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DEPARTMENT OF ENERGY & CLIMATE CHANGE

Smart Metering Implementation Programme

Response to Prospectus Consultation

Supporting Document 3 of 5
Design Requirements

March 2011

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If you would like alternative formats of this consultation document, such as Braille, audio cassette or large print, these are available on request - please contact us at the address below. This also includes a Welsh language version.

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Executive Summary

This document sets out the Government's response to consultation on the design of the smart metering equipment that suppliers should be required to install. Such equipment includes gas and electricity meters, the home area network (HAN), wide area network (WAN) module and in-home display (IHD). This document also sets out the programme's approach to security of the smart metering system and the work to date on this issue.

Technical interoperability is fundamental for the smooth functioning of the retail market for gas and electricity because it promotes effective operation of the end-to-end system allowing consumers to switch suppliers without the need for equipment to be replaced. Functional requirements alone are not sufficient to provide technical interoperability because they only detail what the system should do, not how it should do it. Technical specifications are required to deliver how the action should be executed at a sufficient level of detail to ensure technical interoperability. The Prospectus made proposals for the development of the functional requirements into the necessary technical specifications. The responses to our proposed approach to developing technical specifications are described in appendix 1 of this document.

Minimum functional requirements

One hundred and nineteen (119) functional requirements were presented for consultation in the Smart Metering System Functional Requirements Catalogue (the 'Catalogue'), which was published alongside the Prospectus. Responses to the relevant Prospectus questions were received from across the spectrum of stakeholders.

Stakeholders considered the Functional Requirements Catalogue to be broadly complete subject to a small number of issues related to specific requirements. The evidence presented from consultation responses and in expert group discussions identified a number of significant issues around the technical implications of the proposed functional requirements. The significant points raised related to:

- Data storage within the smart metering equipment
- Outage management ("last gasp")
- Exceptions related to non-domestic smart metering installations
- Assuring the performance of smart metering equipment
- Electromagnetic sensitivity
- Standard meter interface language
- Exchangeable HAN equipment
- WAN module
- IHD design and data requirements.

Following detailed analysis of the arguments and evidence presented in the responses to consultation and in discussions throughout the consultation period, the Government has concluded:

- Outage management should be included as a minimum functional requirement
- Consumption data should be stored at the smart metering equipment

- The smart metering equipment should store 13 months (instead of 12 months) of half hourly consumption data
- The WAN module should be physically exchangeable from the meter
- There is no requirement for the HAN hardware to be physically exchangeable from the meter
- Functional requirements for the majority of non-domestic installations will be the same as for domestic with a small number of technical exceptions
- Further work is required to assess the options for setting a requirement for a standard meter interface language or languages
- Further consideration of the approach to the assurance of smart metering equipment performance and governance arrangements will be part of work in later phases of the programme.

Conclusions on IHD functionality include:

- That guidelines for ambient feedback (ie visual, non-numerical display features of the IHD) and accessibility will be developed as part of the technical specifications work in the next phase of the programme

- That technical specifications to satisfy the minimum prepayment requirements for information to be displayed on the IHD will be developed.

Further consideration will be given to the development of an enduring prepayment interface to provide consumers with prepayment functionality even where meters are inaccessible to consumers. This work is intended to ensure that consumers are not disadvantaged because their meter is inaccessible.

The Catalogue has been modified in line with the Government's conclusions and is published as an appendix to this document.

Developing technical specifications

The technical specifications are required as swiftly as possible to enable meter manufacturers to deliver large volumes of meters conforming to the technical specifications. The current plan is to have comprehensive proposals for the technical specifications in July 2011. The Government has concluded that the most appropriate process to complete this work is for the programme to provide oversight and facilitation of industry experts to develop the draft technical specifications. The Government will review and adopt the technical specifications in a form which it deems to be appropriate. The Government will require the technical specifications to be of sufficient detail to deliver technical interoperability and smart metering benefits.

Security

The end-to-end security of the smart metering system is critical to its successful operation. Programme and stakeholder security expertise will continue to be embedded into the respective working groups developing the draft technical specifications and into other parts of the programme. This will ensure that security requirements are developed in parallel and included in that work.

The approach to security is driven by a risk assessment of the end-to-end system. This enables security requirements to be developed that are proportionate to risks and threats identified through the risk assessment process. Accreditation of smart metering participants will be considered as a route to demonstrate that appropriate security requirements are in place and are being managed correctly. This analysis will be conducted in the next phase of the programme against other potential options.

A Security Technical Experts Group (STEG) has been established to provide advice and support to the programme on security issues. It will continue to be used to ensure that necessary security expertise is available to inform the programme's design conclusions. STEG could develop into a group that considers the security of the end-to-end smart metering system on an enduring basis as new risks emerge or others evolve and mitigating controls need to be revisited. This will be considered in the next phase of the programme.

The conclusions described in this document provide a baseline for the further development of the technical specifications. They support realisation of the benefits of smart metering for consumers and the wider stakeholder community. They also meet the published aim of facilitating the development of smart grids and retain the option for r smart water meters to make use of the smart metering system. Additionally, the emergence of electric vehicles and other initiatives, such as health monitoring, continue to be areas that the evolving smart metering design will support. Liaison with all interested stakeholders from these and other areas will continue in the next phase of the programme.

1. Introduction

1.1. The Government's vision is for every home in Great Britain to have smart energy meters, with businesses and public sector users also having smart or advanced energy metering suited to their needs. The rollout of smart meters will play an important role in Britain’s transition to a low-carbon economy, and help us meet some of the long-term challenges we face in ensuring an affordable, secure and sustainable energy supply.

1.2. To implement this vision, the Government has established a central change programme - the Smart Metering Implementation Programme[1] ("the programme"). The programme is responsible for overseeing the development and implementation of the policy design, including establishing the commercial and regulatory framework to facilitate the rollout. Ofgem E-Serve has worked with the Department of Energy and Climate Change (DECC) during the policy design phase to inform Government conclusions on the policy framework for implementation.

1.3. The Prospectus for the programme, published in July 2010, set out for consultation a range of proposals on the policy design for the implementation of electricity and gas smart metering in the domestic and smaller non-domestic[2] sectors. The installation of advanced meters[3] for larger non-domestic sites[4] has already been mandated for completion by April 2014.

1.4. The Government’s conclusions on the policy design for the implementation of smart metering in the light of consultation are set out in the "Response to Prospectus Consultation: Overview Document". The new obligations to deliver the policy design will be introduced principally using powers under the Energy Act 2008, and will be subject to the appropriate consultation processes.

Purpose of this document

1.5. This document covers:

- Government conclusions regarding smart metering functional requirements covering gas and electricity meters, communications and the IHD
- The process and timescale to confirm the functional requirements and develop the technical specifications for smart metering equipment
- The approach to-end-to-end security.

[1] Smart Metering Implementation Programme: Prospectus, DECC/Ofgem, July 2010
[2] Electricity customers on profile classes 3 and 4 and non-domestic gas customers with consumption of less than 732 MWh per year.
[3] Advanced meters are defined in supply licence condition 12 as being able to provide measured consumption data for multiple time periods (at least half hourly for electricity and hourly for gas) and to provide the supplier with remote access to the data.
[4] Electricity customers on profile classes 5 to 8 and non-domestic gas customers with consumption of 732 MWh to 58,600 MWh per year.

1.6. This document describes evidence submitted through consultation and provides analysis and rationale for the conclusions and further proposals on the functional requirements. This forms a baseline of functional requirements necessary to allow delivery of the benefits of smart metering. Against these requirements technical specifications will be developed.

Stakeholder engagement

1.7. Various activities have informed the work on the design of smart metering equipment including:

- Public consultation
- Expert Group meetings
- Workshops
- Bilateral meetings with subject matter experts
- Requests for information.

Public consultation

1.8. Issues relevant to the design of smart metering equipment were raised in response to the specific questions on design set out in the Prospectus as well as in response to other Prospectus questions and more general comments made by respondents. The responses relevant to design are summarised in Appendix 1 of this document.

Expert group meetings

1.9. To draw on the experience of industry and other stakeholders, the programme set up an expert group (the Smart Metering Design Expert Group, SMDG) following the publication of the Prospectus to consider the functional requirements for smart metering equipment. The expert group and three subgroups (SG 1, 2 and 3) convened at regular intervals between September and December 2010. SMDG, under its terms of reference[5], defined the membership of the three subgroups. These meetings were facilitated by the programme team with around 15 stakeholders attending each one day meeting. Details of the 37 meetings held can be found on the Ofgem website. Consumer Focus was included as a standing member of the SMDG and was therefore able to attend all meetings.

Workshops and bilateral meetings

1.10. A home area network (HAN) workshop was organised to increase understanding of the technology relevant to smart metering. More than 110 individuals attended including consumer groups, suppliers, manufacturers, manufacturer trade associations, network operators, consultants and

[5] *Smart Metering Design Group – Terms of Reference*, Ofgem E-Serve, September 2010

communications providers. Ten exhibitors showed different types of HAN and HAN related technology to inform the workshop.

1.11. Across the programme various workshops were organised to consider particular issues. These covered prepayment, data use and standard meter interface language and the outputs were considered by the programme team and used to inform the assessment of issues related to the design requirements work.

1.12. There were also a number of bilateral meetings with stakeholders to seek further evidence from subject matter experts.

Requests for information

1.13. Requests for information on specific issues were used to test assumptions and confirm, or otherwise, options and proposals presented by expert groups covering:

- Inclusivity by design
- Data storage options
- Welsh language.

We have worked with stakeholders (including consumer groups, suppliers, trade associations, network operators, consultants, communications providers) with an interest in smart metering. We are very grateful for the commitment shown by the industry, consumer representatives and other stakeholders in responding to the consultation and requests for information; and for their participation in expert groups, workshops and other stakeholder events. We acknowledge their support and recognise the positive response through this period of intense activity. The programme looks forward to their continuing engagement as the programme moves forward.

Structure of this document

1.14. This document is structured as follows:

- Sections 2, 3 and 4 summarise the conclusions related to the design of the three major components of smart metering equipment. The components are:
    - The meters (including equipment technical assurance and non-domestic installations)
    - The communications functions (the HAN and the WAN module)
    - The IHD requirements.
- Section 5 sets out the programme's process and timescales to confirm the functional requirements and develop the technical specifications
- Section 6 summarises the programme approach to security and how "security by design" principles will be reflected in the development of the smart metering system.

1.15. There are two appendices to this document:

- Appendix 1 (part of this document) provides a summary of the consultation responses to the design questions within the Prospectus and the Statement of Design Requirements supporting document
- Appendix 2 (separate document) provides an updated Functional Requirements Catalogue reflecting the conclusions set out in this document.

2. Meters

This section focus on significant issues related to the gas and electricity meters that form the integral part of the smart metering equipment that will be installed into the customer premises.

2.1. Detailed proposals on the functional requirements for the smart metering equipment were set out in the Prospectus and supporting documents. The proposals were a development of the high-level list of functional requirements set out in Table 1 below.

Table 1 – High-level functions of the smart metering system

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

* Domestic sector only

2.2. The proposals were set out in a draft Functional Requirements Catalogue . Some of the key features of the proposals included:

- The smart metering system would support the high-level functions set out above
- Electricity and domestic gas meters would be mandated to have functionality to support remote enablement and disablement of supply that signalled the intent to include a gas valve
- The HAN must use open standards and protocols – to achieve interoperability and enable innovation by equipment manufacturers. This would keep open the option of extending the smart metering system in future to support additional services, such as water metering and electric vehicles, where appropriate
- IHDs would be connected to gas and electricity meters through the HAN
- The WAN module would be capable of being separated from the meter to enable the module to be upgraded without exchanging the meter.

2.3. In developing the proposed functional requirements for the smart metering system, we sought and took account of the views of network companies in relation to the development of smart grids. The proposals were developed to facilitate future network requirements.

2.4. We also acknowledged that there are some differences between the functional requirements for the domestic and non-domestic sectors. In particular, it was proposed meters for the smaller non-domestic sector would not be required to include a gas valve and IHDs would not need to be offered by suppliers to their non-domestic customers.

2.5. This section describes four significant areas related to meter design and governance that emerged from the consultation process:

- Data storage at the meter
- Outage management ('last gasp')
- Exceptions to the proposed functional requirements for smaller non-domestic installations
- Assuring the performance for smart metering equipment and potential arrangements for governance of the functional requirements and technical specifications.

2.6. The process of consultation and analysis has resulted in conclusions to retain, largely unchanged (except for clarifications), most of the functional requirements we presented in the Prospectus. These conclusions were informed in part by specific questions posed in the Prospectus.

2.7. Functional requirements include:

- Requirements that smart metering equipment shall be capable of being installed in current existing metering locations, shall enable remote firmware upgrades while maintaining necessary measurement functionality; shall support local access to data and configurability by authorised personnel

- Requirements for the system to support a range of prepayment functions, load control and consumption related data including for gas and electricity and some related to micro generation
- The requirement to support a 15 year gas meter battery life - subject to the need to define profiles for the meter (that will be used in normal operation) in the next stage of the programme.

2.8. The updated Functional Requirements Catalogue (Appendix 3) presents all the requirements and details the changes made to the original proposals and identifies the evidence for such changes. The related technical specifications will be developed during the next stage of the programme.

2.9. In this section we present a number of substantive issues that have been subject to more detailed analysis following consultation and set out the reasoning, conclusions and next steps.

Data storage within the smart metering equipment

2.10. Consumers' interests are at the centre of the smart metering programme. Of particular importance is the ability for consumers to easily access clear consumption data that will help them manage and reduce energy consumption. This should also facilitate decisions on switching supplier and promote consumer facing energy services.

2.11. Technical, commercial and regulatory factors influence the choice of data storage location. In principle data storage could be performed either by service agents, the central data and communications body (DCC) or at customer premises within the smart metering equipment.

Prospectus Proposals

2.12. In the Prospectus we proposed that smart metering equipment in the home or premise should be able to store a minimum of twelve months of half hourly consumption data.

Evidence

2.13. The main issues raised and considered were:

- Should the data be stored remotely (eg DCC) or locally (within the smart metering equipment)
- the amount of data stored within smart metering equipment and the associated cost.

2.14. The proposal for remote or local consumption data storage elicited mixed views. Consumer groups and other respondents (market comparison service providers and energy service companies) supported the proposal to store data locally while manufacturers argued against.

2.15. Consumer groups and others argued that storing data in the smart metering equipment is attractive from the perspective of consumers and energy services providers as technology should allow, with an appropriate interface device (and within the constraints of security and integrity of the end-to-end system), direct access to measurement information at the premises. Access to more granular and seasonal consumption data will allow customers to understand how they could save money by modifying their usage patterns, reducing consumption and allow them to make more informed choices on switching suppliers.

2.16. Feedback from consumer groups and from the programme organised data usage workshops indicated that local data storage is also preferable from a data privacy perspective and for potential ease of access. While supporting the storage of consumption data within the smart metering equipment consumer groups also noted the importance of ensuring data privacy on change of tenancy (see "Data Access and Privacy" supporting document).

2.17. Market comparison service providers indicated that access to granular consumption data was key to enable comparisons to be made between complex tariff arrangements in the future. The preference, to avoid complex commercial and administrative arrangements, was to gain access through the smart metering equipment rather than remotely. Each route would require customer agreement to allow access to the data.

2.18. Manufacturers argued that data storage within the smart metering equipment would increase the technical complexity of the metering equipment and communications leading to higher costs. It was suggested by suppliers that the costs could be reduced by centralising data storage and that a web based interface would be preferred by their customers. Respondents opposed to local data storage also sought firm guidelines on access to the data. This is considered in more detail within the "Data Access and Privacy" supporting document.

2.19. The amount of consumption data stored within the smart metering equipment also elicited mixed views from the same stakeholder groups. In support of 12 months' data storage, market comparison service providers and consumer groups stated that customers having the ability to access 12 months' data would allow a greater degree of comparison now and in the future as time-of-use-tariffs develop. However, it was proposed that the amount should be increased to 13 months to allow comparisons with the previous year.

2.20. Manufacturers challenged the memory costs for 12 months' data storage within the smart metering equipment were underestimated and suggested the benefits were unclear. Respondents also argued that three months' data storage would be sufficient for current market operation purposes. It was noted that memory, and other electronics, is required to be robust for metering applications.

2.21. Thirteen months' data storage for electricity and gas was calculated by industry experts to require less than 300 kilobytes of memory. The costs, provided by meter manufacturers, indicate something in the region of £1 per meter to provide up to 1 megabyte of storage with additional data processing capability within the smart metering equipment electronics.

Conclusions

2.22. Having considered the responses to the consultation, further evidence submitted, and analysis undertaken the Government has concluded that the minimum functional requirements should include local storage of consumption data at the smart metering equipment. Additionally, the smart metering equipment should be capable of storing 13 months of half hourly consumption data (in kWh for electricity and cubic metres for gas).

2.23. Giving consumers direct and simple access to this data within their homes or premises will enhance their ability to manage energy and facilitate competition in the energy services market. Storing 13 months data will provide more information useful to consumers and allow them to compare consumption of equivalent months in consecutive years.

2.24. As outlined above some analysis of the potential costs of meter memory have been undertaken. Our assessment is that any additional cost associated with memory when meters are manufactured in volume (ie to include the 300 kilobytes minimum memory required for storing 13 months of consumption data) will be marginal. This is especially relevant when taking into account that the cost of memory of all types of popular electronic equipment applications (eg PCs, cameras, mobile phones etc.) is reducing.

2.25. It should be noted that memory would be required within the smart metering equipment to store data before transmission to DCC or suppliers. This is necessary because consumption data is required to be retained within the meter as the meter display remains the basis of payment and needs to be stored at the meter to allow bills to be checked against amounts registered. This is a requirement of the European Measuring Instruments Directive (2004/22/EC) (MID). Although the cost of memory within the 2009 impact assessment[6] was not explicitly defined, initial evidence collected from industry contacts suggests that costs to allow the increase to 13 months stored consumption data would be relatively small. Some of this cost could be offset against memory costs for normal operation as described above. To date not enough additional evidence is available to warrant a review of the smart metering modelling assumptions.

2.26. Experience from other sectors and technology change programmes, such as digital TV, has shown that it is preferable to allow for more memory to support innovation, future proofing and increased functionality.

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[6] *Impact assessment of a GB-wide smart meter roll out for the domestic sector*, December 2009

2.27. Local data storage and access also accords with the approach of the European Regulators Group for Electricity and Gas (ERGEG). ERGEG's Guidelines of Good Practice (GGP) on regulatory aspects of smart metering[7] recommend that 'the customer (as well as those that both generate and consume electricity) should be able to access information on his/her up to date consumption and injection data and costs.'

Next steps

2.28. The technical specifications will be developed on the basis that 13 months of half hourly consumption data will be stored in the smart metering equipment. Further consideration will be given to ensuring customers can easily access their own consumption data. This work will also need to take into account the need to protect data privacy (please refer to the "Data Access and Privacy" supporting document for more details) and ensuring that the security of the end-to-end system is maintained. The programme will continue to review any cost implications of this functionality as more detailed design information becomes available. These issues will be considered by a focused working group as part of the technical specification development process described in Chapter 5.

Outage management ('last gasp')

2.29. This functionality enables the meter to communicate a loss of electricity supply event to DCC, suppliers and distribution network operators (DNOs). This provides DNOs, in particular, with more immediate information about problems on their networks.

2.30. Outage detection at premises can be provided by a number of technologies potentially through the WAN module or in the smart metering equipment. In the Prospectus we proposed that the function could be realised without adding additional hardware to the smart metering equipment and that the main consideration was additional battery capacity to ensure the meter has sufficient power to issue a "last gasp" message.

Prospectus Proposals

2.31. The Prospectus proposed that outage management or 'last gasp' functionality should be included as a minimum requirement of electricity smart metering.

Evidence

2.32. Respondents had mixed views on whether the proposed outage management functionality should be included as a minimum functional requirement.

[7] *Guidelines of Good Practice on Regulatory Aspects of Smart Metering for Electricity and Gas*, ERGEG, February 2011

2.33. It was argued that outage management is attractive from a consumer perspective. It was noted by consumer groups that consumers could question "*how smart*" smart metering was if it was unable to detect something as fundamental as loss of supply. The implication being that the new smart equipment in the home has shortcomings if a consumer still needs to find the telephone number for their distribution company and log the fault through a phone call. A positive signal from meters at the time that supply is actually lost would enable a faster response to identify and repair network faults. Some respondents, supportive of including last gasp as a minimum functionality, indicated costs of up to £1 per meter for including this functionality, based on international experience of meters already in production.

2.34. Others suggested that the cost of the last gasp function may be much higher than the proposed benefits. Costs provided by stakeholders who did not support including this functionality were significantly higher than the cost noted above (£3 to £7.50 per meter). In some cases respondents noted products were currently unavailable and needed substantial re-design to enable equipment providers to offer last gasp functionality.

2.35. Some responses suggested that it would be sufficient to be able to contact a meter, or number of meters in an area, to confirm supply status and from that information – as well as incoming consumer reports – respond to an outage.

2.36. Some respondents expressed the view that the WAN technology may need to incorporate features to prevent system overload from multiple outage messages. However, others noted that systems have been developed to deal with similar events and that the communications sector has relevant experience. Some also raised the potential of communications technologies (eg polling smart meters or loss of communication signal alerts) to provide outage management functionality rather than adding hardware to electricity smart meters (eg bigger batteries or capacitors).

2.37. Further analysis has been undertaken by the programme which indicates that benefits can be derived from last gasp functionality related to reduction of customer minutes lost, network operational savings from enhanced fault fixing capability and reduction in consumer calls. It was assumed for the analysis that a cost of £1 for the additional functionality would be realisable. It is also important to note the more intangible benefits to consumers and the potential for future smart grid benefits. These include:

- Less disruption to consumers when a supply outage occurs – such as struggling to locate a non-mains powered telephone and a relevant contact number to notify the outage to the supplier/network operator
- Ability to register when vulnerable consumers lose supply and the ability to rectify the situation promptly
- Ability to reduce impact of outages occurring during the night or when a consumer property may be temporarily empty (eg holidays)

- Consumer confidence in the smart metering system – if the system cannot notify a supply outage consumers may doubt or lose confidence in the capability or suitability of other aspects of the system

- Smart grid requirements are not yet fully defined. However, a fundamental requirement of managing complex systems or networks is the ability to know when components become inactive or lose a connection. Including the last gasp functionality within the smart metering system will avoid future costs or compromises to the smart grid

- Reliable last gasp notification and management will promote innovation by network operators to provide enhanced service levels and improve standards of performance.

Conclusions

2.38. Effective outage detection and management is important to consumers. The availability of precise and timely information about outages should enable network businesses to respond to outages effectively and quickly. Analysis suggests that this functionality can be better than cost neutral where costs are controlled to less than £1 per installation. There are also significant non-monetary benefits to its inclusion.

2.39. Including outage management capability is also in line with ERGEG's GGP on regulatory aspects of smart metering' which recommends that consumers 'should receive immediate information on non-notified energy interruptions at his/her connection point'.

2.40. Having considered the responses to the consultation, further evidence submitted, and analysis undertaken the Government has concluded that the minimum functional requirements of the smart metering system should include outage management. The most cost effective delivery method for this functionality will be determined in the next phase of the programme.

Next steps

2.41. Work in the next phase of the programme will consider the most appropriate technical way to deliver this functionality and whether this might be done through the WAN network or in the smart metering equipment. This will be considered by a focused working group comprising experts from all relevant sectors, including consumer representatives, as part of the process described in Chapter 5. This work will also consider how the functionality would operate, for example, the timescales for notifying an outage or the effects of normal network operations, to ensure false alarms are addressed.

Exceptions related to smaller non-domestic installations

2.42. The Prospectus confirmed that the smaller non-domestic consumers would receive smart meters on the same timescales as domestic consumers. However, it was acknowledged that there are specific challenges and opportunities that are different from the requirements for smart metering equipment in the domestic sector.

2.43. The programme has considered the different customer requirements and particular technical, commercial and operational challenges for the smaller non-domestic sector. This included gaining a clear understanding of cost and benefit differences for non-domestic smart metering equipment compared to domestic requirements.

2.44. This section considers the approach to smart metering equipment within smaller non-domestic premises.

Prospectus proposals

2.45. We proposed that the requirements for the non-domestic meters should be broadly the same as for domestic meters, with a number of technical exceptions including:

- The gas smart metering equipment need not include a valve for disablement/enablement of supply
- The suppliers will not be required to provide IHDs.

2.46. In recognition that some smaller non-domestic consumers already have meters with advanced rather than smart functionality, the Prospectus confirmed that advanced meters can remain, or continue to be installed, under two sets of circumstances:

- where an advanced meter is installed before April 2014 and the customer wishes to retain it, or
- where an advanced meter is installed after April 2014 under pre-existing contractual arrangements.

Evidence

2.47. Consultation responses point to the wide range of non-domestic premise types and the difficulty of introducing smart meters of consistent design to these sites. The necessary variation in design for non-domestic installations could lead to relatively higher equipment costs, in comparison with the domestic sector, as the benefits of mass production cannot be realised. Respondents highlighted issues of particular concern:

- Availability of smart solutions for the larger gas meters (above U6, G4 and E6 types) and current transformer (CT) electricity meters - specifically the ability to retrofit smart functionality so that a potentially higher cost meter asset does not necessarily have to be exchanged
- Lack of technical interoperability for non-domestic equipment – some non-domestic metering installations are bespoke or have been modified to meet the needs of the customer
- Preference for a pulse output (a signal emitted from the smart meter proportional to a unit of consumption) and proprietary HAN – existing equipment could become redundant and equipment suppliers will face costs to modify their commercial offerings
- Upgrading advanced meters to comply with smart metering functional and technical specifications without having to replace the existing meter
- Gas meter battery life – especially those with built-in WAN functionality
- Security vulnerabilities of advanced meters already installed.

2.48. Overall most respondents agreed with the proposed approach to exceptions in the smaller non-domestic sector. Nearly all the large suppliers supported the proposals on exceptions, with the majority commenting that the reasonable steps approach provides flexibility and recognises that there will be circumstances where the installation of a smart meter may not be possible. Further information can be found in the "Rollout Strategy" supporting document.

2.49. We received evidence from all suppliers on the prevalence of the CT electricity meters and larger gas meters, the materiality of the issue and the options for upgrading without removing meter equipment. Respondents provided an indication of the numbers of installations affected by these issues. Evidence was presented from energy service providers on the consumer impact and cost implications of not including pulse output in the minimum functional requirement for non-domestic consumers (and domestic consumers) with gas meters (above U6, G4 and E6 types) and/or CT electricity meters.

2.50. Many of the responses have a bearing on DCC, data privacy and rollout policy work within the programme. These are considered further in the relevant supporting documents. Issues outside the scope of this document include the potential for stranded assets.

Conclusions

2.51. On the basis of the July 2010 impact assessment[8] included in the Prospectus, and further evidence submitted as part of the consultation process, the Government has concluded that:

- **CT electricity meters**: CT meters should be classified as smart meter variants within the development of the technical specifications with no requirement for a supply enablement/disablement mechanism (under a process for derogation or exception to be defined). The rationale for this conclusion is that the benefits

[8] GB wide advanced/smart meter roll out to small and medium non-domestic sites, July 2010.

were significantly outweighed by the cost of components required for higher loads and the substantial equipment re-design.

- **Consideration of technical interoperability and data set requirements for non-domestic meters**: This will be included in the development of technical specifications. Where equipment requirements differ from those used for domestic installations, it is important that those differences are captured by the technical specifications.

- **HAN/Pulse Outputs**: Non-domestic consumers (and domestic consumers) with gas meters (above U6, G4 and E6 types) and/or CT electricity meters should have the choice to have pulse output or HAN enabled meters with smart interoperable technology delivered through either solution. Where a pulse output is provided it should conform to requirements to be developed as part of the technical specification process. This conclusion was based on a number of factors. Many non-domestic consumers and service providers currently utilise pulse outputs. It is apparent that this market sector has keen proponents of this technology, currently delivering advanced metering functionality that meets the needs of consumers. There is little perceived benefit in obligating the HAN in such circumstances. However, from a technical perspective it is apparent that some pulse output technologies are subject to performance issues that should be addressed through the requirement for an appropriate specification.

- **Advanced meter installations upgrading to smart functionality**: Advanced meter installations can be upgraded without having to replace the existing meter. Suppliers will be obliged to ensure appropriate interoperability and compliance with technical specifications. This flexibility is permitted on the basis that some non-domestic installations could be capable, through hardware and/or software changes, to be upgraded to meet the technical specifications. This approach will reduce costs and disruption to consumers. Advanced meters that are not upgraded will need to be exchanged in line with the obligations set out in paragraph 2.46.

- **Battery life for non-domestic gas meters**: An operating profile will be developed as part of the technical specification process. This will ensure that costs for battery exchange and maintenance are kept at a sensible minimum and that manufacturers are incentivised to develop energy efficient designs.

- **Adoption criteria and codes of connections**: These will be developed to ensure only non-domestic meters that conform to the end-to-end smart metering security standards are permitted to use DCC services. This will ensure that the security integrity of the end-to-end system is maintained.

2.52. It should also be noted that there are circumstances where meters capable of measuring larger loads are used by domestic consumers (eg for large dwellings). The technical challenges are the same and hence the same exceptions are applicable. Exceptions should also be considered where it is technically difficult to provide domestic functionality to those larger meters (eg provision of a valve and the scope for using a pulse output).

Next steps

2.53. Smaller non-domestic (and large domestic) meters will be considered by a working group, described in Chapter 5, tasked with developing draft technical specifications. This work will inform the development of the technical specifications and where necessary, smaller non-domestic and larger domestic variants will be included. The governance process for dealing with smaller non-domestic advanced meter exceptions to the technical specifications and the approach for upgrading domestic installations to smart will be considered in the next phase of the programme.

Assuring the performance of smart metering equipment and potential arrangements for governance

2.54. It may be necessary for arrangements to be put in place to assure the performance of smart metering equipment against the technical specifications. The assurance of smart metering equipment is considered within this supporting document. This does not cover extend to end-to-end smart metering system testing and assurance (please refer to the "Implementation Strategy" supporting document).

2.55. The governance for the functional requirements and technical specifications is discussed in Chapter 5. The establishment of overall smart metering governance through a Smart Energy Code is considered in the "Central Communications and Data Management" supporting document.

Prospectus proposals

2.56. We sought views on whether the current arrangements for delivering technical assurance can be developed cost effectively for smart metering equipment. How these procedures would be developed and governed was also discussed alongside arrangements being developed by the National Measurement Office (NMO) for in-service testing of meter accuracy. Monitoring the performance of the new smart metering equipment is important to ensure consumer confidence.

Evidence

2.57. There were mixed views from respondents on whether current arrangements for delivering technical assurance would need to be further developed to support smart metering equipment. Many suggested that the existing arrangements could be applied or extended by adapting, for example, the existing Balancing and Settlement Code (BSC) Performance Assurance Framework. Some urged caution in requiring arbitrary extensions to existing assurance or applying undue weight to the communications elements. Views were also expressed both for and against incorporating technical assurance arrangements in the Smart Energy Code.

2.58. An SMDG subgroup considered options for assurance mechanisms for the functional elements in the smart metering equipment. Its work focused on differences between existing non-smart metering and smart metering requirements and on potential options going forward. The merits of a voluntary approach against the establishment of an independent assurance body were discussed. There were mixed views on whether the costs of establishing and operating such a body provided benefits above the voluntary approach.

2.59. The subgroup also considered the governance arrangements needed to ensure that all parties involved in smart metering (including energy suppliers, network operators, central bodies, manufacturers and energy service providers) would work to a consistent baseline and, in so doing, manage interoperability issues. Governance options for the terms of reference, equipment being governed, the process, timelines and the risks and benefits were considered.

2.60. It was proposed that the terms of reference would be such that any governance arrangements should advise on assurance issues and provide guidance to the Government and regulators. Responsibility for reviewing suggested changes from industry parties to any of the technical specifications and providing recommendations on such changes was suggested as an example of its role.

2.61. An assurance process would also need to identify all potential problems with equipment failure, both in early life and longer term (and operational issues such as unintended interaction with unrelated equipment). It was recognised that smart meter technical assurance goes much further than the scope of the current voluntary in-service monitoring of metrology performance and technical assurance in place for the half hourly electricity market.

Conclusions

2.62. Strong arguments for and against the establishment of an independent technical assurance body and processes have been considered. As the design of the end-to-end system evolves more certainty on equipment performance criteria will emerge. This will influence the approach to technical assurance.

2.63. The programme will consider, in the next phase, the necessary testing and trialling requirements which will need to be in place during the foundation stage. Technical assurance of equipment will be considered in the next phase alongside the options for suppliers to demonstrate compliance with the technical specifications.

Next steps

2.64. Options for technical assurance and governance of any assurance framework, relating to smart metering equipment performance will be considered by the programme, with advice from expert stakeholders, as the technical specification is developed.

2.65. Assuring the functional end to end smart metering system via DCC may require additional assurance processes. This will also be considered in future cross programme activities.

Other Significant Areas

Gas Meter Valve

2.66. The Government proposed that remote enablement and re-enablement of gas supply should form part of the functional requirements. A technical report[9] analysing the technical issues relating to this functionality was also published alongside the Prospectus.

2.67. The responses to consultation provided no further evidence to that submitted in response to earlier consultations. Overall views of stakeholders expressed within expert groups or workshops were focussed on ensuring the appropriate and safe operation of the functionality rather than the decision to include the functionality itself. Evidence submitted by stakeholders in response to previous consultations had already been taken into account and did not alter the outcome of the programme's analysis. The Government has concluded that remote disablement and re-enablement of gas supply will be included as a smart metering functional requirement. Work will now proceed on including this requirement in the development of technical specifications.

Electricity Isolation Switch

2.68. The Electrical Safety Council (ESC), supported by a number of electrician trade associations, proposed that the smart metering equipment should include an electricity isolation switch as an additional minimum functional requirement. This would allow electrical installers to work on equipment between the meter and the consumer's main switch without requiring the main cut-out fuse to be removed. Under existing rules, the situation, as described by the ESC, is that electrical installers must arrange with the supplier, or through its meter operator, to remove the fuse. On this basis other bodies (eg electrical installers) are not permitted to remove the fuse. Complying with this obligation causes inconvenience and cost.

2.69. An isolation switch would require additional hardware in the meter. Estimated costs provided by meter manufacturers indicated an additional cost range of £1 to £5 for this functionality. The ESC estimated that approximately 400,000 installations per year require the main fuse to be removed. The issues raised were submitted to expert subgroups for analysis and responses considered by the programme.

2.70. We have noted the issues raised by the ESC but it is not yet clear that a case exists to address the problem of supply isolation through a relatively expensive solution using the smart meter. Further work is required to understand and assess

[9] *Analysis on disablement/ enablement functionality for smart gas meters*, Gemserv, 2010

the issues and the role that smart metering could play. Alternative approaches, for instance a review of current rules and arrangements, may offer a more suitable and cost effective solution to the issue raised and also need to be examined.

2.71. The programme will therefore facilitate further discussion among industry and relevant representative bodies to gather evidence through either an expert working group under the SMDG or the rollout operational issues group proposed in the "Rollout Strategy" supporting document. The objective will be to seek the most cost effective way of addressing the issue through either an operational or technical solution.

3. Communications

Electronic communications are key components of the smart metering equipment and support delivery of many of the benefits identified for smart metering. Communication technology is required to transmit and deliver data throughout the system reliably, securely and on demand. This section centres on significant issues related to the home area network (HAN) and wide area network (WAN) module.

3.1. In this section we present a summary of the conclusion and discussions on the key issues related to smart metering electronic communications within the consumer premises, including:

- Electromagnetic Sensitivity
- Standard meter interface language
- Exchangeable HAN
- WAN module.

3.2. The process of consultation and analysis has resulted in conclusions to retain, largely unchanged (except for clarifications), most of the communications related functional requirements we presented in the Prospectus.

3.3. These requirements include:

- Both WAN and HAN interfaces shall be based on open and non proprietary standards and shall support the security and privacy requirements
- The HAN interface shall be backwards compatible and shall not interfere with existing prevalent premises networks
- The smart metering system shall be capable of supporting at least two suppliers in the same premises as well as switching between any licensed suppliers.

3.4. As noted earlier in this document, the updated Catalogue presents all the requirements and shows the changes made alongside relevant supporting evidence. The related technical specifications will be developed during the next stage of the programme.

3.5. In this section we present a number of substantive issues that have been subject to more detailed analysis since consultation and set out the reasoning, conclusions and next steps.

Electromagnetic Sensitivity

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

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

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

Standard meter interface language

3.9. Smart meters transmit and receive data throughout the system using a number of languages. These languages ensure that messages, such as meter readings, can move from meters to DCC and then onto suppliers and third parties. These messages need to be readily understood and translated into information meaningful to market participants.

3.10. A key component of technical interoperability will be to agree on the common language or languages for the smart metering equipment as part of the minimum requirements. There are a number of protocols available in the market that could be adopted for use in smart metering.

Prospectus proposals

3.11. The Prospectus noted that future work of the programme would define whether single or multiple meter interface languages should be adopted for the smart metering equipment.

Evidence

3.12. There was no explicit question in the Prospectus on this subject. However various responses did comment on the issues related to identifying suitable meter interface languages. There was also work undertaken by SMDG and the Data and Communications Expert Group (DCG) to examine the issues and challenges. Evidence was also provided via bilateral meetings with stakeholders to deepen our understanding of the issues.

3.13. SMDG meetings highlighted the need for common smart meter interface languages to achieve interoperability and minimise the costs associated with supporting multiple solutions. This initial dialogue resulted in a joint programme expert group comprising experts from SMDG and the DCG.

3.14. This group indicated that there were not many open and non-proprietary languages available and, of those, only a few are included within emerging European standards frameworks for smart meters. However, it was acknowledged by the group that further work and analysis was needed to assess the most appropriate approach. One communication language protocol solution, 'Device Language Message Specification' (DLMS), was considered to be sufficiently developed to be a potential candidate solution. It was also noted that DLMS is being used for most smart meter rollouts across Europe and other parts of the world and is part of the European smart metering standardisation process.

Conclusions

3.15. The Government has concluded that there are benefits to restricting the number of languages that can be used by the smart metering system. Leaving the solution selection to the market could increase cost and complexity through having to support multiple languages and layers of translation between languages. This could hinder deployments during foundation and after DCC is fully operational. There appears to be little benefit for an unrestricted approach which is likely to have an adverse impact on interoperability.

3.16. It is noted that DLMS is reasonably well developed and may offer a solution, although issues specific to Great Britain, such as support for prepayment and possible limitation for use for gas metering, have not yet been fully worked through. There is also insufficient information to rule out other candidate solutions at this stage.

3.17. Further work is required to assess the various solutions before a conclusion can be made. However, on the basis of analysis undertaken to date and further evidence submitted as part of the consultation process the Government is persuaded of the need for the minimum functional requirements to require market-participants to use a minimal number of standard interface languages rather than allowing a market driven approach.

Next steps

3.18. Consideration of the suitability, likely availability in the required timescales and the cost and benefits of candidate solutions will be considered by a focused working group as part of the process described in Chapter 5. This work will inform the final conclusions on the smart metering interface language or languages.

Exchangeable HAN

3.19. Smart metering equipment will communicate within the home or premises through a HAN, using communications technologies located within smart metering equipment. The HAN is the communications medium within the premises that allows the transfer of data between the smart metering equipment and through the WAN module to DCC. As such each piece of smart metering equipment that communicates via the HAN would contain a HAN device (essentially a collection of electronic components) that could either be fully integrated or exchangeable (modular) without having to replace existing meters.

Prospectus proposals

3.20. The Prospectus proposed that there should be no explicit functional requirement in the Catalogue for the HAN device in the smart metering equipment to be modular and exchangeable without having to replace existing smart metering equipment.

Evidence

3.21. The programme's analysis was informed by responses to consultation, the work of SMDG, and by bilateral meetings with stakeholders. In addition the programme supported a HAN workshop to help stakeholders understand technology options and constraints.

3.22. There were responses indicating broad support for the suggestion that the HAN hardware should be exchangeable. The sample size was too small to discern meaningful differences between groups of respondents but there appeared to be a more mixed view from suppliers, network operators, respondents from the telecoms sector and consultants/services providers.

3.23. Some respondents and stakeholders indicated that the HAN requirements contained in the Functional Requirements Catalogue were too prescriptive (eg technology specific) although the Prospectus was clear that the proposed functional requirements did not refer to technology solutions and no decisions have been made on HAN technologies.

3.24. The views expressed by SMDG, following a more detailed assessment, were that the cost and complexity of an exchangeable HAN were likely to be prohibitive; and that it could compromise security.

Conclusions

3.25. On the basis of analysis undertaken to date and further evidence submitted as part of the consultation process the Government has concluded that HAN exchangeability should not be a requirement.

Next steps

3.26. Future work will focus on developing the technical specification to meet the relevant functional requirement. This will be considered by a focused working group as part of the process described in Chapter 5 that will inform the technical specifications.

WAN Module

3.27. The Prospectus confirmed that smart metering equipment will communicate to DCC via a WAN, using communications technologies provided by service providers contracted to DCC.

3.28. This necessitates WAN transmitters and receivers within homes or premises that deal with the communication of metering data between the consumer and DCC. The physical location of this technology has a number of impacts on the commercial, technical, security and operational architecture for the end to end smart metering system and gives rise to the following issues:

- How would the WAN module be installed in the consumer premises?
- How would the WAN module be connected to smart metering equipment (data connection)?
- How would the WAN module be protected from the power supply and tampering?

Prospectus proposals

3.29. It was proposed within the Prospectus that smart metering equipment should include a WAN module that is exchangeable without having to replace the existing meter. The baseline architecture assumes only one WAN module per home or premise, but acknowledged that in certain installations (eg when a gas meter is out of HAN range) there may be a case to have an architecture that supports two WAN modules.

Evidence

3.30. A range of views were expressed about the proposals for the functional requirements of the WAN.

3.31. The exchangeability of the WAN module was seen by some suppliers as advantageous in allowing gas smart meters to be installed when single fuel contracts are in place and the gas supplier wants to install a smart meter before the electricity supplier installs an electricity smart meter. It also provides the flexibility to respond to future smart grid requirements or communication developments.

3.32. Replacing or upgrading the WAN module could be achieved without the cost of a full meter replacement. Clarification was sought over the roles and responsibilities of suppliers and DCC service providers in relation to what equipment each would be obliged to maintain. Roles and responsibilities for smart metering equipment are considered further in the "Central Communications and Data Management" supporting document.

3.33. It was suggested that the WAN should be based on open non-proprietary technology and that the architecture should be sufficiently flexible to allow any potential WAN medium whether wireless or not. But others wanted prescriptive technologies (and interfaces) for interoperability. Several respondents considered that the technical specification should be developed in conjunction with specialist communications service providers.

3.34. A variety of potentially viable locations and configurations for the modular WAN were identified by the SMDG sessions on this topic. The SMDG subgroup suggested that all configurations needed to be supported during the smart metering rollout due to the constraints of meter locations, range of installations and legacy installation constraints. It was suggested that both wired and wireless solutions also need to be supported for the link from meter to WAN.

3.35. Several options for power and tamper protection were identified for a WAN module housed outside of a meter:

- Fuses – depending on low level design, the electricity meter and the communications unit would need re-settable fuses
- Power step down – the WAN module might use alternating (AC) or direct current (DC) so the use of a current transformer and power step down could mitigate safety issues
- Tamper seals – several types of tamper detection methods could be used
- All wired solutions should employ stress/strain relief to ensure that unauthorised parties cannot pull out or remove power/data cables.

Conclusions

3.36. On the basis of analysis undertaken to date and further evidence submitted as part of the consultation process Government has concluded that the requirement for a WAN module that can be exchanged without having to exchange the meter should remain.

Next steps

3.37. Work in the next phase will focus on developing a technical specification for the WAN module that meets this functional requirement. This will also address the location issues, needs for power and tamper protection and ensure that any relevant technology requirements are non-proprietary. This will be considered by a focused working group as part of the process described in Chapter 5 that will inform the technical specification. The roles and responsibilities for the equipment are further clarified in ”Central Communications and Data Management” supporting document.

Other Significant Areas

Suitability of current HAN technologies

3.38. There are a number of HAN technologies currently available in the market. Views on the suitability of these offerings were sought and a number of responses were received.

3.39. A mixture of views were presented. Consultants and service providers, meter manufacturers, installers, meter operators and network operators (as a combined group due to the small sample size) stated that there are technologies that are suitable and ready for smart metering deployment. Conversely, suppliers and respondents from the telecommunications sector had concerns over the capabilities of current HAN technologies. There were suggestions that HAN technologies are not yet available to cover all property types found in Great Britain.

3.40. A number of other issues were raised including:

- Insufficient attention has been paid to the requirement for HAN firmware 'enhancement' once equipment is installed and operational in consumer premises
- The use by HAN technologies of unlicensed radio frequency bands and the potential for interference with other equipment within the home
- The size of firmware upgrades that the HAN should be able to transmit (to enable equipment upgrade) has been understated
- HAN technologies require higher data rates to efficiently support the smart metering system.

3.41. The responses noted above are indicative of the general lack of certainty on HAN capabilities across the stakeholder community. This is recognised and steps are being taken to address this as part of developing technical specifications. A HAN selection working group is working towards developing selection criteria and technology evaluation. This work will include interoperability and security requirements developed by a group of relevant experts reporting to the programme under the SMDG working group arrangements.

4. In-Home Display

As part of the mandated rollout, domestic consumers will receive an IHD that will help them to understand their energy use. This chapter sets out the functional requirements for the IHD.

4.1. As part of the rollout of smart meters, the Government has previously decided that all domestic consumers should be provided with an IHD. IHDs will give consumers timely consumption information in an easily accessible form, promoting greater consumer awareness of energy usage and helping them to reduce their consumption.

4.2. The Prospectus set out the proposed minimum functionality of the IHD. The process of consultation and analysis has resulted in conclusions to retain, largely unchanged (except for clarifications), most of the functional requirements relating to IHD. This section describes the Government's conclusions in three significant areas related to the IHD that emerged from the consultation process:

- Using the IHD for prepayment
- Accessibility and inclusivity
- Ambient feedback (non-numerical presentation of information).

4.3. It also sets out the conclusions on other important aspects of the minimum functional requirements for the IHD. This includes the requirements to support mains power operation and to display indicative financial and consumption information. This section also considers the requirement for information on carbon dioxide emissions

4.4. The conclusions in this chapter were informed by responses to consultation questions, by the work of the expert group, by bilateral meetings with stakeholders and requests for information. The updated Functional Requirements Catalogue presents all the requirements and shows the changes alongside relevant supporting evidence. The related technical specifications will be developed during the next stage of the programme. Further information on the obligations to provide, repair and replace IHDs that comply with the technical specifications can be found in the "Rollout Strategy" supporting document.

Prepayment information displayed on the IHD

4.5. In the Prospectus it was proposed that prepayment information displayed on the IHD should include account credit and debit balances. It was noted that an IHD might be more likely to be used on an enduring basis by prepayment consumers if this information was relevant and useful.

Prospectus proposals

4.6. There was some consideration of the specific IHD requirements for prepayment metering in terms of data items. At a minimum it was proposed that prepayment information on IHDs should include real time credit and debit balances for prepayment consumers. There was no evidence before the Prospectus was published to support inclusion of additional prepayment IHD information requirements beyond the account balance information. Other prepayment information will be available from the display fitted to the meter. It was also recognised that suppliers could offer more prepayment functionality through their commercial offerings as long as overall interoperability would not be compromised on change of supplier.

Evidence

4.7. Prepayment information requirements for IHDs were raised in some consultation responses as well as in expert group meetings. Features such as display of more prepayment specific data items were proposed. Consumer groups noted that the differentiation between credit and prepayment consumers should be further reduced and proposed that comprehensive prepayment information requirements should be included for all IHDs.

4.8. Replicating the same information displayed on the smart meter was also proposed. Although it was noted from responses that prepayment meter information displayed is not currently standardised and varies between manufacturers. It was also stated that over burdening the IHD with excessive information could confuse consumers. Costs for communicating and displaying extra data items on the IHD were minimal (costs ranged from negligible to less than £1).

Conclusions

4.9. In consideration of evidence presented, the Government has concluded that development of minimum prepayment information requirements for IHDs covering additional data items should be included as part of the technical specifications work. This will provide some level of consistency for prepayment consumers. It will also enhance the potential for IHDs to be fully utilised by all consumers, thereby avoiding the need to change IHD if payment methods change. In defining minimum prepayment IHD information requirements, a balance will need to be struck so that technical specifications are sufficiently flexible to promote innovation, while providing consumers with clear unambiguous information.

Next steps

4.10. The programme will facilitate development of technical specifications for the minimum prepayment information requirements that should be displayed on the IHD. An SMDG working group will take this work forward. The group will include consumer representatives.

Prepayment smart meters inaccessible to consumers

4.11. Meters are sometimes installed in locations that are inaccessible to consumers due to technical or building constraints. Currently, prepayment meters should not be installed in such locations because consumers have to access the meters to allow credit to be applied to the meter. The prepayment consumer must physically insert a key or token into the meter to top-up and/or re-enable supply.

4.12. Currently, where meters are inaccessible and a prepayment contract is requested the meter is either moved or suppliers refrain from offering this payment service. Suppliers have a licence obligation to only charge by prepayment where it is safe and practicable to do so.

4.13. Smart meters operating in a prepayment mode will allow remote credit top-up and enablement/disablement of supply. This should enhance prepayment services and incentivise new and innovative payment methods. However, to avoid potential safety issues, the consumer must be physically present to re-enable supply (ie through pressing a button on the meter) following prepayment disconnection. There must also be a route to enable the smart meter to be credited if the WAN and HAN communications have failed. This presents a particular challenge for smart meter installations that are not accessible to the consumer.

Prospectus proposals

4.14. The Prospectus noted that consumers with meters installed in inaccessible locations were potentially being disadvantaged as prepay options *w*ere not being offered in those circumstances.

4.15. With more interaction required for smart prepayment meters it was clear that disallowing consumers from smart prepayment offerings, because of where the meter is installed, should be avoided. A question was posed whether IHD design could be used to address this problem.

Evidence

4.16. Prepayment functionality for IHDs was raised in some consultation responses as well as in expert group meetings. Features such as using buttons on the IHD to top up energy balances or as an enablement mechanism were proposed.

4.17. Meter manufactures and operators and industry groups strongly supported the idea that an appropriate IHD could help overcome meter accessibility issues but the views of other respondents were more mixed. Some disagreed with enabling prepayment via the IHD on the grounds of safety during re-enablement (especially for the gas meter) or security for funding or credit. A number expressed concerns over the cost (and benefits) of adding prepayment functionality to IHDs that may only benefit a small number of consumers. Other respondents raised issues around reliance on a device that might be easily lost (if portable), subject to power failure (if battery powered) or hard for consumers to use (if they need to enter long codes and scroll through many display screens).

4.18. The responses and discussions highlighted that there was not a common view on what a prepayment IHD should include. Views ranged from a few extra data items to keypad top-up, credit card top-up and enablement functionality. The additional cost for a keypad top-up functionality to be integrated into the IHD was estimated by a SMDG sub-group to be at least £5. Without a technical specification it is not possible to provide a more accurate estimate than the one already provided in the relevant impact assessment.

Conclusions

4.19. In consideration of evidence presented, Government has concluded that work will be taken forward as part of the next phase of the programme on how best to make prepayment functionality available to consumers even when smart meters are installed in locations that are inaccessible to the consumer. The development of a robust remote prepayment interface directly linked to the smart meter will be considered further, for such smart metering installations, as a technical solution to the issue.

4.20. It is envisaged that a prepayment interface would provide a physical means of top-up (ie a keypad), a robust link to allow re-enablement of supply (ie wired link to the meter) and replicate and display all relevant prepayment meter data items available from the meter’s display.

4.21. The development of the prepayment interface should be included as part of the technical specification work. A minimum specification will be developed and further consideration given to the costs and benefits. It will also be necessary for the prepayment interface to be maintained while prepayment services are being used. Therefore an enduring obligation will be considered for suppliers to maintain the prepayment interface for when prepayment services are being used for smart meters installed in inaccessible locations.

Next steps

4.22. The programme will facilitate development of the prepayment meter interface for smart meters installed in inaccessible locations through an SMDG working group that will include consumer group representatives and will consider all potential constraints in consultation with stakeholders.

Accessibility and inclusivity

1.1. The Prospectus noted that the engagement of all consumers was key to the overall success of the programme. The IHD should be regarded as the smart metering interface with the consumer. On this basis, for the IHD to be effective, it is important that it is accessible and inclusive for consumers.

1.2. Accessibility and inclusivity are related terms. Accessibility is a measure of how well users with different levels of ability can use a given product through use of design features. Inclusivity is a measure of how many of these design features are adopted to make a product as inclusive as possible across a range of different levels of accessibility.

Prospectus proposals

4.23. In the Prospectus, we did not consider it appropriate to mandate detailed requirements in this area. However, we did welcome views on whether there is a case for a licence obligation on suppliers to provide customers with special requirements with an appropriately designed IHD and/or for best practice to be identified and shared once suppliers start to rollout IHDs.

Evidence

4.24. There was little support for introducing a licence obligation around the need for appropriately designed IHDs. Suppliers and manufacturers expressed the view that the Standard Licence Condition 26 and the Equality Act 2010 are sufficient to ensure that displays are accessible to all consumers. However, other respondents considered that the market may be slow to meet the needs of vulnerable and disabled consumers where there is no mandate.

4.25. It was argued that the adoption of the principle of 'inclusivity by design' should be carried forward. Inclusivity by design is defined as ensuring that the inclusivity of a product or system is designed from the earliest stage to meet the needs of all users. Inclusivity by design ensures that design features to make products accessible to a wide consumer population are incorporated during the design of mass produced consumer products. This would include IHDs meeting inclusivity design standards such as large screen and font size, large and tactile buttons and feedback in plain English. It was suggested that this approach would benefit many consumers who might not identify themselves as disabled or as having special requirements in the use of smart metering equipment.

4.26. The programme's request for information on accessibility issues elicited a small number of responses covering the costs and benefits of inclusivity by design. The request for information indicated that there are no existing international IHD specific standards for accessible IHDs and that additional costs vary depending on the solution.

4.27. A request for information covering Welsh Language resulted in a small number of responses. On analysis of the responses and other information, evidence suggested that mandating Welsh language would add little cost. Some responses to the Request for Information suggested it was likely to be easy and inexpensive to provide for different languages, in addition to Welsh, using solutions such as icons or software. The programme is also aware of the likely extension of Welsh language obligations to suppliers under legislation currently passing through the Welsh Assembly.

Conclusions

4.28. The Government has concluded on the basis of pre-consultation analysis, evidence supplied through the consultation and regulatory/best practice design principles that:

- Best practice parameters will be developed for accessibility as part of the technical specification development process
- A conclusion on whether the technical specifications are the most appropriate vehicle for provision around accessibility will be taken in light of this work
- If it is decided that the technical specifications are the most appropriate vehicle, a conclusion on how to comply with these parameters will be made once they have been developed
- Suppliers should provide Welsh language functionality.

Next steps

4.29. The programme will form an expert group (whose membership will include consumer groups and others) to develop the best practice parameters identified above and the principle of inclusivity by design. Ways of achieving compliance with these parameters, if required, shall be determined in the next phase of the programme.

Ambient feedback

4.30. Ambient feedback is visual, non-numerical means of providing (eg energy consumption) information or feedback that is considered easier to understand than numerical data. Ambient feedback is aimed at peripheral vision, not at supplying detailed numerical information and provides the user with a feel for what is going on without requiring detailed attention. It can also be useful for consumers who are less confident in dealing with numeric information.

4.31. This section describes the approach to the use of ambient feedback in the Prospectus and how this approach is to be progressed in the next phase of the programme.

Prospectus proposals

4.32. In the Prospectus we reported that there is growing evidence that ambient feedback is a useful indicator of energy consumption for consumers. We proposed that the display should include a visual non-numerical presentation that allows consumers to easily distinguish between high and low levels of real-time consumption such as traffic lights or a speedometer style display. We also asked for views on how to establish the settings or calibrate the IHD to ensure ambient feedback is relevant to the diverse range of consumption patterns that are attributable to consumers.

Evidence

4.33. There was strong agreement by respondents that evidence was available (including from respondents' studies) confirming that ambient feedback on the IHD is a useful feature for consumers to manage their energy consumption. However, it should be noted that some respondents suggested that this feedback should be made available through media other than the IHD, such as a computer or mobile phone.

4.34. Forms of ambient feedback discussed included the use of colour, graphics and audible and visible alarms. Issues raised included that ambient feedback should not frighten or alarm consumers. It was suggested that this could lead to consumers, for example, under-heating their homes. Displaying trends rather than short-term spikes was suggested as being more informative. The need for correct thresholds and referencing were also highlighted so that ambient feedback changes reflect when consumption increases or decreases by a meaningful amount. However, there was little consensus as to what the range or parameters for ambient feedback should be.

4.35. It was suggested by suppliers that the specific form of ambient feedback should be left as an area for innovation, as different consumer groups are likely to respond to different stimuli. As such, it was difficult to define a one size fits all approach.

Conclusions

4.36. Government has concluded that on the basis of initial policy analysis and further evidence presented that the display should include a visual (ie non-numerical) presentation that allows consumers to easily distinguish between high and low levels of real-time consumption.

4.37. It is key that this ambient feedback is meaningful and appropriately accurate and timely. The programme will therefore facilitate development of best practice parameters for ambient feedback by an expert group (comprising consumer groups and other stakeholders) that may be integrated into the technical specification.

Next steps

4.38. The programme will continue to work with consumer groups and others to address concerns regarding best practice and develop parameters for ambient feedback on the IHD (and whether these should be mandated). It is expected that the work will be informed by the expert group and information obtained by monitoring existing pilots, trials and consumer testing and research.

Update Frequency of the IHD

4.39. The Prospectus noted that evidence suggests that consumers are able to use timely feedback to identify quick energy savings and reduce energy consumption.

This relates to the time between when an appliance uses energy and when it is actually displayed on the IHD. Consumers are likely to be more engaged with, and less suspicious of, the technology if they can see as close to real time changes in consumption on their IHD when an appliance is switched on.

Prospectus Proposals

4.40. For the IHD, it was proposed that all displays should be capable of receiving and updating the minimum information set at least every five seconds for electricity and at least every 15 minutes for gas with a corresponding requirement placed on the HAN to support this update frequency. This lower update frequency for gas is a consequence of the fact that gas smart meters are generally battery powered for a combination of safety and cost reasons.

Evidence

4.41. Few consultation responses commented explicitly on the update frequency. Of those which did most considered five seconds was reasonable for electricity. Some did suggest other parameters such as more dynamic IHD updates when demand was detected to be changing rapidly and longer update frequencies when consumption was stable.

4.42. In terms of electricity information, the constraint is around the availability of communication technologies. A few respondents noted that some existing HAN solutions are not currently capable of sending updates every five seconds (and are instead limited to updates every 7.5 seconds), although it is anticipated that solutions will develop soon to meet or exceed this.

4.43. Stakeholders informed us that there are currently constraints around gas meter battery life. The lifetime of current batteries and the other services that the gas meter must provide was noted as being a constraint. To send an update to the IHD, the gas smart metering equipment must 'wake up' and transmit a message containing consumption information. Remaining battery life is reduced every time this occurs. Requiring meters to send local HAN updates more frequently than every 30 minutes may mean the battery needs to be replaced before the end of a meter's estimated 15 year life.

4.44. Evidence was presented that showed that 30 minute IHD updates for gas should meet minimum battery life requirements and not impact adversely on the consumer's ability to monitor and manage gas usage. Stakeholders also considered that the gas usage profiles are more stable than electricity. This means that a lower update frequency should not negatively impact significantly on the effectiveness of this functionality.

Conclusions

4.45. The Government has concluded that on the basis of initial policy analysis and further evidence presented the objective of IHD electricity consumption updates every five seconds should remain. In acknowledgement of the current state of HAN technology the initial minimum requirement will be for an update frequency better than ten seconds for the HAN. The minimum requirement for five second updates will be reflected in future functional requirement changes when technology improvements are evident. The change to five second updates will be subject to governance arrangements for maintaining the technical specifications described in Chapter 5.

4.46. For gas, the requirement will be for a HAN update frequency not greater than 30 minutes. It is anticipated that battery technology and smart metering equipment power consumption will improve in the future potentially allowing for more frequent gas IHD updates. As the IHD is capable of operating at the significantly higher update frequency requirement for electricity, a subsequent improvement in gas update frequency would not impact IHDs already installed. Once again the minimum requirement for higher frequency gas updates should be reflected in future functional requirement changes when technology and battery improvements are evident.

Next steps

4.47. The technical specifications relating to the IHD and HAN will be developed according to the process defined in Chapter 5. It is expected that further guidance will be obtained from HAN technology experts to confirm the extent to which a five second update can be achieved in line with other requirements without impacting on areas such as cost or power consumption. The same approach will be adopted for reducing the frequency of gas meter updates, where guidance from meter and battery manufacturers will be sought.

4.48. The programme will monitor both the HAN and metering technology development and consider changes to the relevant minimum specifications at an appropriate point in time.

Other Significant Areas

Portability of displays

4.49. The Prospectus did not propose to introduce a minimum requirement relating to the portability of IHDs as no quantitative evidence was available to support this as an essential function to deliver the smart metering benefits. The Prospectus sought further evidence from the consultation process before confirming this position.

4.50. Mixed views were received from respondents. There was some support for our proposal not to require IHD portability. Others indicated that anecdotal evidence was available (eg based on very small trials or studies) that suggested portability had a short-term benefit. However, it was also noted that in the longer term, users generally leave the IHD in a fixed position. The remaining respondents considered that this matter is best left to supplier or consumer choice.

4.51. Respondents also noted that using batteries to power the IHD to enable portability would have cost and environmental implications. Removing IHD batteries for use in other equipment and never replacing them was another risk raised. The potential for consumers to stop using the IHD when batteries reached the end of their life was also noted.

4.52. In consideration of analysis before the Prospectus was published and the responses received, the Government has concluded that portability should not be an IHD minimum functional requirement.

Carbon dioxide emissions

4.53. The Prospectus sought views on whether carbon dioxide emissions should be included in the minimum information set to be displayed on the IHD . Displaying this information was not proposed as a minimum IHD requirement.

4.54. There were mixed views on whether information on emissions was a useful indicator in encouraging consumers to modify their approach to energy sources and its use. Few were in favour of information being available as part of the minimum requirements. Experience from trials was also referenced. One study reported that consumers do not value carbon efficiency information. Two other studies suggested that fewer than half of consumers are either quite interested or very interested in this information. It was suggested by some respondents that the requirement could be beneficial at some stage in the future.

4.55. On the basis of our analysis before the Prospectus was published and evidence presented the proposal set out in the Prospectus is confirmed. Information on carbon dioxide emissions should not be included as a IHD minimum requirement.

IHD accuracy

4.56. The Prospectus requested views on the level of accuracy which can be achieved in displaying consumption information, in particular in relation to monetary values.

4.57. The majority of responses were from consultants, service providers and suppliers. There were limited numbers of responses from each group. Of those received, there were mixed views on whether consumption and monetary information should be displayed at the same accuracy as available displayed on the meter or supplier bills (eg paper or web based).. However, the costs and issues of achieving equivalent monetary accuracy between the IHD and existing billing information were noted. These included:

- Accommodating tariff structures

- Calculation of thermal energy (eg conversion from cubic metres) for gas
- Higher communications overheads.

4.58. In consideration of the evidence provided during the consultation process, the Government has concluded that defining the appropriate monetary values to be displayed on the IHD and limits of accuracy will be considered further in the next phase of the programme. This will form part of the development of technical specifications. A work group will be tasked to consider the options and report and make recommendations to the programme through the SMDG structure.

HAN Data Set

4.59. The Prospectus sought responses about whether additional HAN data items should be included beyond the list for the IHD. This could add flexibility and a level of future proofing.

4.60. Mixed views were received as to whether additional data items needed to be included in the minimum requirements. Some suggested the proposed data items are adequate or that fewer items are needed. It was also suggested that more research is needed and that suppliers should collectively decide whether more data items are necessary.

4.61. Further suggestions for additional data items included:

- A link between the HAN and microgeneration or smart devices
- Alarms, events and messages
- A wider range of information to help consumers manage consumption such as historic, actual or future consumption, target or other system information such as calorific value or tariff data.

4.62. Some respondents also noted that the specific nature and type of data required for the IHD and HAN could have a significant impact on the design of the system and ease with which the system can be managed.

4.63. In consideration of the responses and our analysis prior to publishing proposals, the Government has concluded that the minimum HAN data item set should be considered further. The programme will define a comprehensive HAN data model, covering all necessary data items, in the next phase. This work will be supported by working groups set up to develop draft technical specifications. This will include expert stakeholder input dealing with the HAN, IHD and data items.

Impact to IHD Innovation

4.64. The potential for hampering IHD innovation by requiring all displays to be capable of displaying the minimum information for both gas and electricity was included as a question within the Prospectus. The Prospectus proposed a minimum requirement that IHDs should display both gas and electricity information.

4.65. The largest group of respondents to this question was suppliers. Others included consumer groups, network operators, service providers, meter manufacturers and operators, consultant/service providers, telecommunications companies and trade associations. A small majority of these respondents either supported our proposal to require all displays to be capable of displaying the minimum information set for both fuels or viewed that this approach would not hinder innovation.

4.66. The proposed minimum requirement that IHDs should display information for both gas and electricity is confirmed. This position was concluded in consideration of initial analysis and the limited further evidence presented.

5. Process for finalising the functional requirements and developing technical specifications

Establishing a set of minimum functional requirements that can then be developed into technical specifications is important to ensure technical interoperability and promote effective operation of the end-to-end smart metering system. This chapter sets out the process for finalising the functional requirements and developing the technical specifications.

5.1. This section describes the process for finalising the functional requirements and developing the technical specification. It discusses the process, organisational structures and need to ensure efficient use of resources.

5.2. The process of consultation and analysis has resulted in conclusions to retain, largely unchanged (except for clarifications), the process for developing technical specifications that was presented in the Prospectus.

5.3. In this section we present a number of substantive issues that have been subject to more detailed analysis in this phase of the programme and set out the reasoning, conclusions and next steps.

Prospectus proposals

5.4. The Prospectus proposed a set of minimum functional requirements that smart metering equipment should provide. Functional requirements are what should be delivered in terms of services and outputs. Functional requirements alone can be provided in many different ways with leading to adverse impact on interoperability.

5.5. Development of technical specifications was proposed. Technical specifications are required to deliver how functions should be executed at a sufficient level of detail to be secure, technically interoperable and provide sufficient certainty to allow manufacturers to prepare for production and suppliers to invest.

5.6. The Prospectus proposed that the programme should provide the oversight and facilitation to allow industry to take forward the development of the draft technical specifications; translating the confirmed functional requirements and developing these into draft technical specifications.

5.7. The Prospectus outlined a timeframe for the development and confirmation of the functional requirements and technical specifications. This timeline was noted as being dependent on industry expertise being available. The Prospectus sought views on the suitability of the proposed timeline and the potential for accelerating the technical specification development process. Views were also sought on whether there was a need for an obligation suppliers to cooperate with this process.

5.8. The primary objective of this process, as noted in the Prospectus, is to design an end-to end-smart metering system that will deliver all published benefits, promote competition and ensure that consumers are protected.

Evidence

5.9. There was significant support for the proposal for the programme to facilitate the development of technical specifications to provide necessary certainty to manufacturers and investors. Respondents indicated a number of routes to achieve the technical specification, such as the approach used for developing technical standards. There was strong support for the process to be led by the programme, to ensure timescales and objectives are met.

5.10. The proposal to oblige suppliers to cooperate with the process of developing technical specifications was not supported. Suppliers noted that it was in their interests to be involved with the development process and that it was essential that the programme sought the contribution of relevant stakeholders.

5.11. The responses to the proposed timelines for developing the technical specifications were mixed. Views were equally split between whether the plan could be delivered more quickly or not. There were strong differences between the categories of respondents, with network operators and some suppliers suggesting that the proposed process timescales were achievable, but not capable of being accelerated.

5.12. By comparison, industry bodies and respondents from the telecommunications sectors mostly suggested that the technical specification could be accelerated. Suggestions to develop the final technical specifications earlier included:

- Applying a variety of project management techniques - it was proposed that a dedicated team should be set up across the stakeholder community and that the number of active participants should be reduced
- Basing the technical specification on existing standards and defining a smaller number of functionalities - suggestions included separating the functionalities for each individual component of the smart metering equipment and developing specifications for the communications functions first.

Conclusions

5.13. Work to complete the technical specifications as swiftly as possible is essential to allow meter manufacturers to deliver large volumes of meters conforming to the technical specifications. The Government has concluded that the draft technical specifications should be developed using task focussed working groups composed of stakeholder experts. The Government will review and adopt the technical specifications when it considers that they are of sufficient detail to deliver technical interoperability and smart metering benefits. Government has also concluded that, at least initially, there is no need for an obligation on suppliers to cooperate with the process to develop technical specifications.

5.14. The programme has developed plans to take the development of technical specifications forward. The proposed approach is based on expert working groups, each focused on a specific technical issue. Working groups will report to the Smart Metering Design Group (SMDG) that is led by the programme. The proposed approach will use programme management techniques to provide tight control. This includes detailed planning, project management and reporting requirements. All relevant points will be reported and reviewed at weekly programme management meetings with working group chairs and SMDG representatives.

5.15. SMDG will continue to inform the programme. It will meet monthly to review the process and discuss issues escalated from the weekly programme management meetings.

5.16. Security expertise, proposed through the Security Technical Expert Group (STEG), will be represented in the working group structure. This will ensure security requirements are built into the evolving designs. Security technical requirements, that describe controls to protect the end-to-end smart metering system, will also be included in the technical specifications. This is discussed further in Chapter 6.

5.17. It is likely that when complete the minimum functional requirements and the technical specifications will be subject to consultation and also notification to the European Commission. Associated proposed supplier rollout licence provisions and relevant governance obligations will be included in this process. Notification obligations are set out under the requirements of the Technical Standards and Regulations Directive (Directive 98/34/EC) (TSD). This process introduces a mandatory stand-still period of three months before the technical specification and associated governance obligations and licence obligations can be adopted. There is a possibility for a further three month period if a detailed opinion is received from the European Commission or a Member State following the initial stand-still.

Next steps

5.18. The working group structure was set up on an informal basis ahead of the Government's response to the Prospectus consultation. This process is aimed at concluding the development of the technical specification as swiftly as possible. This will allow meter manufacturers to deliver large volumes of meters conforming to the technical specifications. The plan is to have comprehensive proposals for the technical specifications in July 2011.

5.19. The programme will continue on-going liaison with relevant stakeholders and officials. The programme will also mitigate risks by ensuring that the technical specification development process is transparent. Draft work will be made publicly available and stakeholder views will be proactively sought ahead of completion (both within Great Britain and at EU level).

5.20. The governance arrangements for the technical specifications will be considered within the next stage of the development of the regulatory and commercial framework for smart metering. This will include arrangements prior to the establishment of the Smart Energy Code and will consider governance for technical specification review and update.

5.21. These will include setting out how the technical specifications may be modified; how suppliers and others will be required to comply with them; and how existing obligations in the gas and electricity legal and code frameworks will need to be modified in the light of their introduction. This will include any consequential changes required to codes such as the Elexon metering codes of practices, the Uniform Network code and codes covering meter installation and maintenance.

6. Security

This section describes the programme's approach to security and how it is integrated into, and impacts on, the development of the end-to-end smart metering system design.

6.1. Security must be embedded into the design of the end–to-end smart metering system in a manner that is proportionate to the risks identified to ensure data and consumer protection. This also will help to ensure a high level of consumer confidence.

6.2. A holistic approach to the security of the end-to-end system is being taken. Combining robust smart meter components that can resist and detect tampering, with secure end-to-end communication and data management processes, is central to the approach. This will ensure that the overarching security and integrity of the complete system is established and maintained.

6.3. The security of the end-to-end smart metering system is dependent on a combination of technical controls, process and governance aspects. These include clearly defined security roles and responsibilities of the smart metering system players.

The Programme's approach

6.4. In defining the programme's security approach we have followed the Cabinet Office Security Policy Framework risk assessment standards and incorporated best practice from commercial information assurance guidance and international standards (eg ISO27001).

Risk assessment review and on-going update

6.5. Security is driven by a risk assessment of the end-to-end system. Any security requirements placed on the end-to-end smart metering system must be proportionate to the security risks to the system and the impact if realised. The risk assessment acts as the driver for the overall approach to security.

6.6. Since the Prospectus was issued, the end-to-end smart metering system risk assessment has developed further. The assessment uses the Government risk assessment methodology and identifies threats, their sources and potential risks to the end–to-end system. This is based on the high-level overview of the evolving smart metering design.

1.3. The scope of the risk assessment covers both the foundation stage and the period after DCC becomes operational. Both scenarios create different risk profiles that will be considered further as the design continues to evolve.

6.7. The initial full risk assessment identified a range of threats such as cyber, insider, viruses and malicious software. The potential impacts of security threats range from fraudulent transactions for financial gain, such as prepayment fraud, to compromise of critical operations such as remote disablement.

6.8. This risk assessment will continue to be carried out iteratively as the details of the end-to-end system design become clear. Review of the risks and mitigation measures will continue into steady state operation of the smart metering system. Threats and threat sources are also unlikely to be static and it is critical that the risk assessment remains relevant.

Development of technical security and security governance requirements

1.4. Completion of the early versions of the full risk assessment provided a starting point for the definition of technical and governance security requirements.

1.5. Technical security requirements cover the technical controls and processes used to protect the confidentiality, integrity and availability of smart metering data and systems. These will cover areas such as data encryption, access control, device security roles, network security and tamper monitoring.

1.6. The programme is defining the technical security requirements using data flows, derived from the functional requirements, to understand how data moves through the end-to-end smart metering system. This allows the potential threats to that data in the various system areas (ie HAN, WAN, DCC, suppliers and third parties) to be identified.

1.7. The technical security requirements to address these threats are defined and mapped back to the risk assessment. This ensures requirements are relevant and suitable. This process takes into account the end-to-end nature of the system and, as noted previously, ensures the security requirements are proportionate to the risks identified.

1.8. Security governance requirements will be needed to ensure processes and policies are in place, operated correctly and managed. These cover areas such as incident management, security awareness and training, personnel vetting and supply-chain management security. The ability to monitor and adjust technical security requirements will also be covered by the security governance requirements.

1.9. Collectively, technical and governance security requirements set down controls, principles, processes and policies which will need to be met by the end-to-end system that is implemented. It will also allow its compliance and security resilience to be measured.

1.10. The technical and governance security requirements will cover both the foundation and DCC environments. For the foundation stage, data will flow directly between energy suppliers and smart metering equipment. When DCC is operational data will flow to suppliers, and other third parties, via DCC. This fundamental difference will result in differing security requirements (technical and governance) from the foundation stage.

1.11. Security requirements for smart metering deployments will form part of energy suppliers' license obligations during the foundation stage and when DCC is operational. Initially, with no DCC in place, meeting the complete set of foundation stage security requirements will be the responsibility of energy suppliers. When the DCC is introduced we anticipate a number of security requirements to form part of the Smart Energy Code that the DCC must comply with.

1.12. Technical security requirements related to smart metering equipment will be included in development of technical specifications described in Chapter 5. It is likely that when complete those requirements will be included in consultation and also notification to the European Commission (also described in Chapter 5).

Security Technical Expert Group (STEG)

6.9. Central to developing the detailed process for security requirements was the creation of the Security Technical Experts Group (STEG). This is an advisory group of technical security specialists formed in November 2010 to provide advice and support to the programme on security issues.

6.10. The STEG membership includes experts from industry and other sectors such as energy suppliers, trade associations, meter manufacturers, system integrators and telecommunications providers. Government is also represented through the Centre for Protection of National Infrastructure, CESG (National Technical Authority for Information Assurance) and technical security specialists working in the programme team. Consumer representatives were also invited to join.

6.11. Monthly STEG meetings have taken place since November 2010. STEG is supporting the programme in the following areas:

- Risk assessment review and ongoing update
- Development of security requirements
- Security representation in design groups
- Analysis of security design options.

6.12. To ensure that security is represented in design, the programme will provide selected STEG participants to contribute security into SMDG and DCG expert working groups.

6.13. By embedding security expertise in all relevant design groups the programme will help to ensure that adequate challenge and advice can be provided in areas where there is a security impact. This also ensures that clarification and awareness of security requirements is available throughout the programme.

6.14. The programme is considering whether a group similar to STEG should be established to consider the security of the end-to-end smart metering system on an enduring basis as the threat landscape evolves and mitigating controls need to be revisited.

Analysis of options for implementing security requirements

6.15. Analysis of evolving options for implementing security requirements into the smart metering system design will be performed by the programme with the support of STEG. This will provide clarity and guidance in areas of risk. These areas include remote disablement, cryptographic key management and secure change of supplier.

6.16. The analysis will support proactive involvement in end-to-end architecture design, and functional design decisions and technical specification development. This will ensure that the programme continues to make informed choices for managing security risks.

Security Accreditation Process

6.17. Experience from other sectors shows that it cannot be assumed that all organisations will follow the specified security standards on an enduring basis. It may therefore be necessary to provide a system of on-going review and accountability. Accreditation is an accepted method of allowing compliance to be certified and assured, on an enduring basis, through periodic audit.

6.18. An accreditation process is being considered as part of smart metering security governance activities for key players operating within the smart metering system. Conclusions will need to be made for the arrangements for determining whether DCC and smart metering deployments, implemented by suppliers, are in line with the security requirements both in the foundation and enduring stages.

6.19. Accreditation could be a method of demonstrating compliance with the technical security and governance requirements in both the foundation stage and when DCC is operational. If accreditation covers the smart metering equipment it is possible that notification to the European Commission, as described in Chapter 5, will be required.

Next Steps

6.20. The next phase of the programme will focus on developing the security requirements in the areas of technical security and security governance across the end-to-end smart metering system. The programme will analyse the costs and benefits of different security requirements to inform decisions on what is the best, most proportionate way to address each risk. This work will be an integral part of developing the design of smart metering equipment, DCC and its services, smart metering communications and equipment installation for the foundation stage and when DCC is operational.

6.21. The use of an accreditation process will be considered in the next phase of the programme. This approach will be assessed against other options for managing and demonstrating compliance with security requirements when complete. The development of compliance obligations, through licence conditions and the Smart Energy Code, will also form part of the future work.

6.22. Security expertise will be included in expert groups developing the end-to-end design to ensure security continues to be embedded into the design. Security requirements will be included in the smart meter equipment technical specifications and communication and data functional requirements associated with the DCC.

6.23. The programme's work on security will continue to involve close liaison with the SMDG expert groups. STEG will be used as an important channel to enable security representation to inform and review programme design considerations. The STEG could develop into a group that considers the security of the end-to-end smart metering system on an enduring basis as the threat landscape evolves and mitigating controls need to be revisited. This will be considered in the next phase of the programme.

7. Next Steps

7.1. The government response to consultation, of which this supporting document forms a part, sets out a range of decisions and conclusions. Collectively, these provide a robust platform for implementation. The next stage of work will require specific outputs to be delivered to build on this platform.

7.2. The following are the main outputs in respect of the "Design Requirements" supporting document drawn from the material presented in chapters 2 to 6:

- Agreed technical specifications for the smart metering system that take into account technical standards for open systems architecture that meet the needs of Ofcom, CESG and other Government agencies involved in the design of technical and communication device
- Notification of the Technical Specification and licence condition to the EU Commission
- GB Consultation of the Technical Specification and licence condition

7.3. The technical specifications comprise:

- The Functional Requirements Catalogue
- The Extended Statement of Design Requirements
- Smart metering architectures
- Use Cases
- Normative References

7.4. These outputs form part of a consolidated plan for the programme as a whole. More detail on the timing and sequencing of these outputs and how they relate to other programme outputs can be found in Supporting Document 5 – "Implementation Plan".

Appendices

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Appendix 1 - Consultation responses related to Design Requirements

Summary of Responses

1.1. The Prospectus consultation document published on 27 July 2010 sought the views of interested parties in relation to a package of proposals. We received 279 responses from 197 different stakeholders. This appendix summarises responses received to consultation questions asked in the Prospectus and its supporting documents on the subject of the design requirements.

1.2. Consultation responses were provided by a wide variety of stakeholders. A full list of those that responded is provided in the "Overview" document, which this document is published alongside. The programme has considered each consultation response and the evidence and opinions contained in it. These have informed our analytical work and, in turn, the conclusions reached by the Government.

1.3. In order to provide an accessible overview of the consultation responses received, we have sought to group responses under types of stakeholders. Where the consultation responses of particular respondents or classes of respondents have not been mentioned in the following overview this does not mean that they have not been considered or given due weight and merely reflects the summary nature of this overview.

1.4. Responses received by the programme which were not marked as being confidential have been published on Ofgem's website (www.ofgem.gov.uk).

Prospectus

The consumer experience

Prospectus question 1: Do you have any comments on the proposed minimum functional requirements and arrangements for provision of the in-home display device?

1.5. Respondents to this question included consumer groups, industry bodies, telecommunications companies, suppliers, network operators and meter manufacturers, installers and operators. Overall, there were mixed views of the proposed minimum functional requirements for the IHD. A minority of respondents also commented on the proposed arrangements for the provision of an IHD.

Consumer groups and those classified as 'other respondents'

1.6. There was strong support from these groups, combined, for further functional requirements for the IHD such as prepayment specific data items and functions (eg keypads). Some respondents made suggestions on ambient feedback in terms of the need to carefully define thresholds to ensure consistency of feedback as well as noting that some forms of feedback (such as red lights) could alarm some groups of consumers. Others expressed concerns regarding the interoperability of IHDs. There was some interest in the IHD being able to support water metering services.

Industry bodies and trade associations

1.7. These groups, combined, expressed strong support for the functional requirements. However, several sought flexibility in the requirements which they felt would lead to innovation and hence an enhanced consumer experience - better meeting their different needs and delivering energy saving benefits.

Respondents from the telecoms sector

1.8. There was strong agreement from this group for the proposed functional requirements for the IHD. The most commonly made suggestions related to messaging and that other forms of interface such as mobile phones, computers and digital TV can also provide feedback.

Other respondents

1.9. The views expressed by many groups were similar and are aggregated here. This includes the views of meter manufacturers, installers or operators, network operators, suppliers and consultants or service providers.

1.10. There were mixed views as to whether the proposed functional requirements were appropriate. While some respondents felt the requirements were sufficient, others argued they were too prescriptive or lacking in key areas. The most common concerns related to the accuracy of the information displayed and the implications of that information being indicative only. Generally respondents reported that carbon dioxide emissions are not understood by consumers but that they welcome ambient feedback (non-numerical presentation of data). Some respondents expressed a desire for consumers to have choices on the functionality of the IHD and real time access to data and for the IHD to support messaging.

1.11. A number of respondents expressed concerns on the cost of including more functionality and the risk of hampering innovation or advocated a desire to provide consumer choice for more functionality (noting that displays must show information using units consumers understand). Several also raised concerns on technical interoperability. Very few respondents noted the need for enhanced security and privacy, particularly in the case of two-way communications and in properties of multiple occupancy.

1.12. A minority of respondents commented on the proposed requirements on suppliers to provide and maintain the IHD. A small number argued either that provision of IHDs should not be mandated or felt this should be optional. These respondents included some smaller suppliers and service providers. It was suggested that some consumers may not interact with the IHD and that there are other means of accessing consumption data stored on the meter. Other respondents either expressed support for our proposals because of the important role the IHD can play in helping to change consumption patterns, or requested further clarity, especially around the arrangements on change of supplier or tenancy.

The Functional Requirements Catalogue

Prospectus question 6: Do you have any comments on the functional requirements for the smart metering system we have set out in the Functional Requirements Catalogue?

1.13. We received limited numbers of responses from each group, with the majority from consultants or service providers to the energy sector. Similar themes emerged from all groups and so are discussed together.

1.14. Functional requirements related to the HAN and WAN (or their integration) elicited the most comments. Respondents also commented on aspects of the IHD, remote disconnection, data storage and data access. Each of these themes is discussed separately below, combined for all the groups of respondents.

<u>HAN</u>

1.15. Responses related to the HAN were focused on its interfaces for interoperability and access. Respondents noted potentially conflicting requirements for the HAN. For example allowing other devices to connect to the HAN is a security risk but is also an essential requirement for the consumer. Clarity about how this connection would work was noted as a being important to address concerns of some.

1.16. Respondents expressed a range of views on the technical specifications including a preference for an open non-proprietary technology for a HAN or a single standard HAN with single wireless frequency based on an existing licensed band.

1.17. There were conflicting views on the availability of technology to meet the requirements. Some suggested that a Great Britain standard could not be realised in the timeframe set by the programme but others believed that the requirements can be met now.

<u>WAN</u>

1.18. Respondents expressed conflicting views on the functional requirements for the WAN. Of those who explicitly commented a majority considered that the WAN should be physically separate and exchangeable (as proposed) while a minority preferred an integrated HAN/WAN within the meter (with corresponding 15 year asset life). Respondents considered that the first approach is advantageous for optimising the communications performance and the ability to install the gas smart meter first. Integrating the HAN/ WAN was noted as being more secure and lower cost.

1.19. Respondents identified additional functionality that could add to the overall effectiveness of the smart metering system. Options presented included a "smarter" WAN capable of operating firmware applications and mirroring gas and electricity metering data, so as to reduce the overall cost of the architecture (particularly in large buildings with multiple apartments). A very small number of respondents also proposed that the WAN be capable of supporting other services and water smart meters.

1.20. The WAN was regarded by many respondents as central to security and resilience. Its design was seen as key to secure connection between the end points. Suggested measures for improving security included allowing each meter to communicate directly or alternative different hub based solutions. Very few respondents explicitly suggested that the WAN could incorporate features to prevent system overload from multiple last gasp messages that might occur in the event of a major outage. These features might be similar to established tools used to prevent attacks on networks.

1.21. Very few explicitly expressed views on suitable technologies for the WAN such as suggestions that it should be based on open non-proprietary technology and for the architecture to be sufficiently flexible not to preclude any potential WAN. A few others wanted prescriptive technologies as they considered this would make interoperability more straightforward. There was a proposal for the technical specifications to be developed in conjunction with specialist communications service providers.

<u>IHD</u>

1.22. A number of common themes for the IHD emerged from this and other questions in the Prospectus:

- The extent to which information on the IHD can be made accurate or, if indicative, how consumer expectations would be managed
- The nature and relevance of the information displayed to the consumer, including for example instantaneous consumption, data for the last day, week, month and related costs
- The rate at which data on the IHD could be updated and the source of that data (directly from the meter rather than via the WAN and DCC)
- The benefit of additional functions including messaging and the ability to display data from micro generation meters.

1.23. These points are discussed in more detail in the evaluation of responses to the specific questions on the IHD.

1.24. Finally, a few respondents suggested that IHDs should not to be mandated. Other display alternatives might be offered, including mobile phones or PC (via the internet).

Approach to developing the Technical Specification

Prospectus question 7: Do you see any issues with the proposed approach to developing technical specifications for the smart metering system?

1.25. We received limited numbers of responses from each group, with the majority from consultants or service providers to the energy sector.

Consultants and service providers

1.26. There was a mixed view from this group of respondents. The most frequently raised issues were those related to standards and timescales for the programme.

1.27. Most of those who commented explicitly indicated that the technical specifications should use open standards based on existing or emerging European or international standards. A few of those who commented described the current smart meter standards landscape as very muddled and that key standards may not be available in time for the GB rollout.

1.28. Very few explicitly commented on who should be involved in developing the specifications. Of those who did there was an almost equal split between those who considered that the technical specifications should be developed by very specific groups of stakeholders with relevant knowledge and those who wanted to involve a broader group of stakeholders.

1.29. Comments related to the timescale largely centred on the emerging technical specifications not being ready within the programme timeframe and that insufficient time has been allowed for either testing or trialling.

Meter installers, manufacturers or operators and network operators

1.30. There was a broad consensus across these groups of respondents that there were a number of unresolved issues with the proposed approach. The most frequently raised issues were those related to specifications and timescales for the programme, similar to those described for the consultants and service providers. Again, very few explicitly commented on the working group based approach. There was a mix between those welcoming the approach and those feeling that membership is too constrained. Security was also regarded as a central element and respondents noted the existence of relevant security standards.

1.31. A number of respondents considered that it is important to finalise the technical specifications as soon as possible to provide the certainty investors require to fund smart metering equipment. Accordingly some considered that the activity to develop the technical specifications should be brought forward. Suggestions were made that there needed to be sufficient detail in the technical specifications to support interoperability such as clearly defined interface specifications supported by testing. A small number suggested that use cases also need to be developed as part of the specifications.

Suppliers

1.32. There was broad support for the approach, albeit with some concerns expressed. The most common concern was that innovation might be constrained by over-specifying the functional and technical requirements. Suppliers generally supported the involvement of industry experts in the working group based approach. The need to consider smaller players in the market was noted.

Industry bodies and trade associations

1.33. There was broad support for the approach from these groups of respondents, with some issues identified. The most frequently raised issues were related to existing standards and the timescale for specification of the HAN and WAN interfaces. A small number of respondents noted the need to define these interfaces as early as possible in the process.

Consumer groups and other respondents

1.34. There were mixed views from these groups of respondents on the proposed approach. Specific concerns included that there is not currently a design authority for the end-to-end smart metering system. A small number of respondents considered that wireless technology was either not sufficiently mature or not the right solution for smart metering.

Respondents from the telecoms sector

1.35. There was a broad consensus that a number of steps could be taken to optimise the proposed approach, and comments were similar to those of other respondents. In addition there was a suggestion to involve more communications providers in the design process and to adopt an end-to-end design approach.

Security

Prospectus question 15: Is there anything further we need to be doing in terms of our ensuring the security of the smart metering system?

1.36. We received limited numbers of responses from each group, with the majority from consultants or service providers to the energy sector.

Consultants and service providers

1.37. There was a broad consensus that the programme needs to carry out further activities. Respondents suggested the architecture introduces a number of potential vulnerabilities. Accordingly, a small majority suggested an increased focus on cyber security and an end-to-end based assessment. Respondents considered that the approach used for Critical National Infrastructure should be adopted. A very small number considered that the architecture and ownership of elements such as the WAN need to be defined and understood before the consideration of the security of the system can progress much further. Conversely one respondent suggested there is a tendency to overspend on security and it may be better to build a working system then add security to it.

1.38. Respondents made a number of suggestions around data network segregation, data encryption, authentication and tamper proofing. A number also identified security standards considered relevant. The security threats are expected to evolve significantly over the life of the smart metering systems and respondents suggested that a privacy and security governance framework is needed to provide this ongoing support.

Meter manufacturers or operators and Network operators

1.39. There was broad support for the approach, with caveats from these groups. The observations were similar to those of the consultants and service providers. Respondents considered that there is a need for an end-to-end approach. They sought a combination of both local and central (DCC based) security measures. It was recognised that these security measures would need to be balanced against the requirements for facilitating competition and interoperability. A very small number explicitly stated a belief that further clarification is needed on the definition of terms used. It was considered that differentiating data requirements of the smart metering participants may be helpful and in line with the approach adopted elsewhere.

Suppliers

1.40. There were mixed views from these respondents on whether the programme needs to be carrying out further actions. The need for end-to-end security was noted and that security solutions must be proportionate to risks. A small number of respondents expressed views on the role of the DCC with observations including a need for strong security pre-DCC and that a decentralised DCC solution may prove more resilient than a single entity.

Industry bodies and trade associations

1.41. There were mixed views from these groups of respondents on whether further actions were required. The observations made included an emphasis on the need for end-to-end assessment, achieving a balance between security, data access and a need for expert risk assessment.

1.42. Respondents highlighted the need for continuing monitoring and control after rollout and that suitable overall governance arrangements would be needed to consider both technical threats and organisational risks.

Consumer groups and other respondents

1.43. There was a broad consensus from these groups of respondents that further actions were required to ensure the security of the smart metering system. The observations were generally in line with those made by other groups of respondent such as the need for end-to-end risk assessment and adequate consideration of cyber attacks as well as physical attacks.

Respondents from the telecoms sector

1.44. There was broad support for the approach. Again, observations were similar to those of other groups of respondents, highlighting a need for security standards and for a governance framework which would continuously review the risk landscape. Several respondents noted that the creation and storage of extensive amounts of data on household consumption patterns and remote functionality will cause a number of security challenges.

Implementation and Next Steps

Prospectus question 19: The proposed timeline set out for agreement of the technical specifications is very dependent on industry expertise. Do you think that the technical specifications can be agreed more quickly than the plan currently assumes and, if so, how?

1.45. We received limited numbers of responses from each group, with the majority from consultants or service providers or suppliers.

Suppliers, meter installers, manufacturers or operators and network operators

1.46. Broadly, respondents from these groups combined considered that the technical specification could not be developed more quickly. The suggestions for accelerating the specifications included building on existing specifications or solutions already in use and to work with all stakeholders in an open process.

Consultants and service providers

1.47. Broadly, respondents considered that the technical specification could not be developed more quickly. Suggestions to develop the specification faster included commissioning groups to develop solutions in parallel from which a selection would be made or to base the technical specifications on existing standards.

Respondents from the telecoms sector

1.48. There were mixed views on whether the technical specification could be developed more quickly. Suggestions included defining the communications technology early (WAN and DCC), reducing the number of participants in working groups, narrowly focused working groups and basing the solution on existing open standards.

Industry bodies and trade associations

1.49. There were mixed views from these groups of respondents on whether the technical specifications could be developed more quickly. A small number of respondents suggested a concentrated team approach or the establishment of a full time team using all available expertise.

Other respondents

1.50. There was a strong view that the technical specification could not be developed more quickly. Similar solutions to those identified above were suggested, such as parallel working and a focus on the minimum rather than a future proof specification.

Consumer Protection

Prepayment and remote disconnection

Consumer Protection question 7: Could provision of an appropriate IHD help overcome meter accessibility issues to facilitate prepayment usage?

1.51. We received limited numbers of responses from each group, with the majority from suppliers. There were relatively few respondents in each group other than suppliers and so responses are combined.

Suppliers

1.52. Overall there was mixed support for the idea that an IHD (including variants) could help overcome meter accessibility issues.

Other respondents

1.53. There was strong support for an appropriate IHD to overcome meter accessibility issues and to facilitate prepayment from meter manufacturers and operators and the combined trade associations and industry groups. The views of others were more mixed. Concerns included a view that alternative media (phone etc) should be available instead of the IHD. Some disagreed with enabling supply via the IHD, often on the grounds of safety (especially for the gas meter). A small number also explicitly mentioned security or safety issues. A similar proportion expressed concerns over the cost (and benefits) of adding this functionality that may only benefit a small number of consumers.

1.54. There were mixed views from the respondents over the reliance on a device that may be easily lost if portable and subject to power failure if battery powered.

Data Privacy and Security

Smart Metering System Security

Data Privacy and Security question 5: Do you agree with our approach for ensuring the end-to-end smart metering system is appropriately secure?

1.55. We received limited numbers of responses from each group, with the majority from suppliers. Overall, there was broad support for the approach proposed in the Prospectus.

Consultants and service providers

1.56. A majority of respondents considered that, at this relatively early stage, the security approach was sufficient or had few omissions. There was support for the planned stakeholder engagement activities. However, a majority also considered that there appears to be an emphasis on data security with insufficient attention paid to cyber security, including denial of service attacks. Respondents noted the need to address the risk of social engineering (means of manipulating people into divulging confidential information) as part of considerations for security.

1.57. A few respondents suggested that an overarching governance framework is needed to maintain an ongoing focus on security and that there must be accountability for overall end-to-end security, with DCC the appropriate body to take on this role.

1.58. Attention was drawn to security standards elsewhere. Several respondents stated that an effective security assessment needs to be based on the end-to-end architecture and overall system and its lifecycle. Work in the USA was cited as providing a guide on how to consider data and the flow of information for an end-to-end assessment of system security.

1.59. Attention was drawn to the need to carry out testing, including penetration testing, to make sure that no unauthorised access points could be identified. However, a very small number also suggested that a pragmatic view must be adopted to achieve an appropriate balance between robust security and effective access and operation by all users.

Meter installers, manufacturers or operators and network operators

1.60. There was consensus among this group of respondents that the approach and the level of engagement with relevant expertise is generally good and that risk assessment is key. A number of areas for focus were suggested:

- Need to do more to prioritise attack types, and develop countermeasures and to evaluate these against existing schemes
- Focus on an end-to-end based approach and require security compliance to be demonstrated across the total architecture
- Balanced consideration of both local and DCC security, with the suggestion that protecting data in DCC is key
- The need for consideration of the security implications for the types of more interactive system that might be expected to develop over time
- Specific suggestions for local and system security. Examples included allowing dual HANs for different functionality and a domain based solution with asymmetric cryptography.

Suppliers

1.61. This group expressed mixed support for the approach proposed in the Prospectus. As a whole suppliers highlighted the need for standards to be established and be in place before DCC is operational. A combination of trust, transparency and incentives was suggested as a means of ensuring that security measures were effective. Some considered that an accreditation process should span all parties, products and processes that will form part of the end-to-end system and would need to be in place before the start of mass roll out.

1.62. The need for both security measures locally and for the DCC was identified. A small number queried the role of DCC, particularly in terms of its responsibilities for data protection, communications infrastructure and related security. There were explicit suggestions relating to additional in-home measures that might be needed, such as passwords to access sensitive data.

Industry bodies and trade associations

1.63. There was mixed support from these groups of respondents for the approach proposed in the Prospectus. Views were broadly similar to those of other respondents with an emphasis on the need for end-to-end security and overarching governance structures. Respondents sought more clarity and details related to ongoing assurance, the framework for managing the participating organisations and how standards would be implemented in those entities. Examples of other deployments and bodies responsible for electronic security in other jurisdictions were identified with suggestions that the programme could adopt similar models. It was noted that security must not adversely affect settlement processes but also that these processes are not the only source of risk.

1.64. One respondent drew attention to the need for all bodies (suppliers or otherwise) to be treated consistently in relation to security requirements.

Consumer groups and other respondents

1.65. There was mixed support from these groups of respondents for the approach proposed in the Prospectus. Respondents were supportive overall, highlighting similar issues to those raised by other groups of respondents.

Respondents from the telecoms sector

1.66. This group generally considered that the proposal in the Prospectus was at too high a level to form a view. However, the general approach of engaging with stakeholders through working groups was welcomed. Several drew on detailed examples from the communications industry to highlight processes for developing a secure system. This included identifying the nature of threats and mechanisms for addressing them.

In-home display

Functional requirements of the IHD

In-Home Display question 1: We welcome views on the level of accuracy which can be achieved and which customers would expect, in particular in relation to consumption in pounds and pence

1.67. We received limited numbers of responses from each group, with the majority from consultants or service providers and suppliers.

1.68. There was broad support for financial information being displayed. A few explicitly stated that financial information should not be displayed and cited potential confusion between the displayed value and any bill. Some noted that there is evidence from trials that this information does not help customers understand potential savings they can achieve or how to do so.

1.69. There were mixed views on whether the information should be displayed at the same level of accuracy as either the meter or bills. Consultants and service providers appeared strongly in favour of accuracy equivalent to that on the bill. Those from industry bodies and trade associations appeared strongly in favour of the information being displayed at the same accuracy as the meter. Factors highlighted to achieve an accurate display included the need for simple tariff structures and the need to store calorific values for gas. Very few respondents explicitly suggested that higher communications overheads with DCC might also have implications on the accuracy that could be displayed (or the cost to achieve that accuracy). A minority of respondents provided evidence on the accuracy consumers may find acceptable and some cited their own trials. A range of values were expressed typically from a "few pennies" to £1. One respondent reported that a £1 difference is not noticed but that a £10 difference would not be regarded as sufficiently accurate.

1.70. There were mixed views between those explicitly stating a view for or against the display of power or consumption related information (eg kW or kWh). Some considered that these units were not useful because consumers do not necessarily understand them. A few respondents considered that the customer and/or the supplier should decide on the information that should be provided. Very few respondents explicitly stated that the IHD is not the appropriate tool to provide financial information and other methods should be considered.

In-Home Display question 2: We welcome evidence on whether information on carbon dioxide emissions is a useful indicator in encouraging behaviour change, and if so, how it might be best represented to customers.

1.71. The largest groups of respondents to this question were consultants or service providers and suppliers. There were limited numbers of responses from each group with mixed views on whether carbon dioxide emissions would be a useful indicator in encouraging behaviour change. A small number were in favour of such information being available for those with an interest in microgeneration. Several respondents cited their own trials. They typically reported that either consumers did not value the information or that there was no evidence that it was useful if provided in addition to a monetary display.

In-Home Display question 3: We welcome views on the issues with establishing the settings for ambient feedback.

1.72. We received limited numbers of responses from each group, with the majority from suppliers.

1.73. There was strong agreement that ambient feedback (non-numerical display of information) is a useful feature for consumers to manage their energy consumption. A small number of respondents considered that suppliers should be able to decide whether to include this feature and very few restated their view that the IHD should not be mandatory for consumers. Many different forms of ambient feedback were discussed. These included the use of colour, graphics and audible/visible alarms.

1.74. The need for correct baselining and referencing was highlighted so that changes in the ambient feedback reflect meaningful changes in consumption and do not cause alarm to vulnerable consumers. For example, some vulnerable consumers might not heat their homes sufficiently if the ambient feedback caused undue alarm. A very small number suggested trends rather than short term spikes are more useful. Overall there was little consensus as to what these baselines should be or where they have previously been defined.

1.75. There was general consensus that ambient feedback should be an area for innovation as different consumer groups respond to different stimuli. Accordingly, it would be difficult to define a consistent approach for each consumer. Ambient feedback was noted as being an area of active research but with no available "standard" or specification.

In-Home Display question 4: Do you think that there is a case for a supply licence obligation around the need for appropriately designed IHDs to be provided to customers with special requirements, and/or for best practice to be identified and shared once suppliers start to rollout IHDs?

1.76. The largest group of respondents to this question was suppliers. There were limited numbers of responses from each group.

1.77. There were mixed views on whether an obligation should be placed on suppliers. Several groups of respondents (suppliers, consultants and service providers and trade associations) all strongly agreed that there should not be an obligation, supporting instead the sharing of best practice. Very few respondents explicitly highlighted that there were no standards in this area specifically for IHDs.

1.78. A small number stated that an IHD may not be the right solution.

In-Home Display question 5: We welcome evidence on whether portability of IHDs has a significant impact on consumer behavioural change.

1.79. We received limited numbers of responses from each group, with the majority from suppliers.

1.80. Overall there were mixed views on whether portability was valued, although there was strong support from consultants and service providers for portability, albeit only in the short term. One or two suppliers indicated that anecdotal evidence (eg based on very small trials or studies) suggested portability had a short term benefit in achieving energy savings. However it was reported that, in the longer term consumers generally leave the IHD in a fixed position. A small number of respondents suggested that this matter is best left to supplier or consumer choice. Similarly, a small number of respondents stated that the IHD should not be mandated in the smart metering system.

1.81. A small majority of respondents indicated that inclusion of batteries to enable portability would have negative cost and environmental implications. Other issues highlighted about portability included theft of displays and batteries and whether consumers would replace spent batteries. Alternative ways of achieving portability were also discussed including use of solar panels or moving the mains plug around with the IHD.

1.82. Very few respondents explicitly stated that IHDs used for prepayment would need to be a fixed installation for some groups of consumers in order to be available in a timely way for credit top-up.

In-Home Display question 6: Do you agree with the proposed minimum functional requirements for the IHD?

1.83. We received limited numbers of responses from each group, with the majority from suppliers

1.84. There were very mixed views from respondents, with almost equal numbers believing that the proposed functional requirements were correct, lacking or too detailed. A small number reiterated their view that provision of the IHD should not be mandated. Where respondents indicated that the requirements were too detailed the principal reasons given were restriction of innovation, display of account balance information being technically difficult and mains power precluding portability.

1.85. The primary examples of additional requirements that should be included related to the display of text messages on the IHD, prepayment functionality and the provision of more detailed and accurate financial information. The privacy implications of showing consumer billing information on an IHD were highlighted by a small number of respondents.

Nature of the Mandate of Suppliers in relation to the IHD

In-Home Display question 7: Do you have any views or evidence relating to whether innovation could be hampered by requiring all displays to be capable of displaying the minimum information set for both fuels?

1.86. The largest group of respondents to this question was suppliers. Others included consumer groups, network operators, service providers, meter manufacturers and operators, consultant/service providers, telecommunications companies and trade associations. A small majority of these respondents either supported our proposal to require all displays to be capable of displaying the minimum information set for both fuels or felt that this approach would not hinder innovation.

Suppliers

1.87. Nearly all the smaller and larger suppliers who expressed a view felt that innovation would not be hampered by the proposed requirement for all IHDs to be capable of displaying the minimum information set for both gas and electricity. Indeed one larger supplier felt that this approach might drive innovation among IHD manufacturers. Another larger supplier also argued that the proposed requirement would avoid consumers being forced to take two IHDs unless they choose to do so.

1.88. One smaller supplier disagreed with our proposed approach, while another suggested a specialist market for electricity-only IHDs might develop to cater for consumers who are not connected to the gas network. One smaller supplier also argued that the obligation to provide an IHD would restrict innovation around how suppliers provide consumption data to their customers.

Other respondents

1.89. The majority of other respondents who answered this question felt that our proposal would not hinder innovation or expressed support for the requirement for IHDs to be capable of accommodating both fuels. This included one consumer group and the majority of network operators, meter manufacturers, consultants/service providers, telecommunications companies and meter operators who responded. It was felt our proposal would allow suppliers to meet consumer preferences for a single IHD and would avoid provision of second displays unnecessarily.

1.90. A small number of respondents who commented on this question argued that the requirement for all IHDs to display both fuels would hinder innovation. It was felt that the proposed requirement ignores other, more suitable, options for providing gas consumption data to the consumer. Where a consumer takes their electricity and gas from separate suppliers, it was also suggested that the supplier who provides the IHD would control any changes to the functionality of this display or the presentation of information, thereby limiting innovation.

1.91. Among other views raised, a few respondents restated their view that the IHD is fundamentally the wrong approach because there are other means of providing consumption information. One consumer group also sought clarity that IHDs will automatically be able to show both fuels on change of supplier.

Non-Domestic Sector

Flexibility for installations of advanced and smart meters

Non-Domestic Sector question 1: Are there any technical circumstances where only advanced rather than smart metering would be technically feasible? How many smaller non-domestic customers have U16 or CT meters and what scope is there for full smart meter functionality to be added in these cases?

1.92. There was broad agreement that there are technical circumstances where only advanced rather than smart meters would be technically feasible. Technical issues identified for further flexibility around installation included teleswitching, sites where WAN connection is difficult and pulse outputs. The first two issues were also raised in relation to the domestic market. Very few explicitly stated that consumer preferences should be taken into account.

1.93. A very small number of respondents indicated that making current Automatic Meter Reading (AMR) meters smart may be disproportionately expensive due to lack of availability of larger smart meters and the relatively small size of that market (ie lack of economies of scale). Some suggested that there is little incentive for manufacturers to undertake significant research and development for non-domestic smart metering.

1.94. Five of the largest suppliers provided information on the population of these larger meters (see table 2 below).

Table 2 - Numbers of larger non-domestic gas and electricity meters, as provided by consultation respondents.

Type of meter	Number installed in GB
U16 (gas) meters	117,600
CT (electricity) meters	28,813

Non-Domestic Sector question 2: Do you agree with our proposed approach to exceptions in the smaller non-domestic sector?
Non-Domestic Sector question 3: Are there technical circumstances that we have not considered that would justify further flexibility around installation either smart or advanced meters?

1.95. Overall most respondents agreed with the proposed approach to exceptions in the smaller non-domestic sector.

Suppliers

1.96. Nearly all the large suppliers supported the proposals on exceptions, with the majority commenting that the reasonable steps approach provides flexibility and recognises that there will be circumstances where the installation of smart metering may not be possible. A minority of the large suppliers said that they expected the circumstances where it is not possible to install a smart meter to be minimal. It was suggested by one respondent that where a smart meter cannot be installed, reasonable steps should be taken to install an advanced meter. One larger supplier advocated that the market design for both the domestic and non-domestic sector should be the same except where the customer chooses the large business advanced metering option and this should continue post 2014.

1.97. There were mixed views on the proposed approach to exceptions from the smaller suppliers who responded. One respondent advocated that advanced meters could continue to be installed in the smaller non-domestic sector without the requirement to proactively replace them with smart meters prior to the end of their useful life. If customers are given the right to require their supplier to install a smart meter where an advanced meter is already installed, this would present an unacceptable commercial risk to suppliers or require them to recover their costs at a more aggressive rate.

Metering, communications and specialist service providers

1.98. Among the metering, communications and specialist service providers who responded, most supported the proposals. A minority of respondents stated that in general, exceptions are undesirable as they will reduce the level of benefits delivered by smart metering and disrupt the economics necessary to provide a competitive and economic offering. They were also concerned about exceptions on the grounds of supply interruption being risky or expensive. One respondent commented that clear guidelines will be required in the new codes to ensure that fit for purpose advanced metering is not needlessly removed. A very few respondents advocated that smaller non-domestic customers should have the option of choosing advanced or smart meters.

1.99. Respondents considered that there would be merits in using the WAN module for all the meters, such as reducing the maintenance overheads and operational complexity. As with the domestic market, difficulties regarding remote or underground premises were highlighted. Broadly, respondents considered there to be technical circumstances that we have not considered that would justify further flexibility around installation of either smart or advanced meters, eg teleswitches and contactor configuration.

Industry bodies and trade associations

1.100. Of the limited number of trade and industry bodies who responded, nearly all agreed with the proposed approach to exceptions. A minority suggested that they expected that any problems could be overcome and therefore there would be no requirement for any additional exceptions at this time. One advocated that a uniform approach should be taken across the entire non-domestic sector where advanced metering is available to all users and that the time restriction of 2014 is removed. Another suggested that in cases where the installation of a smart meter would be extremely difficult and costly and would lead to significant disruption, then it would be proportionate to allow an exemption.

Network operators

1.101. Nearly all of the network operators who responded supported the proposals. Respondents suggested that DCC should be mandated otherwise a duplicate system would be needed. It was suggested that DCC should migrate all non-domestic customers onto their standard solution and operational models.

1.102. It was suggested by respondents that an optical port could be utilised instead of continuing to require pulses from the meters. Conversely, a number of respondents indicated that there are no technical circumstances that have not been considered that would justify further flexibility around installation of either smart or advanced meters.

1.103. A number of respondents suggested that care should be taken with the timetable for rollout as many of difficult cases may require service alterations.

Other issues related to non-domestic consumers

Non-Domestic Sector question 9: What steps are needed to ensure that customers can access their data, and should the level of data provision and the means through which it is provided to individual customers or premises be a matter for contract between the customer and the supplier or should minimum requirements be put in place?

1.104. The general view of respondents was that it would useful for the programme to consider defining basic minimum data standards that would be common to both domestic and smaller non-domestic customers.

Consultants and service providers

1.105. A range of views were expressed. This included concerns that the minimum data set had not yet been adequately defined and mechanisms for how the consumer gives permission for access to their consumption data beyond the regulatory requirements were not fully addressed. A minority of respondents also suggested that customers should be provided with different routes to obtain their data free of charge (for example via the internet, HAN etc.), but that any access should be secure.

Meter installers, manufacturers and operators

1.106. Respondents suggested that a minimum data set should be defined and suppliers should have the freedom to innovate on how best to present data. In addition, the customer should have unfettered rights to choose access to the data and that this should become part of all relevant supplier contracts.

1.107. Respondents suggested that as the IHD is not mandated in the non-domestic sector, data should be made available in a timely and accurate way. A minority of respondents suggested that with the introduction of smart meters there could be a requirement for the smaller non-domestic market to provide equivalent minimum data using alternative solutions. This should be in the form of access to half hourly consumption data and could be provided via a range of routes such as the HAN, the internet or a physical port.

Suppliers

1.108. There was strong support for provisioning data as part of the contractual agreement between the customer and their supplier. Data should be provided at an appropriate update frequency and level of detail and be accessed in different ways, such as via the internet or through a HAN.

Industry bodies and trade associations

1.109. Respondents observed that customers should be able to choose how data is used beyond the regulatory requirement. They commented that the data should be available free of charge and provided in an open format to enable the consumer to seek energy efficiency advice from any chosen party.

1.110. In the absence of an IHD, a small number of respondents suggested that the supplier be obliged to provide timely and accurate data, including the half hourly data.

Other respondents

1.111. Comments from this group of respondents included views that:

- Data should be relevant to user need and available in a flexible manner. The level of data available to customers and their suppliers should be a matter of commercial agreement
- Access to data by third parties should be regulated
- There should be a licence obligation on suppliers to ensure customer access rights to energy data.

Respondents from the telecoms sector

1.112. There was a consensus from respondents that customers should be able to obtain consumption information free of charge and that access to it should be secure. Data to customers could be made available by a number of routes including the internet or a HAN.

Non-Domestic Sector question 10: Do you agree with our approach to data privacy and security for non-domestic customers?

1.113. A limited number of respondents responded to this question. With the exception of industry bodies, who were very strongly in favour, there was mixed support for the proposals laid out in the Prospectus.

1.114. Some respondents observed that domestic and non-domestic customers had different legal obligations and therefore a consistent approach may not work. However, some respondents considered that the data security and privacy rules for the non-domestic sector should be the same as for the domestic sector.

1.115. Some considered that clarity is needed on what data must remain within the consumer’s premises and what is necessary for effective consumer billing and operation of the competitive market. Similarly, it was considered that there needs to be clarity on how consumers will authorise third parties to collect data on their behalf, whether differing levels of data should be allowed for different users and the mechanism for obtaining this data whether remotely or locally.

1.116. Other observations included the views that there is a need to:

- Recognise that smaller non-domestic customers may need to share data with many others and an appropriate methodology maybe needed so that access is maintained to only those to whom the customer has granted access
- Recognise that, where a supplier opts out of the DCC model, additional confidence regarding security and privacy may be necessary
- Share aggregated data from non-domestic consumers and make it available (in aggregated form) for a range of secondary purposes including energy efficiency initiatives and experiments
- Make third party energy service providers subject to regulation and accreditation to increase the confidence that they are acting in the best interests of the consumer.

Regulatory and Commercial Framework

Roles and responsibilities at consumer premises

Regulatory and Commercial question 6: We welcome views as to which other additional data items should be included in the mandated HAN data set beyond the list for the IHD.

1.117. The largest single group of respondents to this question was consultants or service providers to the energy sector. There were limited numbers of responses.

There were mixed views on whether other additional data items should be mandated. A small majority believed that more data items need to be included in the mandated set to promote innovation and ensure interoperability while a minority suggested the data set is adequate or that fewer items are needed. A small number of respondents suggested that more research is needed and/or that suppliers should decide either now or in the future. Further suggestions included:

- A link between the HAN and micro generation or smart devices
- Alarms or events
- IHD messages
- Awider range of information to help customers manage consumption, for example historic, actual or future consumption, target or other system information such as calorific value or time of use tariff data.

1.118. It was noted that the specific nature and type of data required for the IHD and HAN will have a significant impact on the design of the system and ease with which the system can be managed and that the HAN could be the source of confusion or loss of confidence if it were poorly defined. Accordingly a very small number of respondents explicitly commented that it will be critical to define standards in collaboration with key stakeholders so that the solution is practical and viable.

Other regulatory and commercial issues

Regulatory and Commercial question 10: Can current arrangements for delivering technical assurance be developed to gain cost effective technical assurance for the smart metering system? If so, how would these procedures be developed and governed?

1.119. The largest single group of respondents to this question was suppliers. There were limited numbers of responses and the responses from all groups are combined.

1.120. There were mixed views on whether current arrangements for delivering technical assurance can be developed. A minority suggested that the existing arrangements could be applied or extended by adapting, for example, the existing Performance Assurance Framework. A very few urged caution in arbitrary extensions to existing assurance or applying undue weight to the communications elements.

1.121. Views were also expressed both for and against incorporating technical assurance arrangements in the Smart Energy Code. A minority of respondents explicitly suggested that test procedures, test programmes and testing need to be defined. Some respondents noted that accreditation and/or robust pre-approval testing by independent bodies was needed. Very few explicitly considered that self certification is more appropriate.

1.122. A small number suggested that, at least initially, extra smart metering system checks may be needed. This could include review cycles, inspections, condition monitoring and increased diagnostics capabilities.

Statement of Design Requirements

HAN requirements

Statement of Design Requirements question 1: Should the HAN hardware be exchangeable without the need to exchange the meter?

1.123. We received limited numbers of responses from each group, with the majority from consultants or service providers. Accordingly the responses from all groups are combined.

1.124. Overall, there was broad support for the suggestion that the HAN hardware should be exchangeable. The sample size was too small to discern meaningful differences between groups of respondents. However, there appeared to be more mixed view from suppliers, network operators, consultants and services providers and respondents from the telecoms sector.

1.125. Respondents noted a number of factors to consider if the HAN can be changed without exchanging the meter, including drawbacks such as:

- Increased cost (greater than estimated in the consultation)
- Security issues
- Risk of tampering and damage.

1.126. Benefits included:

- Reduced dependency on specific vendors
- Scope for differentiation by the utilities
- Future proofing as the meter life (15 years) is beyond the specifications for some HAN technologies.

1.127. Respondents also noted the need to define a methodology for a HAN exchange process and made recommendations that the HAN should be able to be exchanged by an unskilled worker (rather than a trained meter installer).

1.128. Not everyone agreed with the cost estimate. Very few provided quantitative suggestions but the majority of those who did suggested that the cost of exchangeable HAN modules is double the estimate of £1-£3 presented in the impact assessment.

1.129. Security issues were noted by respondents and the risk highlighted that the customer might be able to disable the service by changing or otherwise modifying the HAN module were noted. It was proposed that consideration be given to authenticating communications modules that connect to the meter to maintain security at the interface of the HAN module to the metering system.

1.130. Respondents considered that, as part of developing the technical specification, there is a need to define security and access policies for information exchange over the HAN. It was considered that this would reduce the security risks. A very small number of respondents also suggested that two HANs may be needed on the basis of:

- A consumer HAN which provides information to the consumer's IHD and other smart appliances
- A utility HAN for the metering data exchange, maintenance etc.

Statement of Design Requirements question 2: Are suitable HAN technologies available that meet the functional requirements?

1.131. We received limited numbers of responses from each group, with the majority from consultants or service providers

1.132. Overall there were mixed views as to whether suitable HAN technologies exist which meet the functional requirements with differences in views between the groups of respondents. There was strongest support from consultants and service providers, meter manufacturers, installers and meter and network operators (as a combined group due to the small sample size). Conversely, suppliers and respondents from the telecoms sector broadly disagreed, suggesting, on balance, that HAN technologies are not yet available.

1.133. A number of general issues were raised including:

- A view that that insufficient attention has been paid to the requirement for the HAN 'enhancement' or upgrade
- The use of unlicensed radio frequency bands
- That firmware sizes have been understated
- More bandwidth would be needed
- That the data update frequencies, while feasible for individual communications may not be appropriate for mass updates, which will be affected by server and network capacity.

1.134. Technology options suggested by respondents included:

- ZigBee
- M-Bus
- Bluetooth Low energy
- Z-wave
- DECT
- WiFi (802.11a/b/g/i/n)
- IPv6/6LoWPAN
- EEBus
- Power Line Carrier (PLC)
- Ethernet
- KNX.

1.135. Respondents identified shortcomings across these technologies, such as inability to handle GB specific functions such as prepayment, poor range, poor power consumption or high cost. Respondents' viewed indicated that current technology would need to be adapted to meet the requirements.

1.136. The need to serve a diverse range of properties in a secure and open way concerned many respondents and there was a consensus that one HAN technology will not be suitable for all sites due to issues such as:

- Construction materials which cause wireless signal losses such as large, older damp homes and new builds with metallised plasterboard insulation
- Location and relative position of the meters which may result in a large distance between the communications elements of the smart metering system, such as where meters are located in cellars, basements of large tower blocks, or outdoors
- Housing density which may require large numbers of HAN in close proximity, including in homes of multiple occupancy or tower blocks.

1.137. However, a small number of respondents noted that specific technologies are already deployed in smart metering schemes with millions of meters in use globally.

1.138. There were diverse views on the existing standards for HAN technologies. For example, a minority considered that none of the existing EU standards for HAN technologies can meet GB requirements but many considered that these gaps could be remedied and need not delay rollout.

WAN requirements

Statement of Design Requirements question 3: How can the costs of switching between different mobile networks be minimised particularly in relation to the use of SIM cards and avoiding the need change out SIMs?

1.139. Following publication of the Prospectus, we have decided that this question, and responses to it, are not relevant to the current phase of the programme. The responses may be considered in later stages of the programme alongside detailed analysis of evidence supplied by stakeholders on all wide area communications technologies. Evidence may be sought through future consultation or requests for information.

Complete catalogue

Statement of Design Requirements question 4: Do you believe that the Catalogue is complete and at the required level of detail to develop the technical specification?

1.140. We received limited numbers of responses from each group, with the majority from consultants or service providers.

1.141. Overall there was consensus that the Catalogue is broadly complete and at the required level of detail to develop the technical specifications, albeit many placed caveats on specific items. Common themes emerged from the respondents' suggestions on areas for further clarification, change or removal. These themes are discussed below. In addition, some raised concerns over whether some of the functions listed can be achieved cost effectively.

1.142. A small number suggested that the functional requirements are not usually complete until an architecture is determined (with a clear allocation of functions to the smart metering system components) but that partial incompleteness of the functional requirements should not delay the development of technical specifications.

HAN

1.143. A minority of respondents raised issues related to how the consumer will interact with the HAN. Several respondents stated that consumers must be able to connect their own devices (eg smart appliances) to the HAN without the requirement to notify the utility or supplier. Some also suggested that a solution would be for two HANs to be enabled, a customer HAN and a utility HAN. Other respondents considered that insufficient information was provided in the Prospectus on the mechanisms for interchange of data between the HAN and interfaces other than the IHD.

1.144. Technical issues highlighted included lack of availability of HAN solutions for difficult property types such as blocks of flats. Respondents also considered that the need for simultaneous signalling to devices connected to the HAN would be a challenge given the bandwidth and latency capabilities of some HAN solutions.

WAN module

1.145. A small number of respondents suggested that each meter (both gas and electricity) should communicate directly with the WAN module for security reasons. Some proposed that the WAN module should be integrated directly into the meter. Other respondents considered that an emphasis is being given to one form of technology (cellular wireless) when other technologies such as PLC are already in use in mainland Europe and should be considered.

1.146. A small number of respondents suggested that there is a need to better understand real-time (rather than near real-time) data needs of DNOs for WAN data transfer. Some sought a full analysis of all latency and resilience issues and a review of required service levels, in order to better understand the options and costs.

Gas meter and its battery life

1.147. A majority of those who commented identified a need for further work on the feasibility of 15 years gas meter battery life. Some suggested 10 years would be more viable. Others suggested that particular architectures would better support a longer gas meter battery life. For example, if the additional smart functions are put into a mains powered system component such as the WAN module.

1.148. A number of other issues related to the gas meter were also identified:

- Storage of Calorific Value (CV) in the gas meter should be included to allow calculation of energy at the meter
- For safety reasons, it is suggested that a positive confirmation should be required when re-enabling gas supply.

Prepayment

1.149. Many respondents indicated that prepayment requirements would need significant technical input in order to better understand the technical and cost implications. Examples of areas suggested for detailed technical evaluation included prepayment configuration, real-time top up and handling of debt recovery.

1.150. Some suggested that the proposed 20 minute service response period was likely to be acceptable in most cases but where credit, including emergency credit, has expired 10 minutes may be more appropriate. Some suggested that the ability to vend end-to-end should be tested during the commissioning procedure. Clarity was also sought on how microgeneration is to be managed in relation to prepayment in particular.

Smart grids

1.151. A few respondents suggested that smart grid capabilities and requirements of network operators have not been sufficiently included. Others explicitly welcomed the inclusion of elements of the network operators' requirements for smart grids.

1.152. A very few respondents indicated that more consideration is needed of the transition to smart grids in order to avoid costly or hard to manage upgrades and inefficient communications. For example, services related to electric vehicles and home energy management.

Options analysis and functions beyond the minimum definition

Statement of Design Requirements question 5: Do you agree that the additional functionalities beyond the high-level list of functional requirements are justified on a cost benefit basis?
Statement of Design Requirements question 6: Is there additional or new evidence that should cause those functional requirements that have been included or omitted to be further considered?

1.153. We received limited numbers of responses from each group to these two questions, with the majority from consultants or service providers.

1.154. Overall there was broad support for some of the additional functionalities. However, sufficient caveats were presented to indicate that many respondents did not believe all are justified on a cost benefit basis. A minority disagreed with all the additional functionalities. A very small number suggested it would be more cost effective to include additional functionality now rather than waiting. There were mixed views on whether additional evidence was available to support the cost benefit case, but little quantitative evidence was provided.

1.155. There were many comments both for and against an increase in the amount of data stored. These included views that the cost impact of additional data could be reduced by centralising data storage and that the memory costs for data storage were underestimated in the Prospectus.

1.156. Almost all the additional functionalities had supporters as well as those who considered them not to be justified. For example, while 'last gasp' was highlighted by some as beneficial for the consumer experience, others suggested that its cost may be much higher than proposed and that there is unlikely to be a positive cost benefit case. Similarly some agreed that an integral auxiliary switch was not required but others noted that a meter with this as a minimum functionality should be available for demand side management in the future.

1.157. A general observation was made that there are risks in achieving the target costs for the HAN and that achieving robust security will add further to the cost of the meter system.

Achieving technical interoperability

Statement of Design Requirements question 7: Do you agree that the proposed approach to developing technical specifications will deliver the necessary technical certainty and interoperability?

1.158. We received limited numbers of responses from each group, with the majority from consultants or service providers or respondents from the telecoms sector.

1.159. Overall there were mixed views. Few explicitly stated that they disagreed with the proposed approach of programme facilitated and industry drafted technical specification development. Some suggested that it would be preferable to adopt a standardisation rather than technology based approach, meaning that any technologies adopted should be open platforms or similar that have already been through a standardisation process. A very few explicitly recommended coordination with European activities (eg Mandate 441) associated with smart metering standardisation.

1.160. The need for technical certainty to achieve a smooth rollout was noted. One respondent considered that clear parameters for the specifications could be established by early upfront decisions on control and distribution of smartness across the end-to-end process. Several suggested that technical certainty and interoperability will only be achievable through compliance testing, certification and testing against implemented reference standards or specifications.

1.161. A large minority of respondents who commented explicitly considered that the major challenge for the programme will be in achieving technical certainty and interoperability for the HAN and WAN. Some considered that existing HAN & WAN technologies meet functional requirements but not all are interoperable. This means that suppliers would have to be able to deploy multiple technologies at the same time. The view was expressed by a number of respondents that a single HAN technology should be defined for interoperability.

1.162. Some respondents proposed a greater involvement of communications bodies or representatives in order to obtain more information and aid solution evaluation in the required timescale.

Statement of Design Requirements question 8: Do you agree it is necessary for the programme to facilitate and provide leadership through the specification development process? Is there a need for an obligation on suppliers to co-operate with this process?

1.163. We received limited numbers of respondents from each group, with the majority from consultants or service providers.

1.164. Overall there was strong or very strong support for the view that the programme should facilitate and provide leadership (albeit with some caveats such as whether suppliers should be obliged to cooperate). Respondents considered that strong leadership is required from the programme to make decisions, maintain momentum and to ensure that the process is open and transparent.

1.165. There was no strong support for obliging suppliers to cooperate with the process but respondents recognised that there is a definite requirement for suppliers to engage in developing the technical specification, as they will be responsible for complying with the technical specifications. Accordingly, some suggested that there is no need to impose a licence obligation as suppliers have an interest in ensuring the technical specification is developed as soon as possible.

Statement of Design Requirements question 9: Are there any particular technical issues (eg associated with the HAN) that could add delay to the timescales?

1.166. We received limited numbers of responses from each group, with the majority from consultants or service providers.

1.167. Overall, respondents strongly suggested that particular technical issues could delay the timescales. The themes are in line with those raised in responses to earlier questions and are summarised below.

<u>HAN</u>

1.168. A majority of those who identified technical issues considered that there is currently no proven HAN suitable for the Great Britain as a whole and no data on how HANs perform in typical housing stock. HAN technology was regarded as a 'complexity bottleneck' because of the way in which it is central to connectivity to many different types and generations of equipment.

1.169. Respondents indicated that a focus is needed on the communications aspects as meters that do not connect or have an unreliable connection will impose additional costs across the industry and DCC. It was suggested that this could also delay the programme if significant numbers of premises are affected.

<u>WAN</u>

1.170. Some respondents suggested that a reliable specification will only be possible once a number of other commercial and technical factors have been addressed, such as the governance structures of DCC and information from WAN providers on the viability of technology options. The need for parallel development of the end-to-end solution and the WAN technology was suggested.

1.171. There were differences of views on whether multiple or single technologies should be supported. Some considered that allowing multiple technologies, communications protocols and standards will cause delays in the programme. Others suggested that WAN technologies should not be limited and the design should provide flexibility for passing different protocols between the WAN module and the communications network.

Difficult property types

1.172. A small number explicitly expressed concerns that a major technical risk for the realisation of the smart metering system is related to achieving certainty in the communications link via the HAN and the WAN. Respondents considered that there are a number of factors which mean it will be hard to be certain of achieving a first time connection automatically. These factors include the range of domestic meter locations and variable local environment (construction materials, location of the meter and distance between meter and WAN). A number of solutions were suggested such as running tests on sites where the environment and location of equipment would present technical challenges.

Prepayment

1.173. Both technical and operational issues were identified. The main concerns centre on the problem of some meters not easily being exchangeable for smart meters or remotely programmable to prepayment tariffs due to location and that a solution may be excessively expensive. The challenge of allowing export from microgeneration with prepayment meters where supply may be interrupted was also raised.

Statement of Design Requirements question 10: Are there steps that could be taken which would enable the functional requirements and technical specifications to be agreed more quickly than the plan currently assumes?

1.174. The largest single group of respondents to this question was consultants or service providers to the energy sector. We received limited numbers of responses to this question from each group, with the majority from consultants or service providers. A number referred to their responses to Prospectus question 19.

Consultants and service providers

1.175. This group of respondents broadly considered that there were steps which could be taken. Typical suggestions included parallel working, either on different aspects of the end-to-end solution (HAN, WAN etc) or multiple solutions being developed for independent assessment to select the optimal solution. Conversely one respondent considered that an iterative approach would be faster and lead to a more future proof solution. Some suggested increasing the size of the team and number of technical experts committed to the programme while others considered that there is already an appropriate mix.

Meter installers, manufacturers or operators and network operators

1.176. These groups of respondents broadly agreed that there were steps which could be taken. The responses were aggregated due to the small numbers of respondents. Several respondents from these groups suggested making use of specifications that others have already developed or are in the process of being developed.

1.177. The earlier establishment of DCC was suggested as a way of providing focus on the more challenging commercial and security aspects rather than solely technical issues. There were also suggestions to involve other stakeholders, especially those with experience of development and testing processes.

Suppliers

1.178. This group of respondents had mixed views on whether steps which could be taken to accelerate the development of the technical specifications. Suggestions made were similar to those for meter installers, operators and network operators:

- Adopting a phased introduction of meter functionality
- Establishing a design authority.

1.179. However, many considered that the timescale is already tight and that there needs to be a balance between timely delivery and creating a specification that is fit for purpose.

Industry bodies and trade associations

1.180. These groups of respondents (combined due to the small sample size) had mixed views on whether there were steps which could be taken. Suggestions included:

- Asking groups to bring solutions to the programme
- Employing full time technical experts
- Using existing standards
- Obtaining an early understanding of the communications options through requests for information.

Respondents from the telecoms sector

1.181. This group of respondents broadly supported the view that steps could be taken. Suggestions included:

- Using existing standards
- Obtaining an early understanding of the communications options through a request for information
- Establishing parallel working of groups focused on particular issues.

1.182. Some considered that the programme should be redefined around end-to-end business processes and enterprise architectures.

Appendix 2 - Glossary

A

Access control

The mechanism used to ensure that access to smart meters and the data they hold is only available to properly authorised parties.

Advanced meters

Advanced meters are defined in standard supply licence conditions as being able to provide measured consumption data for multiple time periods (at least half hourly for electricity and hourly for gas) and to provide the supplier with remote access to the data.

Alert

Collective term relating to the detection of events and the sending of warning messages relating to them. Events shall be due to: faults, tampers and exceptions.

Authorised parties

Any organisation or person who is authorised by the Smart Energy Code to carry out an activity on the smart metering system.

B

Balancing and Settlement Code (BSC)

The BSC contains the rules and governance arrangements for electricity balancing and settlement in Great Britain. All licensed electricity suppliers must be party to it (see Codes).

C

Catalogue

The minimum functional requirements of the smart metering system are brought together in the Smart Metering System Functional Requirements Catalogue (the "Catalogue"). This covers the smart metering system for both the domestic and smaller non-domestic sectors.

Central bodies

Service providers involved in the operation of Great Britain’s competitive energy markets.

Codes

Industry codes establish detailed rules that govern market operation, the terms for connection and access to energy networks. The supply and network licences require the establishment of a number of industry codes that underpin the gas and electricity markets.

Commercial interoperability

The ability of an incoming supplier to agree mutually acceptable commercial terms with the meter owner for the use of the meter and related equipment when a customer changes supplier.

Communications service providers

Providers of communications services that will enable the transfer of data to and from smart meters.

Consumer

Person or organisation using electricity or gas at a meter point.

Consumer Advisory Group

The Consumer Advisory Group consists of members from groups representing a broad range of domestic consumers. It was set up to help inform the programme and to promote understanding of key consumer issues, particularly more complex issues that cannot be fully explored through primary consumer research.

Credit mode

Smart meters will be capable of switching between prepayment and credit mode. When operating in credit mode, customers will be billed for their energy after using it.

Customer

Any person supplied or entitled to be supplied with electricity or gas by a supplier.

Customer premises equipment

All smart metering equipment in a customer's home or business.

D

Data and Communications Expert Group (DCG)

One of several expert groups established by the programme, following publication of the Prospectus, to draw on the experience of industry and other stakeholders. DCG has considered the scope, set up and activities of the central data and communications body.

DataCommsCo (DCC)

The new entity that will be created and licensed to deliver central data and communications activities. DCC will be responsible for the procurement and contract management of data and communications services that will underpin the smart metering system.

E

Electricity meter

A measuring instrument that records the quantity of electricity supplied.

ELEXON

ELEXON is the Balancing and Settlement Code Company (BSCCo) defined and created by the BSC.

Emergency Control Valve (ECV)

The emergency control valve is a valve for shutting off the supply of gas in an emergency. It is installed at the end of a service or distribution main. The outlet of the ECV terminates, and therefore defines, the end of the gas distribution network.

Emergency credit

Credit applied by a supplier when a prepayment meter is out of credit to help the customer avoid interruption.

End-to-end smart metering system

The end-to-end smart metering system covers all equipment, communication links and connections from every customer through DCC to suppliers, network operators and authorised third-party service providers.

Energy supplier

A company licensed by Ofgem to sell energy to and bill customers in Great Britain.

European Regulators' Group for Electricity and Gas (ERGEG)

The European Commission's formal advisory group of energy regulators. ERGEG was established by the European Commission, in November 2003, to assist the Commission in creating a single EU market for electricity and gas. ERGEG's members are the heads of the national energy regulatory authorities in the 27 EU Member States.

F

Fault

Failure within a component such as to compromise its performance. This may be minor; eg a temporary communications failure; or major eg a gas meter battery about to expire.

Firmware

Firmware is software that runs on a hardware device such as a smart meter or IHD that provides the instructions for how the device operates. As with other types of software, firmware can also be updated.

Foundation stage

The period before market readiness for the mass rollout is fully established. This is also referred to as Phase 2 of the Smart Metering Implementation Programme.

Friendly credit

The facility on a prepayment meter to prevent disconnection if credit runs out during defined time periods such as overnight.

Functional requirements

The minimum functions that must be supported by the different elements of the smart metering system to ensure the delivery of the benefits of smart metering. These describe what the smart metering system must do (not how it must do so).

G

Gas and Electricity Markets Authority (GEMA)

The Authority is Ofgem's governing body. It consists of non-executive and executive members and a non-executive chair. The Authority determines strategy, sets policy priorities and takes decisions on a range of matters, including price controls and enforcement. The Authority's principal objective is to protect the interests of existing and future consumers in relation to gas conveyed through pipes and electricity conveyed by distribution or transmission systems. The interests of such consumers are their interests taken as a whole, including their interests in the reduction of greenhouse gases and in the security of the supply of gas and electricity to them. The Authority's powers are provided for under the Gas Act 1986, the Electricity Act 1989, the Utilities Act 2000, the Competition Act 1998 and the Enterprise Act 2002.

Gas meter

A measuring instrument that records the volume of gas supplied.

Gas valve

A gas valve may be incorporated into a gas meter to regulate the flow of gas into consumer premises. It is distinct from the isolation valve.

H

Half hourly meter (HHM)

A half hourly meter is capable of registering how much electricity is used for every half hour of every day.

Home area network (HAN)

The smart metering HAN will be used for communication between smart meters, IHDs and other devices in customers' premises.

I

Inclusivity by design

A design philosophy promoting the use of products, services and systems by as many people as possible without the need for adaptation for users with differing needs.

In-home display (IHD)

An in-home display is an electronic device, linked to a smart meter, which provides information on a customer's energy consumption.

Installer

Person or persons who physically installs, configures, commissions or repairs equipment, as appropriate, in a consumer’s premises.

Interoperability

The ability of diverse systems, devices or organisations to work together (interoperate) on both a technical and commercial basis. See also commercial interoperability and technical interoperability.

K

Kilowatt hour (kWh)

Kilowatt hour is a unit used to measure energy consumption in both electricity and gas. The kilowatt hour is a unit of energy equal to 1000 watt hours or 3.6 megajoules. Energy in watt hours is the multiplication of power in watts, and time in hours. A 100W light bulb left on for one day will consume 2.4 kWh (0.1*24).

L

Licence

Transporting, shipping and supplying gas; and generating, transmitting, distributing and supplying electricity are all licensable activities. Ofgem grants licences that permit parties to carry out these activities in the GB market. The licences require the establishment of a number of multilateral industry codes that underpin the gas and electricity markets. Licensees need to be signatories to codes in order to operate in the gas and electricity markets (see codes).

M

Measuring Instruments Directive (MID)

The Measuring Instruments Directive is a European Directive (2004/22/EC) that covers a number of different measuring instrument types, including active electrical energy meters and gas meters. The MID enables EU conformity assessment certificates to be issued and the instrument can then be used in any EU Member State. The aim of the Directive is to create a single market in measuring instruments for the benefit of manufacturers and, ultimately, consumers across Europe.

Meter Operator (Mop)

In electricity a Meter Operator is responsible for the installation, commissioning, testing, repair, maintenance, removal and replacement of electricity metering equipment.

Metering services

The provision, installation, commissioning, inspection, repairing, alteration, repositioning, removal, renewal and maintenance of the whole or part of an installed gas or electricity meter.

Microgeneration

Microgeneration is the on-site generation of lower carbon heat and power by individuals, small businesses and communities at a small scale.

Module

Sub assembly of the smart metering system equipment capable of on-site exchange without removing the host equipment, eg the WAN module that can be exchanged without removing the meter.

N

Network operators

The companies that are licensed by Ofgem to maintain and manage the electricity and gas networks in GB.

O

Ofcom

The independent regulator and competition authority for the UK communications industries.

Ofgem

The Office of the Gas and Electricity Markets (Ofgem) is responsible for protecting gas and electricity consumers in Great Britain. It does this by promoting competition, wherever appropriate, and regulating the monopoly companies that run the gas and electricity networks. Ofgem is governed by the Gas and Electricity Markets Authority.

Ofgem E-Serve

Ofgem E-Serve is responsible for Ofgem's support and delivery functions. It focuses on administering environmental programmes and the delivery of sustainability projects such as the policy design phase of the Smart Metering Implementation Programme.

Open standards

The European Union definition of an open standard (taken from "European Interoperability Framework for pan-European eGovernment Services") is:

- The standard is adopted and will be maintained by a not-for-profit organisation, and its ongoing development occurs on the basis of an open decision-making procedure available to all interested parties (consensus or majority decision etc).
- The standard has been published and the standard specification document is available either freely or at a nominal charge. It must be permissible to all to copy, distribute and use it for no fee or at a nominal fee.
- The intellectual property - ie patents possibly present - of (parts of) the standard is made irrevocably available on a royalty-free basis.
- There are no constraints on the re-use of the standard.

P

PAYG (Pay As You Go)

See prepayment mode.

Prepayment meter

Meters that require payment for energy to be made in advance of use or else they will prevent the supply of gas or electricity. A prepayment customer pays for energy by inserting electronic tokens, keys or cards into the meter.

Prepayment mode

Smart meters are capable of switching between prepayment and credit mode. When operating in prepayment mode customers have to pay for their energy before using it.

Programme

The Smart Metering Implementation Programme ("the programme") is the central change programme established by the Government. It is responsible for overseeing the development and implementation of the policy design, including establishing the commercial and regulatory framework to facilitate the rollout. Ofgem E-Serve has managed, on behalf of DECC, the policy design phase of the programme that has informed the Government decisions set out in this document. DECC will be directly responsible for managing the programme during the implementation phase.

PTZ conversion

Means by which the volume increments measured by a gas meter at a set of conditions of pressure (P), temperature (T) and compressibility (Z) are converted to volume increments as if it were operating at base conditions.

R

Rate

A means of charging differing amounts for energy consumed, based on the time of day the consumption occurred (ie units consumed between midnight and 05:59:59 to be charged at x pence, units consumed between 06:00:00 to 23:59:59 charged at y pence).

Remote Communication

Communication (two way) from a head-end system to a smart metering system, and from the metering system to the head-end system.

Remote meter functionality

Functions of a smart meter that can be updated/switched between remotely without the need for direct interaction with the meter.

S

Security by design

Security by design is defined as ensuring that the security of a system is designed from the ground up to be secure. It is an established concept where security risks and issues are identified early in the system's development lifecycle.

Security Technical Expert Group (STEG)

One of several expert groups established by the programme, following publication of the Prospectus, to draw on the experience of industry and other stakeholders. STEG has considered issues relating to the security of the end-to-end smart metering system.

Smaller non-domestic sector

For the purposes of this document, we define smaller non-domestic electricity and gas sites as those sites in electricity profile groups 3 and 4 and those non-domestic gas sites with consumption of less than 732 MWh per annum.

Smart appliances

An appliance that can alter the way in which it uses energy (consumption level or time of use) in response to an external signal, eg a price signal.

Smart Energy Code (SEC)

The proposed new industry code that will cover both gas and electricity and will contain the detailed regulatory, commercial and technical arrangements applicable to smart metering during rollout and on an enduring basis.

Smart grids

As part of an electricity power system, a smart grid can intelligently integrate the actions of all users connected to it - generators, consumers and those that do both - in order to efficiently deliver sustainable, economic and secure electricity supplies.

Smart meter

A meter which, in addition to traditional metering functionality (measuring and registering the amount of energy which passes through it) is capable of providing additional functionality for example two way communication allowing it to transmit meter reads and receive data remotely. The proposed minimum functionality of smart meters is set out in the Functional Requirements Catalogue.

Smart Metering Design Expert Group (SMDG)

One of several expert groups established by the programme, following publication of the Prospectus, to draw on the experience of industry and other stakeholders. SMDG has considered functional requirements for smart metering equipment.

Smart metering system

The smart metering system refers to smart metering equipment in customers' premises. In the domestic sector, this equipment comprises the electricity meter, the gas meter, the home area network, the WAN modules and the in-home display.

T

Tamper

The detection of deliberate interference with a component; eg connecting a meter in reverse.

Tamper alarm

A tamper alarm senses and reports any tampering with the metering system such as removal of the metering case or reversal of current.

Technical interoperability

Technical interoperability is the ability for different smart metering system components to exchange data and work together independent of manufacturer. This ensures that different suppliers can install in premises without having to change existing equipment at change of supplier, thereby minimising disruption to the consumer. It is also the capability of systems or devices to provide and receive services and information between each other, and to use these services and information exchange to operate effectively together in predictable ways without significant user intervention. Within the context of smart metering, this means the seamless, end-to-end connectivity of hardware and software from consumer premises equipment through to DCC, suppliers, network operators and other authorised parties.

Technical specifications

The technical specifications for the smart metering system will be an explicit set of solutions and guidelines as to how the smart metering system will fulfil the minimum functional requirements.

Technical Standardisation Directive (TSD)

Technical Standardisation Directive 98/34/EC lays down a mechanism - a notification procedure -for the transparency of technical regulations and is intended to help avoid the creation of new technical barriers to trade within the Community.

It requires Member States to notify technical regulations, relating to products and information society services, to the Commission in draft, and then generally to observe a standstill period of at least three months before adopting the regulation, in order to allow other Member States and the Commission an opportunity to raise concerns about potential barriers to trade.

The procedure also applies, in a simplified form, to countries that are signatories to the Agreement on the European Economic Area, Turkey and Switzerland.

Tier

A means of charging differing amounts for energy consumed, based on the quantity of energy consumed (ie the first 100 units to be charged at x pence, the next 500 units to be charged at y pence).

Time-of-use tariff

Under a time-of-use tariff, a supplier varies its charges based on when energy is used (eg day/night, peak/off-peak or by season). Such tariffs can be dynamic (changes in real time) or static (changes at predictable times).

W

Wide-area network (WAN)

The smart metering WAN will be used for two-way communication between smart meters and DCC (via the WAN module in the customer‟s premises).

WAN module

The WAN module connects the meter to DCC.