. Since April 2009, such metering has also had to be provided where a meter is newly installed or replaced. The present analysis focuses on remaining, smaller sites – those in electricity profile classes 3 and 4, and those with gas consumption below 732 MWh per annum. These sites are the subject of this Impact Assessment (IA).

The analytical work over the last three years has been supported by cost benefit modelling and analysis from a range of sources, including Mott Macdonald[9], Baringa Partners, Redpoint Consulting and PA Consulting Group, and has been presented in a series of publications since 2008, among which a number of Impact Assessments (IAs).

In Phase 1 of the programme, DECC has worked with Ofgem E-Serve as delivery partner. This Phase concluded in March 2011 with the publication of Government's Response to the Consultation on the Smart Meter Prospectus which set out conclusions on a range of regulatory, technical and commercial arrangements required to implement smart metering in GB.[10] Alongside the Response the Government also published an IA (hereafter March 2011 IA) which considered and arrived at decisions for:

- functionality of the smart meters solution, including meters, communications and real time displays;
- length of the rollout period;
- scope and establishment of the central data and communications provider (DCC);
- implementation strategy for the mass rollout, including the establishment of the DCC;
- and the obligations and protections that should be in place before DCC data and communications services become available.

Since then and with the start of Phase 2 of the Programme, work has included developing a detailed technical specification for the smart meter equipment, building upon the Functionality

[7] HMG, *'The Coalition: Our programme for government'*, 2010

[8] Numbered profile classes are used to categorise electricity sites that are settled by load "profile", rather than by actual information derived from half-hourly metering. Classes 1 and 2 cover domestic sites; classes 3-8, non-domestic.

[9] BERR, *Impact Assessment of Smart Metering Roll Out for Domestic Consumers and Small Businesses*, April 2008, http://www.berr.gov.uk/files/file45794.pdf

[10] The chosen implementation model decided on in the Prospectus Response is based on a supplier led delivery of smart meters combined with a centralised coordination for communication provision (earlier options assessed, consulted upon and discarded included: a fully competitive model, a fully centralised model, a DNO deployment model, an energy networks coordination model and a regulated asset ownership model.

Requirements Catalogue (the “Catalogue”) that was published alongside the Prospectus Response Document. While the Catalogue provided stakeholders with the functional requirements, these would not, in themselves, ensure interoperability between different pieces of smart metering equipment or back offices .

In January 2011, DECC established eighteen Industry Advisory Groups, under the Smart Metering Design Group (SMDG) to develop functional requirements into technical specifications. The technical specifications are intended to outline how the functionality will be achieved. The output of this process is called “Industry’s Draft Technical Specifications”[11] and was published at the beginning of August 2011. Government is seeking views on it via the consultation document published alongside this IA titled “A consultation on draft licence conditions for the roll-out of gas and electricity smart meters”.[12]

Further analysis of the industry draft technical specifications will be conducted alongside consideration of the responses of the consultation.

This updated IA presents new analysis carried out since March 2011 in the following areas:

- technical specifications:
    - Options for the configuration of the Communications Hub in the premise in order to implement the policy of a replaceable WAN transceiver, a requirement identified in the Prospectus Response
    - Outage management benefit increases in light of the provision of outage detection functionality
    - Consumer access to consumption data over the Smart Metering Home Area Network[13] (SMHAN)

The Communications Hub analysis has resulted in a number of options being identified to deliver the intended functionalities. Those options are presented in cost terms in the summary sheets of the IA and discussed and assessed in detail in sections E and F. The remaining areas (outage management benefits, consumer HAN) considered in this IA are discussed in section F.

No new evidence has come to light regarding the analysis of possible rollout completion dates, so this IA sets out the analysis that was undertaken for the March 2011 IA and seeks further views on the question of setting a specific date within 2019 through the consultation.

In other areas new evidence has been developed or received since March 2011. This has been reflected in the revision of the following costs and benefits assumptions:

- changes to our cost assumptions have been made in the areas of electricity meters, communications equipment (to reflect new cost assumptions and also components previously not considered) and outage detection functionality.
- benefits have increased to reflect new assumptions about outage management benefits to networks arising from the provision of outage detection functionality.

All changes to assumptions are referenced in the evidence base in section F, but are also summarised in annex 2.

[11] http://www.decc.gov.uk/assets/decc/11/tackling-climate-change/smart-meters/2393-smart-metering-industrys-draft-tech.pdf
[12] http://www.decc.gov.uk/en/content/cms/consultations/cons_smip/cons_smip.aspx
[13] This is the HAN that connects the meters, communications hub and mandated IHD.

C. The issue

Within Great Britain's small and medium non-domestic energy market (which we define as electricity sites within profile classes 3 & 4 and gas sites with consumption below 732MWh/year)[14], there are information difficulties for both consumers and suppliers. Suppliers often only know exactly how much energy a non-residential customer consumes after a quarterly meter read. Similarly, consumers will generally only be aware of consumption on a quarterly, historic basis if they take active steps to monitor the readings on their meters.

Consumers would benefit from having more dynamic and useful information to enable them easily to manage their energy consumption. In addition, smart or advanced metering would improve data and billing accuracy.

Smart meters with an in-home display (IHD) or other means of providing information, or advanced meters providing information that can be accessed via computer or other remote means, provide the means of addressing these issues. Work specific to SMEs by the Carbon Trust[15] (using field trials) suggested that potential energy savings per business could be between 5% and 12% depending on the advice they received. The Carbon Trust anticipated that, if its field trial were scaled up nationally, there would be savings of over 2% of all carbon emissions from businesses.

Smart meters provide remote communication between the meter and the supplier, facilitating, amongst other things, more efficient collection of billing information, the development of more sophisticated tariff structures and demand management approaches that could be used further to incentivise energy-efficient behaviour by consumers and suppliers alike.

The benefits from a rollout of smart meters together with a free standing display or other means of providing information fall to a number of actors – to consumers (in terms of accurate bills, accurate and real-time information to enable them to manage energy consumption and potentially receive new services), to suppliers (in terms of more frequent 100% accurate information, reduced costs to serve) and to society (in terms of reduced carbon emissions).

There are also benefits for network companies from the use, subject to appropriate data, privacy and access controls, of data collected through smart metering to enable them better to manage the electricity network and to inform long-term investment in the network and development of smart grids.

Companies are already installing integrated smart/advanced meters or retrofitting advanced elements to "dumb" meters in the non-domestic market. However, in the absence of Government intervention, feedback from market participants suggests that a rollout of smart/advanced meters could, over time, only involve around 50% of meters and would thus only realise a proportion of the possible benefits. Experience from other countries shows that suppliers and others interested in meter provision, such as meter-owners (at least in competitive markets), rarely fully embrace smart/advanced metering as the benefits fall to a variety of actors and the market does not effectively maximise and share these benefits without some form of Government intervention.

The present IA has been updated since March 2011 to accompany a consultation on draft licence obligations and technical specifications to implement the arrangements set out in the Prospectus Response. In particular it sets out and seeks views on the costs and benefits of different options for the configuration of the communications equipment in the premise. The identified options serve the purpose of implementing the requirement of an independently replaceable WAN module as identified in the Prospectus Response.

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[14] Where the term "SME" is used, it should be taken to include all sites within these groupings, including the smaller sites of larger private and public sector organisations, as well as those of small and medium enterprises and micro-businesses.

[15] "Advanced metering for SMEs: Carbon and cost savings", Full Report, Carbon Trust, May 2007.

D. Objectives

The objectives of Government intervention in the rollout of smart metering through the Smart Metering Programme are:

1. To promote cost-effective energy savings, enabling all consumers to better manage their energy consumption and expenditure and deliver carbon savings;
2. To promote cost-effective smoother electricity demand, so as to facilitate anticipated changes in the electricity supply sector and reduce the costs of delivering (generating and distributing) energy;
3. To promote effective competition in all relevant markets (energy supply, metering provision and energy services and home automation);
4. To deliver improved customer service by energy suppliers, including easier switching and price transparency, accurate bills and new tariff and payment options;
5. To deliver customer support for the Programme, based on recognition of the consumer benefits and fairness, and confidence in the arrangements for data protection, access and use;
6. To ensure that timely information and suitable functionality is provided through smart meters and the associated communications architecture where cost effective, to support development of smart grids;
7. To enable simplification of industry processes and resulting cost savings and service improvements;
8. To ensure that the dependencies on smart metering of wider areas of potential public policy benefit are identified and included within the strategic business case for the Programme, where they are justified in cost-benefit terms and do not compromise or put at risk other Programme objectives;
9. To deliver the necessary design requirements, commercial and regulatory framework and supporting activities so as to achieve the timely development and cost-effective implementation of smart metering and meeting Programme milestones;
10. To ensure that the communications infrastructure, metering and data management arrangements meet national requirements for security and resilience and command the confidence of stakeholders; and
11. To manage the costs and benefits attributable to the Programme, in order to deliver the net economic benefits set out in the Strategic Business Case.

These objectives refer to the smart metering system as a whole. The objective of the options considered in this IA in particular is the implementation of the requirement for an independently replaceable WAN module as identified in the Response to the Prospectus Consultation in March.

E. Option Identification

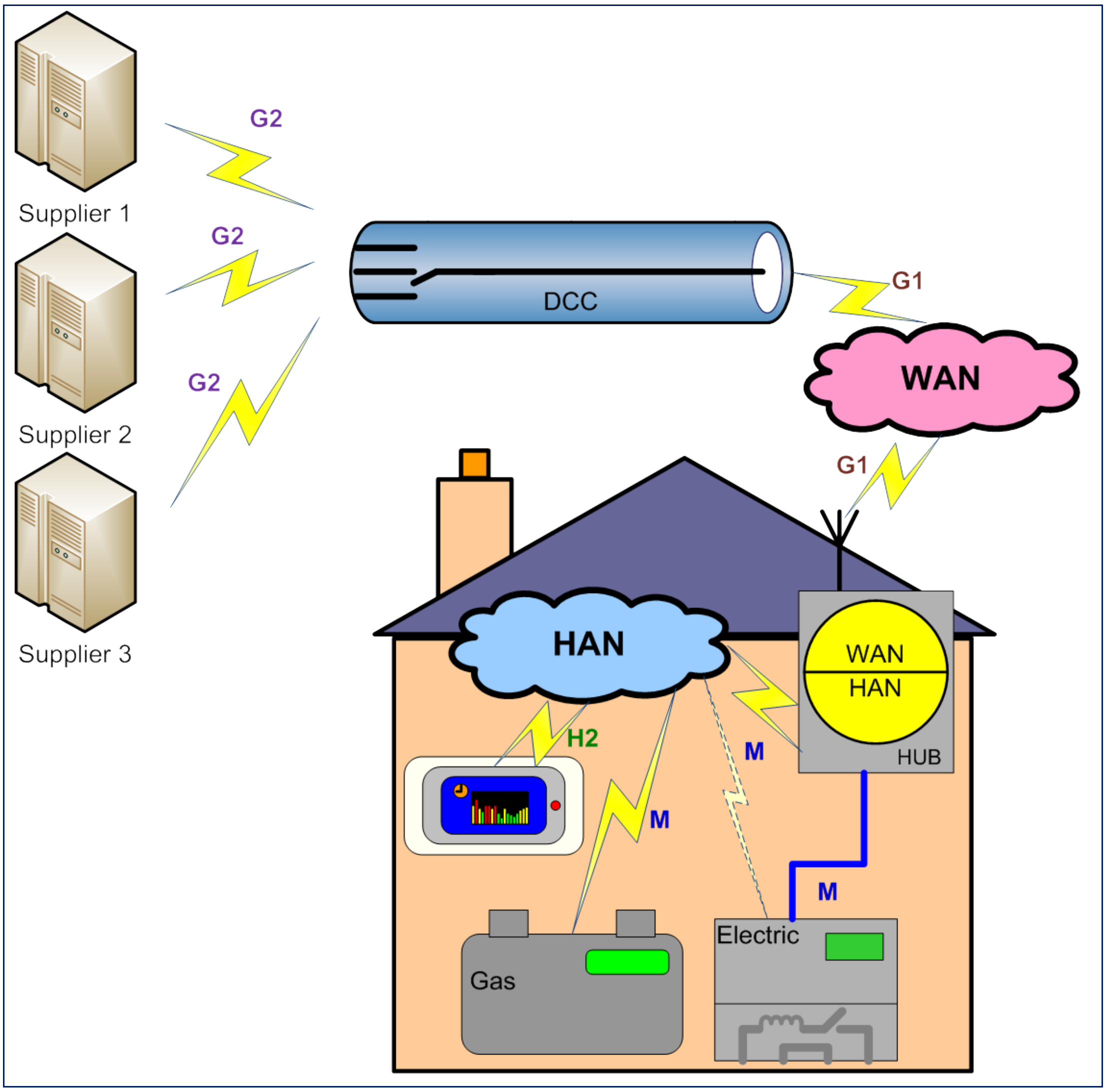
This section presents the different options considered for the configuration of the communications equipment in the premise to achieve the WAN modularity identified in the March 2011 Response to the Prospectus consultation IA.[16]

The smart metering system within the home consists of the below components

- An electricity smart meter
- A gas smart meter
- A real-time display also known as in-home display ("IHD")
- A wide area network (WAN) transceiver to achieve communication between the home and the central data and communications company (DCC)
- A home area network (HAN) chip to achieve communication between the smart meter system components within the home

The last two elements are part of the communications architecture and were subject to further analysis presented in this IA.

The below schematic illustrates the components of the smart metering system and their relation to each other:



The Response to the Prospectus Consultation concluded that "the WAN module" should be exchangeable without having to replace metering equipment. Work in this phase has assessed options that are available to implement this requirement.

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[16] http://www.decc.gov.uk/en/content/cms/consultations/smart_mtr_imp/smart_mtr_imp.aspx .

The identified options for the configuration of the communications equipment in the premise to achieve WAN modularity are:

1. Fully Integrated: the wide area communications functionality is built into the electricity meter with no modular components;

2. Integrated with replaceable WAN: the only modular component is a replaceable wide area communications transceiver and minimal supporting components;

3a. *Separate Communications Hub with fixed WAN:* a separate and replaceable Communications Hub with wired or wireless connection to the electricity meter with all wide area communications components contained within the hub;

3b. *Intimate Communications Hub with fixed WAN:* a Communications Hub that is adjacent (and possibly attached) to the meter but is replaceable without removing the meter – the Communications Hub has no modular components, and shares a HAN transceiver with the electricity meter;

4. Separate Communications Hub with replaceable WAN: a Separate Communications Hub with modular, wired or wireless connection to the electricity meter and a replaceable wide area communications transceiver.

The full appraisal of these options against a number of criteria is set out in section F of this IA. The summary sheets presented at the front of this IA compare the cost implications of the different options. The implications are shown in overall NPV terms. Updates to costs and benefits have been consistently applied to all the options and are included in all the NPV figures presented.

The smart meters programme is seeking views on the identified options through the consultation and this IA should therefore be read in conjunction with the consultation document.

The figures presented in this IA are estimates and should be treated with a degree of caution. They are shown to allow comparison between options and components of costs and benefits rather than implying a high degree of accuracy.

F. New substantive analysis

The delivery of smart metering to GB domestic consumers is a major infrastructure project. Work between July 2010 and March 2011 focused on developing the Prospectus Response Document and planning subsequent phases of the Programme. Since March of this year the Programme has worked on developing draft licence obligations regarding implementation and delivery of the rollout. The consultation published alongside this IA sets out these obligations, and invites stakeholders' to comment on them.

The Prospectus Response Document presented the preferred policy option for the implementation of the rollout of smart meters, following consultation with stakeholders and further detailed analysis carried out over the period July 2010 - March 2011. This is based on a supplier led delivery of smart meters combined with a centralised data and communications company (DCC).[17] Relevant areas of analysis for the decision on implementation included the functionality of the smart meter, the rollout strategy and the establishment and scope of the DCC. To aid the understanding of the smart meters programme as a whole, background information on these areas is provided in annex 1.

This section presents new analysis conducted since March 2011 in the three following areas:

- Configuration of the communications equipment in the premise
- Outage detection and benefits from improved outage management
- Consumer access to consumption data over the to the Smart Metering HAN

Configuration of the communications equipment in the premise

Work in this phase has brought to light that the requirement of an independently replaceable WAN module is possible to achieve through a number of different approaches and that they all have cost implications. This section of the IA outlines in detail the further analytical work that has been carried out in light of the findings from the industry working groups.

In the following we outline in detail the technical solutions identified in the development work and the approach taken to comparing them and assessing their suitability for the deployment in the smart metering equipment within the home.

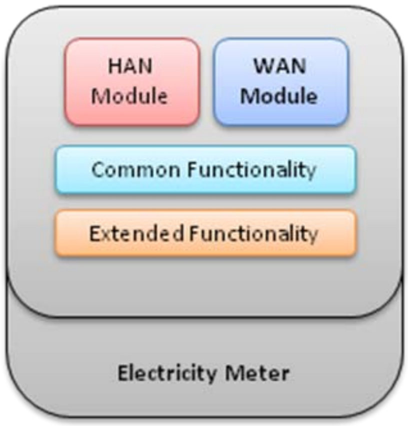
The architecture design of the technical options in detail:

1. Fully integrated (communications equipment within the electricity meter)

This is the most basic architecture design and does not provide the possibility of an independent replacement of the WAN module as identified by the response to the Prospectus Consultation. In light of the potential day 1 cost implications of the alternatives this approach is included in the comparison in order to robustly ascertain whether a flexible approach is indeed desirable and should be prescribed by Government. In this design the communications equipment would be integrated into the electricity meter and be powered via the meter's mains electricity connection. The WAN module would not be independently replaceable, so in the case of a WAN exchange the whole electricity meter would be replaced.

The below schematic illustrates this architecture design:

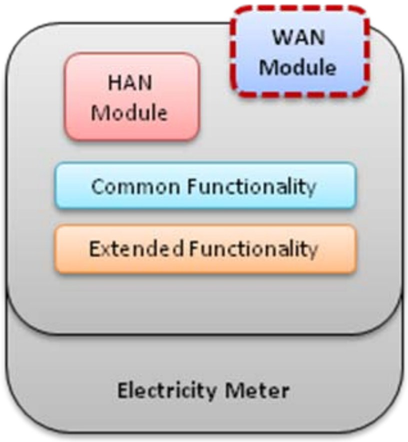
[17] Earlier options assessed, consulted upon and discarded included: a fully competitive model, a fully centralised model, a distribution network operator (DNO) deployment model, an energy networks coordination model and a regulated asset ownership model. See DECC, Impact Assessment of a GB-wide roll-out of smart meters (December 2009).



2. Integrated with replaceable WAN transceiver

This design architecture reflects the approach that was envisaged in the March 2011 consultation response[18]. While the communications equipment would be housed in the same casing as the electricity meter, the WAN module would be easily replaceable – in essence a socket and plug system. This would result in very low equipment costs in case of a WAN technology exchange. This option requires a standardised interconnector that would allow for a straightforward replacement of the WAN component, and that would be suitable for all potential communications technologies that might be deployed. It has however emerged that such an interconnector does currently not exist. While the development of a standardised connector is technologically possible it will take time. Until it is developed, alternative options would have to be deployed during the foundation phase.

The below schematic illustrates this architecture design:

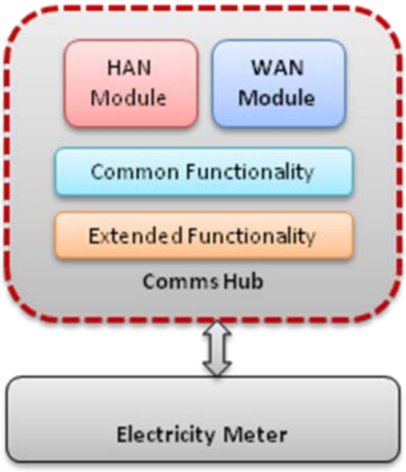


3a. Separate Communications Hub with fixed WAN transceiver:

As explained above, a standardised WAN interconnector does not currently exist. A potential alternative solution is to require the architecture design of a modular Communications Hub. This will allow replacement of the WAN module without needing to replace the whole meter is the architecture design of a modular Communications Hub. This is the technical solution that would likely be deployed in the absence of further government intervention. Under this approach, the communications equipment would be housed in a separate casing to the metering equipment and would be connected via a power cable. Data would be transferred via an additional HAN in the electricity meter. In the case of a WAN replacement, the communications unit would be exchanged completely. While this approach would lead to a reduction of the replacement cost in case a new WAN technology was required, it increases the initial equipment costs.

The below schematic illustrates this architecture design:

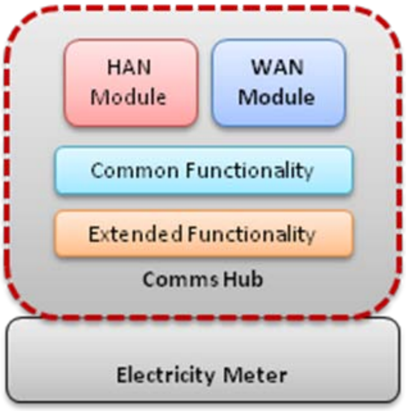
[18] Although the March IA assumed that the replaceable WAN transceiver would be achievable at no incremental cost.



3b. Intimate Communications Hub with fixed WAN transceiver

This is a hybrid approach where the communications equipment sits within a separate casing that is immediately attached to the electricity meter, i.e. on the outside of the meter casing and not connected to it via a cable. The Communications Hub would share the HAN and power supply with the electricity meter. In the case of a WAN exchange the whole casing containing all the communications infrastructure would be replaced, while the meter would stay in place.

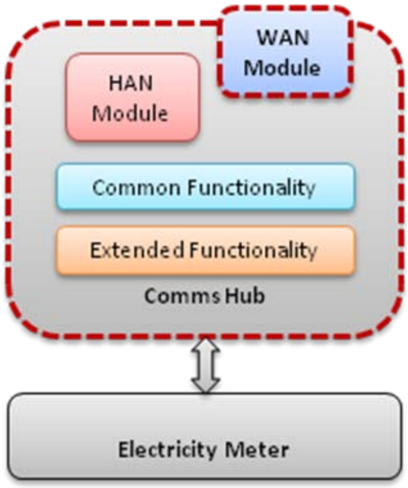
The below schematic illustrates this architecture design:



4. Separate Communications Hub with replaceable WAN transceiver

This architecture design combines the modularity of the Communications Hub with the modularity of the WAN transceiver. Under this approach both a modular Communications Hub and a replaceable WAN transceiver would be deployed.

The below schematic illustrates this architecture design:



Assessment of the identified options

A detailed option appraisal matrix has been developed to assess the available technical solutions against a variety of criteria and to identify Government's preferred option on which we are seeking further views through the consultation.

<u>Criteria for options appraisal:</u>

- *<u>Cost:</u>* What is the day one installation costs for each of the options?
- *<u>Impact for gas-first installations[19]:</u>* How easily can gas-first installations be supported and what are the cost and other impacts on the programme?
- *<u>Impact for viability of Foundation phase:</u>* What is the impact on the incentives for suppliers to roll-out meters in the foundation phase, and what are the implications for the DCC when it goes live?
- *<u>Impact on procurement:</u>* What is the impact on the procurement of equipment (by suppliers and DCC)? Does it add complexity (and cost)?
- *<u>Future Flexibility:</u>* How easily and cost effectively can equipment be upgraded/replaced?

The outcome of the assessment of the options against these criteria is outlined in the following table and discussed further in the detailed description of each of the options.

<u>Table 1: Summary of options appraisal</u>

	1: Fully integrated meter / Communications Hub	2: Integrated meter / Communications Hub with replaceable WAN transceiver	3a: Separate Communications Hub with fixed WAN transceiver	3b: Intimate Com. Hub with fixed WAN transceiver. (Com. Hub shares HAN transceiver and power with electricity meter)	4: Separate Communications Hub with replaceable WAN transceiver
Cost					
Gas-first					
Foundation					

[19] Gas-first installations refer to households that receive their electricity from a different supplier than their gas and where the gas smart meter will be installed first.

Procurement					
Future Flexibility					
OVERALL					

All cost estimates outlined in the following have been developed in close cooperation with industry experts in the technical working groups.

Detailed appraisal of the identified options:

Option 1: Fully Integrated

For this approach the analysis uses the updated communications infrastructure cost assumptions outlined in the cost section of the evidence base (see section G). Both at the point of initial metering installation (day 1 costs) and at the point of WAN replacement communications component costs of £22 are applied. In addition at the point of WAN replacement a new electricity meter at the cost of £43 is required. This option minimises day 1 installation costs, but has the highest costs of replacement.

Gas first installations under this approach are theoretically possible if the gas smart meter installer installs a standalone Communications Hub, however this will result in two Communications Hubs being deployed into the premise. In light of the resulting cost increase (because of the need to have two Communications Hubs) gas first installations are not desirable under this approach.

While this option is readily available in design terms, the high costs of replacement increase the risk for a large scale deployment before the communications technology is decided and the DCC is operational and might discourage suppliers from rolling out smart meters.

With a view to procurement, this option is problematic since it would require suppliers to procure a multitude of different gas meter models, so that compatibility with the communications equipment of the electricity meter can be guaranteed.

Future flexibility is limited under this approach since a WAN replacement would require the whole electricity meter to be exchanged.

Option 2: Integrated with replaceable WAN

For the analysis of costs and benefits, an initial cost of the communications equipment at point of smart meter installation of £25.5 has been assumed. This cost uplift of £3.5 in comparison to the non-modular WAN, as well as all other new technical component cost estimates used in this IA, has been developed in close cooperation with industry experts in the architecture working group. At the point of WAN technology exchange, the replacement WAN module would carry a cost £16.75, reflecting that some of the initial cost uplift would be located in the meter (i.e. the socket would stay in place).

As for option 1, gas first installations would not be desirable under this integrated approach.

The fact that this solution will not be available from day 1 of the foundation stage results in this approach being assessed as problematic, since it would delay the availability of compliant equipment.

Procurement of equipment would only be slightly easier than under option 1, seeing that this option is based on a standardisation of the WAN transceiver. Gas meter installer would however still need to carry different meter models to ensure compatibility with the HAN of the electricity meter in place.

Future flexibility would be ensured under this approach as WAN replacement costs would be low compared to the alternatives.

Option 3a: Separate Communications Hub with fixed WAN

For the modelling of this approach an initial communications equipment cost figure of £25.6 is used (option 1 i.e. £22 plus £1.1 for a separate casing and seal and one additional HAN at £2.5), with the same cost incurred at the point of WAN exchange.

Under this design gas first installations would be possible at no or little additional cost. Rather than receiving mains power from the electricity meter as under the standard approach, the gas meter installer would establish a separate mains connection to power the standalone communications equipment.

For the foundation stage criterion, there would be no delay since metering equipment to this specification is readily available.
In terms of procurement this approach is the strongest option (together with option 4), since it removes the need for any standardisation of the meters.
This approach scores stronger than the fully integrated approach in terms of future flexibility since a WAN exchange would only require the replacement of the Communications Hub rather than the whole meter.

Option 3b: Intimate Communications Hub with fixed WAN
This design slightly decreases day 1 equipment cost compared to option 3a (since the Communications Hub shares the HAN with the electricity meter) and also reduces the replacement costs in comparison to option 3a. The costs applied are £23.1 day 1 costs and £23.1 at point of replacement. However, some development work would be required to achieve a standard specification (including physical form factor and interfaces), resulting in a delay of compliant equipment.
Gas first installations are more difficult than under the fully standalone approach, because the Communications Hub is by default attached to the electricity meter, which might result in two Communications Hubs being deployed in some premises.
The delay from the requirement to develop a standardised design is also problematic regarding the foundation stage, as compliant metering equipment will not be available from day 1.
The assessment against the procurement criterion is similar to option 2, since it is based on a standardisation of some of the components procurement of equipment is not as difficult as under the fully integrated approach. To ensure compatibility with the HAN different equipment in place would still need to be carried by the meter installer.
Given lower WAN replacement costs than under the fully integrated approach but higher costs than under the replaceable WAN transceiver, this approach scores an amber with regards to future flexibility.

Option 4: Separate Communications Hub with replaceable WAN
Since this approach is essentially a hybrid between options 2 and 3a, initial communications equipment costs at point of smart meter installation of £29.1 are assumed (option 3a plus £3.5 for WAN modularity as in option 2), with replacement WAN equipment costing £16.75 (as in option 2). Since this option builds on the availability of a standardised WAN interconnector as under option 2 the same delay to the availability of compliant equipment applies.
Gas first installations are possible under this approach, in line with the rationale outlined for option 3a.
The lack of a standardised WAN interconnector and the resulting delay in compliant equipment negatively impacts the assessment against the foundation criterion.
In terms of procurement this approach is the strongest option (together with option 3a), since it removes the need for any standardisation of the meters.
This option scores slightly higher than option 2 for the assessment of the future flexibility criterion because not only is the WAN replacement possible at lowest cost, but also would be possible to replace the Communications Hub rather than the whole meter should a non-WAN related communications exchange be required.

For all of the above options, there would be installation costs (in addition to the equipment costs set out above) at point of WAN replacement of £29. No cost differential is assumed for the different architectural approaches because in all cases the installer would need to be trained to handle mains electricity powered units. The cost estimate of £29 is equal to the installation costs assumed for an electricity smart meter.

The below table summarises the cost assumptions for the available options, both at point of smart meter installation and at point of replacement.

Table 2: Overview of per unit costs for different communication architectures

Communications architecture	Day 1 costs	Cost of replacement equipment	Installation cost at point of replacement

1. Fully Integrated	£22	£65 (day 1 plus electricity meter cost)	£29
2. Integrated with replaceable WAN	£25.5	£16.75	£29
3a. Separate Communications Hub with fixed WAN	£25.6	£25.6	£29
3b. Intimate Communications Hub with fixed WAN	£23.1	£23.1	£29
4. Separate Communications Hub with replaceable WAN transceiver	£29.1	£16.75	£29

The overall cost of each option in NPV terms is presented in table 3.

Conclusions:

Having considered all relevant factors as outlined above and summarised in table 1, the programme is of the view that option 3a should be taken forward as the preferred approach and option 1 should be ruled out as a possible approach. It is important to note that both quantitative and qualitative criteria have been considered in deciding on the preferred options. While the preferred option has relatively high day 1 costs associated with it when compared to the alternatives, there are a number of unquantified risks that are not reflected in the NPV numbers. Options 2, 3b and 4 are all not currently available and will require a standardisation process before they can be deployed, therefore risking a delay in the rollout and the realisation of benefits. Option 1 results in the highest NPV with regards to day 1 costs, but does not satisfy the identified requirement of having an independently replaceable WAN transceiver and can therefore not be considered as a feasible approach.

We are in addition seeking views through the consultation published with this IA on whether suppliers should be free to choose to install other architectural design approaches once the standardisations required to address some of the identified issues with options 2, 3b and 4 are completed.

Consideration of the options under an illustrative WAN replacement scenario

In order to further illustrate potential benefits from opting for an architecture approach that does not minimise day 1 costs, an illustrative WAN replacement has been modelled and the replacement costs of the identified options are compared . For this illustrative purpose a WAN replacement in 2024 has been modelled. This is not part of the central case in the main model, but serves to illustrate potential cost advantages of options with higher day 1 costs at point of replacement.

An illustrative WAN replacement is important to consider in the context of the realisation of smart grid benefits. Given the cost implications of a WAN replacement, such a replacement would only be undertaken in the future if a positive business case existed, i.e. if the expected benefits outweighed the expected costs. Therefore the costs of an illustrative replacement of the WAN should be interpreted as potential costs that might need to be incurred to realise smart grid benefits.

Table 3 outlines the overall NPV reflective of the cost implications of the individual options and shows the replacement costs day 1 cost increase, the illustrative replacement costs and the net smart grid benefits for the five communication architecture approaches.

Table 3: Comparison of costs

Communications architecture	Overall NPV reflecting day 1 cost (in millions)	Replacement costs (in millions)
1. Fully Integrated	£2,166	£128
2. Integrated with replaceable WAN	£2,155	£62
3a. Separate Communications Hub with fixed WAN:	£ 2,154	£72
3b. Intimate Communications Hub with fixed WAN	£2,163	£70
4. Separate Communications Hub with replaceable WAN	£2,146	£62

While the fully integrated option 1 is the cheapest in terms of day 1 costs, the above illustrates that in the case of an illustrative WAN exchange the replacement costs of option 1 are significantly higher than the alternatives.

Incremental outage management benefits to Network Operators from outage detection functionality

The March IA had identified a range of outage management benefits that are expected to arise to DNOs once smart meters are deployed. This section presents what increase in these benefits can be reasonably expected from the provision of outage detection functionality in the non-domestic sector.
The outage management benefits to networks outlined in the evidence base section of this IA have been revised according to this analysis. Improvements considered here only refer to outages in the low voltage parts of electricity distribution networks, since other parts of the system already have some fault detection processes in place.

The detailed extension of the analysis of outage management benefits that has been carried out in this phase of the work and the rationale for increasing our benefit assumptions are outlined in the domestic IA.

The new outage management assumptions are applied to the non-domestic sector, under consideration that these benefits are only realised by non-domestic smart meters that utilise DCC.

Work during this phase has also brought to light that non-domestic network benefits in the March 2011 IA had been overestimated. The underlying issue in the modelling has been addressed and the benefits have been revised for this IA.

The impacts are outlined below:

Table 4: Corrected network benefits for non-domestic analysis

	March IA as published	Corrected March IA	August IA (i.e. corrected March IA with new assumptions)
Reduction in customer minutes lost	£19m	£1m	£3m
Operational savings from fault fixing	£35m	£3m	£6m
Avoided investigation of voltage complaints	£12m	£1m	£1m
Reduced outage notification calls	£9m	£1m	£1m
TOTAL	£75m	£6m	£11m

Consumer access to data over the Smart Metering HAN (SMHAN)

Two key Programme objectives are:
- supporting a market for ESCOs and other Authorised Third Parties; and
- allowing consumers to access consumption data in a variety of ways

One way in which these objectives will be met is by ensuring that consumers and authorised third parties are able to access consumer data over the Smart Metering HAN (SMHAN). Whilst consumers will have access to a minimum set of consumption information on the SMHAN[20] through their IHD, some consumers may wish to use data on consumption and tariffs from the smart metering system to send commands to other smart appliances in the home; or to transmit the data via a different communications network (such as their existing wifi network) which can be picked up by other devices (e.g. smart phone or computer).

While it may be possible to connect directly to the SMHAN, this would require smart devices to meet a higher level of security. Facilitating bridging to a consumer's network will allow consumers to connect devices to their existing network - currently many homes already have a WiFi network - without having to follow the secure connection process in place for connecting devices to the SMHAN.

Additionally the HAN may not use technologies that are prevalent or are sub optimal for use in consumer devices.

To translate data from the SMHAN to a consumer's network a bridging device/translation chip is required. There are various technical ways in which a bridging device can be connected to the SMHAN.

Further work has been carried out in this phase of the smart meters programme to analyse the approach to delivering or facilitating a local consumer interface with the SMHAN.

[20] Both real-time and historical consumption information will be available over the SMHAN (A full list of data items and detail of access control is set out in the Industry's Draft Technical Specifications).

The short term applications that are enabled by this interface are not critical given the required functionalities of the WAN and IHD.[21] In the medium term, significant benefits could arise from the connection of smart appliances. There is, however, much uncertainty concerning the expected penetration of smart appliances in the short and medium term.

Different technological solutions can be used to facilitate this access. The three approaches assessed by the Programme team are:

1): A consumer owned 'bridging' device (envisaged to be a wireless connection) that will provide a secure connection and converts the signals from the SMHAN into another communication system that can be used by other devices.

2): A physical port within the smart metering equipment where the consumer can 'plug-in' a device (similar to the 'Bluetooth' or '3G' adapters already used to connect laptop computers to a peripheral device such as a mouse, or for mobile internet access) that can communicate with a communications network within the home.

3): Provide the ability to directly connect through an second transmission system (e.g. Wi-Fi or Bluetooth chip etc) that would be embedded into the Smart Metering Equipment. This would allow consumers to communicate with smart metering equipment through their own communications network (in a similar manner to a wireless hard drive, or a wireless printer).

These solutions have been assessed qualitatively against a number of criteria (timing, future flexibility; cost implications and competition impact).

Essentially, the two last solutions build costs into every smart meter (because either a port or a component need to be incorporated in the meter) for a functionality that a large proportion of consumers might not use in the near future, while a wireless bridge does not risk unnecessary expenditure, and leaves consumer's choice to add this functionality if desired, as well as flexibility with regards to technology. It also leaves flexibility to adapt to future HAN technologies. The second alternative could also limit competition if it is only able to support one provider (unless it has multiple ports). In terms of timing, the wireless bridge could be made available by the market in line with the rollout timeline, while the other solutions require further technological development since they would require the development of compliant metering equipment.[22]

The Programme preferred approach is the first solution (wireless bridge), however we welcome comments on that view through the consultation published alongside this IA. Such an approach offers a number of advantages which are described above. This solution is essentially a default option, since it will materialise as consumers create a demand for a wireless interface bridge to the SMHAN which the market consequently would provide. To ensure that consumers are able to easily connect bridging devices, the Programme intends to develop an appropriately secure but consumer-friendly connection process. The Programme will monitor the arrangement during Foundation Stage.

[21] Access to real time consumption and tariff information will be provided as part of the minimum IHD specifications and access to 13 months historical data can be achieved over the WAN.
[22] The likely delay has been estimated by up to one year.

G. Evidence Base

1. Overview over updated areas and differences to the domestic IA

In this section we describe the main assumptions underpinning the analysis and the reasons for them with references to the evidence where appropriate. Further analysis has been undertaken by DECC since the publication of the March IA and has been informed by the outputs of Expert Industry Groups following a process of continuous engagement with industry and externally sourced work by Programme contractors. In addition we have received feedback from stakeholders on many aspects of the analysis during this period.

We have refined some of our assumptions on the basis of a critical examination of the available evidence. Key estimates that were refined for the March 2011 IA included the rollout profile, IT costs, meter costs, benefits from better outage management, other network benefits, theft estimates, avoided site visits, benefits from customer switching, and the methodological approach to assessing the impact of ToU tariffs.

For this version of the IA the analytical focus has been to revise, in dialogue with industry, some of the cost estimates for technical components as well as further analysing the cost implications of different approaches to achieving the functional requirements set out in March 2011. This has led to changes in our estimates of the costs of the electricity meter and the communications equipment.

Further work has also been conducted to refine our understanding of the benefits that can be expected from an outage notification function. In order to reflect continued uncertainty about the costs of the outage detection functionality we have revised our optimism bias assumptions for this component.

Most of the assumptions used in this IA are shared with the assumptions used in the analysis for the domestic sector. Where this is not the case it is noted and explained within the text.

For some of the costs and benefits analysed it is not possible to determine the proportion that falls to the domestic or non-domestic sector. In some cases, we have, therefore, accredited the costs or benefits fully to the domestic analysis[23], in light of the much greater number of meters in that sector.

For modelling purposes IT, legal, marketing and organisational costs, as well as integration of early meters from the rollout, have been fully allocated to the domestic cost benefit analysis. Similarly we have credited all benefits from better informed investment decisions in electricity networks to the domestic analysis. The accredited costs outweigh the benefits, so the result is a potential understatement of net benefits of the domestic policy and a potential overstatement of net benefits of the non-domestic policy. It is important to note however, that the overall impact on the net present value of the smart meter domestic and non-domestic rollouts is neutral and that in aggregate neither costs nor benefits are underestimated or overestimated.

It is also important to note that for the non-domestic sector a different counterfactual is applied than for the domestic analysis. The options are assessed against a baseline in which 50% of non-domestic meters are replaced by smart or advanced meters by 2030 without a government intervention. The evidence base in section G. contains a comprehensive overview of the non-domestic counterfactual scenario.

Differences between the assumptions in this IA and previous IAs are noted and explained within the text. For reference purposes Annex 2 provides an overview of the changes made since March 2011.

It should be noted that, within the economic model, all up-front costs are annuitised over the lifetime of the meter or over the rollout period. The modelling assumes that a loan is required to pay for the asset, which is then repaid over the period. Following Government guidance, a cost

[23] Published in parallel to this document, see: http://www.decc.gov.uk/en/content/cms/tackling/smart_meters/smart_meters.aspx.

of capital of 10% has been assumed. The benefits are not annuitised but annualised, that is, they are counted as they occur.

Overall the case for a rollout of smart meters to SMEs remains strongly positive in central scenarios (see results page 58-61); the SME rollout has a positive Net Present Value (NPV) of over £2.15bn. Table 5 compares costs and benefits of the March 2011 IA against the preferred option in the August 2011 IA. This decreases the value of the NPV published in the March 2011 IA from £2,248m to £2,154m, by £94m.

Table 5: Costs, Benefits and PV (August 2011 IA vs March 2011 IA)

	March 2011 IA (PV 2011)	August 2011 IA (PV 2011)
Total Costs	£574m	£604m
Total Benefits	£2,822m	£2,759m
Net Present Value	£2,248m	£2,154m

The programme has also carried out an exercise to determine the net effect of smart meters on businesses across both the domestic and the non-domestic parts of the policy, establishing that the overall impact on businesses is positive, i.e. benefits outweigh the costs. The overall rollout of smart meters results in a net benefit to businesses of £840m over a 20 year period. This approach has been agreed with the Better Regulation Executive.

2. Underlying assumptions

For the modelling of the rollout, we have made a number of assumptions, which are outlined in the following section.

Advanced meters vs. smart meters
The present analysis builds on decisions previously taken with regard to some flexibility for installation of smart and advanced meters. Meters without full smart functionality can remain, or can continue to be installed:
- Where advanced metering is installed before April 2014 and the customer wishes to retain it; or
- Where advanced metering is installed after April 2014 under pre-existing contractual arrangements.

These decisions reflected the state of development within the non-domestic market, with advanced metering being relatively extensively deployed and attendant early energy and carbon savings being achieved. The Government did not, therefore, wish to limit this beneficial early activity by creating uncertainty around advanced metering investment.

A variety of advanced metering solutions are available, and used, within the non-domestic market, especially by larger or multi-site customers. Many of the existing advanced meters have been installed by advanced metering service providers rather than suppliers. Non-domestic customers, like domestic customers, may install their own meters or appoint an accredited party, other than their supplier, to install the meter and collect readings from it. These providers have grown in number over recent years and offer a service tailored to consumers requirements, providing feedback on consumption patterns via the internet or over a local network. This feedback allows consumers to monitor their consumption and to target energy and carbon savings. Service providers contract with communications companies to permit the meter to be accessed and data downloaded. These advanced metering solutions not only carry a different cost to smart meters as defined by the programme, but are also assumed to deliver different levels of benefits.

There will be no mandate requiring a compliant smart meter (meeting the finalised technical specification) or an advanced meter (providing as a minimum remote access to metered consumption, and capable of measuring half-hourly (electricity) or hourly (gas) consumption) to be installed before the start of a mass rollout, envisaged to be April 2014. Thereafter, smart would be installed on a new and replacement basis (except where advanced metering was permitted under the exceptions arrangements).

It is assumed that by 2020 the split between smart and advanced meters would be:
- Electricity: 77% smart and 23% advanced
- Gas: 60% smart and 40% retrofit advanced

The proportion of benefits realisable for advanced meters is shown in the table below.

Table 6: Proportion of smart meter benefits realisable for advanced meters

	Advanced meters	
	Electricity	Gas
Energy saving	90%	80%
Short run marginal cost savings from Time of Use (ToU)	0%	0%
Inbound enquiries	80%	80%
Customer service overheads	80%	80%
Debt handling	20%	20%
Remote disconnection	0%	0%
Avoided site visit	100%	100%
Reduced losses	0%	0%
Reduced theft	N/A	N/A
Microgeneration	0%	N/A
Supplier switching[24]	£0.8	£0.8
Network benefits	0%	N/A

Use of DCC

The Government decided in March that a voluntary, rather than a mandatory approach to using DCC for smart and advanced meters should be applied for the non-domestic sector since it would only change the number of electricity meters that actually use the DCC to a limited extent. This reflects the fact that suppliers with large, domestic portfolios are likely to wish to install a common, smart meter where they can, and to wish to use a common communications platform, even where they are offered a choice. In the non-domestic electricity sector, supply is dominated by suppliers with large, domestic portfolios.

The incentive to opt out of using the DCC might be more pronounced for non-domestic suppliers of gas. Because there are a number of gas suppliers with a significant share of the non-domestic market, but no domestic business, there is a reduced incentive for those suppliers to use the DCC to ensure compatibility with their domestic operations.

For modelling purposes we have assumed that under this voluntary approach 76% of all non-domestic electricity meters and 45% of all non-domestic gas meters would choose to use DCC. These percentages are in line with the market share of suppliers with large domestic portfolios which are likely to wish to install a common, smart meter where they can, and to wish to use a common communications platform, even where they are offered a choice.

Benefits from using the DCC

Smart metering requires a suitable communications platform over which data can be securely transmitted.

Three broad scope options exist for the functions that the DCC can carry out:

[24] We assume that advanced meters would realise a flat supplier switching benefit of £0.8 per meter, which is in line with the switching benefits realised by smart meters before the DCC is established and for smart meters that choose not to use the DCC under policy option 2.

• a "Minimum DCC" option which would include secure communications and access control[25], translation[26] and scheduled data retrieval functions[27].

• Additionally to the "Minimum scope", registration could be added to the remit of DCC, which would mean that DCC should assume responsibility for managing the supplier registration database that records the registered supplier for every meter point. Such function would facilitate the development of a streamlined dual-fuel change of supplier process.

• Also adding data processing and aggregation functions (for electricity) to the remit of the DCC. These services are currently performed by industry agents and involve the preparation of a meter point data for settlement. Central data storage could also be included in this option.

For modelling purposes we assume an establishment of an operational DCC from the end of Q1 2014 with a "minimum scope", with registration being added to the scope some time after. Information available also indicates that a positive business case may exist for the inclusion of data processing and aggregation. However, decisions on the latter would need to be subject to further technical, economic and competition impacts analysis. For modelling purposes, it is assumed that registration will be added to the remit of DCC in 2016, with data processing and aggregation added in 2019.

Since some of the benefits identified as arising from the rollout of smart meters are fully or to an extent dependent on the use of the DCC then. Benefits that are enabled by DCC are adjusted for the proportion of meters that we assume would opt out of the DCC:
• We assume that by opting out of the DCC, smart meters would only realise those switching benefits that the analysis has identified to be realisable in the pre-DCC situation - £0.8 per smart meter per year
• No benefits from reduced losses are realised for SME smart meters not using the DCC
• Amongst the benefits to networks, we assume that only the savings from reduced investigations of voltage complaints could be realised for non-DCC meters. We assume that network operators would be able to access the voltage information monitored by the smart meter even if no connection to the DCC was established.

Consistent with the domestic analysis, for those meters that would use DCC the benefits are adjusted before 2014, at which point the DCC is implemented in its initial 'minimum' scope.

Meter numbers and SME energy consumption
No new evidence regarding the number of non-domestic gas meters has emerged since the March 2011 IA. Planned work on the non-domestic National Energy Efficiency Data Framework (NEED) will allow us to verify the validity of the current assumption on the number of gas meters for future analysis.

Table 7: Meter numbers and energy consumption

	Electricity	**Gas**
Meters (2009)	2,140,000	1,500,000
Consumption (kWh)	17,400	79,800
New meters	1.5% - 51,000 per annum	

[25] Secure two way communications with smart meters, enabling remote meter reading, meter diagnostics and other data communications.
[26] The conversion of different technical protocols to support inter-operability.
[27] Scheduling of the collection of meter readings and managing that process on behalf of suppliers and network operators.

3. Non-domestic counterfactual

The counterfactual establishes the business as usual world against which the smart meter rollout is assessed. By determining the rollout that would have occurred had there been no policy intervention the analysis can ensure that only incremental costs and benefits are considered.

Advanced meters vs. smart meters

The counterfactual case assumes as in previous versions of the IA that without Government intervention market participants will only install smart/advanced meters where a positive business case exists. We assume that this would be 50% of the market by 2030.

We assume that meter competition and choice will exist – in the model we assume that the meter take-up will be:

- advanced meters: 40% (or 20% of total SME meters) by 2030
- smart meters: 40% (or 20% of total SME meters) by 2030
- retrofit advanced : 20% (or 10% of total SME meters) by 2030

Benefits from using the DCC

As outlined in the assumptions section above some benefits are dependent on the existence and scope of the DCC. Since we assume that in the counterfactual there is no DCC, we adjust the benefits accordingly:

- Smart meters will only realise £0.8 switching benefits per meter p.a.
- Smart meters will not realise benefits from reduced losses
- For network benefits we assume that only savings from avoided investigations of voltage complaints are realised in the counterfactual scenario, as the critical mass of smart meters required for the realisation of the remaining network benefits would not be realised in the absence of a mandated rollout.

Energy consumption

For the non-domestic counterfactual the analysis continues to assume stable levels of energy consumption per SME going forward. This is based on the currently available information and is a sensible and conservative representation of business as usual energy levels projections for SMEs.

Even though energy projections for the non-domestic sector are available[28] it is not possible to derive from these a sensible representation of the diverse business groupings represented in the SME sector as defined in this IA, the drivers of its energy consumption, and its projected levels of energy consumption going forward.

Preliminary analysis suggests that both gas and energy consumption business as usual trends per SME are, if anything, likely to be upwards. Therefore the assumed flat baseline is if anything likely to underestimate the energy and carbon savings of the policy.

4. Costs

Advanced meter

For the non-domestic smart meter IAs we based our assumption of advanced meter costs on the work done by the Carbon Trust and the work done by DECC for the IA for larger non-domestic sites[29]. The costs used were the mid-point between the high and low costs for advanced meters used in the Carbon Trust trials. This also applied to installation and maintenance costs. It is assumed that the up-front communications costs are part of the asset price but running costs are separate.

[28] http://www.decc.gov.uk/en/content/cms/statistics/projections/projections.aspx.
[29] IA of Smart Metering rollout for Domestic Consumers and for Small Businesses: www.berr.gov.uk/files/file45794.pdf .

A variety of advanced metering solutions is available, and used, within the non-domestic market. These carry a variety of costs. If the costs of advanced metering are lower than those we have modelled, the effect would be to increase the overall net present value of the policy[30].

Smart Meter

The tables below show the capital costs of meter and communications assets used for the current analysis.

The cost per electricity meter was updated in the March 2011 IA to reflect an incremental cost of £1 per meter for the inclusion of capability to alert suppliers and networks when electricity supply is lost. Further work regarding the design of the overall smart metering equipment within the premise has resulted in the conclusion that this component is more appropriately located within the communications infrastructure as this will reduce costs. The March cost increase has therefore been removed from the meter cost and added to the communications infrastructure costs which are outlined in detail below.

The installation costs are based on domestic installation cost estimates and the maintenance cost is assumed to be 2.5% of the asset costs. Upfront and running communications costs are seen as separate from the meter.

Table 8: Summary of costs per meter

	Asset cost	Installation costs	Maintenance costs (annual - 2011)
Advanced meter Electric	£247	£136	£6.1
Advanced meter Gas	£247	£136	£6.1
Retrofit option Gas	£120	£68	£3
Smart meter Electric	£43	£29	£1.1
Smart meter gas	£56	£49[31]	£1.4
IHD	£15	-	-

Retrofit advanced

This option means that the dumb meter is not replaced, but is read remotely by a retrofit device attached to the meter, resulting in lower installation costs and avoiding stranding any assets. It is assumed that the upfront communications costs are part of the asset cost and that maintenance is 2.5% of the asset cost.

Display

We continue to assume that delivery of real time information is achieved through a standalone display which is connected to the metering system via a Home Area Network (HAN). In this sector, information would be provided in a variety of ways, not necessarily through a display device, especially via the internet. However, we anticipate that a significant number of customers, particularly smaller customers, would use a display device. Our cost assumptions regarding the in home displays (IHD) remain unchanged.

[30] It is also worth noting that as smart meters decrease in price through economies of scale realised through the domestic rollout, they will become an attractive alternative to costly advanced meters, potentially resulting in a shift towards a greater proportion of smart meters as assumed in this analysis. This would not only have the impact of lowering asset costs, but would also lead to the realisation of greater benefits as some of the discounting of benefits would fall away.

[31] Where a SME receives both gas and electricity fr5om the same supplier and the gas and electricity meters are installed at the same time we expect an efficiency saving of £10 in comparison to the aggregate costs of individual gas and electricity meter installations.

The cost estimate for the IHD has been further tested by the Industry working group meetings and the programme continues to be of the view that the required minimum functionality can be delivered at the £15 cost estimate.

Within the modelling it is assumed that due to technological advancement the costs of the meters and communications equipment will fall over time. We currently assume that costs fall by 1% per annum, resulting in a 10% reduction by the end of 2020. This reduction is split and is applied at three time points: 2010, 2017 and 2024. The assumptions about cost reductions over time are based on historic cost developments of non-smart metering equipment. The programme is of the view that there is a strong rationale for increasing the cost reduction assumptions for a number of reasons:
- as smart meters are being deployed in more countries internationally and production volumes increase, there will be an incentive for new manufacturers to enter the market, leading to increased competition and price pressure
- economies of scale and learning effects from mass volume production will materialise and further reduce production costs of smart metering equipment

Initial views from industry seem to support that the current assumptions about cost erosion over time are low and further work will be undertaken to review them. We invite views on potential costs developments of smart metering equipment through the consultation that this IA accompanies.

Communications equipment

Further work carried out since March 2011 has resulted in a number of revisions of the previous cost estimates.

While the WAN modem cost assumption of £15 per unit remains unchanged from the March publication, a number of additional components within the communications equipment have been identified in the industry working groups. These have been added to our estimate of the communications module cost:

- The HAN for the gas meter was previously assumed to be more expensive than the HAN for the electricity meter as it was assumed to be battery operated. Further work carried out in this phase implies that the same cost for electricity and gas meter HANs should be assumed. The previously assumed costs were £1 and £3 respectively and a cost figure of £2.5 per HAN is now used for both gas and electricity meters. However, further work with industry has concluded that these component costs are already included in the meter cost estimates and have therefore been removed from the communications equipment costs. To reflect the preferred architecture approach of a standalone Communications Hub (see section G.) the cost for a third HAN within the communications equipment has been added.

- The SMDG working groups have identified that the regular transmission of consumption data from the gas meter would reduce the battery life and require a premature exchange. An additional component (called gas mirror) will store the gas consumption information within the communications infrastructure so it can be accessed without depletion of the gas meter battery. Meter manufacturers in the working groups have provided their views that this has a cost of £4 per unit. This technical approach is more economical than having to replace the battery of the gas meter.

- A power supply unit will have to be built in to power the communications infrastructure. This is necessary because the meter is likely to have different power requirements to the wide area communications components within the Communications Hub. Work in the architecture working group has estimated a cost of £2 per unit.

- Section F details analytical work that has been carried out to determine a preferred approach to the design of the communications infrastructure within the premise. To reflect the current preferred option of a standalone Communications Hub, £1.1 for a separate casing and seal for this are also added to the costs of the communications infrastructure. This cost estimate has been developed in the architecture working group of SMDG.

- The cost increase for the electricity outage detection functionality has been moved from the electricity meter cost into the costs of the communications infrastructure since this is where the technical component will be located within the metering equipment. We continue to apply a £1 cost per unit estimate for this functionality. The cost estimate is based on cost information received from meter manufacturers already producing smart meters with such capability. No compelling evidence has come to light that indicates that this cost figure would not be possible to realise in a GB smart meter rollout context and that would require a revision of this cost estimate. The consultation this IA accompanies is seeking further views on the costs associated with the outage detection functionality as well as on the achievable outage management benefits. However, until there is further clarity about the costs of components required to deliver the functionality we will follow our conservative approach to cost estimates and apply an optimism bias factor of 150% to the cost estimate for outage detection functionality. This will be revisited in light of evidence received through the consultation and be adjusted at the final stage of this IA, once the technical specification is complete.

Table 9: Communications Hub (£ per device)

WAN (modem)	£15
Communications Hub HAN	£2.5
Gas mirror	£4
Power supply unit	£2
Casing / seal	£1.1
Outage detection	£1

In line with the previous IA, we retain our cost estimates for the operation and maintenance costs of the communication technology. We assume – in line with the available evidence – these to be £5.3 per meter per year (annuitised) for the WAN devices which includes an allowance for network security that enables secure communications.

Cost of capital

The costs of assets and installation are assumed to be subject to a private cost of capital, i.e. resources committed to assets and installation have an opportunity cost. That cost is fixed at 10% p.a. in the IA. A number of stakeholders have suggested that their own rates of return are lower than this level. This relatively high rate has been chosen to ensure that the full opportunity cost of the investment is reflected in the IA.

Energy costs

The smart metering assets will consume energy, and after discussions with meter specialists we continue assuming that a smart meter system (meter, IHD and communications equipment) would consume 2.6W more energy than current metering systems. These assumptions are therefore unchanged.

Disposal costs

The July 2010 IA considered costs from having to dispose of dumb meters as part of the roll out, estimated at around £1 per meter. Included among these are the costs of disposing of mercury from gas meters.

These costs would have been encountered under business as usual meter replacement programmes, but would be accelerated by a mandated rollout. While the underlying cost assumption of £1 per meter has not changed, the cost-benefit model since March 2011 reflects that meters would have had to be disposed of regardless of the implementation of the smart meters programme and now only takes into account the acceleration and bringing forward of the disposal over and above the counterfactual. The calculation now also applies the £1 disposal cost to smart meters, with resulting costs for the first generation meters to be replaced from 2027.

Pavement reading inefficiencies
The April 2008 IA first set out the rationale for an equation to capture the decreasing efficiency of reading non smart meters as the roll out of smart meters proceeds – described as pavement reading inefficiencies. The May 2009 IA included some modifications to this equation to better represent the increasing cost of reading non-smart meters as the total number of non-smart meters decreases. The assumption of the maximum additional cost of these readings was increased and they increase exponentially to a limit of four times the existing meter reading cost. These reads are treated as an additional cost per meter and the costs are spread across the roll out. The assumptions underlying these costs have not been changed between the March 2011 IA and this IA.

Apportioning of costs to domestic IA
As outlined in the introduction to this section, some of the costs have been credited exclusively to the domestic analysis, because a split by incidence in domestic and non-domestic sector is not possible.
IT, legal, marketing and organisational costs as well as integration of early meters from the rollout have been fully allocated to the domestic cost benefit analysis and are not included in the cost benefit modelling presented in this IA.

5. Benefits

We classify benefits in three broad categories: consumers, businesses (energy suppliers, networks and generation businesses) and UK-wide. For the non-domestic IA it is important to note that the consumer category in this case also captures businesses as customers of the energy industry.

Benefits are allocated to the first order recipient of the benefit. To the extent that businesses operate in a competitive market –in the case of energy suppliers– or under a regulated environment –in the case of networks– a second order effect is expected as benefits or cost savings are passed down to end energy users i.e. consumers. For example, avoided meter reads are a direct, first order, cost saving to energy suppliers. As energy suppliers operate in a competitive environment, we expect these to be passed down to consumers. Second order benefits are however not modelled in order to avoid double counting.

Consumer benefits
In the context of the non-domestic analysis we refer to consumers as non-domestic entities that purchase energy from energy suppliers.

Energy demand reduction
We assume that smart/advanced meters, together with provision of data, will reduce energy consumption by between 2.8% (electricity) and 4.5% (gas) per meter in the central case. This is in line with the changes seen in trials carried out by the Carbon Trust.

Microgeneration
We have attempted to estimate the savings from using smart meters to deliver export information from microgeneration devices. We have done that by estimating the number of microgeneration devices that will be in use by 2020 in the non-domestic sector. Our estimate of the number of units (under 300,000 by 2020) results in savings per SME electricity meter per annum (£0.43) that reflect that a separate meter and its installation cost are not needed.

Business benefits
Most benefits (or cost savings) in this section are attributed to energy suppliers. When benefits are related to generation, network or transmission businesses this is noted as appropriate.

Avoided site visits
Currently energy suppliers have to visit their customers' premises for a number of reasons, namely for taking meter reads and for carrying out safety inspections. The rollout of smart meters will have implications for the requirement to carry out such visits in a number of ways.

For the March 2011 IA additional evidence had emerged and had resulted in a revision of our approach to avoided site visits in comparison to the July 2010 IA. The revised assumptions are retained for this IA. Because all aspects discussed in the following are closely interlinked and reflect changes to the operations of visiting customers' premises as a result of the rollout of smart meters, they are grouped here in a section on 'avoided site visits'.

• Regular visits

- Regular meter read visits
Smart meters will allow meter reading savings for all the suppliers once the rollout is complete. We continue to assume that avoided regular meter reading will bring in benefits (cost savings) of £6 per (credit) meter per year in our central scenario taking into consideration both actual and attempted reads. This is reflective of the avoided costs of the regular meter reading cycle, for which meter reading operatives cold call premises in an area to read a meter and repeat to do so if access is not gained at the first instance.

- Regular safety inspection visits
This updated IA now also takes account of additional costs for regular safety inspections of smart meters. These had previously not been considered, but consultation responses have led the programme to review previous assumptions.

The impact of these additional visits is a cost of £0.6 p.a. for 90% of meters and of £8.75 p.a. for 10% of meters.

Currently safety inspections are carried out as part of the regular meter reading visits and therefore carry little if any additional cost. While the programme is of the view that this is not reflective of the effort that should be undertaken to ensure safeness of a meter, the model contains no incremental costs for safety inspections in the current situation.

The programme expects that the rollout of smart meters will help facilitate a change in the underlying regime and that the current required frequency of one inspection every two years will not persist across the population of meters once smart meters have been installed. This will need to be subject of a policy decision by The Health and Safety Executive (HSE), but initial discussions with HSE have already indicated that it is willing to consider reform, subject to any changes being risk and evidence based and not resulting in any reduction in existing levels of safety. This adheres to the principles of better regulation and would directly reduce the regulatory burden placed on businesses.

For modelling purposes we have made assumptions on the costs to suppliers of carrying out safety inspections after the rollout of smart meters. We assume a new risk-based regime with different requirements for different risk categories:

- Low risk group:
- 90% of meters
- Require a safety inspection every 5 years
- Area based approach with £3 cost per successful visit

- High risk group:
- 10% of meters
- Require a safety inspection every 2 years (or 5% of meters every year)
- Approach of scheduled appointments with £17.5 cost per successful visit[32]

[32] This results from using the current commercial rate of £10 for an appointed special visit and reflecting that first time access rates will be below 100%. Only 50% of premises are expected to provide access at the first attempt, with 25% of premises each requiring a second and third visit. The same assumption is used for modelling the benefits from avoided special safety inspection visits in the current situation, further outlined below.

There is of course uncertainty around what proportion of meters might be considered high risk under a new safety inspection regime, but for modelling purposes it seems reasonable to assume that the same proportion of the population currently requiring special safety inspection visits will continue to require dedicated visits at a greater frequency than the majority of meters (see special visits section).

- <u>Special visits</u>

We have also refined our assumptions with regards to "avoided special visits". Previously we assumed that without smart meters one additional visit per meter at a cost of £3 is required every four years, for purposes of either reading a meter or carrying out a safety inspection, resulting in a benefit of £0.75 per meter p.a. After a revision of the underlying assumptions we now reflect benefits of £0.5 per credit meter p.a. from avoided special meter reads and benefits of £0.875 per meter p.a. from avoided special safety inspections.

- <u>Special meter read visits:</u>

We assume a benefit of £0.5 per credit meter reflecting the following activities in the current situation that will be redundant once smart meters are rolled out:

- 5% of credit meter customers p.a. request a dedicated visit for a special read (e.g. because of bill disputes)
- Such a visit costs £10, as access at first attempt is assumed

- <u>Special safety inspection visits:</u>

We assume a benefit of £0.875 per meter reflecting the following activities in the current situation that will be redundant once smart meters are rolled out:

- 5% of the meter population p.a. requires a dedicated visit for a safety inspection
- Such a visit costs £17.5, reflecting the requirement for repeat visits

<u>Customer service overheads</u>

Call centre cost savings are a result of a reduction in billing enquiries and complaints. Smart meters will mean the end of estimated bills and this is expected to result in lower demand on call centres for billing enquiries. This assumption is unchanged since July 2010 and we assume this cost saving to be £2.20 per meter per year in the central scenario (£1.88 for reduced inbound enquiries and £0.32 for reduced customer service overheads). No new information was gathered and our assumption is based on previous supplier estimates that inbound call volumes could fall by around 30% producing a 20% saving in call centre overheads. Other consultation responses used similar cost assumptions for call centre cost savings.

<u>Remote switching and disconnection</u>

The meter functionality will enable the remote enablement or disablement of the electricity and/or gas supply. The direct benefits associated with these capabilities are the avoided site visits and equipment upgrade costs. These are captured in the debt management and in the prepayment cost to serve savings. We also continue to include a further benefit of £0.5 per credit meter per year for the benefits of being able to remotely disconnect those consumers. Ofgem is consulting on a Spring Package of regulatory measures to strengthen protections for consumers, which covers disconnection arrangements under the smart metering currently being installed by "early movers".

<u>Prepayment cost to serve</u>

These benefits are not of relevance for the SME analysis, as we assume that no prepayment meters are used in the sector. There may some quasi-pay-as-you-go tariffs in this sector in the future, but these would be likely to lie outside the prepayment infrastructure.

<u>Debt management:</u>

More accurate energy use information should help consumers better manage their energy expenditure, preventing large debts arising. This reduces supplier costs in managing and recovering debt. The benefit assumed in our modelling is £2.20 per meter per year, which reflects reduced enquiries related to debt recovery and management. Suppliers estimate that a 30% fall in inbound calls volume could result in 20% savings in call centres overheads. There may also be attendant benefits to customers from increasing supplier readiness to offer terms because of diminished exposure to risk of debt.

Switching Savings

The introduction of smart metering will allow a rationalisation of the arrangements for handling the change of supplier process. Trouble shooting teams employed to resolve exceptions or investigate data issues will no longer be needed. Suppliers will be able to take accurate readings on the day of a change of supplier, resolving the need to follow up any readings that do not match and instances of misbilling will reduce.

In addition to responses to the Prospectus, the Programme has collected further evidence through an Information Request[33] on the costs and benefits associated with the establishment and operation of DCC in the gas and electricity industries. This Information Request was completed by members of the Data Communication Group's Community of Technical Experts, which included industry parties (energy suppliers, network operators and market operators) whose existing systems will be impacted by the introduction of smart metering and the establishment of DCC. Participants were asked to provide feedback under a prescribed set of options for the scope of DCC's activities. These included a minimum scope, inclusion of DCC registration and inclusion of data processing, aggregation and verification.

The main category of benefits examined through this Information Request relates to customer switching. The Information Request asked for views of the potential scale of this benefit and the extent to which the benefits are contingent on DCC providing a centralised supplier registration system covering both electricity and gas.

Suppliers were asked to estimate the value of benefits that could be realised under each option and to comment on the factors which could constrain the realisation of benefits. The benefit estimates provided considered the potential benefits of reducing the complexity / cost associated with interfacing with a variety of registration agents. Where an option resulted in the transfer of functions from suppliers' agents to DCC (e.g. data processing and aggregation), suppliers were asked to estimate the costs that would be avoided. Network Operators and Metering Agents were asked to provide evidence on the extent to which each option will facilitate the realisation of customer switching and related benefits (e.g. the avoided costs of handling registration-related queries from energy suppliers).

In IAs previous to March 2011 we had assumed savings of £100m per year, or £2 per meter per year[34]. Following analysis of responses to the request for information, we now consider customer switching benefits of £3.11 per smart meter per year where the scope of the DCC includes data collection, registration, data processing, data aggregation and data verification functions. Where the scope of the DCC includes data collection and registration, benefits of £2.22 per smart meter per year are considered and where the scope of the DCC includes only data collection, benefits of £1.58 per smart meter per year are considered. Before the establishment of DCC customer benefits are assumed to be of £0.8 per meter per annum. This switching benefit amount is also assumed for advanced meters and for those meters choosing not to use DCC in this non-domestic analysis.
The implementation approach decided on in March leads to the establishment of an operational DCC from the end of Q1 2014 with a "thin scope" , with registration being added to the scope some time after. A decision on the inclusion of data processing and aggregation will be considered in the future. For modelling purposes, it is assumed that registration will be added to the remit of DCC in 2016, with data processing and aggregation added in 2019.

Theft

The approach to benefits from reduced theft differs between the domestic and the SME IA. No benefits from a reduction in theft are accredited to the rollout in the SME smart meter IA, as we assume that no theft occurs in the non-domestic sector. This is a conservative view and any theft that in reality occurs and that could be reduced through the rollout of smart meters would increase the non-domestic benefit case.

[33] issued on 14th October 2010.
[34] Based on estimates from Owen and Ward (2006).

Losses

We continue to assume that smart meters facilitate some reduction in losses and that the benefits per meter per year will be £0.5 for electricity and £0.1 to £0.2 for gas. This represents an initial assessment of the range of possible benefits to network operations made originally by Mott MacDonald[35].

Network benefits

- Outage management

The availability of detailed information from smart meters will improve electricity outage management and enable more efficient resolution of network failures once a critical mass of meters and the resulting geographical coverage is reached. Benefits identified are a reduction in unserved energy (customer minutes lost), a reduction in operational costs to fix faults and a reduction in calls to fault and emergency lines.

We have assumed that in order for the above benefits to be realised, a critical mass of smart meters is required so that sufficient regional coverage is provided to identify location and scope of an outage. The benefits therefore are only considered to be realised from 2018 onwards, at which point over 80% of smart meters will be installed in our central scenario. This will also give network operators sufficient time to adjust their outage management systems to take full advantage of the additional available data. We also assume that only those outages in the low voltage network system would be positively impacted from smart metering technology, because for other voltage systems networks already have sophisticated monitoring and diagnostic systems in place.

Some outage management benefits do not rely on the capability of individual meters to send a message when there is an outage. These are benefits which arise from the ability of a DNO to use the Smart Metering system to remotely check the energisation status of any meter in the system. If meters are unable to send a message to inform of an outage, then Network Operators would continue to rely on 'traditional' non-automated notification of an outage to initially raise awareness of an issue. This notification would typically be provided by a customer calling the network operator to make them aware of an outage. However, once a Network Operator were made aware of an issue, then the functionality of the Smart Metering System would allow them to deal with the fault more efficiently. Only these basic outage management benefits were considered in the March IA. Work since then has resulted in the quantification of the incremental outage management benefits that are expected from the provision of outage detection functionality. The rationale is detailed in section F of this IA and the updated assumptions are reflected below.

1. Reduction in customer minutes lost (CML):

This captures the customer benefit from reduced outages, because better information from smart meters will enable networks to better identify the nature, location and scope of an incident and to take the most appropriate reactive action, leading to quicker restoration times.

In order to calculate benefits we valued the estimated reduction in customer minutes lost (CML) with the average CML price incentive under the Distribution Price Control Review 5 (DPCR5), running from April 2010 to 2015. The CML incentive rate reflects distribution network customers' willingness to pay for quality of supply improvements with regards to a reduction in minutes lost. It also acts as one part of the overall interruptions incentive scheme for network companies to improve the quality of their service (the other part being the number of interruptions experienced). The distribution companies earn additional revenue if they beat their CML target (i.e. their CML for the year in question is lower than their target for that year) and suffer a reduction in revenue if performance exceeds their target. There are several methodologies available to estimate the value of quality of supply improvements to consumers, however as we are trying to establish the benefits to network operators, this figure seems the most appropriate in this case.

[35] Mott MacDonald, *Appraisal of costs and benefits of smart meter roll out options*, April 2008.

International evidence shows a large range of potentially achievable reductions in unserved energy, ranging from 5% to 35%. We have opted for a conservative estimate of 10% reduction of CML in our base scenario which results in an annual benefit of £0.35 per electricity meter. This reflects the uncertainty around potential differences between the UK and the countries where large benefits have been realised (e.g. higher population density and smaller geographical distances between customers might result in lower scope to reduce outage durations) and also takes into account the conservative estimate by ENA (who worked on the assumption of a reduction of 2% based on sample data by one DNO).

2. Reduction in operational costs to fix faults:

This captures operational savings to networks from being able to manage outages better, because with shorter restoration times and better knowledge of a likely cause technical crews can be deployed more efficiently and in a more targeted manner.

DECC has received information from Ofgem detailing the total costs of resolving low voltage faults to network operators in 2008 / 2009, translating into an approximate cost of £2400 per fault restoration. For this analysis we have assumed that these costs could be lowered by 10% in line with the reduction in CML, based on the rationale that quicker restoration of outages will also result in more efficient utilisation of technical crew. We therefore assume that wages and staff time are the main driver of the costs to fix faults – this approach ignores costs reductions in equipment and material. The benefit to network operators accrues to £0.66 per electricity meter per annum.

3. Reduction in calls to faults and emergencies lines:

In the long run customers will be confident that networks are aware of outages due to smart meter information. In the short run we envisage a reduction in the number of calls that need to be answered by the introduction of automated messages that inform callers of the geographic scope and expected restoration time, facilitated by more accurate information from smart meters.

International evidence suggests that the number of calls that have to be answered by networks in regards to outages can be reduced by up to 60%. Over time customers will develop trust in the ability of networks to detect outages through the functionality provided by smart meters and without them calling in to provide notification, enabling very thin network operator call centre operations.

Through Ofgem's telephony incentive DECC has been able to access information on the total annual number and cost of calls to network operators in the UK. For the base scenario we have made a conservative assumption of a reduction of 15%, which results in annual benefits of £0.12 per electricity meter.

- Other electricity network benefits

1. Better informed investment decisions for electricity network enforcement

One area of difference between the domestic and the non-domestic analysis are benefits from better informed investment decisions. As these are realised across the whole electricity network infrastructure, the decision has been taken to accredit them to the domestic side of the analysis only, to reflect that the full picture of investment requirement can only be established under consideration of both domestic and non-domestic demand and to avoid double-counting.

2. Avoided cost of investigation of customer complaints about voltage quality of supply[36]

[36] While the benefit of better informed investment decisions is subject to the same assumption of critical mass that is outlined in Annex 1, the argument can be made that the avoided costs for investigating voltage complaints is not dependent on a critical mass and will be realised for the proportion of premises where a smart meter has been installed. For modelling purposes we have therefore translated the identified benefits from voltage investigation into per meter benefits and linked them to the rollout profile.

With smart meters electricity network operators will be able to monitor voltage remotely, removing the need to visit premises to investigate voltage complaints.
Information collected by Ofgem indicates the total number of notifications that require a visit to the premises. For the base scenario we have used a cost per visit of £1,000, reflecting a significantly reduced figure of the cost per fault (see outage management benefits). The estimate is based on the costs of resolving a fault to network operators, which is on average around £2,400 but will involve locating the issue, which is not the case for voltage investigations. A voltage investigation will generally also not require multiple staff to be dispatched, providing additional reason to discount the fault cost. We assume that such visits would be redundant in the future as voltage can be monitored remotely.

The resulting benefit is £0.14 per electricity meter per year.

- Non-quantified benefits

There are also benefits which we are unable to quantify at this stage, but which will result in operational savings to Network Operators and a reduction in outage times.
One area of operational savings to Network Operators will arise from the ability to check the energisation status of a meter. This will allow them to check whether a reported loss of supply is due to an issue within the consumer's premise rather than with the network (e.g. a blown fuse). Network Operators can thereby avoid unnecessary callouts where customer issues are unrelated to the network.

Energy demand shift

A time of use tariff (ToU) uses different prices depending on the time of day in order to incentivise consumers to shift their energy consumption from peak to off-peak times, in doing so flattening the load demand curve. Smart meters make this type of tariff possible by recording the time when electricity is used, and potentially informing consumers of changes in prices.

Our underlying assumptions on Time of Use (ToU) pricing have not been revised from the March 2011 IA. For SMEs, EA Technology[37] estimate bottom up SME discretionary load to be around 21%, based on heating and cooling demands. Due to a lack of available studies and data, the take up of TOU tariffs and proportion of discretionary load shifted is initially assumed to be the same as in the domestic sector.

We assume that 20% of SME customers will take-up ToU tariffs. Similarly all non-domestic assumptions with regards to a change in the amount of shifted load through time are in line with the domestic smart meter analysis.

UK-wide benefits

DECC has also valued the avoided costs of carbon delivered from the savings of energy through smart meters[38], in line with current government guidance[39]. The analysis for the non-domestic sector parallels the analysis conducted for the domestic sector.

Non-quantified benefits

As for the domestic sector, It has been possible to make a quantitative assessment of the benefits described above within the updated modelling for the August 2011 IA. However there remains an important and substantive subset of benefits where the existence of smart metering will facilitate the uptake or management of new services or enable new, smart approaches to energy supply and grid management– especially in the medium to longer term. These remain not quantified[40] but are key elements of benefit from the rollout.

This assumes that each household within the system has the same probability of experiencing voltage issues and the same probability of having received a smart meter.

37 EA Technology, p38.

38 DECC has not netted off the carbon emissions embodied in production and transportation metering equipment. The analysis does not take account of life cycle carbon emissions.

39 http://www.decc.gov.uk/en/content/cms/statistics/analysts_group/analysts_group.aspx.

40 This is with the exception of the reduction in network losses enabled by smart meters, which we have quantified, As smart meters will enhance fraud detection and loss management capability we expect it to be in network operators' interests to minimise costs arising from losses directly as a result of the smart meters roll-out.

Enabling a Smarter Grid

A smart grid can be seen as an electricity power system that intelligently integrates the actions of all users connected to it – generators, suppliers, and those that do both – in order to deliver sustainable, economic, and secure electricity supplies and support the transition to a low carbon economy[41].

This involves the use of communication technology to deliver more dynamic real time flows of network information and more interaction between suppliers and consumers, helping to deliver electricity more efficiently and reliably from a more complex network of generators than today. This would include the ability to manage fluctuations in supply from intermittent renewables generation.

Smart meters are a key component in the creation of a UK 'smart grid', providing information to improve network management (subject to data, privacy and access controls), facilitating demand shifting, and supporting distributed energy generation. The smart meter functionality minimum requirements have been developed to accommodate these future smart grid considerations.

Although potential benefits to GB from a smarter grid are likely to be significant in the long term, it is difficult at this stage to estimate these with confidence, and we have not attempted to attribute any smart grid related benefits in the smart meters cost benefit analysis.

There have been a number of attempts to quantify potential benefits arising from a smarter grid.[42] Accenture has carried out cost benefit analysis of smart grid investments on behalf of DECC and the ENSG (Electricity Networks Strategy Group), and found a positive business case for smart grid investments[43]. Although there is no single smart grid 'solution', the analysis considers one possible 'path', adopting a two phase approach to take into account the considerable uncertainty post 2020. Phase 1 considers the period 2010-2020 and is found to have an NPV of £1.5bn. This involves investments in smart meters on distribution transformers, direct control equipment, smart appliances and IT; benefits arise due to demand response and system optimisation, reduced need for network reinforcements, lower predictive maintenance, distributed generation, and reduced technical losses and customer minutes lost. Phase 2 (2020-2050) is estimated to have an NPV of £2.6bn. This would include investments in substation automation and enhanced communications; benefits are expected from greater use of demand side management (due to higher assumed levels of heat pumps and electric vehicles) as well as from more cost-effective management of distributed energy resources.

The Energy Networks Association (ENA) and Imperial College have estimated the potential network benefits from Smart Meters due to demand side management at between £0.5 - £10bn NPV from 2020 - 2030.[44] Their analysis assumes that meeting the Government's emissions and renewables targets would lead to higher peak loads of up to 92% due to the electrification of transport and heating (electric vehicles and heat pumps) under a business as usual scenario, requiring more investment in network reinforcement infrastructure to accommodate this. By optimising electric vehicle charging and the use of heat pumps and smart appliances (by shifting towards off-peak times), the peak increase would only be 29%. This would bring significant benefits due to reductions in the network reinforcement costs required: under a 10% penetration of Electric Vehicles and Heat Pumps scenario, the NPV value of smart-meter enabled active control is estimated at £0.5 - £1.6bn, from 2020 - 2030. Other scenarios involving greater levels of heat pumps and electric vehicles could yield benefits of up to £10bn.

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[41] Electricity Networks Strategy Group (ENSG) (2009) 'A Smart Grid Vision' .http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/network/smart_grid/smart_grid.aspx.

[42] DECC does not necessarily endorse these, and emphasises the uncertainty surrounding a future smart grid.

[43] http://webarchive.nationalarchives.gov.uk/20100919181607/http:/www.ensg.gov.uk/assets/ensg_smart_grid_wg_smart_grid_vision_final_issue_1.pdf.

[44] ENA and Imperial College London (2010) ' Benefits of Advanced Smart Metering for Demand Response based Control of Distribution Networks.

Competition
It has been argued that the introduction of smart meters will have an effect on the competitive pressure within energy supply markets – in particular because smart meter reads providing accurate and reliable data flows will support easier and quicker switching between suppliers. In addition the information on energy consumption provided to consumers via displays will enable them to seek out better tariff deals, switch suppliers and therefore drive prices down. In addition the improved availability of information should create opportunities for energy services companies to enter the domestic and smaller business markets; and for other services to be developed, for example new tariff packages and energy services. Overall smart meters should enhance the operation of the competitive market by improving performance and the consumer experience, encouraging suppliers' (and others) innovation and consumer participation.

While we judge that greater levels of competition may result in lower prices, it is difficult to quantify these competition-related reductions and therefore no attempt has been made to quantify these in this IA. A competition Assessment is included in the Specific Impact Tests section at the end of this document.

Future energy products
It is likely that suppliers will profit from selling new energy products as a result of smart meters. This revenue could be of the order of £100m or more per annum from 2020. This will probably represent a benefit to suppliers only, not to society, as it is unlikely that the profits from these products will be passed onto consumers. We are currently unable to estimate the consumer benefit from these new products, therefore, to avoid a biased adjustment of estimates we have excluded the expected supplier profits from the analysis reported in this IA.

Enabled benefits to wider society

Energy consumers might benefit from the increase in consumption information available through smart meters by being able to have access to detailed appliance diagnostics. By identifying individual energy use such diagnostics could help to identify those appliances where investment in more efficient models would be economical. Other areas of potential benefits include more refined automation of heating and hot water controls and the analysis of heating patterns through the availability of detailed energy consumption data.

It has also been suggested that smart metering might contribute to addressing some of the challenges facing the UK's ageing society and that the health system could realise savings through the availability of real time smart meter energy consumption information. Patients requiring care might be enabled to remain in the familiar surroundings of their own home for longer by using tele-care systems and granting family members or carers access to their energy consumption information in real time. This way, if unexpected consumption patterns are detected (for example no increase in energy consumption for cooking at meal times; no changes in level of consumption over extended periods of time) appropriate steps can be taken. By enabling to delay the transfer of patients / elderly into full time care, considerable savings to the healthcare system could result.

6. Rollout profile

The rollout profile for smart meters in the non-domestic sector is assumed to be the same as for domestic customers. Anecdotal evidence indicates that in practice energy suppliers may decide to prioritise non-domestic installations. This would result in an increase in the net present value of the non-domestic rollout. Additionally, by the nature of the exceptions regime for advanced metering, a high percentage of advanced metering assumed in this IA is likely to be installed by April 2014.

For the modelling of the monetised impacts of the options considered in this IA, we continue to use the central scenario as was applied in the March IA. Through the consultation Government is seeking views on the advantages and potential risks and costs of setting the completion date for the roll-out earlier or later in 2019. We are keen to receive further evidence from stakeholders on this point before confirming a final completion date in suppliers' licences.

In order to allow modelling of costs and benefits, we have stylised the rollout period in four distinct stages. In each stage, assumptions have been made in regards to the rollout strategy of individual energy suppliers. This has been informed by extensive information and data gathering, and individual interviews with energy suppliers over the course of the consultation period and beyond.

The latest Programme timeline indicates that the full DCC will be offering services from the end of Q1 2014.

1) Early movers (present to Q3 2012)

In this period some suppliers will be rolling out volumes and most will be carrying out trials. The consumer may be offered a smart meter, but if the consumer subsequently switches supplier, there is a high risk that smart functionality is lost as the incoming supplier may be unable to support the technical configuration.

A modelling assumption is made that 50% of meters installed in this period will not be compliant.

2) Commercial and technical interoperability (Q4 2012 – Q2 2014)

Suppliers will have access to compliant meters as bulk supply of compliant smart equipment is available. This may happen as early as Q2 2012 for some energy suppliers. We also assume that from this point in time there are no constraints on availability of trained field staff and safe harbour on communications is offered. Rollout volumes in this period and smart-readiness of internal systems are driven by energy suppliers commercial strategies. Full and automatic technical interoperability will not be available until the establishment of the DCC. However, from Q4 2012, as in the domestic sector, suppliers are likely increasingly to be able to use meters in smart mode on change of supplier, and to be incentivised to do so.

3) DCC establishment (from Q2 2014)

Maximum deployment rates are achieved 6 months after the establishment of the DCC and there are no constraints on the volumes of communications services that the DCC can offer. Such peak volumes are extended until 10% of the customer base is reached.

4) Ramp down

This is reached when individual suppliers reach the final 10% of installations as a proportion of customer base is assumed to be hard-to-reach due to a range of customer and technical elements: long term vacant premises, repeated customer no access, lack of standard communication coverage and site specific safety issues.

A great deal of uncertainty remains as to the nature and extent of the rollout tail. Information provided by energy suppliers indicates that it could take three years to complete smart meters installations to their hard-to-reach customer base. For modelling purposes, we assume that the yearly distribution of installations in the tail within these last three years is of 6%, 3% and 1% respectively. This reflects increasing complexity in resolving the most difficult customer and technical elements of the rollout.

7. Results

The results below are produced by running a cost benefit estimation model using the assumptions outlined above. Within the model, the upfront costs are annuitised over either the lifetime of the asset or over the period 2011-2030. The cost numbers are risk-adjusted, i.e. they have been adjusted for optimism bias (see section H on risk). We have applied sensitivity analysis to benefits and we present benefits in terms of low, central and high scenarios. Tables

14 and 15 show the impact of smart meters on energy bills of non-domestic customers. This builds on existing DECC modelling on energy prices to estimate the impact on domestic energy bills in cash terms of the deployment of smart meters.

The base year of the analysis is 2011. The price values are nevertheless still based on a 2009 basis (for example, energy prices are based on 2009 to reflect the latest available price data from the Interdepartmental Analysts Group guidance[45]).

As outlined in section E, the March IA overestimated some of the network benefits for the non-domestic sector. Addressing the underlying issue in the cost benefit model results in a reduction of the benefits by £59m. The changes to the march IA outlined in the following tables should be considered with this in mind.

Table 10: Total costs and benefits

	Total Costs £bn	**Total Benefits £bn**	**Net Present Value £bn**
August 2011 IA	0.604	2,759	2,154
March 2011 IA	0.574	2.822	2.248

Table 11: consumer and supplier benefits

	Consumer Benefits £bn	**Suppliers Benefits £bn**	**UK-wide Benefits £bn**	**Total Benefits £bn**
August 2011 IA	1.629	0.446	0.535	2.759
March 2011 IA	1.629	0.658	0.535	2.822

Table 12: low, central, and high estimates

	Total Costs £bn	**Total Benefits £bn**			**Net Present Value £bn**		
		Low	**Central**	High	Low	**Central**	High
August 2011 IA	0.604	1.980	2.759	3.535	1.375	2.154	2.932
March 2011 IA	0.574	2.013	2.822	3.662	1.438	2.248	3.089

Table 13: benefits

	Consumer Benefits £bn			**Business Benefits £bn**			**UK-wide Benefits £bn**		
	L	**C**	H	L	**C**	H	L	**C**	H
August 2011 IA	1.062	1.629	2.169	0.536	0.595	0.674	0.382	0.535	0.692
March 2011 IA	1.062	1.629	2.169	0.568	0.658	0.800	0.382	0.535	0.692

The modelling results show that our central estimates for costs of the rollout have increased since March 2011. Benefits show a decrease, but this stems from a combination of a decrease due to the resolution of the previous overestimation of network benefits in the March IA and an increase due to a revision of the outage management benefits through outage detection functionality. In the SME sector, the changes lead to an aggregate decrease in NPV of £94m.

[45] http://www.decc.gov.uk/en/content/cms/statistics/analysts_group/analysts_group.aspx

The benefit-cost ratio, which is a good indicator of the cost-effectiveness of the policy, slightly decreases at from 4.8 to 4.6 in central scenarios, 6.2 to 5.9 in the high scenario and remains constant at 3.3 in the low case scenario[46].

The programme has also carried out an exercise to determine the net effect of smart meters on businesses across both the domestic and the non-domestic parts of the policy, establishing that the overall impact on businesses is positive, i.e. benefits outweigh the costs. While costs to business total £11.8bn in present value terms, business benefits of £12.6bn result in a net present benefit to businesses of £840m. This approach has been agreed with the Better Regulation Executive.

Distributional impacts

Impacts of smart/advanced meters on SME energy bills

The costs to energy suppliers will be recovered through higher energy prices, although we assume that any benefits to suppliers will also be passed on to SME consumers[47]. This increase in price will result in higher energy bills. However, the reduction in energy consumption from smart meters will counteract this impact, leading, on average, to a net decrease in energy bills. The results below show the average impact on SME energy bills. It is possible there will be some variation between SMEs depending on the level of energy they save and on how suppliers decide to pass through costs to SMEs. For the purposes of our analysis we have assumed that on average energy suppliers will pass down to SMEs the average additional cost of installing smart/advanced meters.

The bill impact for SMEs is shown in Table 14, with substantial reductions in energy bills from the first year of the rollout It is important to note that prices are expressed in nominal terms, hence not being discounted by the opportunity cost of time.

Table 14: Impact on SMEs energy bills for a dual fuel customer (preferred policy option)

Year	Impact on gas bill	Impact on electricity bill
2012	-4	-2
2013	-8	-4
2014	-15	-5
2015	-29	-9
2016	-47	-16
2017	-66	-22
2018	-84	-30
2019	-96	-36
2020	-103	-40
2021	-108	-42
2022	-111	-44
2023	-114	-46
2024	-117	-49
2025	-121	-59
2026	-124	-66
2027	-127	-68
2028	-131	-71
2029	-135	-72
2030	-137	-74

[46] As for the change in NPV, the decrease in benefit-cost ratio stems from a combination of a decrease due to the resolution of the previous overestimation of network benefits in the March IA and an increase due to a revision of the outage management benefits through outage detection functionality.

[47] For this analysis we have assumed that suppliers, networks and generation businesses pass 100% of the additional costs and benefits on to consumers.

The price impacts of smart meters in the SMEs sector are detailed in Table 15 below. It is important to note that even though the price impact per unit of energy is expected to be positive for a number of years, the reduction in energy consumption arising from the policy will mean that overall the average net impact on bills will be negative from year one.

Furthermore, price impacts are projected to become negative from 2023 since the savings to suppliers - for example from avoided meter reading and site visits, lower customer overheads and debt handling costs - will lead to suppliers lowering prices, despite having to pay for smart meters. Note that the vast majority of meters will be installed by 2020 and the installation cost will fall substantially from then whilst the benefits continue.

Table 15: Price impacts on SMEs– all smart and advanced meters

£/MWh	Gas price impacts	Electricity price impacts
2012	-0.01	-0.03
2013	-0.02	-0.06
2014	0.04	0.11
2015	0.12	0.36
2016	0.15	0.46
2017	0.18	0.56
2018	0.16	0.50
2019	0.10	0.32
2020	0.07	0.21
2021	0.04	0.11
2022	0.02	0.05
2023	-0.01	-0.03
2024	-0.03	-0.09
2025	-0.05	-0.16
2026	-0.07	-0.23
2027	-0.09	-0.28
2028	-0.11	-0.34
2029	-0.13	-0.39
2030	-0.14	-0.44

As outlined in the assumptions section, we assume a flat energy baseline for non-domestic organisations.

Stranding

Stranding costs are incurred when a meter is taken out before the end of its expected economic life. Stranding costs are the costs incurred when a meter is taken out before the end of its expected economic life. This does not include the costs of removing old meters and installing new meters, but includes the costs from an accelerated depreciation of the asset (i.e. reduced length of the meter's life). This cost depends on the speed of a rollout; we assume it would be avoided in a new and replacement scenario, but that costs would occur in a 10-year or shorter rollout option (the basic meter life span is 20 years). To assess the impact of the different options, we have made some simple assumptions with respect to stranding. These are as follows:

- meter asset value is based on the replacement cost of a basic meter;
- for assets provided by commercial meter operators, the stranding costs include a profit margin and annuitised installation costs since these are included in the annual meter charge;
- no installation costs are included for meters provided by DNOs since installation is paid upfront by suppliers;
- stranding costs for National Grid provided meters include 50% of annuitised installation costs to reflect the fact that prior to 2000 installation costs were annuitised in the meter charges, whereas after 2000 installation was paid up-front;
- meter recertification continues during the deployment period.

Under both options we estimate stranding costs of £90m present value.

The total stranding costs over the period of a specific smart meter rollout profile should be the same regardless of the order of meter replacement. Whilst specific contractual relationships between suppliers and meter operators may influence behaviours to an extent, we assume for the economic evaluation that there is no attempt to minimise stranding costs in the early years of the rollout by replacing older meters first. Hence we assume that the age of the meters replaced (outside of the recertification Programme) is the average age of legacy meters remaining in each year.

H. Risks

<u>Costs: Risk Mitigation and Optimism Bias[48]</u>

The rollout of smart meters will be a major procurement and delivery exercise. The project will span several years and will present a major challenge in both technical and logistical terms.

There is a consensus that stakeholders do not explicitly make allowances for optimism bias in the estimates they provide for procurement exercises. By calling for pre-tender quotes for various pieces of equipment, suppliers are revealing the likely costs of the elements of smart metering and hence no further adjustment is necessary. However, historically, major infrastructure and IT contracts have often been affected by over–optimism and gone substantially over-budget, so we have adjusted the estimates for optimism bias, in line with guidance from HMT's Green Book.

The optimism changes adopted in the present non-domestic IA are shared with the domestic IA and detail of such changes can be found in that IA.

<u>Table 16: Optimism bias factors</u>

	Optimism bias factor
IHD	15%
Smart meter	15%
Outage detection	150%
WAN CAPEX	10%
WAN OPEX	10%
HAN	15%
Installation	10%
Commercial risk	10%

More detail on optimism bias and how it is applied can be found on the Treasury website in the Green Book guidance[49].

[48] Baringa Partners, *Smart Meter Roll Out: Risk and Optimism Bias Project*, 2009.
[49] http://www.hm-treasury.gov.uk/economic_data_and_tools/greenbook/data_greenbook_supguidance.cfm#optimism.

Benefits: sensitivity analysis

No sensitivity analysis was made for costs as it was felt that the risks for costs were covered by the optimism bias. We ran the following sensitivities on the benefits:

Table 17: Sensitivity analysis for benefits

	Low benefits	Central benefits	High benefits
Consumer benefits			
Energy savings electricity	1.5%	2.8%	4.0%
Energy savings gas	3.5%	4.5%	5.5%
Business benefits			
Supplier benefits			
Avoided site visit	underlying visit cost + 8%	underlying visit cost	underlying visit cost - 8%
Call centre savings	£1.9	£2.2	£2.5
Reduced theft	5%	10%	15%
Network benefits			
Avoided investment from ToU	10%	20%	40%
Reduction in customer minutes lost	2%	10%	15%
Operational savings from fault fixing	2.5%	10%	15%
Better informed enforcement investment decisions	3%	5%	10%
Avoided investigation of voltage complaints	£500	£1,000	£1,493
Reduced outage notification calls	5%	15%	20%
Generation benefits			
Short run marginal cost savings from ToU	10%	20%	40%
Avoided investment from ToU (generation)	10%	20%	40%

The below table presents the impacts of the above sensitivity analysis in present value terms:

Table 18: present value impact of benefit sensitivity analysis

£m	Low benefits	Central benefits	High benefits
Consumer benefits			
Energy savings electricity	£330	£674	£992
Energy savings gas	£725	£948	£1,171
Business benefits			
Supplier benefits			
Avoided site visit	£227	£248	£269
Call centre savings	£53	£60	£68
Network benefits			
Avoided investment from ToU	£0	£1	£2
Reduction in customer minutes lost	£1	£3	£4
Operational savings from fault fixing	£1	£6	£8
Avoided investigation of voltage complaints	£0	£1	£1
Reduced outage notification calls	£0	£1	£1
Generation benefits			
Short run marginal cost savings from ToU	£14	£27	£54
Avoided investment from ToU (generation)	£10	£20	£39

Despite having previously received responses indicating a lower price for advanced electricity meters (around £120 rather than the assumed £247), we have retained our original cost assumption.

I. Enforcement

All of the options outlined in this IA would be implemented direct via licence obligations or through industry codes underpinned by licence obligations. New licence requirements would be enforced in the same manner as existing licence obligations – by Ofgem as the gas and electricity markets regulator. Ofgem has power to investigate any company which is found to be breaching the terms of their licence (including any consumer protection provisions) or is found to be acting anti-competitively. The Office of Fair Trading also has a range of other enforcement powers in respect of consumer protection (see the Consumer Protection annex to the Prospectus).

J. Recommendation – Next Steps

The Government is seeking views on the rollout strategy and the technical specifications, via the consultation document that this IA accompanies.

K. Implementation

The Implementation approach is described in the Government Response document which was published in March 2011.

L. Monitoring and Evaluation

The plan for managing and measuring benefits realisation will be developed alongside the detailed design for the smart meter solution. The objectives set out in section D will form the basis for the benefits realisation work.

It is envisaged that as the rollout progresses, particular attention will be paid to monitoring early behavioural responses to smart meters with the objective of feeding back any findings from this experience into the rollout process. This way, adjustments to the rollout Programme can be realised in order to maximise the benefits from the smart metering rollout.

Results from piloting schemes are also expected to feed into a better monitoring and evaluation of the rollout. This includes both previous pilots such as the EDRP, and piloting carried out during the Foundation stage.

Annexes

Annex 1 - Background

This Annex provides an overview and some background information over the smart metering system that is required to deliver the benefits identified in this IA. Three system components that are crucial to the delivery of the smart meters rollout are described below: section 1 provides an overview of the metering system functionality, section 2 on the Data Communications Company and section 3 on the rollout stages and strategy.

Section 1: The metering system functionality

This section sets out the high-level functional requirements for the smart metering system. This was presented in March and formed the basis for the work by industry to develop the technical specification. This "minimum" functionality will ensure that smart metering delivers the wide range of anticipated benefits. It should be noted that there are certain assumptions made about how the functionality is delivered.

This is restricted to a level that provides certainty on interoperability and that all functional and security requirements can be delivered. This includes: where the functionality resides (i.e. the smart metering equipment architecture); the communications protocols and languages (i.e. application layers); and certain hardware (e.g. switches/valves, displays, equipment form factors).

Table 1 below summarises the high level functionality that we consider should comprise the electricity and gas smart metering equipment and the underpinning capabilities these are expected to provide. The Prospectus Response supporting Design Requirements document and updated Functional Requirements Catalogue published alongside the March 2011 IA provided specific details on the minimum functional specifications of the meter.

Table 1: Functionality of metering system

	High level functionality	Electricity	Gas
A	Remote provision of accurate reads/information for defined time periods • delivery of information to customers, suppliers and other designated market organisation	✓	✓
B	Two way communications to the meter system • communications between the meter and energy supplier or other designated market organisation • upload and download data through a link to the wide area network, transfer data at defined periods, remote configuration and diagnostics, software and firmware changes	✓	✓
C	Home area network based on open standards and protocols • provide "real time" information to an in-home display [50] • enable other devices to link to the meter system	✓	✓
D	Support for a range of time of use tariffs • multiple registers within the meter for billing purposes	✓	✓
E	Load management capability to deliver demand side management • ability to remotely control electricity load for more	✓	

[50] Domestic only.

	sophisticated control of devices in the home		
F	Remote disablement and enablement of supply • support remote switching between credit and prepayment modes	✓	✓ [51]
G	Exported electricity measurement • measure net export	✓	
H	Capacity to communicate with a measurement device within a microgenerator • receive, store, communicate total generation for billing	✓	

For gas and electricity it is judged that this level of functionality will deliver the policy objectives and benefits anticipated for smart metering across consumers, suppliers, networks and the environment. In addition for electricity this level of functionality aligns with wider policy developments around renewables, microgeneration, electric vehicles and smart grids.

The Prospectus and Statement of Design Requirements supporting document[52] described in further detail the functional requirements and associated services for the smart metering system. These have been further refined through the period of the Prospectus consultation to form the basis for the meter design supporting document published in March 2011, on the basis of which working groups reporting to the Smart Metering Design Group (SMDG) have developed the draft technical specifications published on 4 August 2011.

In translating the functional requirements into technical specifications a number of areas have been identified where multiple options to achieving the functionality exist. The programme has formed initial views on the options and it is seeking further views and evidence through the consultation published alongside this IA.

Below are described the relevant areas that need to be considered for the functionality of the smart metering system.

Displays and provision of information: consumer engagement and action to save energy is central to the benefits case for smart metering. Access to the consumption data in real time provided by smart meters combined with appropriate advice and support will provide consumers with the information they need to take informed action to save energy and carbon. The Government believes that free-standing in home displays (IHDs) which provide real-time, near-instant feedback on consumption (in terms of energy, money or CO2) can help to raise consumers' awareness of the energy they use and how savings can be made. The Government Response and supporting documents set out the specification and regulatory arrangements for providing IHDs to consumers which provide information on both gas and electricity use.

Interoperability: competition in the supply of gas and electricity requires that customers can easily switch to their chosen supplier. If not all smart meters are interoperable it may not be possible for an energy supplier to read the data from a meter installed by another supplier. It is important to note that interoperability is not an issue with traditional meters as any meter can be manually read by any supplier. In addition to ensuring benefits are gained, the framework of functional requirements will provide a first step towards ensuring interoperability in metering systems. If the metering systems used by different suppliers are interoperable, smart meters will also make an important contribution to ensuring that the switching process can be quicker and more reliable. Suppliers will be able to comply with their licence obligations and can retrieve data from all meters without having to visit premises or change a meter or other equipment.

In addition to a specification of the minimum functionality of the metering system, the achievement of interoperability will require adherence to open data and communications protocols and is likely to be underpinned by a range of more detailed industry standards, preferably developed at an EU-wide level. In the period preceding availability of DCC services, interim interoperability arrangements will allow customer switching suppliers without the need to visit the premise or replace smart metering assets or communications.

[51] Domestic only.
[52] http://www.decc.gov.uk/en/content/cms/consultations/smart_mtr_imp/smart_mtr_imp.aspx.

Section 2: Communications infrastructure and the Data and Communications Company (DCC)

Smart metering requires a suitable communications platform over which data can be securely transmitted. In addition ad hoc remote configuration and diagnostics, software and firmware changes should be able to be made remotely.

The rollout of smart meters presents an opportunity for fundamental streamlining and efficiency improvements to existing gas and electricity industry processes and systems. In preparing the Prospectus Response Document, the Programme has analysed options for both the establishment of the DCC and for its initial scope[53].

There are a range of functions that might be included within the scope of the DCC. Three broad options have been considered as part of Phase 1 of the Programme:

- a “minimum DCC” option which would include secure communications and access control[54], translation[55] and scheduled data retrieval functions[56].

- Additionally to the “Minimum scope”, registration could be added to the remit of DCC, which would mean that DCC should assume responsibility for managing the supplier registration database that records the registered supplier for every meter point. Such function would facilitate the development of a streamlined dual-fuel change of supplier process.

- Also adding data processing and aggregation functions (for electricity) to the remit of the DCC. These services are currently performed by industry agents and involve the preparation of a meter point data for settlement. Central data storage could also be included in this option.

The analysis indicates that a positive economic case exists for the inclusion of registration within the scope of DCC. Information available also indicates that a positive business case may exist for the inclusion of data processing and aggregation. However a decision on the latter would need to be subject to further technical, economic and competition impacts analysis.

Decisions on the establishment and scope of DCC have an impact on the timing and scale of IT costs, as well as the cost savings that are achievable by streamlining current industry processes, particularly systems related to the switch of supplier process. Further information about the scope of the potential impacts is provided in the domestic IA.

Increasing the scope of the DCC further than a “minimum scope” may also increase the complexity of the establishment process, as a larger remit could delay the establishment of the first generation of services. An early establishment of DCC is key for ensuring that the rollout progresses adequately and that the benefits are realised.

The policy option chosen in the Prospectus Response strikes a balance between maximising the long term benefits and ensuring a rapid establishment of the DCC. The preferred establishment option of a parallel procurement option leads to the establishment of an operational DCC from the end of Q1 2014 with a “minimum scope”, with registration being added to the scope some time after. A decision on the inclusion of data processing and aggregation would need to be considered in the future.

[53] As outlined in section G, within the small and medium non-domestic sector it is voluntary to use the DCC.
[54] Secure two way communications with smart meters, enabling remote meter reading, meter diagnostics and other data communications.
[55] The conversion of different technical protocols to support inter-operability.
[56] Scheduling of the collection of meter readings and managing that process on behalf of suppliers and network operators.

Section 3: Rollout stages and strategy

In the Prospectus Response the Government concluded that obligations should be put on suppliers to complete the roll-out of smart meters by a specified date in 2019.

The Response set out a central case profile for completing the roll-out at the end of 2019, together with upper and lower bound scenarios for completing roll-out at the end of 2018 and 2020 respectively. It also identified a number of risks and uncertainties associated with accelerating the rollout. Setting the date earlier or later in 2019 may affect the risks and uncertainties, but evidence is not currently available to quantify or scale these risks with sufficient certainty to identify one particular completion date.

Since no new evidence regarding different rollout completion dates has come to light, the analysis remains unchanged to the March 2011 IA. All the options outlined in the summary sheets are based on the central rollout scenario, to reflect that Government continues to see value in an ambitious rollout timetable.

However, as stated above, through the consultation Government is seeking views on the advantages and potential risks and costs of setting the completion date for the roll-out earlier or later in 2019. We are keen to receive further evidence from stakeholders on this point before confirming a final completion date in suppliers' licences.

Ahead of the March publication, analysis of consultation responses, open letter submissions and bilateral meetings indicated that a large scale rollout before the establishment of the DCC could suppose a significant risk, as it is vital that sufficient time is spent upfront to prepare end-to-end systems and processes for a large volume rollout and ensure the customer experience is a successful one. The Evidence Base section sets out our assessment of the additional costs that could be incurred for those smart meter installations preceding the establishment of DCC.

Some suppliers are keen to progress with the installation of meters during this period and the regime will allow suppliers to do this with increasing degrees of certainty, while suppliers who face longer system change times will have flexibility to defer when they commence smart installations. This period is referred to as 'foundation stage' in this IA.

There are two key parameters that will determine how the mass rollout progresses:

1. Commencement of the mass rollout; and
2. Speed of mass rollout once this has started;

Together these allow the formation of a rollout profile.

a) <u>Commencement of mass rollout (Foundation Stage)</u>

Three factors are likely to influence when suppliers will commence rolling out smart meters at volume and therefore when an estimation of these costs and benefits should be modelled. These are:

- availability of a functional DCC (end Q1 2014);
- availability of the technical specification (meter and IHD functionality and certainty on communications standards) (Q2 2012, Q1 2013);
- the scope for an effective interim interoperability solution between these two dates

In order to establish the volumes of meters that can be rolled out previously to the mass rollout, the programme has carried out significant analysis on this phase fully involving a broad range of stakeholders.

The introduction of obligations and protections in relation to smart meter deployments before the DCC services are operational (see Prospectus Response Document) will allow and to some extent encourage installations to occur before the establishment of the first generation of DCC services. We have therefore modelled a range of different conceivable rollout volumes in this phase of the deployment (see page 41).

Before these obligations and commercial protections are introduced, some suppliers are already installing smart meters, at their own risk. One supplier has indicated that they will have installed substantial numbers of meters by the end of 2012. Other suppliers are proceeding with their own trials. We note that such activities remain at the suppliers' own risk but that as the Programme develops its work on functionality and communications the likelihood of suppliers' smart meter installations being compliant with the final requirements will increase. The installation of meters will also mean that costs and benefits are being incurred. It seems sensible then to apply a small percentage to our profile for smart meters being installed in advance of the mandated rollout and count both the costs and benefits in the profile. In the absence of certainty over the number of pre-mandated rollout installations that would remain compliant we have applied an assumption, for modelling purposes, that 50% of meters installed would be compliant to allow us to develop a profile.

b) Speed of Rollout (Mass rollout)

Previous modelling had assumed a maximum rollout averaging around 17% of meters in any one year, which is over three times the current annual installation rate. DECC and Ofgem further considered the speed of rollout to understand the implications of applying a more aggressive profile to the rollout model. Evidence provided by energy suppliers and meter manufacturers, complemented by analysis of the workforce needs carried out by the National Skills Academy of Power on the course of this process suggests that moderately higher peak installation rates than previously assumed are possible with a negligible impact on costs and risks. There is a risk that a more substantial increase in the peak installation rate may cause a more material impact on the net present value and increase the risks incurred during the rollout.

These risks include overall installation targets not being achieved; a reduction in installation quality; heightened risk of operational incidents; and social costs from a steep ramp down, as large numbers of similarly qualified workers could lose their jobs over a short period of time. Importantly, it could also result in a reduction in the time being spent on customer engagement which is an important driver of the benefits case.

These inherent uncertainties constrain the efforts to capture the relative degrees of risks and impact on net present value between the high and low case. For modelling purposes our central scenario assumes only somewhat higher peak installation rates than in the July 2010 IA, to the extent that the available evidence indicates this would not have a significant impact on the costs and risks of the rollout.

We also looked at the international experience in order to draw lessons for the GB rollout. However a direct comparison is difficult, as the GB rollout is more ambitious in terms of covering both fuels, and by requiring important consumer engagement at the point of installation. International experience shows in general that large-scale pilots typically run for a period of 2-3 years in advance of mass deployment, followed by five-year timescales for the mass rollout of tens of millions of single fuel smart, with peak deployment levels at comparable levels to the proposals for GB in most countries.

The Evidence Base section sets out in more detail the assumptions made, the different scenarios considered, and the factors that would impact on costs and benefits with faster installation rates. We were able to quantify some of the risks from faster installation rates as we move from the lower bound to the higher bound scenario, however we were not able to quantify many of the risks outlined above. The scope of the potential impact is further outlined in the domestic IA.

c) Rollout strategy and consumer engagement

In the early stages of the rollout energy suppliers will manage and be responsible for the deployment of smart meters to their customers. A review process in the early stages of the rollout will consider whether this approach is maximising the overall benefits and supporting broader policy objectives.

The programme has worked with stakeholders to identify potential mechanisms to promote consumer engagement. This has identified the likely need for some consumer engagement activities to be carried out on a coordinated basis. Such an approach could be important both to promote general consumer awareness and confidence and to enable all consumers to access the potential benefits of smart metering. Further work will be carried out in the phase 2 to develop an overarching consumer engagement strategy. This will include analysis to determine the appropriate objectives, scope, governance and funding arrangements for any coordinated activities. It will also include further investigation of initiatives to promote engagement, such as activities to build consumer knowledge and awareness, and how the programme could assist particular consumer groups such as the vulnerable

Annex 2 - Base assumptions and changes made

The table below sets out changes that have been made to the base assumptions on costs and benefits since the March 2011 IA. The basis for the change is also identified.

Costs

Item	Assumptions	Rationale for changes
Cost of Meters	Electricity meter costs have decreased by £1 per meter	Costs have been decreased in order to reflect that the outage detection components have been moved into the communications equipment
Cost of Meters	Electricity meter costs have increased by £1.1 per meter	Costs have been increased in order to reflect the preferred option of ensuring an independently replaceable WAN transceiver
Cost of HANs	For all HANs a cost of £2.5 is assumed	Cost have been updated from previously £3 (gas HAN) and £1 (electricity HAN) in light of additional evidence from industry
Cost of communications infrastructure	Communications Hub costs have increased by £4 to reflect the addition of a gas mirror component	Components previously not considered have been added in light of detailed technical work in this phase
Cost of communications infrastructure	Communications Hub costs have increased by £2 to reflect the addition of a power supply unit	Components previously not considered have been added in light of detailed technical work in this phase
Cost of communications infrastructure	Communications Hub costs have increased by £2.5 to reflect the addition of a third HAN within the Communications Hub	Costs have been increased in order to reflect the preferred option of ensuring an independently replaceable WAN transceiver
Cost of communications infrastructure	Communications Hub costs have decreased by £4 to reflect that the meter HANs previously assumed are already captured by the meter costs	A breakdown of meter component costs has brought to light that the meters already include a HAN for the electricity meter and the gas meter each and that considering them within the communications infrastructure as well would be double counting
Cost of communications infrastructure	Communications Hub costs have been increased by £1 to reflect the location of the outage detection functionality	The outage detection component will be physically located within the communications equipment.
Outage detection optimism bias	The optimism bias for the component cost has been increased from 15% to 150%	In light of the uncertainty about the component costs the optimism bias uplift has been increased

Benefits

Item	Assumptions	Rationale for changes
Better Outage Management - Reduction in Customer Minutes Lost	In light of the outage detection functionality this benefit has been increased from £46m to £69m	Benefit of better information from smart meters will enable networks to better identify the nature, location and scope of an incident and to take the most appropriate reactive action, leading to quicker restoration times.
Better Outage Management - Operational savings fault fixing	In light of the outage detection functionality this benefit has been increased from £86m to £129m	With shorter restoration times technical crew can be utilised more efficiently and with better knowledge of a likely cause of an issue teams can be deployed in a more targeted manner.
Better Outage Management - Reduced calls	In light of the outage detection functionality this benefit has been increased from £21m to £31m	Customers will be confident that networks are aware of outages due to smart meter information.

Annex 3 - Detailed results

Below are the detailed results from the model (in £million) for the central case scenario of preferred option 3a – Separate Communications Hub with fixed WAN transceiver:

Total costs		**604**
	Capital	263
	Installation	96
	O&M	39
	Comms upfront	91
	Comms O&M	93
	Energy	28
	Disposal	3
	Pavement reading inefficiency	- 8
	Supplier IT	-
	Central IT	-
	Industry IT	-
	Industry Set Up	-
	Marketing	-
	Integrate early meters into DCC	-
NPV		***2,154***
	(Stranding costs	090)

Total Benefits		**2,759**
Consumer benefits		1,629
	Energy saving	1,622
	Microgeneration	7
Business benefits	Supplier benefits	446
	Avoided site visits	248
	Inbound enquiries	51
	Customer service overheads	9
	Debt handling	51
	Avoided PPM COS premium	-
	Remote (dis)connection	7
	Reduced theft	-
	Customer switching	80
	Network benefits	101
	Reduced losses	90
	Avoided investment from ToU (distribution/transmission)	1
	Reduction in customer minutes lost	3
	Operational savings from fault fixing	6
	Better informed enforcement investment decisions	-
	Avoided investigation of voltage complaints	1
	Reduced outage notification calls	1
	Generation benefits	47
	Short run marginal cost savings from ToU	27
	Avoided investment from ToU (generation)	20
UK-wide benefits		535
	Global CO_2 reduction	434
	EU ETS from energy reduction	84
	EU ETS from ToU	17

Annex 4 - Post Implementation Review (PIR) Plan

Basis of the review: The Department of Energy and Climate Change will ensure that the smart meters Programme is subject to a comprehensive and integrated review and evaluation process, both during the initial Foundation stage and towards the end of the main rollout – provisionally by 2018. The Secretary of State has powers that are likely to be extended until the end of 2018 for introducing regulatory requirements on suppliers regarding the rollout of smart meters

This process will meet a number of obligations, including Programme Management requirements (as set out in OGC guidance e.g. Managing Successful Programmes), policy commitments set out in the Government Response document, and to ensure evidence is available to help DECC maximise the benefits of the Programme and report on outcomes including Carbon reductions required under the Government's Carbon Plan.

There are planned to be two separate review processes:

1. A review of the roll out strategy to establish whether additional requirements should be placed on suppliers with regard to local coordination (the review of early rollout)

2. A Post Implementation Review (provisionally by 2018)

Review objective: The review of early rollout objective will be to identify whether suppliers' approaches to roll out are meeting the Government's overall objective to roll out smart meters in a cost-effective way, which optimises the benefits to consumers, suppliers and other parties and delivers environmental and other policy goals. At this point it has not been determined whether this review process will apply to non-domestic customers.

The PIR which will be carried out by DECC will take a broad perspective on the results of Government intervention and the results of the approaches taken to policy and benefits realisation, in order to feed back into the policy making process.

Review approach and rationale: The review of early rollout will consider the impacts of installations of smart meters on consumers, in particular in respect of the quality of the customer experience and changes to energy consumption, and the effectiveness of different approaches to roll out (for example the quality of communications and approaches to local coordination and community involvement). Consideration will be given to the impacts on different types of consumer, including the vulnerable. However it has not yet been decided whether impacts on non-domestic customers will be the subject of specific scrutiny.

The PIR will include evaluation of the impacts of smart metering on residential and non-domestic customer service benefits (e.g. ease of switching, availability and uptake of smart-enabled products and services), on industry costs and process simplification, on competition in relevant markets, including energy management products and services, and of the way that smart metering is enabling and supporting other policies e.g. Smart Grids and the Green Deal, as well as the evaluation of the impacts on energy consumption behaviour and customer experience of the rollout. The PIR has yet to be designed but is likely to draw on evidence from the Benefits Management Strategy (BMS) work, further research commissioned by DECC, stakeholder interviews and international comparisons.

Baseline: The comparison to be made is with the position prior to roll out. Baseline data will be collected as part of the evaluation plan and BMS work.

Success criteria: Quantitative targets will be set for all relevant benefits, including those described in this IA, as part of the BMS work as a basis for deciding whether the Programme objectives had been achieved. However the extent to which this will be done separately for non-domestic customers has not yet been determined.

Monitoring information arrangements:

Work to develop the requirements for the first stage of evaluation planning is currently in progress and will identify detailed requirements and options for the early rollout review. See domestic IA for the planned approach to collecting data as part of the first phase of implementation planning. It has not yet been decided how far these arrangements will apply to non-domestic customers. Measurement of other benefits and costs (e.g. network cost savings and support for smart grids, reduced supplier costs), will be carried out under the Programme Benefits Management Strategy (BMS) which is under development and will track benefits delivery. Benefits metrics for these will be developed as part of the BMS. Given the broad objectives of the Programme, a wide range of information will be required.

Where practicable, information would be collected from suppliers on a voluntary basis. Legislative powers are being taken under the Energy Bill currently before Parliament so that the Department will be able if necessary to require energy suppliers to provide information on matters relating to the rollout of smart meters for this purpose.

Consideration will be given to the potential interfaces between the Smart Meters monitoring and evaluation process and DECC's National Energy Efficiency Data framework.

Specific Impact Tests

Type of testing undertaken	*Results in Evidence Base? (Y/N)*	*Results annexed? (Y/N)*
1. Competition Assessment	No	Yes
2. Small Firms Impact Test	No	Yes
3. Legal Aid	No	Yes
4. Sustainable Development	No	Yes
5. Carbon Assessment	Yes	No
6. Other Environment	No	Yes
7. Health	No	Yes
8. Equality IA (race, disability and gender assessments)	No	Yes
9. Human Rights	No	Yes (see Consumer Protection Annex to Prospectus document)
10. Privacy and data	No	Yes (see Privacy and Security Annex to Prospectus document)
11. Rural Proofing	No	Yes

Specific Impact Tests

1. Competition assessment

Consumers
From a consumer point of view the introduction of smart meters will have an effect on the competitive pressure within energy supply markets – in particular because accurate and reliable data flows facilitate faster switching, encouraging consumers to seek out better deals, thereby driving prices down.

In addition, the improved availability of more accurate and timely information should create further opportunities for energy services companies to enter the smaller non-domestic market; and for other services to be developed, for example new tariff packages and energy services, including by third party providers. Overall, smart metering should enhance the operation of the competitive market by improving performance and the consumer experience, encouraging suppliers' and others' innovation and consumer participation.

Whilst these effects are difficult to quantify in terms of the overall IA it is important for the pro-competitive aspects to be considered going forward.

Industry
Great Britain is the geographical market affected by the rollout of smart meters. The products and services affected will be:
- gas and electricity supply;
- gas and electricity meters;

- provision of energy services (including information, controls, energy services contracting, demand side response) and smart homes
- meter ownership, provision and maintenance;
- other meter support services;
- gas and electricity network services;
- communications services.

In competition terms the rollout would therefore affect:

- gas and electricity suppliers;
- gas and electricity networks;
- meter manufacturers;
- meter owners, providers, operators and providers of ancillary services;
- energy services businesses and providers of smart home services;
- communications businesses.

The competition impact of the Data Communications Company (DCC).

There is an impact on competition through the establishment of the DCC.

DCC will be responsible for managing the procurement and contract management of data and communications services that will underpin the smart metering system. All domestic suppliers will be obliged to use the DCC. In the non-domestic sector, use of the DCC will be elective.

DCC will be a new licensed entity, which is granted an exclusive licence, through a competitive tender process for a fixed term. In effect the DCC would secure the communications services for a fixed period, locking-out competitors for that period. However, Ofgem will then be able to exert direct regulatory control over it to ensure that it applies its charging methodology in line with its licence obligations as well as regulating the quality and service levels delivered by the DCC.

Competition will be maximised within the model by re-tendering for services on a frequent basis, but a balance would need to be struck to take account of the length of contract needed to achieve efficiencies.

As non-domestic suppliers would not be obliged to use the DCC services, there would be continuing opportunity for suppliers and other metering and energy service providers to differentiate through delivery of communications systems as well as other aspects of their offerings. As metering service providers are particularly active in the current advanced metering market, the exceptions allowing continued installation of advanced metering until April 2014 (and, in some cases, thereafter) would help them continue to offer services and to innovate.

Where the DCC is used, centralised communications could lead to improved supplier competition as a result of making switching between suppliers easier. This is because many of the complexities involved in switching involving numerous stages could be stripped away, making the process simpler, shorter and more robust, resulting in a faster and more reliable consumer experience and thereby encouraging more consumers to switch.

The voluntary approach to the DCC could theoretically adversely affect competition because a customer could lose some smart functionality when switching supplier. However, as set out in the IA, we expect the overwhelming majority of smart meters to utilise DCC services. Where they do not, the Programme's approach to promoting technical and commercial interoperability will strongly incentivise gaining suppliers to offer smart services where meters meet the technical specification.

Speed of Rollout

One possibility is that smaller energy suppliers might be disadvantaged in a rollout by being unable to obtain equipment and services at the same cost and rate as larger suppliers, and that this would be exacerbated by a faster rollout. Similarly, if resources are scarce for all under a rollout (i.e. equipment and installers), small suppliers might feel a greater cost impact than larger suppliers due to the relative size of the increased costs in proportion to the size of the business. However, some of this may be mitigated by the more flexible approach for roll out to be applied to small suppliers.

2. Small Firms

There may be small firms affected by the domestic rollout in the areas of:

- gas and electricity purchase (customers)
- gas and electricity supply;
- meter manufacturing;
- meter operating and services;
- energy services and smart homes.

As part of the consultation on the Smart Metering Prospectus, the Smart Meter Programme sought and received the views of small business customers and their representatives, and of those who deal with this sector.

Small businesses and their representatives see particular benefits in timely and entirely accurate billing. Their concerns have included:

- costs that would be passed through to business during a rollout
- delivery of interoperability in the absence of mandatory use of the DCC
- cost transparency
- undue burdening of micro-businesses
- avoiding or minimising business disruption
- possible use of remote disconnection
- the need for thoroughgoing advice and support on use of the meters and on energy efficiency as a whole.

The Government has decided that suppliers should be required to accede to an approved installation Code of Practice governing the domestic sector. It has further decided that micro-businesses will be also be protected by a Code. We expect that both sectors would use the same core Code, with appropriate adjustments for micro-business customers. The customer engagement strategy, which will be developed during phase 2 of the Programme, will consider approaches to micro-businesses. In developing rules on disconnection in the light of early installation of smart meters by some suppliers, Ofgem considered whether these should also apply to the non-domestic market, but concluded that the proposed rules would not materially address small business concerns or add to existing protections. It will closely monitor disconnections in the non-domestic sector, and its consultation on the “Spring Package” enables non-domestic customers and their representatives to comment further on its proposals in this area, including coverage.

The IA indicates that there would be a net benefit from smart or advanced metering, but, to maximise the benefits, business will have to respond to the additional information provided by the new metering, for example, by changing energy-use patterns or taking energy efficiency measures. Help and clear guidance will help mitigate small businesses’ costs and increase benefits. In respect of information about use, the Government has decided that micro-businesses with smart meters will have access to data from smart meters on the same basis as domestic customers.

In terms of regulatory burden, responsibility for installing new metering rests with suppliers. There is, therefore, no new administrative burden on small business customers. The overwhelming majority of small firms are likely to receive domestic-style smart meters and, like domestic customers, will benefit from the economies of scale from a large-scale rollout of these meters. Advanced meters will tend to be installed at the sites of large users or multi-site organisations.

Previous consultations have assumed that climate change objectives, to which smart and advanced metering contribute, should not be compromised by exemptions for particular sectors of the market, including small firms. In fact, small firms using the meters can benefit from improving energy efficiency, thus reducing energy costs and defraying the costs of the meters themselves.

The competition test (above) notes that smaller energy suppliers might be disadvantaged in a rollout by being unable to obtain equipment and services at the same cost and rate as larger suppliers, and that this would be exacerbated by a faster rollout. Similarly, if resources are scarce for all under a rollout (i.e. equipment and installers), small suppliers might feel a greater cost impact than larger suppliers due to the relative size of the increased costs in proportion to the size of the business. However, some of this may be mitigated by the more flexible approach for roll out to be applied to small suppliers.

Most small suppliers provide either gas or electricity, but not both. One view is that as the volume of smart metering increases there will be an increase in the dual-fuel supply share of the market although this is already a trend that is being seen in the market. It is difficult to assess whether this will be the case – the view is based on the projections of the types of dual-fuel-related offerings that suppliers will make in a smart metering world and the popularity of these. It is possible that small suppliers could therefore be impacted negatively unless they are, or become, dual fuel suppliers.

More generally, smart metering is expected to provide new business models for energy services which may have relatively low entry costs and regulatory restrictions if they do not involve the licensed supply of energy. Experience in other areas e.g. Internet businesses show that small firms may be highly competitive in such areas. Decisions on the role of DCC and data protection and access arrangements will need to promote a level playing field for small firms.

3. Legal Aid

The proposals would not introduce new criminal sanctions or civil penalties for those eligible for legal aid, and would not therefore increase the workload of the courts or demands for legal aid.

4. Sustainable Development

An objective of the rollout is to reduce energy usage and consequently achieve carbon emissions.

Smart metering will provide consumers with the tools with which to manage their energy consumption, enabling them to access innovative solutions and incentives to support energy efficiency and take greater personal responsibility for the environmental impacts of their own behaviour. This will be supported by the Consumer Engagement Strategy which is under development.

The rollout can also contribute to the enhanced management and exploitation of renewable energy resources, for example by helping to facilitate the introduction of smart demand-side management approaches such as time-of-use (TOU) and dynamic tariffs which enable the more effective exploitation of renewable energy. The proposals would particularly contribute to the need to live within environmental limits, but would also help ensure a strong, healthy and just society (see health IA) and would put sound science in metering and communications technology to practical and responsible use. The proposals would promote sustainable economic development, both in terms of enhancing the strength, and improving the products, of meter and display device manufacturers, and by increasing employment and raising skills levels in the installation and maintenance of meters and communications technologies.

5. Carbon assessment

Following DECC guidance[57], we have carried out cost effectiveness analysis of the options in addressing climate change. The existence of traded (electricity) and non-traded (gas) sources of emissions means that the impact of a tonne of CO_2 abated in the traded sector has a different impact to a tonne of CO_2 abated in the non-traded sector. Reductions in emissions in the traded sector deliver a benefit but do not reduce GHG, whereas reductions in the non-traded sector do actually reduce GHG emissions.

[57] http://www.decc.gov.uk/en/content/cms/statistics/analysts_group/analysts_group.aspx.

Cost effectiveness analysis provides an estimate of the net social cost/benefit per tonne of GHG reduction in the ETS sectors and/or an estimate of the net social cost per tonne of GHG reduction in the non-ETS sectors.

We calculate the cost-effectiveness of traded and non-traded CO_2 separately:

Cost-effectiveness (traded sector) = (PV costs – PV non- CO_2 benefits – PV traded carbon savings)/tonnes of CO_2 saved in the traded sector

Cost-effectiveness (non-traded sector) = (PV costs – PV non- CO_2 benefits – PV non-traded carbon savings)/tonnes of CO_2 saved in the non-traded sector

The table below presents the present value of costs and non- CO_2 benefits as well as the tonnes of CO_2 saved in the traded and non-traded sectors, the corresponding cost effectiveness figures and the traded and non-traded cost comparators (TPC and NTPC). The Cost Comparators are the weighted average of the discounted traded and non-traded cost of carbon values in the relevant time period. If the cost per tonne of CO_2 saving of the policy (cost-effectiveness) is higher than the TPC/NTPC the policy is non-cost effective.

Table 16: Cost effectiveness

Option	PV costs	PV Non-CO_2benefits (£million)	EU ETS permits savings (Millions of tonnes of CO2 saved equivalent)	Millions of tonnes of CO_2 saved – non-traded sector	Traded sector cost comparator	Cost-effectiveness – traded sector	Non-traded sector cost comparator	Cost-effectiveness – non-traded sector
Preferred option	604	2,223	4.14	10.31	20.92	-416	42.07	-199

Table 16 shows how the rollout will save over 4 million of tonnes of CO_2 equivalent in the traded sector and over 10 million tonnes of CO_2 in the non-traded sector over a 20-year period. Both options are cost-effective: in both the traded and non-traded sector, the cost per tonne of CO_2 of abating emissions (cost-effectiveness) is lower than the cost comparator for both the traded and non-traded sector.

6. Other Environment

A smart metering Programme would have some negative environmental impacts. The first is the costs of legacy meters. Most significant among these would be the cost of disposal of mercury from gas meters, estimated at around £1 per meter. These costs would have to be met under usual meter replacement Programmes, but would be accelerated by a mandated rollout. The smart metering assets will consume energy and after discussions with meter specialists we continue with the assumption that the smart metering equipment installed within a consumer's premises will not consume more than 2.6W above the consumption of conventional metering equipment. These assumptions are unchanged. Gas meters would require batteries for transmitting data and some display devices may also use batteries. The batteries would be subject to the Directive on Batteries and Accumulators.

The Government's view is that the positive environmental impacts of smart meters clearly outweigh any negative impacts.

7. Health

There are a number of positive health impacts from the rollout of smart meters. In particular, smart meters enable suppliers to target energy efficiency measures better and encourage customers to take such measures. These confer health benefits to individuals – particularly vulnerable individuals – deriving from greater thermal comfort.

Many of the benefits of smart metering are underpinned by the ability to access the meter remotely and to provide customers with real time data on their gas and electricity consumption. In the home or premises the system will comprise various elements including a wide area communication module to provide communications to the DCC and a home area system linking devices within the home or premises to the smart metering system (including the in-home display).

A small number of responses to the consultation expressed concerns about electromagnetic sensitivity relating to smart meter communications technologies, particularly to wireless technologies. At this stage communications technology solutions have not been selected for the smart metering system. Both wired and wireless technologies exist that could be used and, for practical and technical reasons, both will need to be utilised by installers during the roll-out. However where wireless technologies are used they will have to comply with relevant regulations, best practice and international standards as set out by the International Commission on Non-Ionizing Radiation Protection. Compliance with these standards will be a functional requirement of the smart metering equipment and using smart metering equipment that meets the functional requirements will be a licence obligation.

The programme will continue to engage with the Department of Health and our full range of stakeholders on all relevant practical issues as work progresses on communications for smart metering.

8. Human Rights

The smart meter rollout may engage the following Convention rights: Article 1 of the First Protocol (protection of property); Article 8 (right to privacy); and Article 6 (right to a fair trial).

Article 1, Protocol 1 may be engaged because a Government mandate will entail changes to the existing market structure, which might constitute an interference with supplier licenses, and current meter owners' and providers' possessions. DECC's view is that any interference would be in the general interest and proportionate to the benefits that this policy would accrue.

Article 8 may be engaged because smart technology is capable of recording greater information about a non-domestic customer's energy use in its property than existing dumb meters. As the preparatory work under the smart meter Implementation Programme progresses the Government will need to continue to be satisfied that any interference with privacy is justified, proportionate and necessary in accordance with Article 8 ECHR.

In addition, to roll out smart meters, installers will have to enter consumers' property. As the preparatory work under the smart meter Implementation Programme progresses the Government will need to continue to be satisfied that any interference with privacy is justified, proportionate and necessary, in accordance with human rights and European law.

Ofgem is responsible for enforcing the conditions of gas and electricity supply licences. DECC's view is that the existing enforcement regime under the Electricity Act 1989 and the Gas Act 1986 (which, for example, give licensees the opportunity to apply to the court to challenge any order made, or penalty imposed, by Ofgem), which would continue to apply during a rollout of smart meters, is compliant with Article 6. In addition, as a public authority, Ofgem is bound by section 6 of the Human Rights Act 1998 to act compatibly with the European Convention on Human Rights. Article 6 may also be engaged in relation to the grant of any new licences under a centralised model. DECC's view is that a new licensing regime in the Energy Act 2008 would be compliant with Article 6.

9. Equality IA (EIA)

The Government is subject to general duties in respect of disability, race and gender equality. The current duties are:

- Disability Equality Duty: designed to eliminate unlawful discrimination and victimisation; eliminate harassment of disabled persons that is related to their disabilities; ensure that public sector organisations promote equality of opportunity between disabled persons and other persons; promote positive attitudes towards disabled persons; encourage participation by disabled persons in public life; and take steps to take account of disabled persons' disabilities, even where that involves treating disabled persons more favourably than other persons;

• Race Equality Duty: designed to eliminate unlawful discrimination and victimisation and to promote equality of opportunity and good relations between persons of different racial groups;

• Gender Equality Duty: designed to eliminate unlawful discrimination, harassment and victimisation and to promote equality of opportunity between women and men.

The non-domestic rollout will affect businesses and public bodies, rather than individuals. The Government does not, therefore, envisage an impact in respect of the duties, but it will continue to keep this issue under review as work continues during Phase 2 of the Smart Metering Programme.

10. Data and Privacy

Customer access to data

Smart metering will result in a step change in the amount of data available from electricity and gas meters. This will, in principle, enable energy consumption to be analysed in more detail (e.g. half-hourly) and to be 'read' more frequently (e.g. daily, weekly or monthly) by suppliers. This will allow consumers to view their consumption history and compare usage over different periods (e.g. through the IHD or internet applications).

The Prospectus Response proposes that the data arrangements for micro-businesses with smart meters in respect of access to, and granularity of, data will be the same as those for the domestic sector. Those for larger non-domestic customers with smart meters or for any non-domestic customer using an advanced meter will remain a matter for contract.

Data privacy

The frequency with which meters are read and the level of detail of data to be extracted will vary according to the mode of operation (eg some form of pay-as-you-go or credit) and the type of tariff the customer has chosen. As now, suppliers will need regular meter readings to provide accurate bills. Where they offer innovative tariffs, such as those based on time of use, they will need more detailed consumption information. The availability of data to suppliers, particularly half-hourly data, raises some potential privacy issues. Energy consumption data may be considered personal data where a living individual can be identified from the data itself or from the data and other information in the possession of the person, e.g. address details. On that basis, energy consumption data will be personal data for the purposes of the Data Protection Act 1998 regardless of whether the data is from a conventional, prepayment or smart meter.

In Phase 2, the Programme will consider further the appropriate rules for the non-domestic sector, taking account of the fact that, under the Data Privacy Act 1988, only sole traders could be considered "living individuals", including whether data privacy arrangements going beyond the requirements in the DPA are desirable.

Data security

Smart metering will result in a step change in the amount of data available from electricity and gas meters. This will in principle enable energy consumption to be analysed in more detail (e.g. half-hourly) and to be 'read' more frequently (e.g. daily, weekly or monthly) by suppliers. This will allow consumers to view their consumption history and compare usage over different periods (e.g. through the IHD or internet applications). We believe it is essential consumers can readily access the information available from their meters. They should be free to share this information with third parties, for example to seek tailored advice on energy efficiency or to consider which supplier or tariff is best for them.

The frequency with which meters are read and the level of detail of data to be extracted will vary according to the mode of operation (i.e. prepayment or credit) and the type of tariff the customer has chosen. For example, as now, suppliers will need regular meter readings to provide accurate bills. For many credit customers, meter readings every month or so are likely to be sufficient. Where suppliers offer innovative tariffs, such as those based on time of use, they will need more detailed consumption information.

The availability of data to suppliers, particularly at a half hourly level, raises some potential privacy issues. Energy consumption data may be considered to be personal data where a living individual can be identified from the data itself or from the data and other information in the possession of the person, e.g. address details. In this case energy consumption data will be personal data for the purposes of the Data Protection Act 1998 regardless of whether the data is from a conventional, prepayment or smart meter.

The Programme has taken a rigorous and systematic approach to assessing and managing the important issue of data privacy. It is intended to build on safeguards already in place, notably in the DPA, to develop a privacy policy framework for smart metering data.

The Programme has listened to the views of a broad range of stakeholders on this key issue. In the Prospectus we committed to 'privacy by design', so that privacy issues are considered before and while the smart metering system is designed, rather than afterwards.

We also proposed the principle that consumers should have a choice as to how their data is used and by whom ,except where it required to fulfil regulated duties. This reflects the important principle that data control rests with the consumer, while recognising that there are a range of instances when there will be a legitimate need to access that data, for example by energy suppliers for billing purposes.

We have undertaken a series of workshops to establish the different data requirements of industry participants and whether data collected needs to be personal or aggregated, and the level of detail that is required. Our views on the scope of regulated duties and on data for purposes that are not regulated are set out in the 'Data Privacy and Security' Annex to the main Prospectus Response Document

To protect the privacy of data, it is imperative that the smart metering system is secure. Building on best practice we have looked at the privacy and security issues across the end-to-end smart metering system, undertaking an initial risk assessment which will be further developed as the Programme progresses. A set of security requirements for how these risks should be addressed will be produced which will inform development of the technical specifications that the industry will be required to adopt.

To support our work in this area, we have held discussions with stakeholders and have established a Privacy Advisory Group (PAG), which includes the Information Commissioner's Office (ICO) and more recently has been expanded to include representatives of consumer groups and suppliers, to provide expert advice to the Programme. We will continue to expand and deepen our engagement with stakeholders on these issues.

The Programme will undertake more work in the current phase 2 to inform the development of a privacy policy framework. The Programme will continue to work with the expanded PAG and other stakeholders to help us reach a final decision on these issues.

Data privacy and security issues are also discussed more fully in the 'Data Privacy and Security' Annex to the main Prospectus Response Document.

11. Rural proofing

Smart meters will address the problems attached to "difficult to read" meters, which may at present lead to those in rural areas receiving fewer actual meter readings and estimated bills. The scope for introducing different payment methods for smart prepayment meters would assist those in rural areas who find key-charging or token purchase difficult. The opportunity, through smart meters, to provide more targeted and tailored energy efficiency advice would also assist those in rural areas, including those in "hard to reach" SMEs.