

Summary: Intervention & Options

Department /Agency: DECC	Title: Impact assessment of a GB-wide smart meter roll out for the domestic sector	
Stage: Consultation	Version: Final	Date: May 2009
Related Publications: Consultation Impact Assessment of Smart Metering Roll out for domestic consumers and small businesses (April 2008) [http://www.berr.gov.uk/files/file45794.pdf], Baringa Partners reports on market model and risk (2009), DECC Consultation Document and Statement (2009).		

Available to view or download at:

http://www.decc.gov.uk/en/content/cms/consultations/smart_metering/smart_metering.aspx

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

The lack of accurate, timely information on energy consumption may prevent consumers from taking informed decisions on energy usage to reduce consumption and thereby bills and carbon emissions. Smart meters will provide accurate and timely data on energy consumption to consumers and suppliers enabling informed decisions on energy use. Currently, suppliers are only likely to roll-out smart meters to 20-30% of the market where a commercial case exists. With Government intervention, smart meters can be extended to the rest of the market capturing the benefits of increased energy efficiency, improved consumer experience, energy network benefits and the ability to respond to future energy market and policy developments.

What are the policy objectives and the intended effects?

The overall objective of government intervention is to provide consumers with better information on energy usage to encourage energy efficiency and to reduce carbon emissions.

What policy options have been considered? Please justify any preferred option.

This policy focuses on the replacement of 47 million domestic gas and electricity meters. A range of policy options are considered, the main variants of which are:

- Option 1: Mandated roll-out of smart meters under the **competitive model** by the end of 2020
- Option 2: Mandated roll-out of smart meters under the **centralised communications model** by the end of 2020
- Option 3: Mandated roll-out of smart meters with the **fully centralised model** by the end of 2020
- Option 4: Mandated roll-out of smart meters under the **competitive model** on a new and replacement basis.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?

The policy will be reviewed once the rollout of smart meters had been completed and a medium term review undertaken within 5 years of roll out start. The reviews should include consideration of the costs and where possible the benefits accrued/expected.

Ministerial Sign-off For consultation stage Impact Assessments:

I have read the Impact Assessment 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:

Summary: Analysis & Evidence

Policy Option: 1

Description: Mandated roll-out of smart meters under the competitive model by the end of 2020

COSTS	ANNUAL COSTS		Description and scale of key monetised costs by 'main affected groups' The transitional costs (related to assets, installation, and IT costs) amount to £6.56bn. Opex costs amount to £1.77bn.
	One-off (Transition)	Yrs	
	£0.33bn	20	
	Average Annual Cost (excluding one-off)		
	£0.14bn	Total Cost (PV)	£9.29bn

BENEFITS	ANNUAL BENEFITS		Description and scale of key monetised benefits by 'main affected groups' Total consumer benefits amount to £4.33bn and consist mainly of savings from reduced energy consumption (£3.10bn). Total supplier benefits amount to £6.16bn and come mostly from avoided meter reading (£2.64bn). Total other benefits amount to £1.30bn.
	One-off	Yrs	
	£0.0bn	20	
	Average Annual Benefit (excluding one-off)		
	£0.59bn	Total Benefit (PV)	£11.79bn
Other key non-monetised benefits by 'main affected groups'			

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. Once final decisions on the market model are taken, further work will need to be done on detailed delivery plans.

Price Base Year 2008	Time Period Years 22	Net Benefit Range (NPV) -£0.66bn to £5.74bn	NET BENEFIT (NPV Best estimate) £2.50bn
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What is the geographic coverage of the policy/option?				GB	
On what date will the policy be implemented?				2009	
Which organisation(s) will enforce the policy?				DECC/Ofgem	
What is the total annual cost of enforcement for these organisations?				£N/A	
Does enforcement comply with Hampton principles?				N/A	
Will implementation go beyond minimum EU requirements?				Yes	
What is the value of the proposed offsetting measure per year?				£0	
What is the value of changes in greenhouse gas emissions?				£0.50bn	
Will the proposal have a significant impact on competition?				Yes	
Annual cost (£-£) per organisation (excluding one-off)		Micro n/a	Small n/a	Medium n/a	Large n/a
Are any of these organisations exempt?		no	N/A	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)			(Increase - Decrease)		
Increase of	£	Decrease of	£	Net Impact	£

Key: Annual costs and benefits: Constant (Net) Present Value

Summary: Analysis & Evidence

Policy Option: 2

Description: Mandated roll-out of smart meters under the centralised communications model by the end of 2020

COSTS	ANNUAL COSTS		Description and scale of key monetised costs by 'main affected groups' The transitional costs (related to assets, installation and IT costs) amount to £5.50bn. Opex costs amount to £1.52bn.
	One-off (Transition)	Yrs	
	£0.28bn	20	
	Average Annual Cost (excluding one-off)		
£0.13bn		Total Cost (PV)	£8.11bn

BENEFITS	ANNUAL BENEFITS		Description and scale of key monetised benefits by 'main affected groups' Total consumer benefits amount to £4.30bn and consist mainly of savings from reduced energy consumption (£3.07bn). Total supplier benefits amount to £6.12bn and come mostly from avoided meter reading (£2.62bn). Total other benefits amount to £1.29bn.
	One-off	Yrs	
	£0.0bn	20	
	Average Annual Benefit (excluding one-off)		
£0.59bn		Total Benefit (PV)	£11.70bn
Other key non-monetised benefits by 'main affected groups'			

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. Once final decisions on the market model are taken, further work will need to be done on detailed delivery plans.

Price Base Year 2008	Time Period Years 22	Net Benefit Range (NPV) £0.45bn to 6.81bn	NET BENEFIT (NPV Best estimate) £3.59bn
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What is the geographic coverage of the policy/option?		GB	
On what date will the policy be implemented?		2009	
Which organisation(s) will enforce the policy?		DECC/Ofgem	
What is the total annual cost of enforcement for these organisations?		£N/A	
Does enforcement comply with Hampton principles?		N/A	
Will implementation go beyond minimum EU requirements?		Yes	
What is the value of the proposed offsetting measure per year?		£0	
What is the value of changes in greenhouse gas emissions?		£0.50bn	
Will the proposal have a significant impact on competition?		Yes	
Annual cost (£-£) per organisation	Micro n/a	Small n/a	Medium n/a
Are any of these organisations exempt?	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)		(Increase - Decrease)	
Increase of £	Decrease of	Net Impact	

Key: Annual costs and benefits: Constant Prices (Net) Present Value

Summary: Analysis & Evidence

Policy Option: 3

Description: Mandated roll-out of smart meters with the fully centralised model by the end of 2020

COSTS	ANNUAL COSTS		Description and scale of key monetised costs by 'main affected groups' The transitional costs (related to assets, installation and IT costs) amount to £5.01bn. Opex costs amount to £1.46bn.
	One-off (Transition)	Yrs	
	£0.25bn	20	
	Average Annual Cost (excluding one-off)		
	£0.13bn	Total Cost (PV) £7.67bn	

BENEFITS	ANNUAL BENEFITS		Description and scale of key monetised benefits by 'main affected groups' Total consumer benefits amount to £4.08bn and consist mainly of savings from reduced energy consumption (£2.91bn). Total supplier benefits amount to £5.78bn and come mostly from avoided meter reading (£2.49bn). Total other benefits amount to £1.22bn.
	One-off	Yrs	
	£0.0bn	20	
	Average Annual Benefit (excluding one-off)		
	£0.55bn	Total Benefit (PV) £11.08bn	
Other key non-monetised benefits by 'main affected groups'			

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. Once final decisions on the market model are taken, further work will need to be done on detailed delivery plans.

Price Base Year 2008	Time Period Years 22	Net Benefit Range (NPV) £0.43bn to £6.47bn	NET BENEFIT (NPV Best estimate) £3.41bn
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What is the geographic coverage of the policy/option?				GB
On what date will the policy be implemented?				2009
Which organisation(s) will enforce the policy?				DECC/Ofgem
What is the total annual cost of enforcement for these organisations?				£N/A
Does enforcement comply with Hampton principles?				N/A
Will implementation go beyond minimum EU requirements?				Yes
What is the value of the proposed offsetting measure per year?				£0
What is the value of changes in greenhouse gas emissions?				£0.47bn
Will the proposal have a significant impact on competition?				Yes
Annual cost (£-£) per organisation	Micro n/a	Small n/a	Medium	Large n/a
Are any of these organisations exempt?	No	N/A	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)		Net Impact	(Increase - Decrease)
Increase of £	Decrease of		£

Key: Annual costs and benefits: Constant Prices (Net) Present Value

Summary: Analysis & Evidence

Policy Option: 4

Description: Mandated roll-out of smart meters under the competitive model on a new and replacement basis

COSTS	ANNUAL COSTS		Description and scale of key monetised costs by 'main affected groups' The transitional costs (related to assets, installation, and IT costs) amount to £3.15bn. Opex costs amount to £1.03bn.
	One-off (Transition)	Yrs	
	£0.16bn	20	
	Average Annual Cost (excluding one-off)		
	£0.10bn	Total Cost (PV)	£5.15bn

BENEFITS	ANNUAL BENEFITS		Description and scale of key monetised benefits by 'main affected groups' Total consumer benefits amount to £2.72bn and consist mainly of savings from reduced energy consumption (£1.94bn). Total supplier benefits amount to £3.90bn and come mostly from avoided meter reading (£1.63bn). Total other benefits amount to £0.82bn
	One-off	Yrs	
	£0.0bn	20	
	Average Annual Benefit (excluding one-off)		
	£0.37bn	Total Benefit (PV)	£7.43bn
Other key non-monetised benefits by 'main affected groups'			

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.

Price Base Year 2008	Time Period Years 22	Net Benefit Range (NPV) £0.31bn to £4.31bn	NET BENEFIT (NPV Best estimate) £2.28bn
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What is the geographic coverage of the policy/option?				GB	
On what date will the policy be implemented?				2009	
Which organisation(s) will enforce the policy?				DECC/Ofgem	
What is the total annual cost of enforcement for these organisations?				£N/A	
Does enforcement comply with Hampton principles?				N/A	
Will implementation go beyond minimum EU requirements?				Yes	
What is the value of the proposed offsetting measure per year?				£0	
What is the value of changes in greenhouse gas emissions?				£0.32bn	
Will the proposal have a significant impact on competition?				Yes	
Annual cost (£-£) per organisation		Micro n/a	Small n/a	Medium	Large n/a
Are any of these organisations exempt?		No	N/A	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)				(Increase - Decrease)	
Increase of	£	Decrease of	£	Net Impact	£

Key: Annual costs and benefits: Constant (Net) Present Value

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Evidence Base

A. Introduction and Strategic Overview

Introduction

In April 2008 the Government published a consultation Impact Assessment on the roll out of smart meters to domestic and small business consumers¹. A number of areas of work were identified as being required to further develop and refine the assessment, in particular to focus on the following areas:

- treatment of risk within the economic analysis;
- assessment of market structures;
- attribution of benefits to technology functionality;
- communications options and structures; and
- further work on smart metering for small businesses.

Two reports were commissioned from Baringa Partners (formerly The Structure Group): one to consider the treatment of risk in the economic analysis² and a second to define and evaluate potential market structures to underpin a roll out of smart metering³. The 2009 Impact Assessment of a GB-wide smart meter roll out for the domestic sector⁴ therefore builds on and develops the analysis published in April 2008; the underlying assumptions and cost/benefit estimation model have been further updated in the light of the additional work undertaken and as a result of further information and supporting evidence received. The changes made to the analysis are noted within the text of this Impact Assessment and for ease of reference an overview of the changes to input values is also provided at Annex 1; section F below sets out the important changes to optimism bias adjustment factors that have been made.

This assessment and the supporting evidence base underpins the Government's decision to proceed with the roll out of smart meters for domestic consumers announced in October 2008⁵.

Strategic overview

The Energy White Paper published in May 2007⁶ sets out the Government's international and domestic energy strategy for responding to the challenges of climate change. Goals for the strategy include:

¹ BERR, *Impact Assessment of Smart Metering Roll Out for Domestic Consumers and Small Businesses*, April 2008, <http://www.berr.gov.uk/files/file45794.pdf>

² Baringa Partners, *Smart Meter Roll Out: Risk and Optimism Bias Project*, 2009

³ Baringa Partners, *Smart Meter Roll Out: Market Model Definition & Evaluation Project*, 2009

⁴ This Impact Assessment is only for the roll out of smart metering to domestic consumers; work on smart metering for small businesses is presented separately

⁵ *House of Lords Hansard*, 28 October 2008, Column 1516

⁶ *Energy White Paper: Meeting the Energy Challenge*, <http://www.berr.gov.uk/files/file39387.pdf>

- to maintain the reliability of energy supplies;
- to promote competitive markets in the UK and beyond; and
- to ensure that every home is adequately and affordably heated.

Using energy more efficiently is recognised as a way to cut carbon dioxide emissions. It can also improve productivity and can contribute to the security of our energy supplies by reducing our reliance on imported sources of energy and ensuring we make maximum use of our own and global energy resources. Improving energy efficiency and reducing the energy usage of homes can also reduce energy bills and help ensure that the most vulnerable can afford to heat their homes.

In the Energy White Paper (2007) the Government set out its expectation that smart electricity and gas meters would be installed within every home over the next decade. This was in addition to separate policies on improved billing and provision of information to consumers through displays. The Government consulted on proposals for taking forward proposed policies in its August 2007 consultation on metering and billing issues⁷. The Government's response to this consultation was published in April 2008⁸ with the April 2008 consultation Impact Assessment.

The Heat and Energy Saving Strategy⁹ consultation was published in February 2009. This sets out the Government's vision up to 2020 and beyond, and seeks views on a range of policies which could help to decarbonise the way we heat our homes and businesses. The aims are to help reduce the UK's CO₂ emissions and to contribute to the target of obtaining 20% of all EU energy from renewables by 2020. This consultation recognises the role that smart meters can play in this agenda in terms of helping people to change their behaviour and take action on energy use, as well as supporting the introduction of new renewable generation and microgeneration.

The Acting Chief Economist has reviewed the Impact Assessment and considers that it provides a reasonable assessment of the costs and benefits of the leading options at this stage.

⁷ BERR, *Billing and Metering Changing Consumer Behaviour, Energy White Paper Consultation*, August 2007, <http://www.berr.gov.uk/files/file40456.pdf>

⁸ BERR, *Government Response to Consultation Billing and Metering Changing Consumer Behaviour* <http://www.berr.gov.uk/files/file45996.pdf>

⁹ DECC, *Heat and Energy Saving Strategy*, 2009 http://hes.decc.gov.uk/consultation/consultation_summary

B. The issue

Within the current domestic energy market in Great Britain there are information asymmetry problems for both consumers and suppliers. 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. In addition many of those quarterly reads may be estimates made by the supplier or based on readings taken by the consumer.

Consumers have no simple way of gaining dynamic and useful information in order to manage, and potentially reduce on average, consumption more actively. In addition problems with accuracy of data and billing create costs for suppliers and consumers, causing problems in terms of disputes over bills (complaints) and problems with the change of supplier process thereby possibly hindering competition.

Smart meters and the provision of real-time information help address these issues, enabling consumers and suppliers to access more information about energy use and cost. Smart meters provide for remote communication between the meter and the supplier facilitating, amongst other things, more efficient collection of billing information, the development of more sophisticated tariff structures and demand management approaches that could be used to further incentivise energy efficient behaviour by consumers and suppliers alike.

The benefits from a roll out of smart meters together with a visual 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 potential benefits for network companies from the use of data collected through smart metering to better manage the electricity network and to inform long-term investment in the network.

In the absence of Government intervention, a roll out of smart meters would probably take place only where suppliers can make a positive business case (e.g. for pre-payment consumers or those whose meters were difficult to access). This may result in 20-30% of the meter stock being replaced with smart meters. Arguably this would affect the business case for other segments and could lead to a “tipping point” where the cost of maintaining non-smart meters outweighed the cost of installing smart meters, but that is not guaranteed and therefore the wider benefits of smart metering and addressing the information asymmetry problems for the rest of the population are unlikely to be realised without Government intervention. In addition, in practice, experience from other countries shows that suppliers and others interested in meter provision (at least in competitive markets) rarely fully embrace smart metering unless or until Government either explicitly requires the provision of smart meters, or requires the provision of services which cannot be delivered, or are uneconomic to provide without smart meters.

C. Objectives

The overall objective of Government intervention in the metering market is to deliver information on energy usage to consumers and energy suppliers in order to:

- mobilise the transition to a low-carbon Britain; and
- ensure the supply of energy which is affordable, secure and sustainable.

Smart meters will facilitate or make possible a range of outcomes:

Energy savings and related carbon savings: in terms of overall savings, raise awareness of energy consumption, in particular at peak time, as well as provision of accurate energy consumption data to consumers thus enabling consumers to reduce their consumption and suppliers to provide better targeted energy efficiency advisory services and other packages.

Accurate bills and consumption data: ensure consumers are aware of how much they consume; open up the possibility of more frequent billing which would enable consumers to better budget for their energy-related expenditure; removing problems associated with direct debits; significantly reducing problems caused by delay in re-calibrating pre-payment meters when prices rise (which can cause consumers to face unexpected debt).

Improved consumer service and experience: this includes reducing complaints associated with billing and meter exchanges; reducing problems associated with data which cause exceptions in the change of supplier process and therefore difficulties for consumers; enabling consumers to select new tariffs and for suppliers to transfer consumers onto new tariffs remotely; easier switching between pay-as-you-go / credit tariffs; and a reduction in the service costs associated with pre-payment meters.

Facilitating the development of demand management, improved network management and other innovative services and tariffs including time-of-use tariffs: smart meters will contribute to various energy market developments such as increased use of electric cars; increased intermittent energy supply as part of renewables deployment; reductions of peak demand and remote demand management to contribute to managing a potential future energy gap; detailed consumption data to enable better informed investment decisions, improved detection of losses etc, as well as lower overall consumption reducing pressure on the network.

Facilitation of wider policy goals: smart meters also facilitate measures in other policy areas for example the development of energy efficiency measures; take up of microgeneration. They may boost development of 'smart homes' more widely potentially improving management and networking of domestic appliances. Developments in other areas (e.g. water etc) may also be realised.

D. Option identification

As set out in the introduction this impact assessment builds on the analysis set out in the April 2008 consultation Impact Assessment. The focus here is on the domestic roll out of smart metering and on options to deliver on the Government's decision to proceed with a roll out of smart metering to the domestic sector. The further policy development work which has been taken forward since April 2008 including feedback from discussion with a wide range of stakeholders and the work commissioned from consultants has enabled the various options for the roll out to be further refined and updated. The variables around market model, meter functionality and interoperability, communications infrastructure and speed of roll out have been developed to inform the options for the economic assessment set out in Section E.

1. Market delivery model

The delivery of smart metering to GB domestic consumers will be a major infrastructure project. Changes to the current metering market structures will be required to underpin its successful delivery and to maximise benefits. We have examined three potential delivery models:

1. a fully **competitive model** – all elements of delivery are supplier-led, generally utilising existing market structures;
2. a **centralised communications model** – a national communication network is put in place to support smart metering, but provision and installation of meters is left to suppliers; and
3. a **fully centralised model** – a national communications provider and regional (or national) monopoly providers are put in place for provision and installation of meters.

Detailed work to define and evaluate these models has been undertaken by Baringa Partners and has involved the participation of industry stakeholders¹⁰. Their reports are published alongside this Impact Assessment and their work has informed development of the assumptions used in the analysis and results.

2. 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.

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.

¹⁰ Baringa Partners, *Smart Meter Roll Out: Market Model Definition & Evaluation Project*, 2009

Table 1: Functionality of metering system

	Functionality	Electricity	Gas
A	Remote provision of accurate reads/information for defined time periods	✓	✓
B	Two way communications to the meter system - upload and download 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, 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 load	✓	
F	Remote disablement and enablement of supply - enables Remote switching between credit and pre-payment	✓	✓
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.

With respect to gas metering the cost benefit analysis we have undertaken demonstrates a positive case for these functional requirements. This includes a functionality to remotely enable and disable supply (this requires inclusion of a physical valve.) It is judged that this level of functionality will deliver the policy objectives and benefits anticipated for smart metering across consumers, suppliers and the environment. An alternative approach – to not require the valve in all meters – is also considered in the analysis for the competitive model for comparative purposes. This level of functionality delivers a reasonable level of the benefits from smart gas metering including those around delivery of accurate data to consumers as well as removing the need for manual meter reads. Annex 4 provides further information on the background to the options selected for analysis.

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 will provide consumers with the information they need to take informed action to save energy and carbon. The Government believes that free-standing real-time displays which provide real-time, near instantaneous 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. In its April 2008 response to the August 2007 Metering and Billing Consultation the Government set out its expectation that a standalone real-time display would be provided with a smart meter to ensure the full environmental and energy-saving benefits of smart metering are delivered – that is the assumption we

use in this analysis, but this does not rule out other approaches being taken to the delivery of information.

Interoperability¹¹: competition in the supply of gas and electricity requires that customers can easily switch to their chosen 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. It will be important to strike a balance between the restrictions of operating within defined standards and the freedom for competing suppliers to innovate.

3. Communications infrastructure

Smart metering requires a suitable communications platform over which data can be uploaded and downloaded (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. Potentially a number of different technology solutions could be used and the previous impact assessment considered a number of the possible options and hybrids of different approaches. However for the purposes of this analysis the decision has been taken to base communications cost on a currently available communications technology infrastructure, which can provide sufficient functionality. We have assessed costs based on a GSM GPRS solution. This simplifies the analysis as it does not entail the modelling of hybrid options and, using a currently available technology, reduces the level of cost risk attributable¹².

4. Speed of roll-out

The speed of the roll out of smart meters has implications for the costs and benefits of the project overall. Our analysis considers two approaches:

- three variations on an accelerated approach which would see completion of the roll out by the end of 2020, and
- a new and replacement approach, which would take approximately 20 years.

The economic modelling of the accelerated approaches incorporates different lengths of the planning and preparation phase which is required before the actual installation of any meters. The effects of these variations are examined in the results section. It is also possible that a variety of alternative planning and roll out durations could be envisaged. We believe that the options we analyse show a number of realistic approaches to the overall delivery of smart meters and that the approach would also be robust across a range of other possible variations.

¹¹ It should be noted that this Impact Assessment remains at a consultation stage. It is not a final version for the purposes of the EU Third Package

[http://ec.europa.eu/energy/gas_electricity/third_legislative_package_en.htm]

¹² This is in line with the recommendations of Baringa Partners *Risk and Optimism Bias Project*

A number of issues can be contrasted with different speeds of smart meter roll-out, and again these are valid for any variants of speed:

- **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. Electralink's 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;
- achieving a **dual fuel** delivery is likely to be more difficult on a new and replacement approach because it is unlikely that gas and electricity meters will be on the same replacement cycle; and
- **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. This will create costs for either the owner of the asset or suppliers, depending on the contractual arrangements in place. In this analysis these are considered a form of sunk costs and for this reason are not included in the headline analysis of total costs and benefits (see also page 23).

5. Options analysed

The variables assessed above have informed the Government's identification of the following options:

- Option 1: Mandated roll-out of smart meters under the **competitive model** by the end of 2020
- Option 2: Mandated roll-out of smart meters under the **centralised communications model** by the end of 2020
- Option 3: Mandated roll-out of smart meters with the **fully centralised model** by the end of 2020
- Option 4: Mandated roll-out of smart meters under the **competitive model** on a new and replacement basis.

N.B.: Where we talk about “smart meters” this means the proposed common functionality of the smart metering systems as set out above.

E. Analyse the options

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 April 2008 Impact Assessment to look at risk, market structure, functionality and communications. This further analysis has been undertaken by DECC and has been informed by the outputs of the externally sourced work of Baringa Partners. 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 Impact Assessment and the one published in April 2008 are noted and explained within the text. For reference purposes Annex 1 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 available evidence and stakeholder feedback has led to downward revision of key assumptions, notably asset costs and adjustments for optimism bias factors. In these two areas we have been able to amass and cross reference information from various sources (including drawing on international experience). We have an improved evidence base for decision making and our understanding of the key issues and assumptions has increased. Overall the case for a roll out of smart meters to domestic consumers is positive in central scenarios (see results page 25); which contrasts to the initial partial analysis and Impact assessment published in April 2008.

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

1. Asset costs
2. Benefits
3. Speed of roll-out
4. Other Key assumptions

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 and sensitivities are applied.

1. 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 supplier and/or other market actor (e.g. in centralised delivery models this may not be a supplier). As explained above for the purposes of the cost benefit modelling we assume that the WAN communication is provided by GSM GPRS technology. This provides one realistic approach to the

communications infrastructure and simplifies the analysis. In the cost benefit modelling we calculate the communications devices as separate to the meter specification.

Under either of the centralised delivery models we assume that there is one WAN connection to a household and one display is provided. However under the competitive delivery model we assume there is one WAN and one display for households which receive gas and electricity from the same supplier, and for those which only have electricity supply. However where a household receives its gas from one supplier and its electricity from a different supplier we assume that there will be two WAN connections and that two displays will be supplied.

Capital costs

The tables below shows the capital costs of meter and communications assets used for the current analysis alongside those from the April 2008 Impact Assessment.

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

	Electricity		Gas	
	2009	(2008)	2009	(2008)
Display	£15	£15	£15	£15
Meter	£43	£47	£56	£60

The changes to asset costs have been made in the light of the analysis by Baringa Partners and in the light of further stakeholder feedback received.

Table 3: Communications infrastructure (£ per device)

	2009	2008
WAN (modem)	£15	£8
WAN (VPN)	£0	£10
WAN (SIM)	£0	£4
HAN	£1 Electricity/ £3 gas	£1 Electricity/ £3 gas

The treatment of communication capital costs in respect of the WAN has been revised since the April 2008 Impact assessment. These changes have been made in the light of new evidence and stakeholders' feedback. The GSM modem cost has been increased from £8 to £15, whilst the Virtual Private Network (VPN) and Subscriber Identity Module (SIM) costs are now captured in the operation and maintenance costs. 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

The April 2008 Impact Assessment did not recognise that there may be different installation costs for different types of households i.e. where one supplier provides gas and another electricity (single fuel installations), or where the same supplier

provides both gas and electricity (dual fuel installations). The electricity and gas only installation costs are unchanged, but we now also use a third assumption for dual fuel installations as below.

Table 4: Installation costs

Electricity only		Gas only		Dual fuel	
2009	2008	2009	2008	2009	2008
£29	£29	£49	£49	£68	None

Operating and maintenance costs

Smart meter maintenance costs are uncertain, because an integrated solution including communication provision has not been tried in the British market. The assumption used in the April 2008 Impact assessment based on Ofgem¹³ work 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 2009 Impact Assessment.

For the operation and maintenance costs of the communication technology we assume – in line with the available evidence – these to be £4.8 per meter per year (annuitised) for the WAN devices. 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.

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 impact assessment. A number of stakeholders have suggested that their own rates of return are lower than this level. However, a conservative rate has been chosen to ensure that the full opportunity cost of the investment is reflected in the impact assessment.

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/h, and a display 0.6 w/h and the communication equipment 1 w/h. These assumptions are unchanged.

Meter reading costs

The April 2008 Impact Assessment 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. We have made 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 has been increased and they increase exponentially to a limit of four times the existing meter reading cost. These

¹³ Ofgem, *Domestic Metering Innovation Consultation and supporting documentation*, February and March 2006

reads are now treated as an additional cost per meter and the costs are spread across the roll out. As a result of these changes overall costs are lower.

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.

2. 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. Although a number of international studies exist (summarised by Sarah Darby¹⁴), and these sometimes show dramatic behavioural changes (reductions in energy consumption of over 10%), it is difficult to transfer the 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 regimes). As a consequence most commentators have adopted relatively conservative assumptions. For example Ofgem's cost-benefit analysis¹⁵ 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^{16, 17} studies (2006, 2007). Other studies have been more optimistic with Energywatch¹⁸ giving a range of energy saving of 3.5-7%. It is worth noting that Darby reported that the majority of the savings were the result of the provision of direct feedback which was immediate from the meter or a display.

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.

¹⁴ Sarah Darby, *The Effectiveness of Feedback on Energy Consumption*, April 2006

¹⁵ Ofgem, *Domestic Metering Innovation Consultation*, February 2006

¹⁶ Owen and Ward, *Smart Meters in Great Britain: the Next Steps*, July 2007

¹⁷ Owen and Ward, *Smart Meters: Commercial, Policy and Regulatory Drivers*, March 2006

¹⁸ Energywatch, *Smart Meters – Costs and Consumer Benefits*, 2007

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 April 2008 Impact assessment. We assume a 20% take up by consumers of the ToU tariff (in addition to the existing group using this option) and a resulting 3% electricity bill reduction; sensitivities are made on the take up at 0% and 40%. However for the 2009 assessment to simplify the modelling we now assume the percentage change in peak load is the same as that in total demand (i.e. 2.8%). Energy is valued largely consistently with guidance produced by DECC¹⁹. To comply with the new guidance, electricity costs are now separated from carbon-related costs/benefits.

Valuing avoided costs of carbon from energy savings

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 circa Present Value (PV) £0.3bn.

For gas: the value of carbon savings from a reduction in gas consumption uses the Shadow Price of Carbon (SPC). This corresponds to a net reduction in global carbon emissions and corresponds to approximately PV £0.5bn for options 1, 2 and 3 (£0.2bn for option 4).

Reduction in carbon emissions

Over a twenty year period, we assume that as a result of a reduction in energy consumption, CO₂ emissions reductions will take place in the traded and non-traded sectors. The table below presents the CO₂ emissions associated with the energy savings in the central scenario across options.

Table 5: reductions in CO₂ emissions and energy savings

Option	Million of tonnes of CO ₂ saved in the non-traded sector	Million of tonnes of CO ₂ saved in the traded sector	Energy savings – electricity (£bn – PV)	Energy savings – gas (£bn – PV)
1	25.0	18.6	1.8	1.3
2	24.9	18.5	1.8	1.3
3	23.9	17.9	1.7	1.2
4	16.2	12.6	1.1	0.8

Valuing consumer time savings

The April 2008 Impact Assessment 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 April 2008 and we have therefore not included any savings in this assessment.

¹⁹DECC Greenhouse Gas Evaluation Guidance
<http://www.defra.gov.uk/environment/climatechange/uk/ukccp/pdf/greengas-policyevaluation.pdf>

Microgeneration

We have considered the idea that smart meters will improve the linking of microgen units back to the grid as they could include export capability. We have attempted to estimate this saving by estimating the amount of microgen units that will be in use in 2020 by the estimated saving which we would expect a smart meter to allow. After initial discussions we have made a conservative estimate of the number of units (about 1 million by 2020) and the saving (assuming a separate meter is not needed and its installation cost - savings per annum per meter of £0.1).

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 Impact Assessment.

Meter reading

This assumption is unchanged from the April 2008 Impact Assessment. 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 £0.8 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 April 2008 and we assume this cost saving to be £2.2 per meter per year in the central scenario (£0.9 for reduced inbound enquiries and £0.3 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.

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. As set out in the April 2008 Impact Assessment 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 2008 assumption was that smart meters would enable a 20% saving, however after considering further responses and evidence from Ofgem we have increased the level of savings attributed to smart meters to 40%

representing an annual savings of £12 for each electricity PPM and £16 for each gas PPM.

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 £2.2 per meter per year.

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. There is discussion about whether this is a transfer from consumers to suppliers (people having energy for free, and now paying for it) or if it is a benefit to society (suppliers cost savings from not having to investigate fraud). We believe that a substantial proportion will be a transfer and as a result we consider only marginal savings in our analysis. The assumption of a reduction of 10% or about £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 for gas. This represents an initial assessment of the range of possible benefits to network operations made originally by Mott MacDonald²⁰. 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 year²¹ (any additional systems costs are included in the IT and systems cost estimate).

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 impact assessment.

Intangible benefits

It has been possible to make a quantitative assessment of the benefits described above within the updated modelling for the 2009 Impact Assessment. However there remains a subset of benefits where the existence of smart metering may facilitate the

²⁰ Mott MacDonald, *Appraisal of costs and benefits of smart meter roll out options*, April 2008

²¹ Based on estimates from Owen and Ward (2006)

uptake or management of new services or approaches to energy supply – especially in the medium to longer term. These remain generally unquantified but we consider they remain important potential elements or areas for future consideration.

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 accurate and reliable data flows may make the switching process easier and encourage consumers to seek out better deals, thereby driving 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.

Longer term network management and demand-side load shifting

In the longer term more sophisticated approaches to management of the energy networks may be possible and the possibility of remote management of energy use or the network becomes real. It is difficult to quantify what the benefits of these changes would be or the other opportunities which may flow from them. Smart metering could facilitate responses to future changes in energy demand (through, for example a greater take up of electric cars or the adoption of dynamic demand technologies, which are currently being assessed by DECC officials) which is likely to require more proactive management and pricing. In addition smart meters may enable more effective management of the future grid where energy will come from a variety of sources – including some which may be more intermittent – and generation becomes more decentralised. There are potential benefits here from reduced overall demand and the smoothing of demand between peaks. In the longer term benefits may also be identified in this area which may contribute on security of supply objectives.

With additional renewable electricity being delivered predominantly by wind generation back-up generation is required to maintain security of supply. Smart metering with automated controls to switch load would reduce the need to bring on-line conventional generation and reduce the need for investment in backup generation.

3. Roll-out duration

New and replacement

Each year approximately 5% of the gas and electricity meter stock is replaced as meters come to the end of their operational life or breakdown and as new connections are made. Our modelling of this approach (option 4) assumes this cycle continues and that a Government mandate for a roll-out on a new and replacement basis would take about 20 years to achieve the full deployment of smart meters.

The benefits from a new and replacement approach include likely reduced overall costs because requirements for capital, assets, labour and communications will be spread over a longer time period. Stranding costs would be minimised. In addition the potential for suppliers to learn from the process and limit ongoing mistakes is greater and delivery risk lessened.

Conversely the full benefits would take over 20 years to completely come on stream. Suppliers would need to run multiple back office systems for a longer period than

under an accelerated roll-out. Achieving a dual fuel delivery is likely to be more difficult because gas and electricity meters will not be on the same replacement cycle and separate gas and electricity communications systems may emerge without regulatory intervention or industry agreements.

Roll-out by end 2020

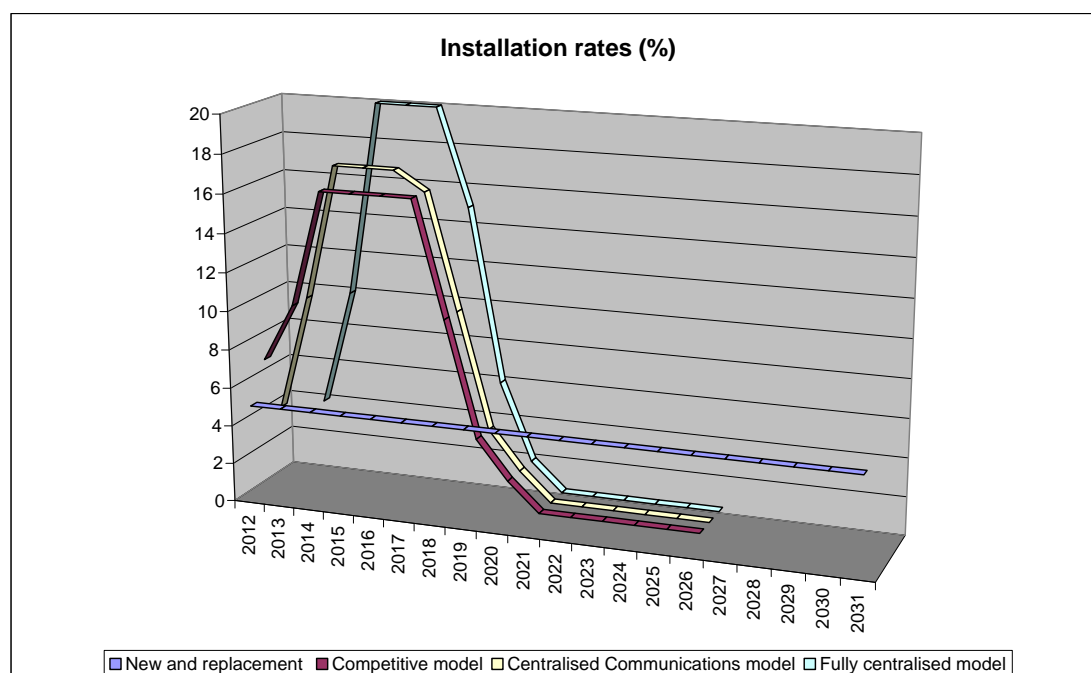
An accelerated roll out means that the benefits come on line more quickly and a more intensive approach would provide greater benefits of scope and scale. The necessity to run multiple back office systems would be reduced.

However, costs would come on line just as quickly as benefits. 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 inevitable stranding costs. Additionally the scope to adjust delivery and learn from mistakes is less – the time available to adjust being much shorter. There is potential for greater risk to consumers in terms of cost.

Our modelling varies the time period within which meters are deployed by delivery model. We assume that the different delivery models require different preparation period. The analysis we have undertaken assumes that:

- Under Option 1 – the **competitive model** – the preparation period is 2.5yrs and the period for meter installation is 9yrs,
- Under Option 2 – the **centralised communications model** – the preparation period is 3yrs and the period for meter installation is 8.5yrs, and
- Under Option 3 – the **fully centralised model** – the preparation period is 4yrs and the period for meter installation is 7.5yrs

The roll out profiles used in our analysis are shown in the chart below (they are the same as those used by Baringa Partners for options 1 to 3).



It should also be noted that 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.

4. Other assumptions

IT, legal and contractual costs

New IT systems for data management, settlement and storage are likely to be needed to underpin the roll-out of smart meters. We continue to assume a one off cost of around £12m for the new IT system across suppliers and an additional annual cost of £1m for operation and maintenance for the major suppliers. In addition there will be costs for legal, institutional and planning of the roll out, this relates to the governance and legal set up costs assumed for each model. Here we have made assumptions around the differentiation between different delivery models and we assume costs of £100 million under new and replacement, £200 million under the competitive model, £300 million under the central communications model and £500 million under the fully centralised model.

Stranding

Stranding costs are the costs incurred when a meter is taken out before the end of its expected economic 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;
- no installation costs are included for meters provided by Distribution Networks Operators since installation is paid upfront by suppliers;
- stranding costs for National Grid provided meters include 50% of annuitised installation costs to reflect the fact that prior to 2000 installation costs were annuitised in the meter charges, whereas after 2000 installation was paid upfront; and
- meter recertification continues during the deployment period.

All options, except probably option 4, would involve significant stranding costs and our estimates based on the assumptions above are that these costs would be around £0.75bn. 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 it is assumed that the costs of stranding will be passed on to consumers and the cost is reflected in the final table in the following section (Average Annual Impact per Meter).

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 remains 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.

Competition

While we judge that the market models that include 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 cover this issue in this Consultation Impact Assessment. A competition Assessment is included in the Specific Impact Tests section at the end of this document.

Impact on consumers

This consultation impact assessment analysis breaks down the costs and benefits on a per meter basis which gives an indication of the impact on the consumer. The results can be found in table 7 and in table 9. DECC officials are also doing more detailed work on consumer impacts and this will be reported on at a later date.

5. Counterfactual/benchmarking

As set out in the April 2008 Impact Assessment 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 metering²². It includes:

- the costs of the continued installation of basic meters,
- benefits from better billing,
- benefits from policies on new, replacement and on request clip-on displays (the deployment rate for displays is assumed to be 5% and the savings to persist for 15 years),

We did not consider the 20% to 30% of the market to which suppliers might roll out smart meters without a government mandate. The reason for this is that issues around interoperability would need to be resolved before this could be done effectively in the market.

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

²² A 'do nothing' option is not analysed because policy implementation as described will continue

of each option. As already mentioned 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.

6. Results

The results below are produced by running 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 a 20-year period. The cost numbers are risk-adjusted, i.e. they have been adjusted for optimism bias (See page 28 on risk). We have applied sensitivity analysis to benefits and we present benefits in terms of low, central and high scenarios.

The options assessed are:

- Option 1: Mandated roll-out of smart meters under the **competitive model** by the end of 2020,
- Option 2: Mandated roll-out of smart meters under the **centralised communications model** by the end of 2020,
- Option 3: Mandated roll-out of smart meters with the **fully centralised model** by the end of 2020, and
- Option 4: Mandated roll-out of smart meters under the **competitive model** on a new and replacement basis.

Table 6: Central case results

	Total Costs £bn	Total Benefits £bn	Net Present Value £bn
Competitive Model	9.29	11.79	2.50
Centralised Communication Model	8.11	11.70	3.59
Fully Centralised Model	7.67	11.08	3.41
New and Replacement	5.15	7.43	2.28

Table 7: Benefits by recipient and average meter impact

	Consumer Benefits £bn	Supplier Benefits £bn	Other benefits £bn	Total benefits £bn	Average annual net impact per meter (£)
Competitive Model	4.33	6.16	1.30	11.79	1.5
Centralised Communication Model	4.30	6.12	1.29	11.70	2.5
Fully Centralised Model	4.08	5.78	1.22	11.08	2.3
New and	2.72	3.90	0.82	7.43	2.0

Replacement					
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Table 8: Results showing sensitivities around benefits

	Total Costs £bn - central	Total Benefits £bn			Net Present Value £bn		
		Low	Centra l	High	Low	Centra l	High
Competitive Model	9.29	8.60	11.79	15.05	-0.66	2.50	5.74
Centralised Communication Model	8.11	8.54	11.70	14.94	0.45	3.59	6.81
Fully Centralised Model	7.67	8.09	11.08	14.15	0.43	3.41	6.47
New and Replacement	5.15	5.42	7.43	9.51	0.31	2.28	4.31

Table 9: Results showing benefits sensitivities

	Consumer Benefits £bn			Supplier Benefits £bn			Other benefits £bn			Average annual impact per meter (£)		
	L	C	H	L	C	H	L	C	H	L	C	H
Competitive Model	1.78	4.33	6.97	5.59	6.16	6.74	1.24	1.30	1.35	-1.4	1.5	4.4
Centralised Communication Model	1.76	4.30	6.92	5.54	6.12	6.69	1.24	1.29	1.34	-0.4	2.5	5.4
Fully Centralised Model	1.68	4.08	6.57	5.24	5.78	6.31	1.17	1.22	1.27	-0.4	2.3	5.1
New and Replacement	1.11	2.72	4.38	3.52	3.90	4.28	0.78	0.82	0.85	0.3	2.0	3.8

Alternative approach to gas meters

As discussed at page 12 a variation of the competitive model has been assessed for gas metering. If the metering system has no valve – i.e. it does not include functionality to remotely disable and enable supply – this would reduce the asset cost for gas credit meters by £13 (the cost of the valve) to £43. Under the competitive model this would reduce capital costs from £3.6bn to £3.2bn and total costs overall from £9.3bn to £8.9bn. However it would also reduce benefit levels because there are benefits from debt handling and remote disablement/enabling of supply for non prepayment customers (see remote disconnection and debt management – page 12) from £11.8bn to £11.3bn.

Table 10: Results of segregated approach to gas meters

Competitive model only	Net benefit (£bn)	Total cost (£bn)	Total benefit (central scenarios) (£bn)
Prepayment meters with valves – all others no valve ²³	2.43	8.85	11.28

²³ It is assumed that remote disablement functionality will be deployed to replace the current stock of pre payment meters estimated to be about 2.1million of the total 22.4million gas meters

All meters with valve	2.50	9.29	11.79
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F. Risks

Costs: Risk Mitigation and Optimism Bias²⁴

The roll-out of smart meters will be a major procurement exercise 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 Impact Assessment, 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 table below presents the treatment of particular cost category under the April 2008 Impact Assessment and the recommended and adopted change, along with its justification.

²⁴ Baringa Partners, *Smart Meter Roll Out: Risk and Optimism Bias Project*, 2009

Table 11: Changes in treatment of risk by cost category

Cost category	Past treatment	Current treatment	Rationale
Meter capex	45%	15%	The level of costs has been extensively researched, buyers can protect themselves, trends of incremental cost reductions support a reduction but because smart meters haven't been deployed yet the full removal of the adjustment for OB is not justified.
IT and settlement capex	135%	50%	Evidence supports the costs used and domestic experience warrants a proportionate OB adjustment, whilst bearing in mind the uncertainty surrounding the scope of system changes..
Installation	45%	10%	Domestic experience of installing smart meters (through the trials) and thorough quotes provided by suppliers indicate minimal optimism bias and warrant limited treatment, whilst bearing in mind the uncertainty surrounding the communication system to be chosen.
HAN capex	0%	15%	In recognition of the tight functional relationship between HAN system and meter assets.
Comms capex	0%	10% - 30%	For the competitive market model only because the communications costs provided do not include any contingency against obsolescence and under a competitive market model, suppliers would be exposed.

More detail on optimism bias and how it is applied can be found on the Treasury website in the Green Book guidance²⁵.

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:

²⁵ http://www.hm-treasury.gov.uk/economic_data_and_tools/greenbook/data_greenbook_supguidance.cfm#optimism

Table 12: 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%
Shadow price of carbon savings	£30.6	£25.5	£23.0
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 and shadow price of carbon affect the total cost for each option due to the energy use by the devices, but the effect is minimal.

G. Enforcement

All of the options outlined in this impact assessment 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 powers under the Gas Act 1986 and the Electricity Act 1989 to take enforcement action including imposing financial penalties for breaches of licence conditions. Under the Competition Act 1998, Ofgem has concurrent powers with the OFT to bring an end to anti-competitive behaviour as well as impose financial penalties on licence holders of up to 10% of their turnover. Ofgem investigates any company which is found to be breaching the terms of their licence, acting anti-competitively, or breaching consumer protection law via a formal investigation. Investigations can be undertaken on Ofgem’s own initiative or on the receipt of complaints or on referrals from other regulatory bodies.

H. Recommendation – Next Steps

Reference should be made to the consultation document is being published in parallel to this Impact Assessment.

I. Implementation

Reference should be made to the consultation document is being published in parallel to this Impact Assessment.

J. Monitoring and Evaluation

Approaches to the monitoring and evaluation of the policy will be set out when further decisions on the delivery model are made.

Annexes

Annex 1 – Base assumptions and changes made

The table below sets out the base assumptions on costs and benefits within the impact assessment. Where changes have been made to the assumptions since the April 2008 Impact assessment these are shown and the basis for the change identified.

Table 13: Changes to base assumptions

COSTS		
Item	Assumptions	Rationale for changes
Capital costs	Smart electricity meters costs reduced from £47 to £43 and gas smart meters from £60 to £56	The meter capex costs have been revised downwards in light of domestic and international evidence and experience Baringa Partners and stakeholder feedback
Installation costs	Electricity only £29 Gas only £49 Gas and electricity £68	Essentially unchanged, but differentiation included between households. Little consensus between responses and less evidence to support any changes
O&M costs	2.5% of meter asset cost	Unchanged No new evidence
Comms costs	Modem costs increased to £15 SIM and VPN captured in O&M Assume one WAN and one HAN but with differential approaches according to market model. WAN O&M £4.8/meter/p.a. (annuitised)	Costs changed on the basis of evidence received Overall approach revised to model only one “base case” realistic communications scenario. Reduce complexity of analysis and move away from attempting to assess uncertain costs for uncertain solutions
Energy cost (devices)	Meter 1 w/h Display 0.6 w/h Comms equipment 1 w/h	Unchanged No new evidence
Disposal costs	£1/meter	Unchanged.
IT system	£12m one off	Unchanged

	O&M: £1m per year	No new evidence
Pavement reading inefficiency	Equation reassessed to better represent the increasing marginal costs of reading non-smart meters as the total number of non-smart meters decreases	Improve the modelling The previous calculation included existing reading costs instead of being an additional cost per meter. Costs were also front-loaded Equation now allows the marginal cost to read a dumb meter to increase exponentially and to apply a cap so the cost does not exceed 4 times the existing meter reading cost.
Legal and contractual	£100m – new and replacement £200m – competitive £300m – central comms £500m – fully centralised	Varied by market model
BENEFITS (sensitivities applied – this table shows central case used)		
Consumer benefits		
Item	Assumptions	Rationale for changes
Energy saving	2.8% for electricity; 2% for gas credit and 0.5% for gas PPM	Unchanged
Peak load shifting	Peak shift now 2.8%	Peak reduction is now assumed to be same as overall energy saving. Simplifying assumption which it is recognised may understate benefits
TOU tariffs – shifting load through price signals	20% take-up and 3% electricity bill saving	Unchanged
UK Income gain fewer EU ETSS	-	Unchanged
Global Carbon reduction	-	Unchanged
Supplier benefits		
Item	Assumption	Rationale for changes
Avoided meter reading	£6 per meter per year from reduced meter reading	Unchanged Additional information received did not warrant any changes to these assumptions.
Customer service overheads	Cost saving pre meter per year is assumed at £0.3	Unchanged
Inbound enquiries	Cost saving per meter per	Unchanged

	year is assumed at £1.9	
Debt handling	£2.20 per meter per year	Unchanged
Avoided PPM COS premium	£12 per electricity PPM per year £16 per gas PPM per year (increased the % of PPM cost of serve savings from 20% to 40%)	Benefit increased after consideration of responses to the published impact assessment and further information from Ofgem
Remote (dis)connect	£0.50 per credit meter per year	Unchanged
Avoided site visit	£0.80 per meter per year from not having to make special reads.	Unchanged
Other benefits		
Item	Assumption	Rationale for changes
Reduced network losses	£0.5 per electricity meter and £0.1 for gas meter – both p.a.	Unchanged
Reduced theft	£0.20 per meter per year	Unchanged
Microgeneration	£0.10 per meter per year	Unchanged
Switching savings	£2.0 per meter per year	Unchanged

Annex 2 – Detailed results

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

Option 1: Mandated roll-out of smart meters under the competitive model by the end of 2020

Total costs	9,288	Total benefits	11,787
Capital costs	3,585	Total consumer benefits	4,329
Installation costs	1,898	Energy saving	3,091
O&M costs	616	Load shifting	298
Comms costs	2,181	TOU tariffs	116
Energy cost (devices)	382	Global Carbon reduction	498
Disposal costs	38	UK Income gain fewer ETSA's	326
IT system	40	Total supplier benefits	6,162
Pavement reading inefficiency	287	Avoided meter reading	2,639
Legal and contractual	261	Inbound enquiries	943
		Customer service overheads	164
		Debt handling	967
NPV	2,499	Avoided PPM COS premium	852
Annual average impact per meter	1.5	Remote (dis)connect	220
		Avoided site visit	377
		Total other benefits	1,296
		Reduced losses	134
		Reduced theft	103
		Microgeneration	32
		New settlement system	1,027

Option 2: Mandated roll-out of smart meters under the centralised communications model by the end of 2020

Total costs	8,110	Total benefits	11,702
Capital costs	3,306	Total consumer benefits	4,299
Installation costs	1,522	Energy saving	3,069
O&M costs	611	Load shifting	296
Comms costs	1,543	TOU tariffs	115
Energy cost (devices)	379	Global Carbon reduction	495
Disposal costs	38	UK Income gain fewer ETSA's	324
IT system	40	Total supplier benefits	6,117
Pavement reading inefficiency	279	Avoided meter reading	2,620
Legal and contractual	392	Inbound enquiries	937
		Customer service overheads	162
		Debt handling	961
NPV	3,592	Avoided PPM COS premium	844
Annual average impact per meter	2.48	Remote (dis)connect	218
		Avoided site visit	375
		Total other benefits	1,286
		Reduced losses	133
		Reduced theft	102
		Microgeneration	32
		New settlement system	1,019

Option 3: Mandated roll-out of smart meters with the fully centralised model by the end of 2020

Total costs	7,668	Total benefits	11,075
Capital costs	3,151	Total consumer benefits	4,083
Installation costs	1,225	Energy saving	2,910
O&M costs	578	Load shifting	280
Comms costs	1,479	TOU tariffs	109
Energy cost (devices)	359	Global Carbon reduction	473
Disposal costs	37	UK Income gain fewer ETSAAs	311
IT system	37	Total supplier benefits	5,775
Pavement reading inefficiency	148	Avoided meter reading	2,494
Legal and contractual	654	Inbound enquiries	886
		Customer service overheads	154
		Debt handling	915
NPV	3,407	Avoided PPM COS premium	764
Annual average impact per meter	2.3	Remote (dis)connect	208
		Avoided site visit	354
		Total other benefits	1,217
		Reduced losses	126
		Reduced theft	96
		Microgeneration	30
		New settlement system	965

Option 4: Mandated roll-out of smart meters under the competitive model on a new and replacement basis

Total costs	5,154	Total benefits	7,434
Capital costs	1,857	Total consumer benefits	2,720
Installation costs	656	Energy saving	1,940
O&M costs	387	Load shifting	187
Comms costs	1,239	TOU tariffs	73
Energy cost (devices)	240	Global Carbon reduction	317
Disposal costs	30	UK Income gain fewer ETSAAs	203
IT system	40	Total supplier benefits	3,899
Pavement reading inefficiency	554	Avoided meter reading	1,627
Legal and contractual	151	Inbound enquiries	593
		Customer service overheads	103
		Debt handling	596
NPV	2,280	Avoided PPM COS premium	607
Annual average impact per meter	2.02	Remote (dis)connect	136
		Avoided site visit	237
		Total other benefits	815
		Reduced losses	84
		Reduced theft	65
		Microgeneration	20
		New settlement system	646

Annex 3 – Functionality: the cost/benefit build up of electricity and gas metering systems

In the April 2008 Impact assessment we looked at the costs of Automated Meter Reading Meters (AMR) and Automated Meter Management Meters (AMM). Little differentiation was made in the Impact Assessment between the benefits attributed to the functionality delivered by each.

In December 2008 we prepared an informal paper which attempted to allocate the costs of different levels of functionality to benefits. We suggested that for electricity:

- AMR functionality accounted for 72% of costs and delivered 69% of the benefits benefit, and
- increasing functionality to AMM accounted for the remaining 27% of costs and delivered the remaining 30% of benefits.

And for gas:

- AMR functionality accounted for 57% of costs and delivered 74% of the benefits benefit, and
- increasing functionality to AMM accounted for 43% of costs and delivered the remaining 25% of benefits

Overall our approach suggested that there were net benefits for both electricity and gas for all the levels of functionality. Discussion on the allocation of costs to benefits indicated that there was general agreement that, at a high level, the cost and benefit attribution to functionality was thought to be about right. There was some disagreement about the absolute numbers used rather than the relative attribution of benefits to functionality.

The costs used for electricity meters were broadly accepted. In addition a number of policy drivers were identified that pointed towards requirements for the full functionality set. The asset costs assumed for such a meter was £43 for the December paper. The further work by Baringa Partners confirmed this cost. This functionality option and cost assumption is used in the main analysis.

The costs used on gas were questioned especially around the AMM functionality and the inclusion of remote disablement of supply (requiring the inclusion of a valve in the metering system). Our December analysis had taken a conservative asset cost estimate for such meters as being £82 with the cost of a valve within this as £18. Evidence received from the work Baringa Partners have undertaken and from other sources suggested lower costs for both an AMM specified gas meter and for the incremental cost of the valve. The current Impact Assessment uses revised costs of £56 for the meter including £13 for the valve.

In addition a further run of the cost benefit model competitive market approach has been undertaken to assess deployment of gas meters without valves. The results can be compared as follows:

Table 14: Comparison of gas meters with/without valves

	Net benefit	Total cost	Total benefit (central scenario)
All gas meters with valve	2.50	9.29	11.79
Prepayment meters with valves – others no valve ²⁶	2.43	8.85	11.28

Deploying all meters with or without valves delivers net benefits and there is no realistic economic difference between the cases, given the scale of the overall smart meter project. There is also a current level of “churn” where credit meters are replaced with pre payment meters. Ofgem estimate there are about 200,000 replacements of credit meters with pre payment meters each year. Assuming a continued similar level of churn (non-valve to valve) in a segregated approach then additional asset and installation costs would be incurred thus increasing the overall costs of this approach. This reinforces the case for gas functionality to include remote disablement, which is the option assessed in the impact assessment.

However there has been discussion (outside the economic assessment) of the most appropriate approach on gas functionality. Further views on this issue are invited in the consultation document published with this Impact Assessment.

Attribution of benefits to functionality

The tables below provide more detail on the build up of costs and the attribution of benefits to functionality for electricity and gas meters. They provide a description of functionality which could be included in a smart metering system (column 1), the capital asset cost of the functionality is shown (column 2) and the annuitised annual costs per meter per year (column 3). The total estimated benefit per meter per year is shown for various benefit elements (column 4) and an proportions of these benefits are allocated to the functionality levels shown, as a percentage of the total benefits(column 5), and then as an attributed value (column 6).

²⁶ It is assumed that remote disablement functionality will be deployed to replace the current stock of pre payment meters estimated to be about 2.1million of the total 22.4million gas meters

Table 15: Electricity functionality, cost and benefits

Electricity Functionality	COSTS		BENEFITS			
	Base asset cost	Annual annuitised cost per meter per year	Total benefit per year per meter	Estimated benefit attributed to functionality		
Basic electricity meter: the basic electric meter is currently (99% of new meters) an electronic meter rather than a mechanical meter and current procurement requirements and reliability modelling expect such meters to perform accurately for at least 20 years.	£10.0	£1.3	Required for measurement, but no smart benefits derived			
Automated Meter Reading (AMR) This level created by basic two way communications (two way communications to meter is restricted to prompting the meter to download data) this provides accurate and timely data. The display allows the interaction between the supplier, meter and the consumer. It provides customers with information to make intelligent choices on energy management and consumption	£12.0	£1.6	Customer losses	£0.3	100%	£0.3
			Avoided meter read	£6.0	100%	£6.0
			Energy savings	£4.8	80%	£3.8
			Debt Handling	£2.2	20%	£0.4
			Supplier switching	£2.0	70%	£1.4
			Distribution losses	£0.3	70%	£0.2
Interoperability level: Where the connectivity to the display is provided (and between meters). This will result in improved information directly to the consumer through the display. Enhanced two way communication that allows some limited remote configuration of meter functionality	£5.0	£0.7	Total energy savings	£4.8	10%	£0.5
			Time of use tariffs	£1.5	30%	£0.5
			Supplier switching	£2.0	10%	£0.2
			Cost to serve (only PPM)	£0.9	70%	£0.6
Display: required to provide information to customer and to deliver energy savings (for both electricity and gas, but cost applied to electricity only)	£15.0	£2.0	Required to ensure energy savings are delivered			
TOTAL (for this level of functionality)	£42.0	£5.5	Annual Benefit			£14.0
Import / Export: Allows measurement of excess electricity supplied from distributed generation to the network (i.e. does not account for distributed energy generated and used by the consumer). This add-on is for renewables and microgen policies and could be difficult to add to the meter at a later date (i.e. will require another meter or exchange).	£1.0	£0.1	Microgen	£0.1	100%	£0.1
Automated Meter Management (AMM) level: Sophisticated level which would involve more memory and processing power within the meter. This allows suppliers to have a wide scope of remote control of all meter functionality that include; remotely making changes to the meter and downloading extra programmes to the meter (including potential mobile connections to the meter). A switch within the meter allows for remote connection/disconnection.	£13.0	£1.7	Remote disable/ enable	£0.5	100%	£0.5
			Avoided site visit	£0.8	100%	£0.8
			Energy savings	£4.8	10%	£0.5
			Debt handling	£2.2	80%	£1.8
			Time of use tariffs	£1.5	70%	£1.1
			Cost to serve (only PPM)	£0.9	30%	£0.3
			Distribution losses	£0.3	30%	£0.1
			Call centre (back office)	£2.2	20%	£0.4
			Supplier switching	£2.0	20%	£0.4
Tamper Proof: Additional tamper detection mechanisms will be necessary once the AMM level has been reached, e.g. hacking electronically into the meter. This level of protection will allow suppliers to know if anything out of the ordinary has happened to a households consumption of energy	£2.0	£0.3	Reduced theft	£0.2	100%	£0.2
TOTAL (for this level of functionality)	£16.0	£2.1	Annual Benefit			£6.1

Table 16: Gas functionality, cost and benefits

Gas Functionality	COSTS		BENEFITS			
	Base asset cost	Annual annuitised cost per meter per year	Total benefit per year per meter	Estimated benefit attributed to functionality		
Basic gas meter: Basic gas meters are predominantly still mechanical, but a basic electronic, or an electronic/mechanical hybrid, design will be a necessary basis for a smart meter.			Required for measurement, but no smart benefits derived			
Basic gas meter, Interoperability, AMR level: this level allows basic two way communication with the supplier and also to the display device allowing accurate and timely data for both the supplier and the consumer.			Customer losses	£0.3	100%	£0.3
			Avoided meter reads	£6.0	100%	£6.0
			Supplier switching	£2.0	70%	£1.4
			Energy savings	£5.6	80%	£4.5
			Carbon savings	£1.9	80%	£1.5
			Call centre back office	£2.2	80%	£1.8
			Debt handling	£2.2	20%	£0.4
			Distribution losses	£0.1	70%	£0.1
TOTAL (for this level of functionality)	£33.6	£4.4	Annual Benefit £16.0			
Functionality to deliver capability above plus additional functionality involving more memory and processing power. This allows suppliers to have a wider scope for remote control of meter functionality to remotely manage and and change settings.	£9.4	£1.2	Avoided special meter reads	£0.8	100%	£0.8
			Energy savings	£5.6	20%	£1.1
			Debt Handling	£2.2	50%	£1.1
			Carbon savings	£1.9	20%	£0.4
			Distribution losses	£0.1	30%	£0.0
			Supplier switching	£2.0	30%	£0.6
			Call centre back office	£2.2	20%	£0.4
			Theft	£0.2	100%	£0.2
TOTAL (for this level of functionality)	£9.4	£1.2	Annual Benefit £4.6			
Addition of functionality to remotely disable/enable supply (valve)	£13.0	£1.7	Debt Handling	£2.2	30%	£0.7
			Remote disconnect	£0.5	100%	£0.5
			Cost to serve (PPM only)	£0.8	100%	£0.8
TOTAL (for this level of functionality)	£13.0	£1.7	Annual Benefit £1.9			

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 Impact Assessment (race, disability and gender assessments)	No	Yes
9. Human Rights	No	Yes
10. Privacy and data	No	Yes
11. Rural Proofing	No	Yes

Specific Impact Tests

1. Competition assessment

Consumers

From a consumer point of view 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 accurate and reliable data flows may make the switching process easier and encourage consumers to seek out better deals, thereby driving prices down.

In addition the improved availability 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. 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.

Whilst these effects are difficult to quantify in terms of the overall impact assessment it is important that consideration of the pro-competitive aspects of the delivery models are considered going forward.

Industry

Great Britain is the market affected by the roll-out of smart meters. The products and services affected will be:

- gas and electricity supply;
- gas and electricity meters;
- meter ownership, provision and maintenance;

- other meter support services;
- communications services (e.g. telecommunications, radio communications).

There are also potential implications for energy service businesses and providers of smart home services.

In competition terms the roll-out would therefore affect:

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

As set out above in the main body of the IA, we have considered three main options for the delivery model to underpin the roll out of smart meters:

1. a fully **competitive model** – all elements of delivery are supplier led, generally utilising existing market structures;
2. a **centralised communications model** – a national communications network is put in place to support smart metering, but provision and installation of meters is left to suppliers; and
3. a **fully centralised model** – a national communications provider and regional (or national) monopoly providers for provision and installation of meters are put in place.

The impacts in terms of competition on the different parties are expected to vary and are considered below for each delivery model.

Competitive model (all elements of delivery are supplier led, generally utilising existing market structures)

This option would have the least impact on competition. Suppliers would, as now, individually contract with various suppliers of meters and services. They would also contract individually for the provision of communications services.

It is possible that suppliers might wish to achieve a degree of brokered co-operation on installation within this option. While this could be beneficial in terms of cost, it might have an effect on competition and would require careful consideration of any likely, possible or unintended effects. Ofgem would need to have oversight of any such arrangements, with regulatory action on this point being triggered by a complaint or other information coming to its attention.

It is possible that larger suppliers of metering and metering services would be better placed to take advantage of the new market for smart meters through economies of scope and scale and their current market positions.

Under this model third party access to and use of the smart metering infrastructure would be dependent on suppliers' agreement and would probably have to be achieved through commercial agreement, whereas this could be opened up more widely under the other models. This could reduce opportunities for energy service businesses and smart home service providers. There are however risks that under this model the change of supplier process could become more complex as the new supplier would have to take over and be prepared to manage the communication arrangements installed by the previous supplier.

Access to data for third parties (e.g. network operators) will require some degree of coordination between suppliers, but the facilitation of this access and rules governing it would not vary across the delivery models except in potential complexity i.e. the competitive market will need to have rules governing how data will be delivered by suppliers, whereas in the other two data would be expected to be accessible from a central service provider although that would depend on the way access controls were configured.

Centralised communications model (a national communications network to support smart metering is put in place, but provision and installation of meters is left to suppliers)

The impacts of this model on suppliers of meters and metering services should not differ from the impacts of the competitive market. However, it would have a more significant impact on communications providers. A new market function would be created to implement and manage communications infrastructure and data carriage. All suppliers would be obliged to use this service.

Providers of communications services could be contracted for fixed periods, locking-out competitors for that period. Competition could 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.

All suppliers would be obliged to use this service, which would mean there would be limited opportunity for suppliers to differentiate through delivery of communications systems. It is possible that some suppliers would consider themselves to be disadvantaged by being compelled to use the communications services of the central communications provider.

Arguably, both of the centralised options 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. Although this would depend on the extent to which any model required the centralised management of data rather than just the movement of data.

Fully centralised model (a national communications provider and regional – or national – monopoly providers are put in place for provision and installation of meters)

This model raises more significant competition issues than the others. Under this model, centralised regional franchises would procure, own and maintain meters, and provide the communications infrastructure. This would entail termination of the existing competitive meter market where suppliers have a choice of selecting metering service provision.

Providers of metering services and communications would be contracted for fixed periods and there could be bulk procurement of meters, with contracts for these going to various providers. Competition could be maximised within the model by re-tendering for services on a frequent basis, but on the other hand if re-tendering takes place part way through the roll-out it could provide an advantage to the incumbent service providers. A regional approach would allow for there to be comparisons of cost and performance across regions to maintain competitive pressure. Re-tendering may be an issue whenever it happens because whilst frequent re-tendering

potentially increases competitive pressure it may also cause disruption in service delivery and potentially costs.

It is possible that this model would favour larger providers of meters and metering services in bidding for contracts, who could be better placed to deliver economies of scope and scale. This could also impact on the likelihood of new entrants to the market. Any centralised procurement arrangements would need to be devised to minimise any negative impacts on smaller suppliers and potential new entrants.

There would be limited opportunity for suppliers to differentiate through delivery of metering systems. It is possible that some suppliers would consider themselves to be disadvantaged by being compelled to use the services contracted by the franchise.

Market Model-Neutral Impacts

There are some competition impacts which will not vary significantly by market model.

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. These concerns have been expressed in responses to consultations, albeit only to a limited extent.

2. Small Firms

Impacts on small business consumers are considered in the impact assessments 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.

The competition test (above) notes that smaller 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. Ofgem has advised that there is no significant difference in the way that large or small suppliers approach their metering arrangements. However, it may be necessary in the roll-out to establish mechanisms to ensure that suppliers are not 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.

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 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 impact assessment] 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. These benefits would also apply at a regional level, including regions with higher levels of economic deprivation.

5. Carbon assessment

Following DECC guidance²⁷, we have carried out a cost effectiveness analysis. 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.

Cost-effectiveness = (PV costs – PV benefits)/tonnes of CO2 saved in either the ETS or non ETS sectors

Table 5 below presents the present value of costs and non-CO2 benefits of each option as well as the tonnes of CO2 saved in the traded and non-traded sectors, the WAD EUA (for the traded sector) and WAD SPC (for the non-traded sector), and the corresponding cost effectiveness figures.

Table 17: Cost effectiveness

Option	PV Costs (£million)	PV non-CO2 benefits (£million)	Million of tonnes of CO2 saved - traded sector	Million of tonnes of CO2 saved - non-traded sector	WAD EUA (£)	WAD SPC (£)	Cost effectiveness - traded sector	Cost effectiveness - non-traded sector
1	9288	10963	18.6	25.0	21.1	23.6	-90	-67
2	8110	10883	18.5	24.9	21.1	23.6	-150	-111
3	7678	10291	17.9	23.9	21.7	24.3	-146	-109
4	5154	6914	12.6	16.2	20.4	23.2	-140	-109

All the options are cost effective: over a 20-year period, between 13 and 19 million of tonnes of CO2 would be saved in the traded sector, representing a net benefit of

²⁷ DECC Greenhouse gas policy evaluation and appraisal in Government departments – December 2008.

between £90 and £150 per tonne of CO₂ saved. And between 16 and 25 tonnes of CO₂ would be saved in the non-traded sector, representing a net benefit of between £67 and £111 per tonne of CO₂ saved. 100% of emissions are under the SPC and EUA, respectively.

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/h, and a display 0.6 w/h and the communication equipment 1 w/h. 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). In moving forward the Government, energy suppliers and communication technology providers will need to consider potential impacts.

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. The impact may differ depending on the selected market model. For instance, maintaining the competitive market would have less impact on the existing market structure and meter ownership and operation than would a fully centralised model. However, DECC's view is that any interference would be in the general interest and proportionate to the benefits that this policy would accrue.

Article 8 may be engaged because smart technology will enable a supplier to receive real-time information about a consumer's energy use in his property. In addition, to roll out smart meters, installers will have to enter consumers' property. If these proposals engage Article 8, DECC's view is that any interference would be

proportionate to the benefits of the policy and necessary in the interests of the economic well-being of the country.

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 Impact Assessment (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.

With regard to smart metering the April 2008 Impact assessment contained some early analysis of the potential equality impacts from a programme to install smart meters in every British household. This EIA develops the initial work recognising that there will need to be a further examination of equality issues once the full details of a smart meter roll out are established. This EIA therefore:

- 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 Impact Assessment recognised that a domestic roll out of smart meters has the potential to adversely affect certain consumer groups. Responses to the Billing and Metering consultation by a number of consumer organisations, such as the National Consumer Council, confirmed that there are a range of potential consumer related issues. Since then the Department has continued to explore these issues with relevant stakeholders and have 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 (eg potential abuse of remote disconnection facilities)
- 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. The consultation responses and subsequent discussions with stakeholders has led the Government to conclude that there was 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.

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 expectation is that this information will be delivered through a 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. With Supply Licence Conditions 26.2 and 26.3 requiring 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.

Much will be dependent on the functionality of the smart meter ie whether there is a meter, with a separate mobile display unit and whether such a display unit would have functionality in terms of providing 'voice information' for the blind/visually partially sighted, or have adjustments for the hard of hearing. If a mobile display unit is envisaged, then accessibility in terms of location should also be less of an issue. However, any unit would need to be located in a suitably accessible location for individual consumers.

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. This would require further consideration with relevant parties.

Information associated with a smart meter will not just be provided to the consumer via the visual display device. It is likely that energy suppliers (and possibly some

third parties) will want to analyse 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 licensee's 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.

In addition to these provisions an element of the design of the roll out will be to explore establishing an accreditation scheme or certification mark for smart meter installers.

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 will work with organisations such as Consumer Direct, Consumer Focus, Citizens' Advice Bureau, Age Concern and a range of disability groups to explore ways to ensure information is provided in formats suitable for all consumers. We also envisage that local authorities, councils, support and police services may need to play a role.

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 require further detailed consideration and action. 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

The gas and electricity supply industries require and rely upon numerous, complex and substantial data flows, collection and management processes arising from the need to manage 25 million domestic electricity and 21 million domestic gas consumer accounts. The introduction of domestic supply competition between 1996 and 1998 required the establishment of new industry data transfer processes and thus data flows because of, among other things, the need to allow consumers to switch supplier. The subsequent introduction of competition in meter ownership, provision and management further increased the complexity of gas and electricity supply as a whole, and the nature and volume of data flows.

Some of the data to which suppliers and others have access is personal, such as bank account details²⁸, whilst other data relates to a meter or property, rather than an individual²⁹. For the Purposes of the Data Protection Act (1998), both, or the

²⁸ Suppliers will provide bills or statements for the use of gas or electricity. Information on use is derived from a meter-reading or an estimate of consumption. Bills are usually provided on a quarterly basis, although there are variations. Prepayment consumers usually receive an annual statement of their energy use and expenditure. There are also special arrangements for consumers with online accounts. For billing purposes, suppliers will usually have the name and address of the account-holder, which will often accord with that listed on the Electoral Register. Depending on payment method, the supplier will hold information about an individual bank account. If the property-owner is entitled to special services, such as the Priority Service Register or a free gas safety check, the supplier will also hold that information. Aside from the data they can obtain from their own meters, consumers' usual additional access to data from suppliers beyond the bill is usually in respect of past energy use for accounts dispute purposes.

²⁹ Suppliers provide and measure supply through a meter linked to a property (not an individual), which has an asset number, known as a Meter Point Administration Number (MPAN) for electricity and a Meter Point Reference Number (MPRN) for gas. This is held by the supplier in respect of an individual account, and in all cases by the local distribution network operator (for electricity) or National Grid or an independent gas transporter (for gas). Consumers can access their MPAN or MPRN details by using the MPAS database. Meter information does not, except in tandem with other information, identify an individual

combination of the two, would be likely to fall under the definition of “personal data” under the Act. Whilst a smart metering programme will not, in essence, affect this particular data, except to improve its accuracy, it is likely to increase the volume of data collected, collated and analysed by parties within the gas and electricity industries. This will present new issues around data protection, privacy and security and clarity will be required around what personal data is collected and why. The new arrangements may affect the annual notification about their processing of personal information made by data controllers to the ICO.

Because of the range of objectives of a smart meter programme, data – or greater volumes of data - may also be made available to, and used by, particular industry parties, such as gas and electricity distribution networks, which may require access to information to improve network management. There is also scope for data to be made available to energy-service providers, within or outside the supply business, for further processing with a view to providing bespoke energy services and advice to consumers. Indeed, the provision of tailored energy efficiency advice and the consequent increase in domestic energy efficiency is one of the key benefits of smart metering. However, data subjects will need to be kept informed of the way in which their information is being used and due consideration will need to be given as to whether each additional use complies with the Data Protection Act. Data controllers will need to be certain that service users/customers are aware that their personal data is intended to be used for these purposes and ensure that meter data collection for these purposes is adequate, relevant and not excessive.

Information from smart meters could also make it possible for a supplier to determine when electricity or gas was being used in a property and, to a degree, the types of technology that were being used within the property. This could be used to target energy efficiency advice and offers of measures, social programmes etc to householders. Again, for the purposes of the Data Protection Act, customers will need to be made aware that their data will be shared in this way and have the right to opt-out of having their data processed for these purposes.

Beyond this, whilst the impact assessment assumes a discrete roll-out of smart metering, with no linkage to non-energy sectors, there is theoretically scope – particularly as a roll-out develops or once it has been completed – for using the smart metering communications infrastructure to enable a variety of other services, such as monitoring of vulnerable householders by health authorities or social services departments. If this were to prove the case then data flows and consent arrangements would need to be clear and consideration would need to be given as to whether additional uses of data complied with the Data Protection Act. There may also be linkages with the provision of other home-based technology services, although these would principally involve arrangements around the meter and connection to the property, rather than data. There is also scope, subject to the agreement of individuals, for non-energy businesses to provide information to consumers via the metering system for example home security services. All of this will need detailed consideration, consultation and the establishment of rules, at an appropriate point in the policy design and delivery process to ensure compliance with relevant legislation.

In terms of potentially intrusive non-physical behaviour unrelated to data, smart metering potentially offers scope for remote intervention such as dynamic demand management, which is designed to assist management of the network and thus security of supply. This could involve direct supplier or distribution company interface with equipment, such as refrigerators, within a property, overriding the control of the

householder. The privacy and other aspects of such activity would need to be fully considered if dynamic demand management proposals were made in the future.

In addition to data privacy, physical privacy issues will require consideration. Installing smart meters will, for a period, increase the number and duration of visits to homes and businesses. Meter-providers currently enter property to install a new meter at the end of the certification period of the existing meter, but any accelerated roll-out of smart meters would significantly increase the total number of meter exchanges and home visits. Because smart metering technology is more complex, and because of consumers' lack of familiarity with the technology, more visits may be required to address problems that arise. Conversely, home visits by meter-readers will decrease over the period. Depending on the functionality of the meter, home visits to disconnect supply will largely end.

Gas and electricity suppliers have substantial experience in handling data, and in meeting the range of legislative requirements attached to it, which lie within the Data Protection Act 1998 (DPA), which, inter alia, addresses an individual's right of access to data and the limits on data that companies may hold, and s.105 of the Utilities Act 2000, which contains provisions about the disclosure of information. However, as the smart metering project develops and crystallises, policy and programme designers and potential data controllers (owners of data) and data processors will need to consider in detail:

- the definition of "personal" data
- consumers' rights to access their personal data
- data ownership
- suppliers' rights to charge for data access or provision of advice based on it
- access by other licensed gas and electricity companies, eg electricity distribution networks and gas distribution networks and transporters
- rights of suppliers to hold data (defined above) for non-supply purposes
- access to data on health and other public interest grounds by third parties
- access to data by third parties for commercial and marketing purposes
- data security in terms of both the transmission and holding of data
- physical security

Next steps

Smart metering will result in a step change in the amount of data available from electricity and gas metering. There may be value and interest in using such data in new ways. Careful consideration of the implications both legally and in terms of public acceptability and transparency will be necessary. As part of the implementation phases Privacy Impact Assessments will need to be conducted by the policy designers and those responsible for data under the roll-out. Similarly, a DPA Compliance Check will be needed for the project as a whole and by individual actors. In respect of data and privacy issues, the design and delivery of the project will, therefore, be taken forward in close co-operation with the Ministry of Justice and the Information Commissioner.

11. Rural proofing

If introduced, smart meters would address the problems attached to "difficult to read" meters, which may at present lead to those in rural areas receiving fewer actual meter readings. 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 treat” dwellings.