Title: **GB-wide smart meter roll out for the domestic sector**	**Impact Assessment (IA)**
Lead department of agency: DECC	**IA No:** DECC0009
	Date: 27/07/2010
Other departments or agencies: Ofgem	**Stage:** Consultation
	Source Intervention: Domestic
	Contact for Enquiries: Pau Castells/David Jones (0300 068 6541/6665)

Summary: Intervention and options

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

Lack of sufficiently accurate, timely information on energy use may prevent customers from taking informed decisions to reduce consumption and thereby bills and CO_2 emissions. The lack of accurate, timely information 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 Great Britain, the provision of energy meters to consumers is the responsibility of energy retail suppliers, and is subject to competition. Although some suppliers are rolling out smart meters to a selection of their customers it is expected that, 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. This will facilitate the capture of wider benefits to consumers, the environment, network operators and new businesses.
The policy for smart meters therefore addresses the market failures in the energy markets described above (information asymmetries, lack of coordination and negative externalities from energy consumption).

What are the policy objectives and the intended effects?

To roll-out smart metering to all GB residential 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? Please justify preferred option (further details in Evidence Base)

This policy focuses on the mandated replacement of 47 million residential gas and electricity meters in GB by end 2020. The main IA considers two options on implementation of the roll-out:

- Option 1: "Full Establishment" – roll-out commences when central communications systems are in place
- Option 2: "Staged Implementation" – roll-out begins in advance of the full establishment of the central communications system

The NPV of the two options is very close. Option 2 is the preferred option as it provides an earlier start of the roll- out and therefore allows for delivery of policy objectives earlier, especially provision of energy information to consumers. Annex 1 sets out the impacts on Option 2 of the inclusion/exclusion of a Gas Valve to Gas smart meters. The preferred option is to mandate the inclusion of a gas valve on the basis that it provides greater certainty for the market and supports the growth of pay as you go tariffs. In parallel with this IA DECC and Ofgem are undertaking a review, with stakeholders, of the options for the scope of the Data Communications Company (DCC) and the associated costs and benefits of those options.

When will the policy be reviewed to establish the actual cost and benefits and the achievements of the policy objectives?	The policy will be reviewed during the course of the smart meter rollout. An evaluation is expected to be complete by 2017. The Benefits Realisation Strategy will set out the approach (See Annex 4 – 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 a subsequent phase of the programme.

Ministerial Sign-off For consultation stage IAs: **I have read the IA and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.**

Signed by the responsible Minister: ***Date:*** *27/07/2007*

Summary: Analysis and Evidence Policy Option 1

Description: "Full Establishment" - Rollout commences when central communications systems are in place

Price Base Year 2009	PV Base Year 2010	Time Period Years 21	Net Benefit (Present Value (PV)) (£m)		
			Low: 574	High: 9,392	Best Estimate: 5,036

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	NA		NA	NA
High	NA		NA	NA
Best Estimate	1,024		566	**9,119**

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

Capital costs, installation, and opex costs amount to £5.50bn. Comms costs amount to £1.94bn. Legal, setup, IT, disposal, energy, and pavement reading inefficiency costs amount to £1.67bn.

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

NA

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	0		658	9,671
High	0		1,261	18,532
Best Estimate	0		963	**14,154**

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

Total consumer benefits amount to £6.43bn and include energy savings (£4.23bn) and load shifting/ time of use tariffs (£1.06bn) which are partially realised upstream in the electricity markets and are assumed to be passed down to consumers. Total supplier benefits amount to £6.33bn and include avoided meter reading (£2.69bn), and reduced inquiries and customer overheads (£1.13bn).

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

Smart metering is likely to result in stronger competition between energy suppliers due to increased ease for consumers of switching and improved information on energy consumption and tariffs. As a result from increased competition, further benefits to consumers could be realised such as more innovative products, lower prices and increased choice. Non-monetised benefits include the potential benefits from the development of a smart grid.

Key assumptions/sensitivities/risks

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.

Impact on admin burden (£m):			Impact on policy costs (£m):			In scope
Costs: 0	**Benefit:** 0	**Net:** 0	**Costs:** N/A	**Benefits**: N/A	**Net: N/A**	N/A

What is the geographic coverage of the policy/option? GB	Options

Summary: Analysis and Evidence Policy Option 2

Description: "Staged Implementation" - Rollout proceeds without a central communications system in place

Price Base Year 2009	PV Base Year 2010	Time Period Years 21	Net Benefit (Present Value (PV)) (£m)		
			Low: 266	High: 9,602	**Best Estimate: 4,989**

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	NA		NA	NA
High	NA		NA	NA
Best Estimate	1,233		620	**10,051**

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

Capital costs, installation, and opex costs amount to £6.05bn. Comms costs amount to £2.14bn. Legal, setup, IT, disposal, energy, and pavement reading inefficiency costs amount to £1.86bn.

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

NA

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	0		700	10,291
High	0		1,339	19,679
Best Estimate	0		1,023	**15,040**

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

Total consumer benefits amount to £6.80bn and include savings from reduced energy consumption (£4.47bn), and load shifting/ time of use tariffs (£1.13bn) which are partially realised upstream in the electricity markets and are assumed to be passed down to consumers. Total supplier benefits amount to £6.76bn and include avoided meter reading (£2.87bn), and reduced inquiries and customer overheads (£1.21bn).

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

Non-monetised benefits include the potential benefits from the development of a smart grid. Smart metering is likely to result in stronger competition between energy suppliers due to increased ease for consumers of switching (in particular from the point that DCC is established) and improved information on energy consumption and tariffs. As a result from increased competition, further benefits to consumers could be realised such as more innovative products, lower prices and increased choice.

Key assumptions/sensitivities/risks

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.

There are specific risks to the Staged Implementation option. There is potentially a greater complexity of processes for industry. Costs to suppliers from stranding dumb meters are likely to be higher as installation rates go above the natural rate of replacement earlier in the roll-out. Communications may be more expensive or result in sub-optimal technology choices, and interoperability problems may increase costs and limit the scope of benefits to suppliers from switching. Policy measures are being developed to manage these risks.

Impact on admin burden (£m):			Impact on policy costs (£m):			In scope
Costs: 0	**Benefit:** 0	**Net:** 0	**Costs:** N/A	**Benefits:** N/A	**Net: N/A**	N/A

What is the geographic coverage of the policy/option?			GB		
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 total annual cost (£m) of enforcement for these			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 (for preferred option)?			**Traded:** 18MtCO2		**Non-traded:** 16.3MtCO2
Does the proposal have an impact on competition?			Yes		
Annual cost (£m) per organisation (excl. Transition) (Constant Price)	**Micro** N/A	**< 20** N/A	**Small** N/A	**Medium** N/A	**Large** N/A
Are any of these organisations exempt?	N/A	N/A	N/A	N/A	N/A

Evidence Base (for summary sheets) – Notes

References

No.	Legislation or publication
1	Consultation Response: Towards a smarter future: Government response to the consultation on electricity and gas smart metering – December 2009.
2	Domestic IA for smart meter rollout – December 2009.
3	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
4	ENA and Imperial College London (2010) ' Benefits of Advanced Smart Metering for Demand Response based Control of Distribution Networks
5	Sustainability First (2010) 'Smart Pre-Payment in Great Britain'
6	Gemserv (2010) 'Analysis on disablement/ enablement functionality for smart gas meters
7	Baringa Partners, Smart Meter Roll-out: Energy Network Business Market Model Definition and Evaluation Project, 2009
8	Baringa Partners, Smart Meter Roll Out: Risk and Optimism Bias Project, 2009
9	Erhardt-Martinez, Donnelly, Laitner (2010) 'Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities'
10	Darby (2006) 'The effectiveness of feedback on energy consumption'
11	Fischer (2009) 'Feedback on household energy consumption: a tool for saving energy?'

Evidence Base

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

	2010	2011	2012	2013	2014	2015	2016
Transition costs[1]	0	50	69	90	122	137	146
Annual recurring cost	0	0	57	201	374	536	698
Total annual costs	0	50	126	292	496	673	844
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	0	0	84	265	505	732	959
Total annual benefits	0	0	84	265	505	732	959

	2017	2018	2019	2020	2021	2022	2023
Transition costs	142	122	99	87	26	24	21
Annual recurring cost	828	873	898	900	893	890	888
Total annual costs	970	995	997	988	919	913	909
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	1,151	1,244	1,314	1,358	1,393	1,426	1,465
Total annual benefits	1,151	1,244	1,314	1,358	1,393	1,426	1,465

	2024	2025	2026	2027	2028	2029	2030
Transition costs	18	15	13	12	12	12	12
Annual recurring cost	888	900	909	899	884	870	857
Total annual costs	906	916	921	911	896	882	870
Transition benefits	0	0	0	0	0	0	0
Annual recurring benefits	1,509	1,643	1,735	1,782	1,824	1,856	1,889
Total annual benefits	1,509	1,643	1,735	1,782	1,824	1,856	1,889

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	0.00	0.00	0.00
	Non-traded	0.00	0.00	0.00
Transport	Traded	0.00	0.00	0.00
	Non-traded	0.00	0.00	0.00
Workplaces & Industry	Traded	0.00	0.00	0.00
	Non-traded	0.00	0.00	0.00
Homes	Traded	0.08	3.11	5.74
	Non-traded	0.08	2.80	4.88
Waste	Traded	0.00	0.00	0.00
	Non-traded	0.00	0.00	0.00
Agriculture	Traded	0.00	0.00	0.00
	Non-traded	0.00	0.00	0.00
Public	Traded	0.00	0.00	0.00
	Non-traded	0.00	0.00	0.00
Total	Traded	0.08	3.11	5.74
	Non-traded	0.08	2.80	4.88

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

* For non-monetised benefits please see summary pages and main evidence base section

Contents

Evidence Base

A. Glossary of Terms

CAPEX – Capital Expenditure
DCC – Data Communications Company
DNO – Distribution Network Operators
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
RTD – Real Time Display
SPC – Shadow Price of Carbon
ToU – Time of Use (tariff)
WAN – Wide Area Network

B. Introduction and Strategic Overview

Introduction

The Government set out its commitment to the roll out of smart meters within its coalition programme[1].

The coalition programme sets out the strategic context for the roll-out of smart metering alongside the establishment of a smart grid. The smart meter policy sits in the broader Government programme for 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 home 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 including facilitating demand-side management which will help reduce security of supply risks and help with our sustainability and affordability objectives. Smart metering is a key enabler of the future Smart Grid, as well as facilitating the deployment of renewables and electric vehicles.

As part of the Third Package of Energy Liberalisation Measures adopted on 13 July 2009, EU Member States are obliged to "ensure the implementation of intelligent metering systems that shall assist the active participation of consumers in the gas and electricity markets" - in other words, to roll out some form of smart metering subject to the results of an economic assessment.

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

This Impact Assessment (IA) builds upon the work DECC has undertaken in the last 3 years to establish a case for rolling out smart meters. This has been supported by cost benefit modelling and analysis by Mott Macdonald[2], Baringa Partners and Redpoint.

DECC has been working with Ofgem E-Serve as delivery partner for the scoping phase of the programme that has concluded in this IA. Ofgem engaged PA Consulting Group and Frontier Economics to support them.

The smart meter programme has assessed the requirements, costs and options for the smart meter solution in the areas of:

- functionality for the meters, communications and real time display;
- length of the rollout period;
- scope of the central communications provider;
- timing of commencement of the rollout.

The changes made to the analysis against the December 2009 IA are noted within the text of this IA in section F. For ease of reference an overview of the changes to input values is also provided in Annex 2.

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[1] HMG, *'The Coalition: Our programme for government'*, 2010
[2] BERR, *Impact Assessment of Smart Metering Roll Out for Domestic Consumers and Small Businesses*, April 2008, http://www.berr.gov.uk/files/file45794.pdf

The IA assesses costs and benefits for two options on the implementation strategy for the roll-out: a “Full Establishment” option and a “Staged Implementation” option. The IA considers separately in an analytical annex the impact on costs and benefits of options on whether the minimum mandated functionality for gas smart meters should include the capability to turn gas supply on and off remotely (Annex 1).

This IA accompanies a Prospectus produced by the smart meter programme setting out the detail and discussion on the policy options considered by the smart meter Programme.

C. The issue

Existing metering allows for a simple record of energy consumption to be collected, mainly by physically reading the meter. Whilst this allows for energy bills to be issued, there is limited opportunity for consumers or suppliers to use this information to manage energy. On average suppliers only know how much energy a household consumes after a quarterly (or less frequent) meter read and consumers are generally only aware of consumption on a quarterly, historic basis unless they take active steps to monitor the readings on their meters. In addition many of those quarterly reads may be estimates made by the supplier.

Consumers do not have dynamic and useful information to enable them to easily manage their energy consumption. In addition problems with accuracy of data and billing create costs for suppliers and consumers, causing disputes over bills (complaints) and problems with the change of supplier process, thereby possibly hindering competition and diminishing the customer experience.

Smart meters and the provision of real-time information help address these issues, enabling consumers to access more information about energy use and cost. Combined with appropriate advice and support, consumers will then be able to take positive action to manage energy consumption and costs. Smart meters provide for remote communication with the meter, facilitating, amongst other things, more efficient collection of billing information and identification of meter faults. Information from the meter, subject to appropriate data, privacy and access control, will assist in the development of more sophisticated tariff structures and demand management approaches that could be used to further incentivise energy efficient behaviour by consumers and suppliers alike.

The benefits from a roll out of smart meters together with a free standing display 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 better manage the electricity network and to inform long-term investment in the network and development of smart grids.

In the absence of Government intervention, it is difficult to judge whether a substantial roll-out of smart meters would take place. However, without a Government sponsored inter-operability agreement, meter owners face a large risk of losing most of the value of the meter when customers switch energy suppliers, and switching by customers is relatively likely to occur. The provision of central communications provides greater efficiency for managing the connection and change of supplier processes for smart meters. A decision by Government not to intervene would therefore probably result in a limited roll out. Either a lack of interoperability or a limited roll-out would impede the development of a smart grid and the speed with which new renewable generation could be accommodated.

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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 will form the basis of the benefits management work which will be developed in greater detail as part of the next phase of the Programme.

E. Option identification

As set out in the introduction this IA builds on the analysis set out in the December 2009 consultation response IA. Core to that response and IA was the concept of a central communications provider. This provider would manage central communications and data and is referred to as Data Communications Company (DCC) throughout this IA.

The focus of this domestic roll out of smart metering IA is on options for implementation of the full rollout with DCC. Cost and benefit estimates of timescales of the roll-out, communications, meter functionality and interoperability, in-home displays and speed of roll out are all covered within the main IA and have been developed to inform the options for the economic assessment set out in Section F.

The IA presents updated costs and benefits for the preferred option as scoped in the December 2009 IA: a centralised communications market model (also called "Full Establishment" in this IA). This option is compared against one other option, a preferred option involving a transitional arrangement approach where the start of the roll out precedes full establishment of the DCC ("Staged Implementation" option).

The IA also considers separately in an analytical Annex (Annex 1) the impact on costs and benefits of options on whether the minimum mandated functionality for gas smart meters should include the capability to turn gas supply on and off remotely.

The cost benefit analysis presented in the summary sheet of the IA includes:

- Revised estimates of cost and benefits across all options and assessment of the impact on costs and benefits of a "Staged Implementation" where the roll-out commences before the DCC is operational. This is compared against a "Full Establishment" option where the roll-out of smart meters does not commence until the DCC is in place as announced in December 2009. These revised costs and benefits have arisen as a result of the work carried out by DECC, Ofgem and PA Consulting Group over the period January-July 2010; and
- The costs and benefits of the preferred option scoped in Annex 1.

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.

The delivery of smart metering to GB domestic consumers is a major infrastructure project. Work since December 2009 has focused on developing the Prospectus. The Prospectus 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[3]). As a result of the work carried out by Ofgem and DECC in the last 6 months it has become apparent that the DCC is likely to become operational in late 2013. The Staged Implementation model allows for the benefits of smart metering to be realised for a proportion of consumers in advance of the full solution.

[3] DECC, Impact Assessment of a GB-wide roll-out of smart meters (December 2009)

This section scopes the key decision areas for the smart meters Programme where implementation options may have a substantive impact on overall costs and benefits.

1. Metering system functionality

This section sets out the high-level functional requirements for the smart metering system. This “minimum” functionality will ensure that smart metering delivers the wide range of anticipated benefits. It should be noted that there is no assumption about how the functionality is delivered i.e. whether within a “meter”, modularly, or through some other technical solution (other than for the WAN communications on the consumer premises, which needs to be separate from the meter).

Table 1 below sets out the high level functionality that we consider should comprise the electricity and gas smart metering systems and the underpinning capabilities these are expected to provide.

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 - two way transmission of data through a link to the wider 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 - 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 sophisticated control of devices in the home	✓	
F	Remote disablement and enablement of supply - that will support remote switching between credit and pre-pay	✓	✓
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 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 this level of functionality aligns with wider policy developments around renewables, microgeneration, electric vehicles and smart grids.

The high-level functionality set out in December has now been developed by the Programme into a more detailed set of functional requirements and description of associated services. These are set out in detail in the Prospectus and Statement of

Design Requirements supporting document[4]. In developing the functional requirements consideration has been given to the associated costs especially where requirements go beyond the original A-H list above, for instance in the development of potential smart grid requirements. We consider that the functional requirements set out for the meter itself in the Prospectus and Statement of Design Requirements fall within the cost envelope set out in the December 2009 IA.

Gas Valve: With respect to gas metering, the analysis for the December 2009 IA assumed that all smart gas meters would be deployed with a valve.
However, the consultation brought a range of views from stakeholders over whether the remote enablement and disablement functionality should be mandated for gas meters. To address these points, DECC commissioned Gemserv to provide expert advice on the technical, economic and commercial issues of fitting gas smart meters with valves.[5] This has informed the work in Annex 1 which considers the economic arguments for and against a mandated approach, taking into account costs and benefits and factors such as the extent of customers paying by credit moving to pay as you go, and whether retrofitting existing gas meters would be a viable interim alternative.

On the basis of this, DECC concluded that remote enablement and disablement should be part of the minimum functionality for gas smart meters.

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 Prospectus 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 non-smart 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, and all 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. The IA notes that, until the functional and communication requirements are specified in the next phase of work, the risk of interoperability

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

issues remains. However the risk diminishes significantly when the requirements are confirmed. This has allowed for the development of a Staged Implementation.

2. Communications infrastructure

Smart metering requires a suitable communications platform over which data can be securely transmitted (e.g. consumption data transmitted for defined periods). In addition ad hoc remote configuration and diagnostics, software and firmware changes should be able to be made remotely. The December 2009 IA assumed the communications costs of a currently available communications technology infrastructure, which can provide sufficient functionality (GSM GPRS solution). This simplified the analysis as it did not entail the modelling of hybrid options and, using a currently available technology, reduces the level of cost risk attributable[6].

Further work carried out by PA Consulting Group (PA) for DECC and Ofgem in the course of Phase 1 considered a wider range of technology options. PA's review was based on informal soundings with service providers, commercially confidential inputs to Ofgem and PA's own experience of cost drivers in the communications sector. The review indicated that the existing £4.80 assumption with an additional £0.50 as an allowance for communications security is a reasonable estimate, subject to the inclusion of 10% optimism bias to reflect residual uncertainty prior to an RFI process and the potential need for additional expenditure to address 'hard to reach' meters.

3. Minimum scope of the Data Communications Company (DCC)

The smart metering Programme presents an opportunity for fundamental streamlining and efficiency improvements to existing gas and electricity industry processes and systems. For modelling purposes we have assumed a "thin" scope of the DCC which would include activities including secure communications and access control[7], centralised head-ends[8] and data retrieval functions[9]. This should not be interpreted as a policy preference for this scope but rather as an initial view which is subject to change as a result of ongoing cost and benefit analysis on the scope of the DCC which is being conducted in parallel to this consultation.

4. Commencement and speed of roll-out

There are two key parameters that determine how a rollout progresses:

1. Commencement of rollout; and
2. Speed of rollout;

Together these allow the formation of a rollout profile.

The December 2009 IA included 6 options for rollout all of which completed virtually all smart meter installations by the end of 2020.

The December 2009 IA profile made broad assumptions regarding rollout, which included: a small number of smart meters being rolled out from mid 2012 with a rising profile in subsequent years leading to completion of virtually all meters being

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[6] This is in line with the recommendations of Baringa Partners *Risk and Optimism Bias Project*

[7] Secure two way communications with smart meters, enabling remote meter reading, meter diagnostics and other data communications.

[8] The conversion of different technical protocols to support inter-operability.

[9] Scheduling of the collection of meter readings and managing that process on behalf of suppliers and network operators.

replaced at end 2020, the existence of central communications, and suppliers being resourced and ready with meter assets for installation. The rollout would follow a profile which assumed a ramp up of installations as participants mobilised and became familiar with the processes, with a stable period once the processes were understood and a tailing off from 2018 as the final, more difficult installations were targeted.

Since December the Programme has considered the options for progressing rollout in more detail.

a) Commencement of rollout

Three factors influenced thinking of when suppliers will commence rolling out smart meters and therefore when an estimation of the costs and benefits should be modelled. These are:

- availability of a functional DCC;
- availability of the detailed documentation (meter functionality and understanding of communications requirements);
- impact of early installations.

We have modelled an option that assumes smart meter installation would occur at substantial volumes only once the DCC is in place (Autumn 2013) and suppliers were able to use the central systems. We refer to this as 'Full Establishment'.

However DECC/Ofgem will deliver the detailed documentation that will allow for suppliers to commence their processes for procuring their meter stock well in advance of this date (current estimate, early 2012). It is proposed that from this point suppliers will be able to ensure their meters comply with the requirements for meter functionality and DCC. We have therefore modelled a rollout that sees meters installed prior to the DCC being operational. Any profile that involves smart meters installed before a DCC will be in place will need to adjust the supplier benefits, as some of these benefits may assume some efficiencies from centralised systems and processes. We refer to this as 'Staged Implementation'.

The Programme recognises that some suppliers are already installing smart meters, at their own risk. Since the December 2009 IA was published one supplier has proposed that they will have installed 2 million 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.

The Programme has therefore modelled two options for rollout that incorporate the impact of early movers on the Staged Implementation and Full Establishment options.

b) Speed of Rollout

We have considered qualitatively the speed of rollout to understand the implications of applying a more aggressive profile to the rollout model. In doing so we recognise that further testing of cost-benefit impacts of such an approach with industry and other interested parties needs to be carried out in order to improve the understanding of how achievable this will be.

Previous modelling had assumed a maximum rollout of around 17% of meters in any one year, which is over three times the current annual installation rate. We have applied a similar peak installation rate level to the Full Establishment and Staged Implementation rollout, with a slight increase on 'Full Establishment' from 2015-2018 as suppliers will have had more time to procure meters and mobilise their workforce.

We have considered the factors that would impact on costs and benefits with faster installation rates. In our assessment these will include:

- **benefits (and costs)** come on stream sooner the faster the roll-out;
- with a longer roll-out the need for suppliers to **run two "back-office" systems,** one to support the old meter stock and one for smart meters, is extended and therefore costs are likely to be higher. Other non-supplier central systems, processes and bodies may also need to be maintained in parallel during this period e.g. the Data Transfer Network, Master Registration Agreement Data Flows Catalogue;
- any roll-out of smart meters will require equipment, a skilled labour force and availability of suitable meters to fulfil the roll out. In an accelerated roll out pressures on **capital costs and availability** may be increased as these will be required in a shorter space of time;
- there is potentially greater **complexity of processes for industry** in transitioning to a Staged Implementation and then DCC. These additional costs are discussed in more detail in section F.
- **stranded assets** – setting an accelerated deadline for a smart meter roll out will cause a certain proportion of electricity and gas meters to be removed before the end of their normal economic life. Whilst we do not account for stranding costs in the NPV, this will create costs for either the owner of the asset or suppliers depending on the contractual arrangements in place.

c) Roll-out strategy

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 roll-out will consider whether this approach is maximising the overall benefits and supporting broader policy objectives.

5. Functionality of the smart meter

A separate Annex has been produced to assess the minimum functionality for gas smart meters. In the 2009 consultation response decisions were made on the minimum functionality for gas and electricity smart meters - the only exception was whether the gas meter should include the capability for remote enablement and disablement of supply (a valve in the gas smart meter is required to provide this capability).

Two options have been considered in Annex 1 and these are assessed against the preferred option (Option 2):

Option 2a. Mandate that all gas smart meters must have a valve fitted. Under this option, remote disablement and enablement of supply (and therefore a valve for gas smart meters) would be included as part of the minimum functionality for smart meters.

Option 2b. Do not mandate gas meters to have a valve, except for customers currently with pre-pay meters.

We have concluded on the basis of externally sourced work by Gemserv and our own analysis that remote disconnection should be included as part of the minimum functionality for gas smart meters.

6. Options analysed

Based on the assessment of where progress in the implementation of the smart meters Programme requires further decisions which may have an impact on the business case, the following options have been identified:

The main IA considers two policy options to deliver the preferred Government solution for a smart meters roll-out:

- Option 1 – Full Establishment
- Option 2 – Staged Implementation

On functionality, Annex 1 identifies the following options:

- Option 2a – Mandated gas valve
- Option 2b – Supplier-led decision

F. Evidence Base

In this section we describe the main assumptions underpinning the analysis and the reasons for them with references to the evidence where appropriate. Further work has been undertaken since the December 2009 IA looking at roll-out, functionality and communications. This further analysis has been undertaken by DECC and Ofgem and has been informed by the outputs of externally sourced work by PA Consulting Group and Gemserv. In addition we have received feedback from stakeholders on many aspects of the analysis throughout this period.

We have refined our assumptions and methodology on the basis of a critical examination of the evidence we have received and changes have also undergone a process of cross-Government peer review. Differences between the assumptions used in this IA and the one published in December 2009 are noted and explained within the text. For reference purposes Annex 2 provides an overview of the changes made. The assumptions are generally shared between the options under consideration, but where there are differences these are noted.

In general further analysis of the methodological approach to calculation of costs and benefits, the available evidence and stakeholder feedback since publication of the December 2009 IA has led to a downward revision of the estimated Net Present Value of the roll-out of smart meters. This is largely driven by a revised assumption of household energy consumption in the future, which is now assumed to be lower than in the December 2009 IA. Previously smart meters IAs had assumed that energy consumption per household would remain constant through time, whereas the revised methodology, based on the official energy projections produced by DECC[10], projects a decrease in energy consumption per household in the future. As a result, energy savings from smart meters, which are calculated as a percentage of total energy consumption, are also estimated to be lower.

The adoption of this revised assumption for energy consumption in the business as usual world now accounts for overlaps with energy savings arising from other Government policies, as well as the impact of macroeconomic variables such as income, energy prices and population growth on business as usual energy levels. This methodological change has reduced the Net Present Value in central scenarios by approximately £1bn.

Other areas with notable revisions since December 2009 include the roll-out profile, operating and maintenance costs for communications assets, legal, IT, setup and organisational cost estimates and updated projections for carbon an energy prices and factors.

Overall the case for a roll out of smart meters to domestic consumers remains strongly positive in central scenarios (see results page 34);

The main assumptions used to calculate the costs and benefits of each option described in this section are:

1. Counterfactual/benchmarking
2. Asset costs
3. Benefits
4. Speed of roll-out

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10 http://www.decc.gov.uk/en/content/cms/statistics/projections/projections.aspx

5. Results

It should be noted that within the economic model all up-front costs are annuitised over the lifetime of the meter or over the roll out 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 of capital of 10% has been assumed. The benefits are not annuitised but annualised, that is they are counted as they occur.

1. Counterfactual/benchmarking

As set out in the April 2008 IA a counterfactual case has been constructed. This assumes no Government intervention on domestic smart metering but includes the implementation of the policies on billing (primarily provision of historic comparative data) and displays set out in the August 2007 consultation on billing and metering[11]. It includes:

- the costs of the continued installation of basic meters,
- benefits from better billing,
- 5% of the predicted 2.8% consumer electricity savings from smart metering are assumed to occur in the counterfactual world as a result of CERT[12] and other delivery of clip-on RTDs.

It is difficult to judge whether any significant numbers of smart meters would be rolled out in the absence of Government facilitation. Suppliers or other meter owners are reluctant to install their own smart meters without a commercial and technical inter-operability agreement. Without such an agreement meter owners would face a large risk of losing a major part of the value of any smart meter installed. This is because there is a significant chance that consumers will switch to a different energy supplier who will not want or be able to use the technology installed earlier and will, therefore, not be willing to pay to cover the full costs – making the smart meter redundant.

It is therefore reasonable to assume for modelling purposes a counterfactual world in which no smart meters roll out: this is the assumption used in the headline estimates presented in this IA. It is worth noting that the situation is different in the case of non-domestic customers (subject of a separate IA). The provision of smarter metering is already established at larger sites, and such metering, whether self-standing or retrofitted to existing meters, is increasingly being installed at smaller sites, particularly of multi-site customers. This reflects, among other things, the proportionately larger potential savings and lower stranding or redundancy risks from smart and advanced metering for larger consumers and the lower relative cost of the meters, as well as incentivisation of installation of smarter metering under the Carbon Reduction Commitment.

However, recognising that some level of smart meters may be rolled out, for illustrative purposes we have also considered a situation where smart meters are rolled out to a significant part of the residential population. A counterfactual scenario has therefore also been examined which reduces NPV by over £2.5 billion for each of the options under examination.

This alternative scenario is very conservative and assumes that a roll-out of smart meters in the counterfactual world would mean that energy suppliers roll-out first to those consumers which benefit more from it and hence a 20% roll-out of smart

[11] A *'do nothing'* option is not analysed because policy implementation as described will continue
[12] Carbon Emissions Reduction Target

meters, in a competitive metering counterfactual world, results in a reduction in gross benefits of 30% and a reduction in costs of 20%. Even in this conservative scenario, the NPV of all options considered in the IA is positive.

The cost of the continued basic meter installation is deducted from the costs for the smart meter deployment. This cost is deducted from the asset and installation costs of each option. The numbers of meters that can be fitted on a coordinated basis is also constrained by the fact that a certain number of meters have to be replaced in any case every year due to either breakdown or because they have reached the end of their operational life.

The benefits from better billing and displays policies result in a reduction in benefits for smart meters; these benefits are subtracted from the overall benefits for smart meters. An increase in take up of clip-on displays would therefore reduce the level of benefits accruing to smart meters.

Review of the business as usual case.

The assumption on business as usual levels of energy consumption has been revised since the December 2009 IA.

The revised assumption accounts for the impact of other policies in reducing the overall level of energy consumption[13], as well as the impact of macroeconomic variables such as income, energy prices and population growth on energy levels. This is because overlaps, and their consequential benefits, have to be tested robustly enough against other policies. This is crucial for example when assessing the most cost-effective way to meet Government strategic targets such as carbon budgets.

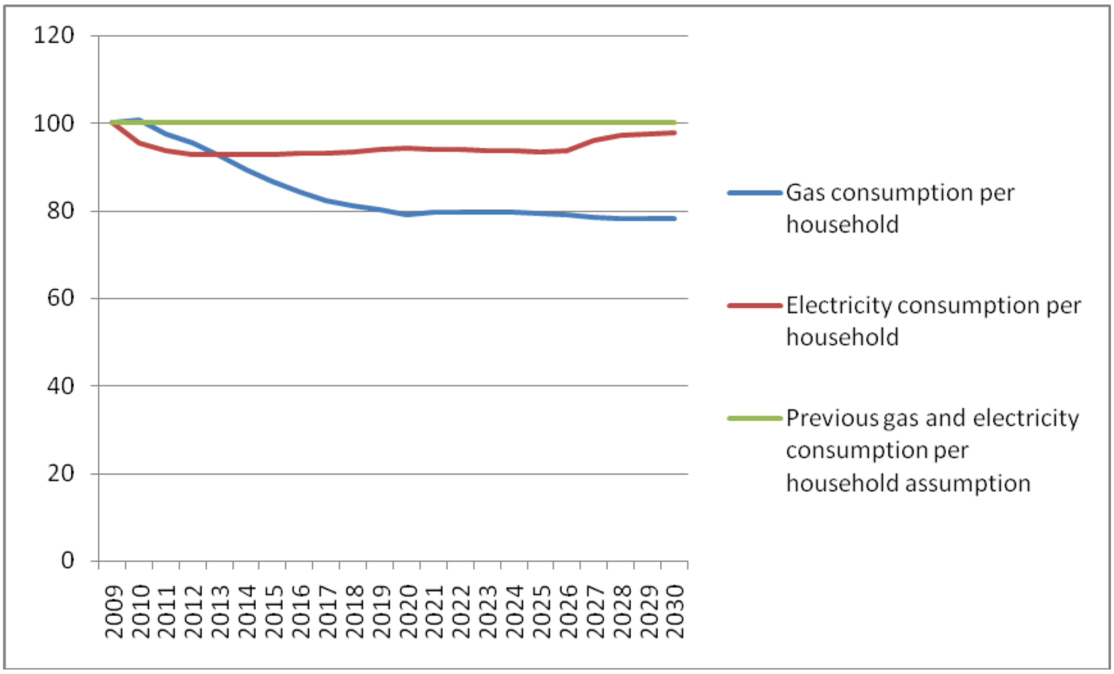
Previous smart meter IAs had assumed that energy consumption per household would remain constant through time, whereas the revised methodology, based on the official energy projections produced by DECC[14], projects a substantial decrease in energy consumption per household in the future. As a result, energy savings from smart meters, which are calculated as a percentage of total energy consumption, are also estimated to be lower.

The main impact of such methodological change is to those items in the smart meters IA which are contingent on the level of energy consumption (mainly consumer energy savings, which currently account for approximately a third of the benefits).

The figure below presents the projected levels of consumption per household for gas and electricity in DECC's official projections and compares them against the original assumption in the smart meters economic case (i.e. flat energy consumption per household going forward).

[13] The business as usual energy consumption accounts already for the reduced energy consumption levels as a result of the impact of the following policies: EEC1, EEC2, CERT, Product Regulations, Building Regulations and Warm Front and fuel poverty policies.
[14] http://www.decc.gov.uk/en/content/cms/statistics/projections/projections.aspx

Figure 1. Projected energy consumption



The impact of these reduced projected energy levels in the smart meter economic case is a decrease in expected net benefits of just over £1bn. The changes also have an impact on the contribution that the smart meter roll-out makes to meeting carbon reduction targets by 2020. In the December 2009 IA DECC estimated that smart meters would reduce carbon emissions in the domestic sector by 1.5Mt CO_2 a year by 2020. With the revised estimates, savings are now expected to be of 1Mt CO_2 by 2020.

Other adjustments have also been carried out to the business as usual case since the December 2009 IA in order to obtain consistent figures on number of meters, energy consumption per meter and their projected growth rates in the period 2010-2030. These are discussed in Annex 2.

2. Asset costs

Our underlying assumption for cost benefit modelling purposes is that the metering technology deployed will provide the functionality already set out. For the purposes of this analysis delivery of real time information is assumed to be through a standalone display which is connected to the metering system via a Home Area Network (HAN). It is assumed that a Wide Area Network (WAN) is also required to provide the communications link to the DCC. In the cost benefit modelling we calculate the communications devices as separate to the meter specification.

IHDs will have dual fuel functionality so any second supplier providing gas or electricity in a dual fuel home can use the IHD provided by the first supplier. It will be at any second suppliers' discretion whether they wish to provide a second display. This will allow for continued competition and customer choice.

Capital costs

The tables below show the capital costs of meter and communications assets used for the current analysis, all of which are unchanged from the December 2009 IA.

Table 2: Capital Costs of Assets (£ per device)

	Electricity	Gas
Display	£15	£15
Meter	£43	£56

Table 3: Communications infrastructure (£ per device)

WAN (modem)	£15
HAN	£1 Electricity/ £3 gas

There are different costs associated with the HAN for gas and electricity because the former is battery operated.

Within the modelling it is assumed that due to technological advancement the costs of the meters will fall over time. This has been the experience with current meters and has also been seen in the international deployments of smart meters. We assume that costs fall by 1% per annum, resulting in 10% by the end of 2020. This reduction is split and is applied at three time points: 2010, 2017 and 2024.

Installation costs

We have retained the assumptions from the December 2009 IA for installation costs; this includes a £10 per installation efficiency resulting from the dual fuel installation.

Table 4: Installation costs

Electricity only	Gas only	Dual fuel
£29	£49	£68

Operating and maintenance costs

Smart meter maintenance costs are uncertain, because an integrated solution including common communication provision has not been tried in the British market, even though some suppliers are already installing smart meters. The assumption used in the December 2009 IA was based on Ofgem[15] work which assumed an annual operation and maintenance cost for smart meters of 2.5% of the meter purchase cost. No further substantive evidence has been brought forward on this point and we have therefore retained this assumption for the 2010 IA.

For the ongoing services charges for the communication technology that provides connectivity to the premises we assume – in line with the available evidence – these to be £5.30 per household per year (annuitised) for the WAN connection. This is assumed to gradually decrease over the period of the roll out. The costs of operating and maintaining the HAN are assumed to fall within those for the meter as above.

This estimate has increased from the £4.80 per meter per year assumption made in the December 2009 IA to £5.30. This is to include an additional cost allowance for network security, for example using key encryption, that enables secure

[15] Ofgem, *Domestic Metering Innovation Consultation and supporting documentation*, February and March 2006

communications. We have assumed that there would be an additional annual operating cost of £0.50 per household

No optimism bias adjustment for operating and maintenance costs of the communications solution was assumed in the December 2009 IA as for modelling purposes a GSM GPRS communications solution was assumed. More detailed work carried out by PA Consulting Group for DECC and Ofgem in the course of Phase 1 has allowed us in the present IA to relax this assumption and assess the costs of the communications solution against a mix of different technology solutions.

A 10% optimism bias adjustment has now also been applied to reflect that depending on the technology solutions deployed, some additional cost may be required to address 'harder to reach' meters, whether due to geographic factors or the specific circumstances of meter deployments at premises. Under both options considered, there is also a risk that smart meters installed previously to DCC being in place do not have an appropriate communications solution.

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 cost

The smart metering assets will consume energy and after discussions with meter specialists we continue with the assumption that a smart meter would consume 1 W, and a display 0.6 W and the communication equipment 1 W. These assumptions are unchanged.

Meter reading costs

The April 2008 IA 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.

For the purpose of this analysis our assumption is that the current regime of two-yearly safety and tampering checks for gas and electricity meters remains in place. Smart metering functionality may remove the need for these inspections, but the relevant regulators and authorities will need to be convinced that the standards concerning safety and revenue protection are maintained before such a change could be made. Those discussions have not yet taken place and we therefore have no justification for removing the costs associated with these inspections.

Legal, IT, setup and organisational costs

The December 2009 IA included a cost of £300m covering legal, institutional and planning activities of the roll-out. For example, it included amongst others cost estimates for supplier contractual costs, marketing, testing of the infrastructure and conducting trials, and costs for the data protection and security solution[16].

The December 2009 IA also included, separately to that cost item, the costs of supplier IT systems for data management, settlement and storage which are likely to be needed to underpin the roll-out of smart meters.

Both these figures have been revised following further work with Ofgem and stakeholders. In this IA, in order to provide greater transparency to our estimates, we provide a more granular breakdown of the cost items covered in our estimate. The table below summarises the revised costs estimates:

Table 5. Legal, IT, setup and organisational costs

	£m
Supplier IT one-off costs	45
DCC one-off costs	55
Marketing and consumer support costs	100
Legal costs	30
Others (data protection, ongoing regulation, assurance, accreditation, tendering, Programme delivery, trials, testing)	140

We assume one-off costs of £45m for the new IT system across suppliers. This has been revised from the previous assumption of £12m IT costs on the basis of the more detailed assessment carried out by DECC/Ofgem.

It is important to note that in practice it is possible that the DCC may expand its role through time, which may result in additional costs resulting from a broader role and larger benefits by realising efficiency savings in functions currently performed by other bodies. For modelling purposes we have assumed these costs and benefits arising from a broader scope will cancel out. This is because such an estimate cannot be provided at this point without further detailed work carried out by industry. This is why in parallel with this IA DECC and Ofgem are undertaking a review, with stakeholders, of the options for the scope of the DCC and their associated costs and benefits.

The updated figures in the table now also account for higher than previously assumed costs of raising awareness via marketing and other consumer support activities. It is important to note that we make no assumption about who will bear the cost of this activity in our analysis. Such activity was previously estimated to cost £30m, which has been revised upwards to £100m. This estimate is indicative and is based on the costs for the Digital switchover campaign.

The NAO published a report on the Digital switchover marketing which set out the spend as:

[16] Baringa Partners, *Smart Meter Roll-out: Energy Network Business Market Model Definition and Evaluation Project*, 2009

Table 6. Digital switchover consumer engagement spend

Activity	Budget
TV, radio & press advertising	£57m
Other customer outreach & support	£29m
Call centre & website	£20m
Planning & production	£18m
Regional mailings	£14m
Trade support	£12m
Research & tracking	£8m
Regional management	£8m
Total	£166m

The spend for smart metering should be substantially less given the high profile role taken by suppliers, hence for example the call centre costs should be reduced, or removed entirely. In addition the regional costs can be removed. The £100m will be reviewed in our subsequent phase of work which will establish a clearer remit and budget.

Additionally to the costs discussed in the table, we have assumed ongoing operational costs of £15.5m required to support the minimum scope of the DCC and £1m suppliers' IT costs.

3. Benefits of smart metering

Consumer benefits

Benefits from smart meters can be driven by changes in consumers' expected consumption behaviour. Two potential sources of change in average consumption behaviour may arise:

- a reduction in overall energy consumption as a result of better information on costs and use of energy which drives behavioural change, and
- a shift of energy demand from peak times to off-peak times.

Energy demand reduction

There remains a great deal of uncertainty about the likely response of consumers to the full roll out of smart meters. A number of international studies exist, the most recent a review of 57 feedback studies in nine different countries by the American Council for an Energy-Efficient Economy[17] which finds that on average feedback reduces energy consumption between 4-12%. Sarah Darby[18] and Corinna Fischer[19] – ' also show that feedback can result in dramatic behavioural changes (average reductions in energy consumption of over 10%). Even though substantial savings are a common finding from the introduction of real-time displays, it is difficult to transfer these findings to the domestic GB situation (because for example there is little use of air conditioning, a different counterfactual world, or different cultures and pricing

[17] Erhardt-Martineaz, Donnelly, Laitner, *Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities*, June 2010
[18] Sarah Darby, *The Effectiveness of Feedback on Energy Consumption*, April 2006
[19] Corina Fischer, *Feedback on household energy consumption: a tool for saving energy?*, Energy Efficiency (2008) 1:79-104

regimes). The Energy Demand Research Project[20] has been funded by the Government to provide information on consumers' responses to a range of forms of feedback in Great Britain. The final report from the project is currently expected to be available in early 2011. Ofgem and DECC have recently commissioned the Centre for Sustainable Energy, University College London and University of Reading to provide additional statistical analysis and scientific input to evaluating the results on energy savings from smart metering. The next progress report on the project is currently expected to be published in September.

As a result of the existing uncertainty most commentators have so far adopted relatively conservative assumptions. For example Ofgem's past cost-benefit analysis[21] for domestic metering innovation assumed a 1% energy saving from smart meters, which is at the lower end of the savings of 1-3% reported in the Owen and Ward[22, 23]studies (2006, 2007). Other studies have been more optimistic with Energywatch[24] giving a range of energy saving of 3.5-7%.

For our analysis we have assumed that the following gross annual reductions in demand will take place as a result of improved feedback on the use and cost of energy. The reductions are as follows:

- 2.8% for electricity (credit and PPM); 2% for gas credit and 0.5% for gas PPM.

We also apply sensitivity analysis to these benefits as follows:

- In the higher benefits scenario: 4% for electricity (credit and PPM), 3% for gas credit and 1% for gas PPM.
- In the lower benefits scenario: 1.5% for electricity (credit and PPM), 1% for gas credit and 0.3% for gas PPM.

Energy demand shift

Another potential source of change in consumption patterns through smart meters is a shift of energy demand from peak times to off-peak times. The rationale and our underlying assumptions on Time of Use (ToU) pricing have not changed since the December 2009 IA. We assume a 20% take up by consumers of the ToU tariff (in addition to the existing group using this option) and a resulting overall 3% electricity bill reduction and 5% peak use reduction for these customers; sensitivities are made on the take up at 0% and 40%.[25] Energy is valued largely consistently with guidance produced by DECC[26]. This includes consideration of the revised carbon valuation methodology, which was published alongside the Low Carbon Transition Plan.

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[20] The Energy Demand Research Project (EDRP) started in July 2007. Four suppliers are leading the project trials which are examining how energy consumers respond to better information about their energy consumption. The project is funded by £10m from the Government, matched by equivalent funding from the companies. Several interventions are being tested: smart meters, real-time display devices; additional billing information; monthly billing; energy efficiency information; and community engagement. There are a combination of interventions in around 42,000 different households and some 18,000 smart meters. See: http://www.ofgem.gov.uk/Markets/RetMkts/Metrng/Smart/Pages/SmartMeter.aspx

[21] Ofgem, *Domestic Metering Innovation Consultation*, February 2006

[22] Owen and Ward, *Smart Meters in Great Britain: the Next Steps*, July 2007

[23] Owen and Ward, *Smart Meters: Commercial, Policy and Regulatory Drivers*, March 2006

[24] Energywatch, *Smart Meters – Costs and Consumer Benefits*, 2007

[25] These assumptions have not changed since the May 2009 Impact Assessment, but were incorrectly described in that document.

[26]DECC Greenhouse Gas Policy Evaluation and Appraisal in Government Departments, May 2009

Valuing avoided costs of carbon from energy savings
We have valued the avoided costs of carbon from energy savings in order to show whether the UK is introducing cost-effective policies to reduce carbon emissions, which is discussed with some more detail in the carbon assessment in page 53..

For electricity, reductions in electricity use will mean the UK purchasing fewer EU ETS allowances and this saving is assimilated as a benefit. In our analysis and across all options, it accounts for Present Value (PV) of approximately £350m.

For gas, the value of carbon savings from a reduction in gas consumption uses the non-traded carbon prices under DECC's carbon valuation methodology. This corresponds to a net reduction in global carbon emissions and corresponds to approximately PV £0.60bn for option 1 and £0.65bn for Option 2.

Reduction in carbon emissions

Over the period covered in the IA, we assume that as a result of a reduction in energy consumption, CO_2 emissions reductions will take place in the traded and non-traded sectors[27]. The table below presents the CO_2 emissions associated with the energy savings in the central scenario across options.

Table 7: reductions in CO_2 emissions and energy savings

Option	EU ETS permits savings (Millions of tonnes of CO_2 saved equivalent) – traded sector	Millions of tonnes of CO_2 saved – non-traded	Energy Savings – electricity (£bn, PV)	Energy Savings – gas (£bn, PV)
1	17.1	15.4	2.9	1.3
2	18.0	16.3	3.0	1.4

Please note that the observed reduction in carbon savings from the December 2009 IA is due to the change in business as usual energy consumption levels rather than a downward revision of the impact of smart meters.

Valuing consumer time savings
The April 2008 and December 2009 IAs discussed the potential for valuing savings in consumers' time from the introduction of smart meters and we concluded that there was insufficient information to include any savings. We have received no further information since December 2009 and we have therefore not included any savings in this assessment.

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. We have made a conservative estimate of the number of units (about 1 million by 2020) and the

[27] Note that the impact of a tonne of CO2 abated in the traded (electricity) sector has a different impact to a tonne of CO2 abated in the non-traded (gas) sector. Traded sector emissions reductions lead to a reduction in UK territorial greenhouse gas emissions, but do not constitute an overall net reduction in global emissions since the emissions will be transferred elsewhere to member countries in the EU-ETS. The UK gains a cost saving from buying fewer emissions allowances, but these allowances will be bought up by other member states – the total size of the EU-wide 'cap' on emissions does not change during each phase of the EU-ETS. Non-traded sector emissions reductions will reduce both UK and global emissions.

savings per annum per meter (£0.12) that result in assuming a separate meter and its installation cost are not needed.

Supplier benefits

Supplier benefits are the cost reductions that suppliers will see once smart meters are installed. The following are the main supplier benefits used in the IA.

Meter reading
This assumption is unchanged from the December 2009 IA. Smart meters will allow meter reading savings for all the suppliers once the roll-out is complete. We continue to assume that "avoided meter reading" will bring in benefit (cost savings) of £6 per (credit) meter per year in our central scenario taking into consideration both actual and attempted reads. We have also included another benefit linked to meter reading – "avoided site visit" these are avoided special visits to read meters or ad hoc safety-related inspection visits outside the normal cycle. Reductions in the requirements for these visits are assumed to give a benefit of £0.75 per meter per year.

Customer service overheads
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 December 2009 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 on this point 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.

Remote switching and disconnection
The meter functionality we assume 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 pre payment 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. The implementation Programme will need to examine the existing protections for consumers and amend these where appropriate to ensure that consumers are properly protected.

Pre payment cost to serve
Smart meters are expected to bring savings in the cost to serve for consumers with pre payment meters (PPMs). These savings arise primarily from reduced maintenance and service needs. We assume that the additional cost to serve consumers with PPMs are £30 for electricity and £40 for gas. The introduction of smart metering would reduce (but not remove all) those additional costs. Our assumption is unchanged from that used in December 2009 and is based upon consideration of the 2009 consultation responses and evidence from Ofgem. The level of savings attributed to smart meters is 40%, representing an annual saving of £12 for each electricity PPM and £16 for each gas PPM.

Consumers on pre-pay could benefit if these savings were passed on as lower prices. In practice, pre-pay customers have already made those savings because suppliers have artificially lowered prepay tariffs to standard credit levels. In so far as that process has involved cross-subsidy, part of the benefit of reduced prepay costs might fall to standard credit customers.

A single credit/prepay meter means that cost-differentials between standard credit and prepay tariffs will be substantially reduced (although, in practice, suppliers have already chosen to remove the differentials between the tariffs paid by prepay and standard credit customers)

Debt management
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 change of occupier and change of supplier. Suppliers estimate that a 30% fall in inbound calls volume could result in 20% savings in call centres overheads.

Theft
The implementation of smart metering could reveal existing theft and allow suppliers to combat it better. Information provided suggested that this could reduce theft by 20-33%, equivalent to £0.27 to £0.85 per meter per year. We continue to assume that the amount of theft is likely to decrease as suppliers will have access to more accurate and frequent data and will detect theft more quickly; however we also recognise that new methods of theft will arise. The assumption of a reduction of 10% or c. £0.2 per meter per year continues to be used in our central scenario.

Losses (Distribution)
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[28]. Further work is needed to assess potential costs and benefits for networks in detail.

Switching Savings
The introduction of smart metering should allow a rationalisation of the arrangements for handling the change of supplier process. Trouble shooting teams employed to resolve exceptions or investigate data issues would 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 mis-billing would reduce. We continue to assume savings of £100m per year[29] (any additional systems costs are included in the IT and systems cost estimate).

Generation capacity investment
The assumed consumer energy demand shift to off-peak load could realise savings in investment in generation capacity. In our model we have assumed that the cost of additional investment in generation capacity is of £600 per additional kw of investment. If consumers shift to off-peak consumption some of the investment in generation capacity will be unnecessary, therefore realising savings to energy suppliers.

[28] Mott MacDonald, *Appraisal of costs and benefits of smart meter roll out options*, April 2008
[29] Based on estimates from Owen and Ward (2006)

Intangible benefits

It has been possible to make a quantitative assessment of the benefits described above within the updated modelling for the 2010 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[30] but we consider they remain important potential elements or areas for future consideration.

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.[31]

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.[32] 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. 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

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[30] 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.

31 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

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

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.[33] 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 EV and HP 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.

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 Consultation 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.

[33] ENA and Imperial College London (2010) ' Benefits of Advanced Smart Metering for Demand Response based Control of Distribution Networks [web ref?]

4. Roll-out duration

An accelerated roll out means that the benefits come on line more quickly and a more intensive approach would provide greater benefits of scope and scale and the necessity to run multiple back office systems would be reduced.

However, costs would also come on line earlier. Where timelines are shorter, higher capital costs might be expected as it would be necessary to acquire the equipment, competent labour and meters within a compressed period. And there would be additional stranding costs. Additionally the scope to adjust delivery and learn from mistakes is less – the time available to adjust being shorter. There is potential for greater risk to consumers in terms of cost.

The latest Programme timeline – discussed in more detail in Prospectus - indicates that the full DCC will be offering services from Autumn 2013. The roll-out start date and profile have been slightly amended to reflect this.

The Government has stated it will work with suppliers to establish more ambitious installation targets. In advance of this work, for modelling purposes we have assumed different installation rates for the two options. These rates should not be interpreted as policy options on the installation targets that could be set on suppliers.

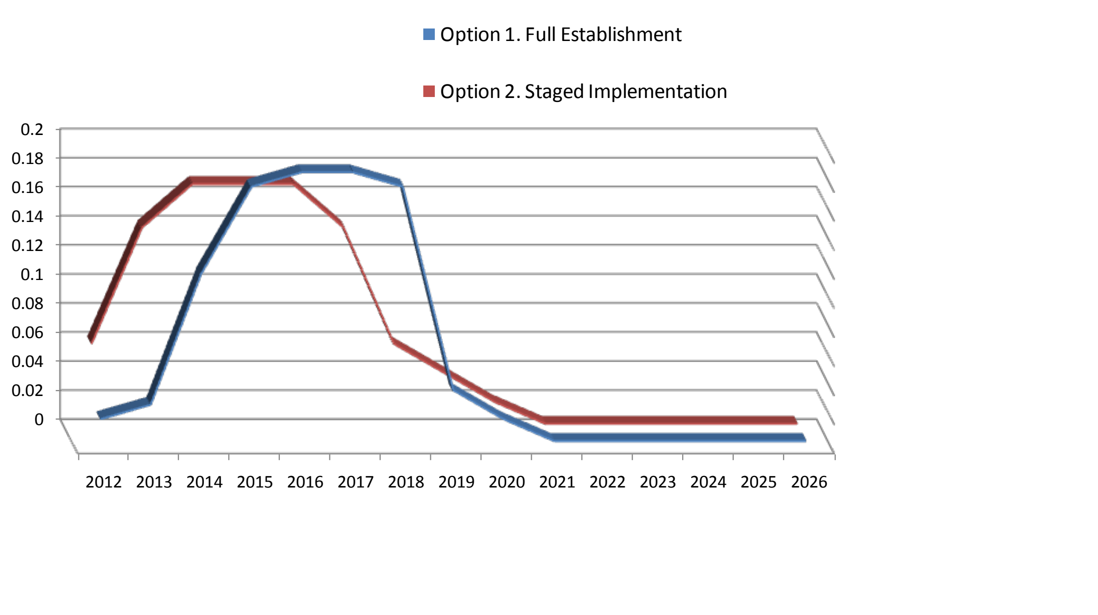
For option 1 – Full Establishment – the following assumptions have been made:

- The mass rollout commences when DCC goes fully live in Autumn 2013.
- However some suppliers will start rolling out smart meters previous to that date. We have assumed that due to early movers approximately 10% of all meters will be to some degree smart before the start of the roll-out in Q4 2013.
- There is no guarantee that these meters will be compliant with the detailed meter and communications specification. For modelling purposes we have assumed that 50% of early movers will be supported by the DCC.
- Suppliers will want as flat a profile as possible over the bulk of the roll out (2015 to 2018) as it is easier to manage their resources.

For option 2 – Staged Implementation model – a technical specification for meters and associated technology would be agreed and referenced in supplier licences. This would provide suppliers the certainty they need to install meters prior to full DCC operation being in place. The following assumptions have been made under this model for the roll-out profile:

- Suppliers' base preparations for the roll out on meter specifications available at end of Q2 2011.
- Suppliers start to roll out meters at volume from summer 2012 once the supplier licence conditions are finalised.
- Suppliers also want as flat a profile as possible over the bulk of the roll out (2014 to 2018) as it is easier to manage their resources.

Figure 2 – Roll out profiles



For modelling purposes we have assumed similar, but not identical, installation rates for the two options. Our aim in modelling these profiles is to assess the costs and benefits of the two options for the start of the rollout. Overall we feel this approach to the profiles best isolates the impacts on costs and benefits of the two options. The profiles are not intended to assess the impacts on costs and benefits of different target dates for completion of the rollout. Therefore the difference in assumed rates should not be interpreted as policy options for the installation targets that could be set on suppliers. We have defined roll-out profiles for the two options on the basis of:

- when the mass roll-out gets underway
- a vast majority of smart meters is rolled-out within the proposed timescales
- peak installation rates are kept below an assumed annual rate of 17%[34]
- beyond 90% coverage, installation rates are likely to decelerate substantially because of harder to reach customers

For Option 1, so as to not to extend the duration of the rollout overall, peak installation rates are slightly higher than 17%. We have increased installation costs accordingly in the years where this occurs.

5. 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 device or over the period 2010-2030. The cost numbers are risk-adjusted, i.e. they have been adjusted for optimism bias (see section G on risk). We have applied sensitivity analysis to benefits and we present benefits in terms of low, central and high scenarios. Table 12 shows the impact of smart meters on energy bills of domestic customers[35]. 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.

[34] The existing cost/benefit model and the December 2009 IA assume that installation costs increase by 1% for every percentage point the installation rates are above 17%. We need to do further work to test this assumption.
[35] Updated values of the average annual impact per meter are available for the central case in Annex 2

The period of the analysis has been adjusted to reflect the fact that we are in 2010. Therefore the PV base year for the analysis is 2010 in contrast with 2009 in the December 2009 IA. The price values are nevertheless still based on 2009 (for example, energy prices are based on 2009 to reflect the latest available price data from the Interdepartmental Analysts Group guidance[36]).

The options assessed are:

- Option 1: **Full Establishment:** Mandated roll-out of smart meters under the centralised communications model. Roll out complete by the end of 2020
- Option 2: **Staged Implementation:** Mandated roll-out of smart meters with transitional arrangements and mandatory use of DCC when available. Roll out complete by the end of 2020.

Under option 1, suppliers would not have a guarantee that their installations of smart meters prior to late 2013 (when the DCC would be operational) would not be stranded. Hence it is assumed that no mass roll-out of smart meters would take place previous to the DCC being operational. For modelling purposes, we have assumed that 10% of meters would be smart due to early movers and that half of these smart meters would be supported by the DCC. For these meters however some of the benefits from the DCC being in operation would be compromised, such as supplier switching benefits, and there are likely to be one-off integration costs to DCC once this is put in place. Other costs have also been considered such as increased risk of sub-optimal communications solutions due to lack of coordination and increased operation and maintenance costs for communications as the DCC would need to support multiple communications solutions. The assumptions for this option are:

- 40% reduction in supplier switching benefits for those smart meters installed previous to DCC being in place.
- £30m one-off nugatory costs to integrate existing communications solutions to DCC
- CAPEX and OPEX communications cost optimism bias adjustments are assumed to be 30% - rather than 10% - in the period 2011-Q3 2013. After this point both opex and capex are assumed to return to the levels in the DCC solution as we are assuming that the one off integration provides a full DCC solution.
- There is a risk that the DCC solution may not be the same as the solution that suppliers use pre DCC. In this case, DCC would need to support multiple communications solutions which would have a cost impact. An increased optimism bias of 5% is included to account for this risk.

The roll-out profile for this option is slightly changed from the December 2009 IA as explained above. The remaining assumptions for the model – this is, where the general assumptions have not changed- remain unchanged.

Under option 2, transitional arrangements are put in place which guarantee a functional specification for meters and associated technology would be agreed and referenced in supplier licences. This would provide suppliers the certainty they need to install meters prior to full DCC operation being in place. As discussed in section 4 above, smart meters would start being rolled-out at a faster rate than under option 1 due to the greater regulatory clarity provided to suppliers by the transitional arrangements. As in option 1, some of the benefits from the DCC being in operation

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

would be lower during this period and costs are likely to be higher. Under this option one-off costs to integrate existing communications solutions would increase to £100m because of the larger number of smart meters installed previous to the DCC being in place.

It is important to note that where there are specific risks to the Staged Implementation the IA has attempted to quantify these risks to allow a comparison of costs and benefits between the options. There is however uncertainty around the extent and the degree to which these risks would be realised and hence the estimates presented should be treated with caution.

Table 8: Total costs and benefits

	Total Costs £bn	**Total Benefits £bn**	**Net Present Value £bn**
Option 1	9.12	14.15	5.04
Option 2	10.05	15.04	4.99

Table 9: consumer and supplier benefits

	Consumer Benefits £bn	**Supplier Benefits £bn**	**Other benefits £bn**	**Total benefits £bn**
Option 1	6.43	6.33	1.40	14.15
Option 2	6.80	6.76	1.48	15.04

Table 10: low, central, and high estimates

	Total Costs £bn – central	**Total Benefits £bn**			**Net Present Value £bn**		
		Low	**Central**	High	Low	**Central**	High
Option 1	9.1	9.7	14.1	18.5	0.6	5.0	9.4
Option 2	10.1	10.3	15.0	19.7	0.3	5.0	9.6

Table 11: benefits

	Consumer Benefits £bn			**Supplier Benefits £bn**			**Other benefits £bn**		
	L	**C**	H	L	**C**	H	L	**C**	H
Option 1	2.60	6.43	10.16	5.73	6.33	6.92	1.34	1.39	1.45
Option 2	2.75	6.80	10.74	6.12	6.76	7.40	1.42	1.48	1.53

Modelling results show that a “Staged Implementation” to implement the roll-out of smart meters (Option 2) is likely to deliver very similar costs and benefits to a model where the roll-out does not commence until the DCC is in place (Option 1).

The NPV results for both options are close and virtually the same if we account for the margin of error in the modelling, even though NPV is marginally higher for option 1. Option 2 shows both higher benefits (£0.9bn higher) and higher costs (£1bn higher) than Option 1. This is largely driven by consumers being able to realise energy savings earlier in the roll-out under Option 2 and by the higher costs in PV under

Option 2 due to the earlier roll-out and the larger costs incurred to roll-out and maintain those smart meters installed previous to DCC being in place.

The cost-benefit ratio is also marginally higher for Option 1(1.6 in contrast with 1.5 for Option 2). This is because those smart meters rolled-out previously to DCC being in place realise lower supplier savings and higher costs, and these occurs to a larger extent under Option 2 than under Option 1.

Finally, it is also important to note the different impact of the two options in distributional terms for both consumers through energy bills impacts and suppliers through stranding costs. These are discussed in section 7 below.

We have also considered qualitatively the consequences for the smart meters roll-out of setting more ambitious roll-out targets.

On the one hand, a more aggressive roll-out profile would imply that benefits from smart metering would be delivered earlier, increasing total benefits. On the other hand, a more compressed roll-out would result in higher stranding costs and would also increase the risk of supply chain constraints. The latter may result for example in:

- manufacturing costs increasing due to bottlenecks in the supply chain
- a lack of resources to undertake installation work which is trained and has the appropriate certification which in turn would drive up costs
- increased use of overtime to account for the above
- risk that manufacturing the communications network at the assumed cost is not viable

Due to the uncertainty around the cost implications of these risks we have not here quantitatively assessed the costs (or benefits) of any particular accelerated roll-out profile. Costs implications for meters, IHDs, communications and installation will be tested further with industry.

7. Distributional impacts

a) Consumer impacts of smart meters

The costs to energy suppliers will be recovered through higher energy prices, although any benefits to suppliers will also be passed on to consumers[37]. However, once the roll-out is completed, the reduction in energy consumption from smart meters will counteract this impact, leading to a net decrease in energy bills on average. The results below show the average impact on GB household energy bills. It is expected there will be variation between households depending on the level of energy they save and on how suppliers decide to pass through the costs.

The impact on consumers is shown for both options in the IA. The results show long term reductions in energy bills for dual fuel customers. For example, by 2020 we expect the savings on energy bills for the average dual fuel costumer to be in the region of £14 per annum.

In the short term, transitional and stranding costs from the roll-out will be passed down to consumers, and energy savings will only be realised by those consumers who have already received a smart meter. We estimate that this will result in an

[37] For this analysis we have assumed that suppliers pass 100% of the costs and benefits on to consumers due to the pressures of the competitive market.

average bill increase of £8-9 by 2015. From 2018 onwards, as most consumers start realising the benefits, and transition and stranding costs decrease, the net impact of smart meters on the average electricity and gas customer will be a reduction in bills. By 2030 we estimate average bill savings will be as large as £34 per household.

Table 12 shows that for both options bill impacts would be broadly similar, even though option 1 is slightly more positive in the short and medium term as transition and stranding costs are lower. In the long run bill impacts for both options converge as the effect of a different approach to implementing the roll-out disappears.

Table 12: Impact on average domestic energy bills for a dual fuel customer

	Option 1 "Full Establishment", £	**Option 2. "Staged Implementation", £**
2010	**0**	**0**
2015	**8**	**9**
2020	**-14**	**-14**
2025	**-27**	**-26**
2030	**-34**	**-34**

The price impacts of smart meters in the domestic sector are detailed in Table 13 below. The price impact per unit of energy is expected to be positive, but the reduction in energy consumption arising from the policy will mean that overall the long term average net impact on bills will be negative.

Table 13. Price impacts on domestic energy bills (Option 2)

Year	Electricity price impact (£/MWh) (Inc VAT)	Gas price impact (£/MWh) (Inc VAT)
2010	-	-
2011	**0.23**	**0.07**
2012	**0.44**	**0.13**
2013	**1.47**	**0.42**
2014	**2.26**	**0.63**
2015	**2.67**	**0.72**
2016	**2.99**	**0.79**
2017	**3.03**	**0.79**
2018	**2.47**	**0.63**
2019	**2.20**	**0.56**
2020	**1.94**	**0.49**
2021	**1.44**	**0.36**
2022	**1.30**	**0.34**
2023	**1.21**	**0.31**
2024	**1.12**	**0.29**
2025	**1.10**	**0.29**
2026	**1.06**	**0.28**
2027	**0.94**	**0.26**
2028	**0.81**	**0.23**
2029	**0.69**	**0.20**
2030	**0.59**	**0.17**

Please note that the present bill impacts update the estimates presented in the December 2009 IA. The December 2009 IA estimated the impact of smart meters on domestic consumers energy bills to be of -£3 in 2015 and -£28 in 2020 for dual fuel customers. These are different to the updated values in table 12. This is because, in the first place, the average base bill from which smart meters impacts are calculated has been reduced as a result of methodological changes to the calculation of bill impacts and the downwards revision of impacts of other policies on bills. As smart meters bill impacts are calculated as a percentage of total bills, lower base bills result in lower savings from smart meters. Secondly, the cost passed down to consumers as a result of the smart meter roll-out has been revised upwards since the publication of the December 2009 IA which results in increased costs being passed down to consumers in the form of higher prices. Finally, minor errors in the input data utilised in calculating bill impacts in the last IA have now been corrected, which has also resulted in lower estimated bill savings from smart metering.

b) **Remote switching**

The proposed functionality requirements include enabling remote switching between credit and pre-payment. The Implementation Programme will need to examine the existing protections for consumers and amend these where appropriate to ensure that consumers remain properly protected. This work will need to cover a variety of issues, including rules relating to remote disconnection and switching between credit and pre-pay.

c) **Stranding costs**

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 is dependent on the speed of the roll-out option; we assume it would be largely avoided in a new and replacement scenario, but costs would occur in a 10-year or shorter roll-out option (the basic meter life span is 20 years). In order 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;
- 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; and
- meter recertification continues during the deployment period.

The two options considered in the IA would involve significant stranding costs. Stranding costs are not reflected in other parts of the analysis because they are considered to be a form of sunk costs i.e. costs already incurred but for the purposes of the analysis it is assumed that the costs of stranding will be passed on to consumers and the cost is therefore reflected in price and bill impacts as in tables 10 and 11 in the above section.

Under option 2 ("Staged Implementation") we estimate stranding costs of £820m in contrast with comparatively lower stranding costs of £660m for option 1 ("Full Establishment"). This is because the roll-out profile for the latter option assumes that before DCC is in place smart meter installation rates would be lower than the natural replacement rate. This results, prior to DCC being operational, in smart meters only being installed to replace dumb meters at the end of their life and hence cause no stranding. In contrast, for option 2 we have assumed that the roll-out starts more aggressively from 2012, with roll-out rates in that year already above the 5% replacement rate. This results in the first years of the roll-out in smart meter installation rates being higher than the natural replacement rate of meters which causes stranding of dumb meters.

The total stranding costs over the period of a specific smart meter roll-out 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 roll-out 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. Other things being equal (e.g. annual new meter installation numbers, rental arrangements, discount rates), suppliers are not expected to prioritise replacement on the basis of age of meter. To justify this finding it is worth considering two extreme scenarios, one where suppliers hypothetically target older meters first and a second where the youngest are targeted first.

Under the first scenario taking out older meters first could mean smaller termination fees in the early year, but it also means that younger meters remain on the wall. When the younger meters are finally replaced the supplier no longer has the opportunity to replace the older meters, so the termination fee in this later year is higher than it would have been if we had adopted the alternate strategy of replacing the youngest first. Adopting the second strategy would mean higher termination fees in early years, but lower fees in later years. Overall our termination fees will be the same in total with either strategy.

d) **Administrative burdens on businesses**

The business as usual administrative burden of informing customers about the instalment or removal of meters was initially estimated by PwC as £31 million in 2005. In the course of discussions with DECC officials, energy suppliers advised DECC that they would carry out the notification prior to installing or removing a meter irrespective of the obligation because:

a) it is good business practice to inform their customers of imminent actions – this ensures a good customer experience; and
b) it greatly reduces suppliers' costs if they are certain that customers will be present at the premises to ensure access (as the need for repeated visits is removed).

Based on these views DECC and the Better Regulation Executive have amended the original admin burden baseline.

In light of the above it is our view that the roll-out of smart meters will not impose an admin burden on businesses. The roll-out may increase the need to install meters in the period of the roll-out and as such imposes a compliance cost, but there is no associated administrative burden from having to inform customers of these works.

G. Risks

Costs: Risk Mitigation and Optimism Bias[38]

The roll-out 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.

After the publication of the April 2008 IA, it was acknowledged that more work needed regarding the treatment of risk to the costs of a GB-wide smart meter roll-out. Baringa Partners were commissioned to consider these issues, in particular to provide:

- Assessment of the international and domestic evidence available,
- Development of a risk matrix based on the identification of key risks, their potential impacts and mitigation actions,
- Assessment of the sensitivity of these risks to market model and duration of the roll-out,
- Assessment of the treatment of risk in the April 08 IA, and
- Make recommendations, in light of the above.

The changes were adopted in the December 2009 IA. Since then, an additional adjustment to optimism bias adjustments has been made on the operating and maintenance costs of the communications solution. A 10% optimism bias adjustment has now been applied to reflect that depending on the technology solutions deployed, some additional cost may be required to address 'harder to reach' meters, whether due to geographic factors or the specific circumstances of meter deployments at premises. Under both options considered, there is also a risk that smart meters installed prior to DCC being place do not have an appropriate chosen communications solution. No additional optimism bias has been applied for this reason A 10% optimism bias has also been applied to DCC operational costs to reflect the uncertainty around the final scope of the DCC and the costs involved.

IT optimism bias adjustment has also been revised downwards from 50% to 10% as a result of more detailed cost assessment which has allowed to identify more clearly the nature of the costs involved in the central IT and DCC set-up costs estimates.

More detail on optimism bias and how it is applied can be found on the Treasury website in the Green Book guidance[39].

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

Benefits: sensitivity analysis

Because of the scarcity of evidence on benefits (smart meters have only been recently rolled out abroad), sensitivity analysis has been applied to the main elements of the benefits. We ran the following sensitivities on the benefits:

Table 14: Sensitivity analysis for benefits

	High benefits	Medium benefits	Low benefits
Consumer benefits			
Energy savings electricity	4%	2.8%	1.5%
Energy savings gas	3%	2%	1%
Energy savings gas PPM	1%	0.5%	0.3%
Supplier benefits			
Call centre costs	£2.4	£2.2	£1.9
Meter reading	£6.5	£6.0	£5.5
Theft	15%	10%	5%
TOU take up	40%	20%	0%
PPM Cost of Serve	50%	40%	30%

It is worth noting that the energy savings affect the total cost for each option due to the energy use by the devices, but the effect is minimal.

H. Enforcement

All of the options outlined in this IA would be implemented via 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).

I. Recommendation – Next Steps

Next steps are described in the Prospectus which this IA accompanies.

The Government will assess the responses to this IA and the Prospectus. In parallel DECC and Ofgem will work with stakeholders to develop further detail, costs and benefits associated with the provision of central communications.

J. Implementation

The Implementation approach is described in the Prospectus which this IA accompanies.

K. 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 roll-out 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 roll-out process. This way, adjustments to the roll-out Programme can be realised in order to maximise the benefits from the smart metering roll-out.

Results from piloting schemes are also expected to feed into a better monitoring and evaluation of the roll-out. For example, as part of the Energy Demand Research Project consumers' behavioural response to the pilots will help monitor and evaluate the design and implementation of the policy.

Annexes

Annex 1. Functionality – Remote disablement and enablement for gas smart meters

Background

This annex provides underpinning analysis to support the decision on whether the minimum mandated functionality for gas smart meters should include the capability to turn gas supply on and off remotely.

High-level functionality requirements already established by DECC left open the question of whether the minimum requirements for gas smart meters should include the ability to remotely disable and enable gas supply. For gas meters the functional requirement to remotely disable and enable gas supply necessitates the inclusion of a mechanical valve in the meter. The valve closes to disable supply and opens to enable the gas to flow again[40]. Equivalent functionality is already included in the electricity meter at minimal cost - for gas meters it is relatively expensive, requiring a mechanical valve costing £10-13 of a total meter cost of £50-£60.

The capability to turn electricity or gas supply on or off remotely supports benefits related to prepay and debt management, reducing the number of days a customer is in debt compared to credit tariffs and costs associated with switching from credit to prepay. The remaining gas smart meter benefits (avoided meter reading, back office efficiencies, energy and carbon savings) are achieved without a valve. Prepay and debt management amount to less than 10% of the total estimated benefits arising from gas smart metering which accrue to suppliers. Non-valve benefits could also be achieved through the installation of an upgrade device to existing meters (see retrofitting below).

This annex focuses on the cost benefit implications of including the valve as part of the minimum high level functional requirements. Further discussion of the technical and consumer aspects is contained in a report by Gemserv which DECC commissioned to examine the range of technical and commercial issues raised by the inclusion of a valve[41].

This annex sets out our cost benefit work assessing the economic case for mandating a valve in all smart meters.

General issues

This assessment is complex as there are a number of variable assumptions affecting both costs and benefits. The key issues are discussed below.

<u>Prepayment and take up of Pay as you go (PAYG)</u>
The gas valve is relevant to prepayment. A gas valve stops the flow of gas when the prepaid amount runs out and allows gas to flow again when a payment is made. This

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[40] Whilst the requirement would not be for a valve itself, for ease of presentation we will use the provision of a valve to mean the high level functional requirement for remote disablement and enablement of gas supply

[41] Gemserv 2010, *Analysis on disablement/ enablement functionality for smart gas meters* – for the technical analysis

is how current prepayment meters work; these already have valves and we would expect current prepayment meters to be replaced by smart meters with valves therefore some 2m meters (around 11% of the total gas meter stock) will have a valve. Whilst it may be possible for suppliers to offer prepayment tariffs without a valve it is not clear that this would be a commercially acceptable approach for many suppliers, because it would remove the capability to stop gas supply when credit has been used.

The Gemserv work has confirmed that smart meters could provide a platform for prepay to become a mainstream payment option through the offer of new pay-as-you-go (PAYG) tariffs assessing that take-up could reach 30% of the total market. Consumer Focus research suggests that at least 22% of energy consumers not already using a prepay meter would be interested in PAYG if the price was competitive with direct debit and they could top-up easily. It is difficult to anticipate how this market may grow so different levels of PAYG take up are examined as sensitivities in the cost benefit analysis[42].

Stranding
A requirement for a valve in every smart gas meter means all non-smart gas meters have to be replaced, creating stranding costs. Stranding costs are considered to be “sunk” costs and are therefore not included in the NPVs set out below.

Retrofitting
The Gemserv work has confirmed that about half of current non-smart meters could be upgraded to deliver smart capability. This "retrofit" involves installing a reading and communications device to the existing non-smart gas meters to deliver a proportion of the benefits of smart metering (eg remote meter reading and information to consumers). A retrofit could allow existing non-smart meters to be used until the end of their normal asset life rather than be replaced early with a smart meter thereby reducing non-smart meter stranding costs. The cost of a retrofit is lower than meter replacement because the device itself costs less (£19 compared with a smart meter cost of £43 without the valve) and installation is quicker and easier (£25 compared with £49). The actual number of retrofits used will depend on suppliers judgements about whether extending the life of the non-smart is worth the cost of the retrofit and its installation; we have examined sensitivities in the cost benefit analysis.

Cost assumptions
We have retained the input cost assumptions for the modelling used in previous the previous Impact Assessment. Gemserv received a number of new estimates on smart meter capital, installation and maintenance costs - some of these exceeded our current estimates, while some were lower. However, we have not revised our estimates because we consider that, given the range of estimates, there was not a sufficiently strong case to do so. Optimism bias has been applied to the cost numbers used in our economic modelling to account for the risk of higher costs.

Non-quantified Benefits
There are a number of potential benefits related to the inclusion of a valve which are not quantified in the modelling, which are nevertheless important for customers, for market developments and for the smart meter rollout, if all gas smart meters include a valve:

- The services offered across gas and electricity would be the same with customers being able to opt for PAYG easily and quickly on both, without

[42] Although higher rates of pre-pay are observed in the Northern Ireland market (40%), this differs in a number of respects from the GB market, and so we do not believe this level would be representative of take up in the GB market.

additional meter exchanges, removing any barriers to take-up of new tariffs.

- Expansion of the market for prepay, encouraged by growth of PAYG, could make this sector of the market more attractive to suppliers, increasing competition within it, as well as removing the perceived stigma of having a prepayment meter.
- A developing market for prepay, encouraged by growth of PAYG, could make this sector more attractive to suppliers, increasing competition within it, and leading to benefits to consumers.
- Suppliers would know what meters they have to procure and install which could reduce some of the complexity around procurement and potentially maximise economies of scale for meter provision.
- Achieving technical interoperability – to support consumer switching – is likely to be easier as the numbers of variations to be considered is reduced.

Options considered

In order to assess the cost benefit case for including a valve in all gas smart meters we have assessed two options:

- **Option A**: a "universal" approach where all gas meters must be smart and fitted with valves.
- **Option B**: a "supplier choice" approach where the minimum requirement does not include a valve, allowing suppliers to choose the approach they wish to take.

Both of the options assessed are based on the Staged Implementation approach – Option 2 – which is set out in the Impact Assessment.

Option A: a "universal" approach where all gas meters must be smart with valves

Under this option the government would mandate that all gas smart meters must contain a valve and therefore all existing non-smart meters would need to be replaced with a gas smart meter with a valve. There would be no supplier choice and all customers would receive gas smart meters with valves.

Table 1	NPV	Costs	Benefits	Stranding
All Valves	£4,989m	£10,051m	£15,040m	£820m

This option delivers the maximum **benefits** of the options considered since the additional benefits of having a valve within the smart meter (benefits related to prepay and debt management) are realised for all the smart meter stock. All meters are immediately capable of switching between credit and pre-pay, supporting the take up of PAYG. As mentioned above there are also potential benefits for customers, for market developments and for the smart meter rollout not quantified in the modelling.

However, **costs** under this option are higher than for option 2 due to the additional capital cost (£13 per meter) of valves. This increases capital costs by around £460m compared with a scenario where only prepay meters have a valve. In addition all non-smart meters have to be replaced incurring higher stranding costs.

Option B: a "supplier choice" approach

Under this option Government would not mandate the inclusion of a valve in every smart gas meter, but suppliers would be free to install this functionality in gas smart meters if they wished. Suppliers would therefore have a number of options open to them:

- They could install gas smart meters with valves.
- They could install gas smart meters without valves.
- They could install a retrofit to existing non-smart gas meters to provide smart functionality.

Suppliers would need to make decisions about what they do on the basis of their business cases reflecting their commercial aims, their meter portfolios and their customers' needs. We expect that the current stock of prepayment meters (about 11% of the total) will receive smart meters with valves. This is included in the base case for the assessments below.

Given the range of possible scenarios we have made a number of assumptions for the purposes of the cost benefit analysis. We have also examined a number of sensitivities.

<u>Deployment of meters with valves</u>
We expect that suppliers will install meters with valves to replace some non-smart credit meters either in anticipation of PAYG requests from some credit customers or to manage anticipated debt. For the purposes of our central case we are assuming that under this option suppliers would install meters with valves for 25% of their customers.

<u>Levels of retrofitting</u>
A retrofit would extend the life of the existing non-smart meter, but the supplier will need to decide whether the extended life is worth the cost of the retrofit and its installation. Based on discussions with Gemserv we assume that a retrofit device will be used in half of the meters that are technically capable of being retrofitted – this means about one quarter of existing meters will be retrofitted. From the information we have, we judge that it would not be economically viable to retrofit more than this because it would involve expenditure on a retrofit device and its installation for a relatively short extension of useful life of the non-smart meter.

Table 2 sets out the results of the assessment based on these assumptions where suppliers install gas meters with valves in 25% of the meter stock and they utilise a retrofit in 50% of eligible meters. These are based on discussions with suppliers and our understanding of what is technically possible.

Table 2	NPV	Costs	Benefits	Stranding
25% valves; 50% of eligible retrofits	£5,141m	£9,562m	£14,703m	£771m

Under this option overall **costs** are lower than the universal option. This is because of the effect of lower asset costs for meters without valves and for retrofits. In addition the use of retrofits reduces the stranding costs.

However **benefits** are also lower than the universal option because smart meters with valves and retrofits do not receive the benefits related to prepay and debt management.

<u>Take up of Pay as you go (PAYG)</u>
As noted above, various estimates for the take-up of PAYG have been made. For this analysis we consider the impact of 2% and 5% of credit customers switching to prepay each year to indicate the impacts of increased take up of prepay methods.

The 2% case would result in just under 20% of all gas customers on pre-pay tariffs by 2020 while the 5% case would lead to about 30%.

Table 3	NPV	Cost	Benefit	Stranding
20% on PAYG by 2020	£5,111m	£9,592m	£14,703m	£771m (+£90m)
30% on PAYG by 2020	£5,070m	£9,633m	£14,703m	£771m (+£210m)

Based on these assumptions **costs** increase slightly when consumers switch to pre-pay because this necessitates an additional meter exchange and additional installation costs and higher costs of a smart meter with a valve. Additional meter exchanges will be needed in circumstances where customers want PAYG or suppliers need to manage debt, but the installed smart meter does not have a valve. Suppliers will attempt to anticipate this by fitting meters with valves, but inevitably there will be a need for additional exchanges adding extra meter and installation costs.

These additional meter exchanges result in some smart meters without valves being removed early creating a form of additional **stranding cost** (shown in brackets in the tables). In reality many of these meters could be recycled and be used again in other locations; this cost is therefore not included the NPV calculation. The larger the shift towards prepay the higher these additional costs.

<u>Benefit assumption</u>

Where there is a switch from credit to prepay the modelled benefits remain unchanged (as can be seen from tables 2 and 3), assuming that the levels of consumption and energy saving remain constant and that the benefits from debt handling and remote disconnection do not change. In practice, benefits could be higher because with increased awareness of energy cost customers moving to prepay may save more energy and suppliers may accrue some benefit from debt manage debt for prepay – the economic model does not capture these potential effects.

Sensitivity analysis

Option B makes a number of assumptions about how suppliers would approach the choices available to them if the valve was not mandated, which reflect what we believe to be one realistic scenario. However a large number of combinations of the variables is possible and table 4 illustrates the effect of two changes. The first row shows the effect of increased numbers of meters with valves being installed in the initial roll out. The second shows the effect of a lower level of retrofitting.

These selected sensitivities show that the results do not vary substantially with the changes made but they do demonstrate that the NPVs move towards that of the universal option.

Table 4 % meters installed with valves	% Eligible retrofits	PAYG by 2020	NPV	Costs	Benefits	Stranding
Higher initial installation of meters with valves:						
50%	50%	20%	£5,108m	£9,692m	£14,800m	£771m (+£61m)
Reduced levels of retrofitting:						
25%	25%	20%	£5,053m	£9,664m	£14,717m	£795m (+£95m)

Summary

The NPVs of both the supplier choice and universal approaches are strongly positive.

Option A ("universal") has higher costs because the meters would be more expensive, however it also attracts the highest benefits, because the additional benefits from valve occur across all gas meters. This option would rule-out supplier choice about whether to install a lower cost meter without a valve or to use a retrofit

Option B ("supplier choice") has the higher NPV but is affected by uncertainty over the proportion of possible retrofits that would in practice be offered and the take up of prepay tariffs. As the proportion of retrofits decreases, the NPV of this option approaches the 'all valve' option. Similarly, the higher meter and installation costs and 'stranding' costs from replaced smart meters without valves rise with higher levels of PAYG take up, and would offset the higher NPV.

The non-quantified benefits also need to be considered. Option B would not provide an immediate platform for development of prepay tariffs and the need for additional meter exchanges could create barriers to take up of prepay. The procurement, logistics and installation to support a mixture of technologies (valves, no valves, retrofits) may also be more complex. By contrast Option A may be simpler option providing certainty about meter functionality, mitigating the risk from additional stranding, and supporting easily the move from credit to prepay/ PAYG without the need for a new meter.

References

No.	Legislation or publication
12	Gemserv (2010) 'Analysis on enablement/ disablement functionality for smart gas meters'
13	Sustainability First (2010) 'Smart pre-payment in Great Britain'
14	Consumer Focus
15	DECC Smart Meter Impact Assessment, December 2009
16	DECC Smart Meter Impact Assessment, June 2010
17	Baringa partners (2009)
18	Mott Macdonald (2007)

Option A – 100% valves

Total costs	10,051		Total benefits	15,040
Capital	3,770		**Consumer Benefits**	6,800
Installation	1,607		Energy saving	4,468
O&M	671		Load shifting	736
Comms upfront	822		TOU tariffs	390
Comms O&M	1,318		EU ETS	354
Energy	709		Global CO2 reduction	640
Disposal	40		Reduced losses	213
Pavement reading inefficiency	311		**Supplier Benefits**	6,762
Legal, setup, IT and organisational costs	665		Avoided meter reading	2,872
Integrate early meters into DCC	137		Inbound enquiries	1,032
			Customer service overheads	179
			Debt handling	1,053
			Avoided PPM COS premium	974
			Remote (dis)connection	239
			Avoided site visit	413
NPV	**4,989**		**Other Benefits**	1,478
Average annual impact per meter (£)	3.6		Reduced losses	213
			Reduced theft	113
Stranding costs	820		Microgeneration	36
Stranding from switching	000		Customer switching	1,117

Option B – 25% of gas credit meters have valves, 50% of eligible gas credit meters are retrofitted

Total costs	9,562		Total benefits	14,703
Capital	3,399		**Consumer Benefits**	6,800
Installation	1,602		Energy saving	4,468
O&M	614		Load shifting	736
Comms upfront	822		TOU tariffs	390
Comms O&M	1,318		EU ETS	354
Energy	709		Global CO2 reduction	640
Disposal	40		Reduced losses	213
Pavement reading inefficiency	311		**Supplier Benefits**	6,424
Legal, setup, IT and organisational costs	665		Avoided meter reading	2,872
Integrate early meters into DCC	137		Inbound enquiries	1,032
			Customer service overheads	179
			Debt handling	919
			Avoided PPM COS premium	974
			Remote (dis)connection	156
			Avoided site visit	292
NPV	**5,141**		**Other Benefits**	1,478
Average annual impact per meter (£)	3.8		Reduced losses	213
			Reduced theft	113
Stranding costs	771		Microgeneration	36
Stranding from switching	000		Customer switching	1,117

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 December 2009 IA. The basis for the change is also identified.

The main change to the quantitative results of the IA is the revised methodology on energy consumption in the counterfactual/business as usual case. This methodological refinement accounts for approximately £1bn of the reduced benefits observed across all policy options when compared to the December 2009 IA.

Changes to base assumptions

BUSINESS AS USUAL		
Item	**Assumptions**	**Rationale for changes**
Business as usual assumptions for gas and electricity consumption projections	Downwards revision to levels of electricity and gas consumption per household projections in the period 2010-2030	DECC has undertaken an assessment of the impact of other policy initiatives that reduce energy consumption over time and macroeconomic trends such as income growth, energy prices and technological progress which have an impact on energy levels
Business as usual assumptions for gas consumption per household in 2009	Downwards revision to levels of gas consumption in 2009 as per DECC UEP projections based on DECC Energy Trends statistics data	DECC official projections show that gas consumption per meter in the domestic sector was in the base year of the CBA substantially lower than the previously assumed figure of 20,879 KWh per meter in the December 2009 IA.
Growth rate of meters	Upwards revision in the natural growth of meters in order to be consistent with the growth in number of households assumed in DECC energy projections	DECC official projections imply an annual average growth in the number of meters of over 500,000 a year
Number of gas meters	Downwards revision to the number of meters in the domestic sector to account overlaps with the non-domestic sector	Better account of lack of transparency in the meter registration system when establishing the number of small non-domestic gas meters.

Energy consumption differential between credit and PPM consumers	The IA previously assumed that electricity PPM customers used 97% as much as credit customers and gas PPM customers used 95% as much as credit customers. We requested data from suppliers to validate these estimates and based on these responses have updated those figures to 94% for electricity and 73% for gas	Update IA to account for better, more updated, evidence
COSTS		
Item	**Assumptions**	**Rationale for changes**
Operational and maintenance costs of the communications network	10% optimism bias in order to reflect uncertainty on the technology solutions deployed	Better account of emerging evidence
Operational and maintenance costs of the communications network	Include an additional cost allowance for network security, for example using key encryption, that enables secure communications	Better account of better, more detailed evidence base
Legal, IT, setup and organisational costs	The one-off costs of legal, IT, setup and organisational costs were previously estimated at £300m. This has been increased to £370m to include increased cost estimates from raising awareness via a national marketing and setting up a DCC.	Better account of better, more detailed evidence base
Legal, IT, setup and organisational costs	Ongoing costs have been increased to £16.5m per annum from £1m per annum which we believe is a better estimate of operational IT costs for suppliers and the DCC. A	Better account of better, more detailed evidence base

	10% optimism bias has also been included on the ongoing central IT costs.	
Legal, IT, setup and organisational costs	Optimism bias for IT costs has been reduced from 50% to 10% as a result of more detailed analysis on the nature of IT costs which has allowed to provide more certainty to the nature of the costs.	Better account of better, more detailed evidence base
BENEFITS (sensitivities applied – this table shows central case used)		
Consumer benefits		
Item	**Assumptions**	**Rationale for changes**
Energy savings	Revision of electricity and gas variable prices used in valuing energy savings	To reflect the latest set of DECC assumptions for these prices. Electricity prices from 2025 are projected to be substantially higher than previously estimated as a result of a higher marginal cost of energy generation.
Carbon savings	Revision of prices for carbon conversion factors	To reflect the latest set of DECC assumptions
Carbon savings	Revision of carbon factors	To reflect the latest set of DECC assumptions
Supplier benefits		
Item	**Assumption**	**Rationale for changes**
None		
Other benefits		
Item	**Assumption**	**Rationale for changes**
None		

Additionally, the calculation of carbon savings in the electricity sector was previously erroneously deducted 25% of their carbon value due to legacy calculations in the CBA model. This did not have an impact on NPV values, but it underestimated the stated tonnes of CO_2 savings. This has been corrected.

Annex 3 – Detailed results

Below are the detailed results from the model (in £million) for central case scenarios.

Option 1:

Total costs	**9,119**	**Total Benefits**	**14,154**
Capital	3,434	Consumer benefits	6,434
Installation	1,442	Energy saving	4,227
O&M	628	Load shifting	699
Comms upfront	735	TOU tariffs	365
Comms O&M	1,203	EU ETS	343
Energy	672	Global CO2 reduction	600
Disposal	39	Reduced losses	201
Pavement reading inefficiency	257	Supplier benefits	6,325
Legal, setup, IT and organisational costs	665	Avoided meter reading	2,687
Integrate early meters into DCC	44	Inbound enquiries	966
		Customer service overheads	167
		Debt handling	985
		Avoided PPM COS premium	910
		Remote (dis)connection	224
		Avoided site visit	386
NPV	***5,036***	Other benefits	1,395
Average annual impact per meter (£)	3.8	Reduced losses	201
		Reduced theft	106
(Stranding costs	657)	Microgeneration	33
(Stranding from switching	000)	Customer switching	1,054

Option 2:

Total costs	**10,051**	**Total Benefits**	**15,040**
Capital	3,770	Consumer benefits	6,800
Installation	1,607	Energy saving	4,468
O&M	671	Load shifting	736
Comms upfront	822	TOU tariffs	390
Comms O&M	1,318	EU ETS	354
Energy	709	Global CO2 reduction	640
Disposal	40	Reduced losses	213
Pavement reading inefficiency	311	Supplier benefits	6,762
Legal, setup, IT and organisational costs	665	Avoided meter reading	2,872
Integrate early meters into DCC	137	Inbound enquiries	1,032
		Customer service overheads	179
		Debt handling	1,053
		Avoided PPM COS premium	974
		Remote (dis)connection	239
		Avoided site visit	413
NPV	***4,989***	Other benefits	1,478
Average annual impact per meter (£)	3.6	Reduced losses	213
		Reduced theft	113
(Stranding costs	820)	Microgeneration	36
(Stranding from switching	000)	Customer switching	1,117

Annex 4: Post Implementation Review (PIR) Plan

Basis of the review: There are expected to be three separate review processes: i. Reviews of benefits delivered under the Programme Benefits Management Strategy (BMS) which is under development – this is expected to track benefits delivery and provide the basis for periodic reviews (frequency still to be established) ii. A formal review of the roll-out strategy to establish whether additional requirements should be placed on suppliers with regard to local coordination iii. A Post Implementation Review (date to be determined)
Review objective: 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 PIR has yet to be designed but is likely to draw on evidence from the BMS work, stakeholder interviews and possibly international comparisons.
Baseline: The comparison to be made is with the position in 2010 prior to the publication of the Prospectus. Baseline data will be collected as part of the 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.
Monitoring information arrangements: Metrics will be developed as part of the BMS. Given the broad objectives of the Programme, a wide range of information will be required. The Prospectus already sets out initial thinking on the need for monitoring of the quality of the customer experience and impacts of the Programme on supplier costs. A key area where informative metrics and effective monitoring arrangements will be needed is the ongoing contribution of smart metering in delivering behaviour change and enabling energy saving. Work is likely to be needed to develop appropriate methodologies taking account of the need for timely evidence to inform policy on the deployment strategy, as well as the ability to evaluate the overall impacts of the Programme in the longer term.

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 (subject to appropriate privacy controls) of more accurate and timely 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, 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 that consideration of the pro-competitive aspects are considered going forward.

<u>Industry</u>
Great Britain is the geographical market affected by the roll-out 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 management) and smart homes
- meter ownership, provision and maintenance;
- other meter support services;
- gas and electricity network services;
- communications services.

In competition terms the roll-out 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.

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.

Suppliers would be obliged to use the DCC services, which would mean there would be limited opportunity for suppliers to differentiate through delivery of communications systems.

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.

Speed of Roll-Out

One possibility is that smaller energy suppliers might be disadvantaged in a roll-out 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 roll-out. Similarly, if resources are scarce for all under a roll-out, small suppliers might be feel a greater cost impact than large suppliers. Such concerns have been expressed in a number of responses to consultations.

2. Small Firms

Impacts on small business consumers are considered in the IAs for non-domestic roll-outs.

There may be small firms affected by the domestic roll-out in the areas of:

- gas and electricity supply;
- meter manufacturing;
- meter operating and services;
- energy services and smart homes.

The competition test (above) notes that smaller energy suppliers could be disadvantaged in a roll-out by being unable to obtain equipment and services at the same cost and rate as larger suppliers. It may be necessary in the roll-out to ensure that suppliers are not unduly discriminated against in terms of access to metering and installation resources.

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, governance 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 roll-out 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 take greater personal responsibility for the environmental impacts of their own behaviour.

The roll-out can also contribute to the enhanced management and exploitation of renewable energy resources. 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[43], 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.

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 of each option 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.

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

Table 15: 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
1	9,119	13,211	17	15.4	21.3	-261	40.3	-305
2	10,051	14,046	18	16.3	20.8	-242	40.7	-284

Table 15 shows how all policy options would save in the region of 17-18 million of tonnes of CO_2 equivalent in the traded sector and 15-16 million tonnes of CO_2 in the non-traded sector over a 20-year period. All 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. In fact, both policy options are not only cost-effective but produce a net benefit of around £305 per tonne of CO_2 saved in the traded sector and of around £285 per tonne of CO_2 saved in the non-traded sector.

There is no significant difference between the two Options in the size of the net benefit they produce. Option 1 however produces substantially lower net benefits per tonne of CO_2 in both the traded and non-traded sectors.

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 roll-out. The smart metering assets will consume energy and after discussions with meter specialists we continue with the assumption that a smart meter would consume 1 W, and a display 0.6 W and the communication equipment 1 W. 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

The likelihood is that any health impacts of a smart meter roll-out will be positive. In so far as smart meters enable suppliers better to target energy efficiency measures, which confer health benefits to individuals – particularly vulnerable individuals – deriving from greater thermal comfort, the proposals would ultimately promote better public health, reduce GP appointments and hospital visits etc.

The communications technologies which are selected to support smart metering may produce radiofrequency signals (e.g. from mobile communications technologies). Some consumers have concerns about the impacts of these. We will keep under review any evidence related to the effects of radiofrequency signals on individuals health.

8. Human Rights

The smart meter roll-out 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 will be engaged because smart technology is capable of recording greater information about a consumer's energy use in his property than existing dumb meters.

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 roll-out 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 for disability, race and gender equality. The current duties are:

- the Race Equality Duty is designed to ensure that public sector organisations actively promote equality of opportunity between persons of different racial groups, and to promote good relations between persons of different racial groups;

- the Disability Equality Duty is designed to 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.

- the Gender Equality Duty is designed to eliminate unlawful discrimination and harassment and to promote equality of opportunity between women and men.

This EIA:

- sets out the background to smart metering policy;
- sets out the evidence gathered to date and the potential equality issues identified; and
- describes the measures proposed to deal with these issues.

Assessing the impact of the policy.

The 2008 IA recognised that a domestic roll out of smart meters has the potential to adversely affect certain consumer groups. Responses to the 2007 Billing and Metering Consultation and the May 2009 Consultation on Smart Metering for Electricity and Gas by a number of consumer organisations, such as the National Consumer Council, confirmed that there are a range of potential consumer related issues. DECC and Ofgem has continued to explore these issues with relevant stakeholders and the Consumer Advisory Group. Our work with stakeholders has identified the following as the main areas of concern:

- Issues associated with the physical design and location of the smart meter/visual display and its usability for certain consumers;
- Issues in relation to the provision of information to consumers;
- This potential impact on certain vulnerable consumers of the installation of the smart meter which will require entry to all homes;
- The potential for the functionality of the metering system to be used in such a way that would be considered unfair or discriminatory (e.g. potential abuse of remote disconnection facilities); and
- The potential for consumer confusion (particularly amongst the elderly) as a result of the greater range of energy tariffs and energy related information which will be provided with smart metering.

The evidence collected to date indicates the policy has the potential to impact most on the visually impaired and the elderly. Discussions with stakeholders lead to a compelling case for ensuring the design and location of the meter is suitable for all consumers, that risks to vulnerable consumers in relation to the installation of smart meters are minimised and that consumers are well informed both before and after the installation of smart meters. These themes are explored in the ‘Consumer Protection’ Annex to the main Prospectus document.

Provision of information from a smart meter.

Provision of information to consumers is a key element in ensuring the benefits of smart meters are realised. The policy is that this information will be delivered through a free standing in home display device associated with the smart meter. This display must therefore be user friendly for all consumers. The evidence suggests that there are two potential equality issues with the display.

Firstly the location of the display will need to reflect particular consumer circumstances, for example consumers who use wheelchairs will need a display to be located at a suitable height. Secondly the design of the display itself. It is possible that consumers will need to be able to interact with the display in some way, rather than just simply view it. It is therefore important the display unit is suitable for the visually impaired, the deaf or those with particular dexterity issues.

In this context, the overarching responsibility for dealing with domestic consumer meter issues currently rests with the supplier. The Disability Discrimination Act (DDA) requires suppliers to provide an 'equivalent service' for those covered by the Act. Supply Licence Conditions 26.2 and 26.3 require the licensee (the supplier) to provide information free of charge which enable blind, partially sighted, deaf or hearing impaired to ask or complain about any bill or statement of account or any other service provided to that consumer by the licensee.

We have already established that a stand-alone display should be provided with the smart meter as this will secure the consumer benefits of smart metering, delivering real time information to consumers on their energy consumption in a readily accessible form. The 'Statement of Design Requirements' Annex to the Prospectus details the requirements for the displays and sets a consultation question on how best to provide the necessary functionality to support the needs of consumers with visual impairment or hearing difficulties.

It may be necessary for industry wide agreements on the usability requirements of the display to ensure it meets all user requirements (for example larger sized buttons) and that a consistent standard is installed in all households across the country.

Information associated with a smart meter will not just be provided to the consumer via the visual display device. It is likely that, subject to the appropriate privacy arrangements, energy suppliers and third parties will want to offer services based on analysis of the information collected by the meter and provide that analysis to consumers for the purposes of assisting them with managing their energy use or to sell them services. Some of this may be done via the display device or through other means such as email or traditional mail.

It will be important to ensure that this information is provided in a format suitable for individual consumers, especially with a potentially much wider range of information available as a result of smart meters. This includes those for whom English is not their first language (there are no statutory requirements other than for the Welsh language and nothing appears specifically in supply licences or codes). Again existing legislation and regulation will continue to apply but consideration may be required as to whether updated or revisions are required as a result of the roll out of smart meters.

Smart Meter installation.

The domestic smart meter roll out will require a visit to every house in Britain to install the meter and any supporting infrastructure. There are potential issues for all consumers but stakeholders have highlighted in particular the need to ensure that vulnerable consumers, such as the elderly or disabled, are protected from potentially disreputable individuals seeking to capitalise on the situation.

Protections are already in place. The Utilities Act 2000, Schedule 4, paragraph 7 & 10 provides the key protections on access to property for maintenance, installation and disconnection. Specifically, Schedule 4, 7 (5) covers a required notice period to be given to the occupier (2 days) prior to entry. Schedule 4, 10 (4) states that a person may only exercise power of entry on production of some duly authenticated document showing his authority. Supply Licence condition 26.1 (a), states that: "if a consumer who is of pensionable age, disabled or chronically sick requests it and it is appropriate and reasonably practicable for the licensee (supplier) to do so, the licensee must free of charge: agree a password with the consumer that can be used by any person acting on the licensees' behalf or on behalf of the relevant distributor to enable that consumer to identify that person." And Supply Licence condition 26.4 further requires suppliers to establish a 'Priority Service Register' which lists all of the licensee's domestic consumers who are of pensionable age, disabled or chronically sick. However although the licence condition requires suppliers to establish a register to cover all vulnerable customers, customers need to register to be included. In reality it may therefore not cover all vulnerable customers. Once added the consumer must be given free of charge advice and information on the services available described in supply licence condition 26.

The 'Consumer Protection' Annex to the main Prospectus deals with these matters further.

Creating consumer confidence and awareness will be a key element of successfully delivering smart meters. A central element of this will be to ensure that before a smart meter roll out commences that consumers are well informed about the purpose of installing smart meters, what the implications are for them and where to find other sources of advice and information. The section below deals with the communication aspects of the project.

Communication Campaign.

As set out above rolling out smart meters across Britain will have direct implications for consumers, not least as it will require a visit to every home in order to install the meter and any supporting infrastructure. A smart meter will also directly change the way consumers receive information about their energy use and interact with their energy supplier. Ensuring consumers are well informed in advance of a smart meter roll out will be essential, as will ensuring there is adequate advice and support available once smart meters are installed.

We have explored the nature of communications with our Consumer Advisory Group as well as other stakeholders. We expect local authorities, councils, support and police services may need to play a role in rollout. The 'Rollout Strategy' Annex to the main Prospectus discusses the potential interactions and approaches for rollout.

Next Steps.

As we move towards the roll out of smart meters an element of the implementation work will be to ensure that all consumers' experience of the roll out and of smart metering in the long term is positive. An aspect of that work will be to ensure appropriate protections are in place to safeguard consumers especially the vulnerable. This EIA identifies some of the issues that are addressed in the Annexes to the main Prospectus. It also shows that significant regulatory and consumer protection regimes are already in place, which will need to be reviewed and where appropriate regulation updated in light of the wider decisions on the smart metering roll out..

10. Data and Privacy

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). 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 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.

There is clear sensitivity of data on consumers' energy usage and the potential to raise privacy concerns for individuals. 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 the Data Protection Act 1998, to develop a privacy policy for smart metering data.

The Programme has listened to the views of a broad range of stakeholders on this key issue. In light of our discussions, we propose that the customer shall choose in which way consumption data shall be used and by whom, with the exception of data required to fulfil regulated duties. This aligns our approach to that being proposed by ERGEG in guidance being developed for smart metering

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. In other areas, industry would be able to obtain access to the data subject to the customer giving customer consent.

We will be undertaking a detailed exercise to establish the different data requirements of industry participants and whether data collected needs to be personal or aggregated, for example. This will allow us to set out in more detail how this principle would work in practice in terms of fulfilling regulatory duties and where consent needs to be obtained (including whether this should be on an opt-in or opt-out basis for different uses).

In order to guarantee data privacy, 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 metering system. We will now be looking to develop the more detailed requirements for how these risks should be addressed, which will then be reflected in the technical specification that the industry will be required to adopt.

To support our work in this crucial area, we have held discussions with stakeholders and have established a Privacy and Security Advisory Group, including the Information Commissioner's Office (ICO) and other key agencies, to provide expert advice to the Programme. We will continue to expand and deepen our engagement with stakeholders on these issues. In this context, we are considering broadening the group to include private sector experts.

Data privacy and security issues are explored more fully in the 'Data Privacy and Security' Annex to the main Prospectus.

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" dwellings.