



**UK Department of Energy and Climate Change
CURRENT Group, LLC October 28th Response to
Consultation on Smart Metering for Electricity and Gas dated July 2010**

Contact: [REDACTED]

1. Summary

The deployment of gas and electric smart meters is an extremely complicated task and DECC and Ofgem (collectively, the "Government") should be commended for the considerable time and effort that has been put forth in analyzing the task and in developing potential solutions to the address potential issues. As the noted in the Regulatory and Commercial Framework Document:

"DECC's updated impact assessment identifies that just under half of the benefits of the smart metering programme are expected to come from consumers using the information they will gain from smart meters to take action to reduce their energy consumption. It will be critical, therefore, that the process of installation and on-going maintenance of smart meters and related equipment in customer premises is a positive experience."

In other words, the success of the programme may well depend on mitigating the risk associated with the consumer's response to Smart Meters. In reviewing the consultation and the attached documents, CURRENT has focused on three primary areas where actions can be taken to mitigate risk or potential alternative solutions provided to improve the likelihood of a positive outcome. These areas involve:

- Increasing the reliability and customer experience of In-Home Display (IHD) through use of integration of an upgradable HAN and WAN "gateway" which can be remotely managed by DCC or its communication providers.
- Increase focus in metering plan on high value Smart Grid solutions that can provide load and carbon savings to offset risk associated with consumer participation. For example a number of U.S. utilities are looking to combine grid focused voltage optimization with their meter rollout to assure they achieve the desired load and carbon savings.
- Structure Supplier's accelerated rollouts in 2012 and 2013 as large trial projects (similar to structure of Low Carbon Network Fund) to assure they test various potential technology solutions and provide feedback that can be incorporated into the metering rollout plans.

This document provides more details around Smart Grid and also provides specific answers to the detailed questions.

Increase focus in metering plan on high value Smart Grid solutions that can provide load and carbon savings to offset risk associated with consumer participation

– The FDS Consumers' views of Smart Metering Report noted "The vast majority of respondents did not care enough about the smart meter and display to worry as to whether they would be among the first or last to have a smart meter installed. . . With many expressing concerns about the cost of implementing the scheme, there will be considerable disappointment if the scheme is not proven to help people reduce their energy bills."ⁱⁱ The impact assessment highlighted the risk "There remains a great deal of uncertainty about the likely response of consumers to the full roll out of smart meters. A number of international studies exist, the most recent a review of 57 feedback studies in nine different countries by the American Council for an Energy-Efficient Economy which finds that on average feedback [to the customer] reduces energy consumption between 4-12%."ⁱⁱⁱ It is important to note the same study, in analyzing potential aggregate savings from a voluntary program, estimated only a 3 to 8% participant ratio, which resulted in overall average residential load savings of only 0.4%.^{iv} Thus, depending on participation rates, this suggests a significant potential shortfall to the 2.8% assumed in the Ofgem Impact Assessment.

CURRENT is presently working with several U.S. utilities who are concerned about the potential shortfall in achieving desired or mandated energy efficiency targets, due to a lack of consumer participation, and who are turning to Smart Grid to make up any shortfalls. Using real-time data from the distribution grid, CURRENT is able to implement a dynamic voltage optimization that improves power factor and reduces voltage requirements. It is estimated that optimization of the distribution grid alone (operated by the DNOs) can reduce electric generation requirements and related CO2 emissions by 3 to 5% without impacting on, or requiring any change in, customer behaviour. Such a Smart Grid results in lower costs to the national grid, the DNO, the supplier and the customer along with more reliable power and reduced carbon emissions. Such a solution could assure the success of the meter program as the results would be equal to or greater than the 2.8% consumer savings estimated in the meter programme. This solution can be implemented with sensors in the grid and the availability to the DNO's of meter reads on a one to five minute basis for a portion of the meters and on an hourly basis for the remainder. While this can be done using wireless, assuming an accurate mapping of meters to transformers (which is typically a very big assumption), a more cost effective solution can be implemented with minor changes to the metering program as listed below:

- The supplier/retailer would install the meters, as previously envisaged (keeping the current industry structure intact), using the EC funded "Open" or "Prime" Metering system that utilizes an open standards power line technology. Such a technology is presently being deployed in Europe and could be tested in the UK as part of the accelerated rollout. The meter could still be at the supplier's choice but would contain a PRIME meter module as opposed to a GPRS chip. The main objective of the PRIME meter project is to specify a comprehensive set

of open and public standards for AMI, supporting electricity, gas, water and heat metering. The OPEN project, part of the EC 7th Framework Program includes many of the largest utilities in Europe including Iberdrola, EDF, Endesa, ENEL, Iberdrola, Netbeher Nederland and RWE and most of the major meter manufacturers.^v

- At the same time, the equipment needed to gather and collect the data from the meters would be installed at the distribution transformer by the DNO, including sensing devices to provide intelligence needed for Smart Grid operations. The DCC would install a high speed connection to the same transformer using GPRS or other Internet Protocol (IP) based high speed communications technologies (fibre, cable, DSL, WiMax, etc).
- This solution will provide a robust lower cost secure metering solution by aggregating the meter data collection of approximately an average of 125 meters to a transformer, thus reducing overall WAN costs by approximately 75%.
- Adding analytic software would allow the DNOs and TOs to have real-time data that would be used to:
 - Implement system optimization and reduce electricity losses during distribution;
 - Manage two way power flow created from widely distributed generation, distributed renewables and PHEV's;
 - Improve reliability through real-time knowledge of grid status and proactive identification of potential outages;
 - Instantaneous outage detection including location and probable cause;
 - Better load forecasting, increased asset management and reduced capital requirements;
 - Reduce emissions;
 - Reduce operating cost.
- For the wider use of the data, this system would also be able to collect the meter data on a rolling basis and communicate it back to the DCC in 15 minute intervals every 15 minutes (as opposed to the once a day, day after data collection presently proposed). This would allow the data to be accessible on the Internet (with proper security), leveraging tools like those developed by Google and Microsoft and eliminating the need for a separate Real Time Display for anyone having Internet access at home or on a mobile device – another potential saving for the customer.
- The use of a PLC system specifically designed to read electric and gas meters in Europe would eliminate many of the hard to reach meters under the proposed plan. For example, Vodafone recently estimated GPRS already covers 98% of all UK households 'to the door'. However, only 70% of UK households have coverage to their meter cupboard.^{vi}

- The system would leverage a European standard in OPEN as well as an IP based network. This would greatly increase security and the availability of 15 minute meter data on the Internet would likely allow the development of a variety of innovative home energy management products.

Responses to Prospectus and Supporting Documents

Smart Metering Implementation Programme: Prospectus

Question 1: Do you have any comments on the proposed minimum functional requirements and arrangements for provision of the in-home display device? (Deadline for response: 28 October)

While we generally support the IHD requirements, there appears to be the general assumption that the HAN is an unmanaged network and we believe there is the need to increase the reliability and customer experience of In-Home Display (IHD) through use of integration of an upgradable HAN and WAN “gateway” which can be remotely managed by the DCC or its communication providers.

As the noted in the Regulatory and Commercial Framework Document:

“DECC’s updated impact assessment identifies that just under half of the benefits of the smart metering programme are expected to come from consumers using the information they will gain from smart meters to take action to reduce their energy consumption. It will be critical, therefore, that the process of installation and on-going maintenance of smart meters and related equipment in customer premises is a positive experience.”^{vii}

As noted numerous times in the consultation documents, the Government believes the IHD is critical to the success of the program. The heart of the Smart Meter program will be successfully linking communications of energy usage to the customer and to the supplier, network operator and other interested parties. We support the position that the Government has taken of separating out the WAN communications solution to assure long term upgradability. We believe that a similar approach should be taken for the HAN.

While not specifically addressed, it appears the present plan includes the following assumptions: a) the electric meter is the gateway for the HAN; b) one HAN technology will work for all types of deployment; and c) HAN technology is more mature and doesn’t need to be upgraded or remotely managed.^{viii} This does not appear to reflect the current state of the market. For example a recent article on HAN technology provided a good history of the various computer LAN technologies and listed ten different emerging HAN technologies and within one, Zigbee, pointed out four or five changes in the standard in the last six years, none of which were backwards compatible.^{ix}

We believe a more flexible approach would be to treat the WAN module as the equivalent of a router or a gateway in an internet based solution. This gateway would also contain a HAN interface to the electric and gas meter as well as a HAN interface to the IHD. Initially, in many cases, this could be the same HAN technology, although it is highly unlikely one HAN technology will work for all of the UK. For example, in the case of multi tenant buildings or hard to reach locations, the connection to the IHD could require a different more robust technology (i.e., power line, Wi-Fi) than the low power wireless technology used to connect to the gas meter. In addition, by adding additional memory and processing capability to this gateway, it could act as upgradable storage capability and act as one gateway to enable one IHD for both gas and electricity. Any additional cost of this device would likely be paid for by reducing the cost of the meter which would be required to provide less functionality - this is especially true in multi tenant situations where one gateway could communicate to multiple meters.

The benefits of this approach would easily facilitate adding new capabilities like water metering and provide an upgraded communications option as IHD innovation occurs without needing to change the meter. This structure would also facilitate the remote network management, security and troubleshooting of the HAN technology which would appear to be highly desirable given the critical nature of the HAN.

The present plan also assumes that the individual Suppliers should acquire the WAN module based on specifications prepared by two expert groups.^x Given that it is likely there will be at least two different WAN communications technologies (wireless and power line) and at least two different HAN technologies (wireless and power line), with at least six major suppliers, it would be possible to end up with 24 different WAN modules for the DCC to integrate with and to be responsible for the security of. History has shown that despite best intentions, different manufacturers working to newly developed specifications often face challenges in achieving interoperability. We believe a better approach would be for the DCC to be responsible for the WAN module initially to limit the potential difficulties in achieving interoperability, similar to how the telecom vendors, in rolling out DSL, chose one or two modem manufacturers. It is possible for the DCC to be responsible for supplying the module to the supplier or the installer who could be responsible for the installation and field maintenance.

Question 2: Do you have any comments on our overall approach to data privacy? (Deadline for response: 28 October)

We in general support the overall approach to data privacy and believe that the consumer should be able to allow access to the data to whomever it chooses.

Question 4: Have we identified the full range of consumer protection issues related to remote disconnection and switching to prepayment? (Deadline for response: 28 October)?

CURRENT has no comments on this area.

Question 5: Do you have any comments on the proposed approach to smaller non-domestic consumers (in particular on exceptions and access to data)? (Deadline for response: 28 October)

We believe for the purposes of Smart Grid that it is important the non domestic sector use the DCC. This will assure the DNOs access to needed information comes from one place rather than attempting to interface with multiple suppliers or their vendors.

Question 8: Do you have any comments on the proposals that energy suppliers should be responsible for purchasing, installing and, where appropriate, maintaining all customer premises equipment? (Deadline for response: 28 October)

We believe that it is appropriate for the suppliers to be responsible for purchasing, installing and maintaining the CPE. However, as noted in Question 1, we are concerned about the need to increase the reliability and customer experience of In-Home Display (IHD) through use of integration of an upgradable HAN and WAN “gateway” which can be remotely managed by DCC or its communication providers.

Question 9: Do you have any comments on the proposal that the scope of activities of the central data and communications function should be limited initially to those functions that are essential for the effective transfer of smart metering data, such as data access and scheduled data retrieval? (Deadline for response: 28 October)

We believe the most important expansion of the DCC would be in the area of providing data to the DNOs for a Smart Grid and the other services mentioned in this section should be prioritized after this is accomplished.

Question 10: Do you have any comments on the proposal to establish DCC as a procurement and contract management entity that will procure communications and data services competitively? (Deadline for response: 28 October)

While we don't have specific comments on the legal structure, we believe it is important the DCC is structure to recognize the fact as noted in the March 2010 Energy Demand Research Project (EDRP) report:

“Delivery of the trials so far has shown that one-size does not fit-all with regard to smart metering technology. Suppliers are having to consider a range of factors in selecting the appropriate technology for a customer. Different geographical locations experience different signal strengths which can affect the ability of the meter to send or receive information. The location of a smart meter within the property is also important, eg communications can be affected if the meter is in a metal box, in a basement, or is too far from the in-home display. . . Installing smart metering in basements, blocks of flats, or communal housing tends to be difficult with regards to gaining access, getting a signal and utilising the Home Area Network (HAN).”^{xi}

As such, it is important that the DCC have two components (1) the ability to use a range of technologies to provide the communications services

and (2) the ability to provide an end to end management of those communication services.

Question 11: Do you have any comments on the proposed approach for establishing DCC (through a licence awarded through a competitive licence application process with DCC then subject also to the new Smart Energy Code)? (Deadline for response: 28 October)

We believe that it is important any regulatory framework drive be structured to integrate Smart Grid with the Smart Meter project as soon as possible as the gains in energy efficiency from a Smart Grid will provide a buffer against the risk associated with the consumer saving the 2.8% of electric use which is assumed in the Smart Metering Business case.

It is increasingly being recognized in the UK that an actively managed dynamic distribution system that is capable of responding to new distributed sources of generation and new sources of electric consumption like Plug-in electric vehicles (PHEV's) while, at the same time, minimizing the impact of carbon is critical to a key UK policy goal of reducing carbon:

- “Network operators will benefit from having more real time information on energy use and supply, and will be able to facilitate two-way flows of energy efficiently on the system through use of more automated response technologies.” (The UK Renewable Energy Strategy).xii
- “Renewable energy use will grow seven-fold in the next decade . . . Enhanced monitoring and information flows for network operators, allowing them to make more efficient decisions about where energy flows across the network on a real time basis. This is likely to be particularly important with increasing levels of intermittent renewable generation on the system.” (The UK Low Carbon Transition Plan: National Strategy for Climate & Energy) xiii

Active Network monitoring requires “two way” data communication be made available to DNO's in real time, to achieve a dynamic, self healing, automated Smart Grid of the future that can deal with multiple energy generation and consumption points, some of it unpredictable and intermittent, efficiently and within seconds. As the consumer energy options becomes more advanced, with more renewables, PHEV's, innovative in-energy management systems, etc., the requirements for such real-time communications will only increase.

It is estimated that optimization of the distribution grid alone (operated by the DNOs) can reduce electric generation requirements and related CO2 emissions by 3 to 5% without impacting on, or requiring any change in, customer behaviour. Such a Smart Grid results in lower costs to the national grid, the DNO, the supplier and the customer along with more reliable power and reduced carbon emissions.

Some of the lessons learned in other Smart Grid projects in the world, including Xcel Energy's SmartGridCity™ project in Boulder, Colorado, U.S.A., are that grid operational improvements through sensing, communications and

control are easier and faster to implement than consumer focused improvements, and provide a high value of benefits across all customers. For example, Xcel recently reported to the Colorado Public Utility Commission preliminary project resultsxiv that demonstrated improved power quality, operating efficiencies and improved reliability, all of which were achieved through the use of grid sensing, real-time communications and analytical software, while the consumer portions of the project are still being rolled out.

Question 12: Does the proposal that suppliers of smaller non-domestic customers should not be obliged to use DCC services but may elect to use them cause any substantive problems? (Deadline for response: 28 October)

As noted in Question 5 above, we believe for the purposes of Smart Grid that it is important the non domestic sector use the DCC. This will assure the DNOs access to needed information comes from one place rather than attempting to interface with multiple suppliers or their vendors.

Question 13: Do you agree with the proposal for a Smart Energy Code to govern the operation of smart metering? (Deadline for response: 28 October)

See Answer to Question 11 and 12 above.

Question 14: Have we identified all the wider impacts of smart metering on the energy sector? (Deadline for response: 28 October)

See Answer to Question 11 and 12 above.

Question 15: Is there anything further we need to be doing in terms of our ensuring the security of the smart metering system? (Deadline for response: 28 October)

See Answer to Question 1. It is important to address the HAN in looking at end to end security.

Smart Metering Implementation Programme: Regulatory and Commercial Framework

Question 1: Have we identified all of the key elements that you would expect to see as part of the Smart Metering Regulatory Regime?

We believe that it is important any regulatory framework drive be structured to integrate Smart Grid with the Smart Meter project as soon as possible as the gains in energy efficiency from a Smart Grid will provide a buffer against the risk associated with the consumer saving the 2.8% of electric use which is assumed in the Smart Metering Business case.

Question 2: Do you agree with the proposal to establish a Smart Energy Code?

CURRENT has no specific comments on the appropriate regulatory structure as long as it properly facilitates a Smart Grid.

Question 3: Do you have any comments on the indicative table of contents for the Smart Energy Code as set out in Appendix 3?

CURRENT believes that it is important that the DNOs have an obligation to provide access to DCC for the implementation of Power line communication (PLC) meter reading technology at their facilities as the use of a PLC system specifically designed to read electric and gas meters in Europe would eliminate many of the hard to reach meters under the proposed plan. For example, Vodafone recently estimated GPRS already covers 98% of all UK households 'to the door'. However, only 70% of UK households have coverage to their meter cupboard.^{xv} As noted in the March 2010 Energy Demand Research Project (EDRP) report: "Delivery of the trials so far has shown that one-size does not fit-all with regard to smart metering technology. Suppliers are having to consider a range of factors in selecting the appropriate technology for a customer."^{xvi} PLC technology will help to address these hard to reach areas but will be possible only with the cooperation of the DNOs.

Question 4: Do you have any comments on the most appropriate governance arrangements for the Smart Energy Code?

CURRENT has no specific comments on the appropriate regulatory structure as long as it properly facilitates a Smart Grid.

Question 5: Do you agree with the proposals concerning the roles and obligations of suppliers in relation to the WAN communications module?

We have concerns about the suppliers purchasing the WAN module for several reasons including that there will likely be multiple HAN and WAN technologies and the need for a managed network, including the HAN. We also believe that the DCC will be able to better achieve economies of scale than individual suppliers.

First, as noted in Question 3 and as noted in the March 2010 Energy Demand Research Project (EDRP) report: ("Delivery of the trials so far has shown that one-size does not fit-all with regard to smart metering technology. Suppliers are having to consider a range of factors in selecting the appropriate technology for a customer."^{xvii}), it is likely that there will need to be multiple WAN technologies and in our opinion as described below, multiple HAN technologies.

We also believe there is a need for a managed HAN. It appears to be the general assumption that the HAN is an unmanaged network and we believe there is the need to increase the reliability and customer experience of In-Home Display (IHD) through use of integration of an upgradable HAN and WAN "gateway" which can be remotely managed by the DCC or its communication providers.

As the noted in the Regulatory and Commercial Framework Document:

“DECC’s updated impact assessment identifies that just under half of the benefits of the smart metering programme are expected to come from consumers using the information they will gain from smart meters to take action to reduce their energy consumption. It will be critical, therefore, that the process of installation and on-going maintenance of smart meters and related equipment in customer premises is a positive experience.”^{xviii}

As noted numerous times in the consultation documents, the Government believes the IHD is critical to the success of the program. The heart of the Smart Meter program will be successfully linking communications of energy usage to the customer and to the supplier, network operator and other interested parties. We support the position that the Government has taken of separating out the WAN communications solution to assure long term upgradability. We believe that a similar approach should be taken for the HAN.

While not specifically addressed, it appears the present plan includes the following assumptions: a) the electric meter is the gateway for the HAN; b) one HAN technology will work for all types of deployment; and c) HAN technology is more mature and doesn't need to be upgraded or remotely managed.^{xix} This does not appear to reflect the current state of the market. For example a recent article on HAN technology provided a good history of the various computer LAN technologies and listed ten different emerging HAN technologies and within one, Zigbee, pointed out four or five changes in the standard in the last six years, none of which were backwards compatible.^{xx}

We believe a more flexible approach would be to treat the WAN module as the equivalent of a router or a gateway in an internet based solution. This gateway would also contain a HAN interface to the electric and gas meter as well as a HAN interface to the IHD. Initially, in many cases, this could be the same HAN technology, although it is highly unlikely one HAN technology will work for all of the UK. For example, in the case of multi tenant buildings or hard to reach locations, the connection to the IHD could require a different more robust technology (i.e., power line, Wi-Fi) than the low power wireless technology used to connect to the gas meter. In addition, by adding additional memory and processing capability to this gateway, it could act as upgradable storage capability and act as one gateway to enable one IHD for both gas and electricity. Any additional cost of this device would likely be paid for by reducing the cost of the meter which would be required to provide less functionality - this is especially true in multi tenant situations where one gateway could communicate to multiple meters.

The benefits of this approach would easily facilitate adding new capabilities like water metering and provide an upgraded communications option as IHD innovation occurs without needing to change the meter. This structure would also facilitate the remote network management, security and troubleshooting of the HAN technology which would appear to be highly desirable given the critical nature of the HAN.

The present plan also assumes that the individual Suppliers should acquire the WAN module based on specifications prepared by two expert groups.^{xxi} Given that it is likely there will be at least two different WAN communications technologies (wireless and power line) and at least two different HAN technologies (wireless and power line), with at least six major suppliers, it would be possible to end up with 24 different WAN modules for the DCC to integrate with and to be responsible for the security of. History has shown that despite best intentions, different manufacturers working to newly developed specifications often face challenges in achieving interoperability. We believe a better approach would be for the DCC to be responsible for the WAN module initially to limit the potential difficulties in achieving interoperability, similar to how the telecom vendors, in rolling out DSL, chose one or two modem manufacturers. It is possible for the DCC to be responsible for supplying the module to the supplier or the installer who could be responsible for the installation and field maintenance.

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.

CURRENT does not provide consumer products and thus has no comments for this area.

Question 7: Do you agree with the proposal that the WAN and the HAN in customer premises should be shared infrastructure, with the installing supplier retaining responsibility for ongoing maintenance? If not, would you prefer to have an arrangement by which if the gas supplier is the first to install, responsibilities for the common equipment is transferred to the electricity supplier when the electricity smart meter is installed?

We believe that to effectively use certain cost effective technologies such as power line communications, and to maximize the impact on the Smart Grid, it is important to provide for geographically focused deployments in the earlier years. A geographic deployment will also facilitate Option 3 where the electric meter is the lead (due primarily to the presence of power) since both the gas and the electric supplier would be fully aware of the areas being rolled out. It would also facilitate the communications plan to consumers as areas could be better targeted for communications.

Question 8: Are there additional measures that should be put in place to reduce the risks to the programme generated by early movers?

We believe that the Supplier's accelerated rollouts in 2012 and 2013 should be structured as large trial projects (similar to structure of Low Carbon Network Fund) to assure they test various potential technology solutions and provide feedback that can be incorporated into the wider metering rollout plans.

While we believe that there are valuable lessons to be learned and the capability to fine tune the entire process by allowing the suppliers to accelerate rollouts into 2012 and 2013, we believe that any such rollouts should be structured so that they test a wide variety of issues such as suitability of various communications technologies, IHD and installation practices. In reviewing the comments and reports from the existing 18,000 home meter trial, it is clear that there are significant potential learnings that could be achieved by an early rollout, structured to create that learning. Examples include the need for multiple communications technologies, difficulties in implementing the HAN, various difficulties in physical installation of equipment and, critically, customer feedback. These projects could be structured similar to the Low Carbon Network Fund and could be designed to test the implementation of, say, 1 million or more meters. Trials of this size and in this time frame would clearly be seen as expediting the meter roll-out from the approximate 18,000 installed to the target of over 50 million gas and electric meters.

There are potential risks to allowing suppliers to implement the meters in any structure they desire. As noted in the Rollout Strategy: “However, there is no guarantee that suppliers would naturally choose the rollout profile that delivers the most benefits for the programme.”^{xxii} For example, focusing on just replacement meters may mean that there is a wide spread deployment of meters using wireless technology which may limit the use of what may be a better and cheaper power line technology, for example, if the deployment was being done on a geographic basis. Specifically, we would propose that any supplier wishing to accelerate their deployment be required to:

- Test multiple WAN communications technologies including wireless and power line;
- Test IHD and HAN technology;
- Test in defined geographical areas and customer selected/replacement deployments;
- Test consumer participation across various customer classes.

Allowing suppliers to independently choose their own technologies and implementation plans at this stage, may result in the implementation of a “low hanging fruit” solution, thinly spread over a wide geography that, while allowing some meter rollout, limits the technology and program choices of future players like the DCC.

Question 9: What is needed to help ensure commercial interoperability?

See Answer to question 5

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?

Question 11: Are there any other regulatory and commercial issues that the programme should be addressing?

See answers to Questions 5 and 8.

Question 12: What evolution do you expect in the development of innovative time-of-use tariffs? Are there any barriers to their introduction that need to be addressed?

CURRENT does not provide consumer products and thus has no comments for this area.

Question 13: Are there changes to settlement arrangements in the electricity or gas sectors that are needed to realise the benefits of smart metering?

CURRENT has no comments for this area.

Question 14: What arrangements would need to be put in place to ensure that customers located on independent networks have access to the same benefits of smart metering as all other customers?

CURRENT has no comments for this area.

Question 15: Are there any other industry processes that will be affected by smart metering and which the programme needs to take into account?

CURRENT believes it is important to address the requirements of a Smart Grid.

Smart Metering Implementation Programme: Communications Business Model

Question 1: Do you agree that access control to secure centrally-coordinated communications, translation services and scheduled data retrieval are essential as part of the initial scope of DCC?

While we agree that these functions are part of the initial scope, we believe there are two assumptions which may be incorrect. The first is the assumption that there are multiple technologies that will fulfill the communications needs of the UK and the second is that the HAN is outside the scope of the DCC from a management and security prospective.

As noted in the March 2010 Energy Demand Research Project (EDRP) report,

“Delivery of the trials so far has shown that one-size does not fit-all with regard to smart metering technology. Suppliers are having to consider a range of factors in selecting the appropriate technology for a customer. Different geographical locations experience different signal strengths which can affect the ability of the meter to send or receive information. The location of a smart meter within the property is also important, eg communications can be affected if the meter is in a metal box, in a basement, or is too far from the in-home display. . . Installing smart metering in basements, blocks of flats, or

communal housing tends to be difficult with regards to gaining access, getting a signal and utilising the Home Area Network (HAN).^{xxiii}

In addition, Vodafone recently estimated GPRS already covers 98% of all UK households 'to the door'. However, only 70% of UK households have coverage to their meter cupboard.^{xxiv} While it appears the working assumption is that of a wireless system, the above facts show that wireless alone will not be sufficient. We believe the use of a PLC system specifically designed to read electric and gas meters in Europe would eliminate many of the hard to reach meters under the proposed plan. PLC technology uses the wires connecting the meter to the transformer and into the home. The result is that a reliable signal can be transmitted from the meter to a transformer where it can be aggregated with the meter data from other meters collected to the transformer and sent back to DCC using a variety of wired or wireless backhaul technologies ranging from fiber to DSL to wireless 3G or picocell.

As noted numerous times in the consultation documents, the Government believes the IHD is critical to the success of the program. The heart of the Smart Meter program will be successfully linking communications of energy usage to the customer and to the supplier, network operator and other interested parties. We support the position that the Government has taken the step of separating out the WAN communications solution to assure long term upgradability. We believe that a similar approach should be taken for the HAN.

While not specifically addressed, it appears the present plan includes the following assumptions: a) the electric meter is the gateway for the HAN; b) one HAN technology will work for all types of deployment; and c) HAN technology is more mature and doesn't need to be upgraded or remotely managed.^{xxv} This does not appear to reflect the current state of the market. For example a recent article on HAN technology provided a good history of the various computer LAN technologies and listed ten different emerging HAN technologies and within one, Zigbee, pointed out four or five changes in the standard in last six years, none of which were backwards compatible.^{xxvi} We believe a more flexible approach would be to treat the WAN module as the equivalent of a router or a gateway in an internet solution. This gateway would also contain a HAN interface to the electric and gas meter as well as a HAN interface to the IHD. Initially, in many cases, this could be the same HAN technology, although it is highly unlikely one HAN technology will work for all of the UK. For example, in the case of multi tenant buildings or hard to reach locations, the connection to the IHD could require a different more robust technology (i.e., power line, Wi-Fi) than the low power wireless technology used to connect to the gas meter. In addition, by adding additional memory and processing capability to this gateway, it could act as upgradable storage capability and act as one gateway to enable one IHD for both gas and electricity. Any additional cost of this device would likely be paid for by reducing the cost of the meter which would be required to provide less functionality - this is especially true in multi tenant situations where one gateway could communicate to multiple meters.

The benefits of this approach would easily facilitate adding new capabilities like water metering and provide an upgraded communications option as IHD innovation occurs without needing to change the meter. This structure would also facilitate the remote network management, security and troubleshooting of the HAN technology which would appear to be highly desirable given the critical nature of the HAN.

The present plan also assumes that the individual Suppliers should acquire the WAN module based on specifications prepared by two expert groups.^{xxvii} Given that it is likely there will be at least two different WAN communications technologies (wireless and power line) and at least two different HAN technologies (wireless and power line), with at least six major suppliers, it would be possible to end up with 24 different WAN modules for the DCC to integrate with and to be responsible for the security of. History has shown that despite best intentions, different manufacturers working to newly developed specifications often face challenges in achieving interoperability. We believe a better approach would be for the DCC to be responsible for the WAN module initially to limit the potential difficulties in achieving interoperability, similar to how the telecom vendors in rolling out DSL chose one or two modem manufacturers.

Finally, we believe that data will need to be made available to the DNOs from the DCC. In order to be meaningful and useful, this will require a coordination of meter reads from a transformer so they are at the same time and a correct mapping of the meters (and thus reads) to the location and the transformer. This second effort will require an up to date meter register. Data will also need to be stored at the DCC until the DNO can access the data.

Question 2: Do you agree that meter registration should be included within DCC's scope and, if so, when?

As noted in question 1, we believe that data will need to be made available to the DNOs from the DCC. In order to be meaningful and useful, this will require a coordination of meter reads from a transformer so they are at the same time and a correct mapping of the meters (and thus reads) to the location and the transformer. This second effort will require an up to date meter register. Data will also need to be stored at the DCC until the DNO can access the data.

Question 3: Should data processing, aggregation and storage be included in DCC's scope and, if so, when?

See Answer to Question 2.

Question 4: Do any measures need to be put in place to facilitate rollout in the period before DCC service availability and the transition to provision of services by DCC, for example requiring DCC to take on communications contracts meeting certain pre-defined criteria?

We believe that the Supplier's accelerated rollouts in 2012 and 2013 should be structured as large trial projects (similar to structure of Low Carbon Network Fund) to assure they test various potential technology solutions and provide feedback that can be incorporated into the wider metering rollout plans.

While we believe that there are valuable lessons to be learned and the capability to fine tune the entire process by allowing the suppliers to accelerate rollouts into 2012 and 2013, we believe that any such rollouts should be structured so that they test a wide variety of issues such as suitability of various communications technologies, IHD and installation practices. In reviewing the comments and reports from the existing 18,000 home meter trial, it is clear that there are significant potential learnings that could be achieved by an early rollout, structured to create that learning. Examples include the need for multiple communications technologies, difficulties in implementing the HAN, various difficulties in physical installation of equipment and, critically, customer feedback. These projects could be structured similar to the Low Carbon Network Fund and could be designed to test the implementation of, say, 1 million or more meters. Trials of this size and in this time frame would clearly be seen as expediting the meter roll-out from the approximate 18,000 installed to the target of over 50 million gas and electric meters.

There are potential risks to allowing suppliers to implement the meters in any structure they desire. As noted in the Rollout Strategy: "However, there is no guarantee that suppliers would naturally choose the rollout profile that delivers the most benefits for the programme."^{xxviii} For example, focusing on just replacement meters may mean that there is a wide spread deployment of meters using wireless technology which may limit the use of what may be a better and cheaper power line technology, for example, if the deployment was being done on a geographic basis. Specifically, we would propose that any supplier wishing to accelerate their deployment be required to:

- Test multiple WAN communications technologies including wireless and power line;
- Test IHD and HAN technology;
- Test in defined geographical areas and customer selected/replacement deployments;
- Test consumer participation across various customer classes.

Allowing suppliers to independently choose their own technologies and implementation plans at this stage, may result in the implementation of a "low hanging fruit" solution, thinly spread over a wide geography that, while allowing some meter rollout, limits the technology and program choices of future players like the DCC.

Question 5: Do you agree that the licensable activity for DCC should cover procurement and management of contracts for the provision of central services for the communication and management of smart metering data?

CURRENT does not have an opinion in the regulatory structure as long as it facilitates the use of multiple communication methods and a Smart Grid.

Question 6: Do you consider that DCC should be an independent company from energy suppliers and/or other users of its services and, if so, how should this be defined?

CURRENT does not have an opinion in the regulatory structure as long as it facilitates the use of multiple communication methods and a Smart Grid.

Question 7: Do you have any comments on the steps DCC would need to take to be in a position to provide its services and the likely timescales involved?

This issue is probably best addressed by those entities interested in bidding for the DCC.

Question 8: Do you have any comments on the proposed approach to cost recovery and incentivisation for DCC?

CURRENT does not have an opinion in the regulatory structure as long as it facilitates the use of multiple communication methods and any charges act as a disincentive for a Smart Grid.

Smart Metering Implementation Programme: **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?

CURRENT has no comments for this area.

Question 2: Do you agree with our proposed approach to exceptions in the smaller non-domestic sector?

Question 3: Are there technical circumstances that we have not considered that would justify further flexibility around installation of either smart or advanced meters?

We believe for the purposes of Smart Grid that it is important the non domestic sector be metered with Smart Meters, especially in areas where it is material to the overall load on the transformer. CURRENT also believes that the use of an open standards based Power line Communication system (PLC) that is being implemented in France, Spain and Portugal among other countries would provide connectivity in areas where wireless WAN and HAN communications technologies have difficulties including high rise buildings,

banks of meters in communal areas, high density urban environments and other areas where meters are often installed in basements, in metal cabinets or other areas which prevent wireless communications, or there is a long distance between the meter and the In-home display (IHD). Thus we believe it is important for the non-domestic sector to be included in the programme.

Question 4: Do you agree with the proposed approach that use of DCC should be optional for non-domestic participants in the sector?

No, we believe for the purposes of Smart Grid that it is important the non domestic sector use the DCC. This will assure the DNOs access to needed information comes from one place rather than attempting to interface with multiple suppliers or their vendors.

Question 5: If use of DCC is not mandated for non-domestic customers, do you agree with the proposed approach as to how it offers its services and the controls around such offers?

See answer to Question 4.

Question 6 To what extent does our proposed approach to the use of DCC for non-domestic customers present any significant potential limitations for smart grids?

We believe that loading on a transformer will be of primary importance to the DNOs as they move into advanced Smart Grid and that such loading on a lagged basis will prove to be insufficient. Thus, this approach presents two challenges. The first is to the extent that the non domestic load is material on any individual transformer, the lack of information on that load will mean the DNO has an incomplete set of data from the meters. Secondly, the use of the DCC will assure the DNOs access to needed information comes from one place rather than attempting to interface with multiple suppliers or their vendors.

Question 7: Is a specific licence condition required to ensure that metering data for non-domestic customers can be provided to network operators or DCC, and should any provision be made for charging network operators for the costs of delivering such data?

Other than our comments on Question 5 and 6, CURRENT has no comments for this area.

Question 8: How can interoperability best be secured in the smaller non-domestic sector?

Other than our comments on Question 5 and 6, CURRENT has no comments for this area.

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?

CURRENT has no comments for this area.

Question 10: Do you agree with our approach to data privacy and security for non-domestic customers?

CURRENT has no comments for this area.

Question 11: Is the proposed approach to rollout (for example in terms of targets and a requirement for an installation code of practice) appropriate for the non-domestic sector?

No, as noted in Question 6, it is important that all meters (with a material amount of load) on the individual transformer be rolled out in a similar time frame. This argues for a geographic approach.

In addition, the piecemeal approach noted in this section seems to assume that the meter communication will be wireless. However, we do not believe that the trials and studies to date confirm that assumption. For example, Vodafone recently estimated GPRS already covers 98% of all UK households 'to the door'. However, only 70% of UK households have coverage to their meter cupboard.^{xxx} As noted in the March 2010 Energy Demand Research Project (EDRP) report:

"Delivery of the trials so far has shown that one-size does not fit-all with regard to smart metering technology. Suppliers are having to consider a range of factors in selecting the appropriate technology for a customer. Different geographical locations experience different signal strengths which can affect the ability of the meter to send or receive information. The location of a smart meter within the property is also important, eg communications can be affected if the meter is in a metal box, in a basement, or is too far from the in-home display. . . Installing smart metering in basements, blocks of flats, or communal housing tends to be difficult with regards to gaining access, getting a signal and utilising the Home Area Network (HAN)."^{xxx}

In contrast to wireless, the use of a powerline communication (PLC) system specifically designed to read electric and gas meters in Europe would eliminate many of the hard to reach meters under the proposed plan. PLC technology uses the wires connecting the meter to the transformer and into the home. The result is that a reliable signal can be transmitted from the meter to a transformer where it can be aggregated with the meter data from other meters collected to the transformer and sent back to the DCC using a variety of wired or wireless backhaul technologies ranging from fiber to DSL, to wireless 3G, BPL or picocell.

Similarly, the same technology can be used to communicate on the electric wire running from the meter into the home regardless of its location.

This will be critical for enabling the In-home displays in high-rise buildings or where the meter is not physically located near the residence. As PLC technology is transformer based, it is best deployed using a geographic approach.

Smart Metering Implementation Programme:
Consumer Protection

While the issues of Consumer Protection are very important as part of a Smart Meter Rollout, CURRENT, as a provider of distribution grid Smart Grid and Smart Metering technology, this is not an area that CURRENT impacts or is impacted by and thus, we have no comments on this document.

Smart Metering Implementation Programme:
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.

CURRENT does not provide consumer products and thus has no comments for this area.

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 consumers.

CURRENT does not provide consumer products and thus has no comments for this area

Question 3: We welcome views on the issues with establishing the settings for ambient feedback.

CURRENT does not provide consumer products and thus has no comments for this area

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 roll out IHDs?

CURRENT does not provide consumer products and thus has no comments for this area

Question 5: We welcome evidence on whether portability of IHDs has a significant impact on consumer behavioural change.

CURRENT does not provide consumer products and thus has no comments for this area

Question 6: Do you agree with the proposed minimum functional requirements for the IHD?

While we generally support the minimum functional requirements, there appears to be the general assumption that the HAN is an unmanaged network and we believe there is the need to increase the reliability and customer experience of In-Home Display (IHD) through use of integration of an upgradable HAN and WAN “gateway” which can be remotely managed by the DCC or its communication providers.

As the noted in the Regulatory and Commercial Framework Document:

“DECC’s updated impact assessment identifies that just under half of the benefits of the smart metering programme are expected to come from consumers using the information they will gain from smart meters to take action to reduce their energy consumption. It will be critical, therefore, that the process of installation and on-going maintenance of smart meters and related equipment in customer premises is a positive experience.”^{xxxix}

As noted numerous times in the consultation documents, the Government believes the IHD is critical to the success of the program. The heart of the Smart Meter program will be successfully linking communications of energy usage to the customer and to the supplier, network operator and other interested parties. We support the position that the Government has taken of separating out the WAN communications solution to assure long term upgradability. We believe that a similar approach should be taken for the HAN.

While not specifically addressed, it appears the present plan includes the following assumptions: a) the electric meter is the gateway for the HAN; b) one HAN technology will work for all types of deployment; and c) HAN technology is more mature and doesn’t need to be upgraded or remotely managed.^{xxxii} This does not appear to reflect the current state of the market. For example a recent article on HAN technology provided a good history of the various computer LAN technologies and listed ten different emerging HAN technologies and within one, Zigbee, pointed out four or five changes in the standard in the last six years, none of which were backwards compatible.^{xxxiii}

We believe a more flexible approach would be to treat the WAN module as the equivalent of a router or a gateway in an internet based solution. This gateway would also contain a HAN interface to the electric and gas meter as well as a HAN interface to the IHD. Initially, in many cases, this could be the same HAN technology, although it is highly unlikely one HAN technology will work for all of the UK. For example, in the case of multi tenant buildings or hard to reach locations, the connection to the IHD could require a different more robust technology (i.e., power line, Wi-Fi) than the low power wireless technology used to connect to the gas meter. In addition, by adding additional memory and processing capability to this gateway, it could act as

upgradable storage capability and act as one gateway to enable one IHD for both gas and electricity. Any additional cost of this device would likely be paid for by reducing the cost of the meter which would be required to provide less functionality - this is especially true in multi tenant situations where one gateway could communicate to multiple meters.

The benefits of this approach would easily facilitate adding new capabilities like water metering and provide an upgraded communications option as IHD innovation occurs without needing to change the meter. This structure would also facilitate the remote network management, security and troubleshooting of the HAN technology which would appear to be highly desirable given the critical nature of the HAN.

The present plan also assumes that the individual Suppliers should acquire the WAN module based on specifications prepared by two expert groups.^{xxxiv} Given that it is likely there will be at least two different WAN communications technologies (wireless and power line) and at least two different HAN technologies (wireless and power line), with at least six major suppliers, it would be possible to end up with 24 different WAN modules for the DCC to integrate with and to be responsible for the security of. History has shown that despite best intentions, different manufacturers working to newly developed specifications often face challenges in achieving interoperability. We believe a better approach would be for the DCC to be responsible for the WAN module initially to limit the potential difficulties in achieving interoperability, similar to how the telecom vendors, in rolling out DSL, chose one or two modem manufacturers. It is possible for the DCC to be responsible for supplying the module to the supplier or the installer who could be responsible for the installation and field maintenance.

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?

CURRENT does not provide consumer products and thus has no comments for this area

Question 8: Do you agree with the proposals covering the roles of and obligations on suppliers in relation to the IHD?

See answer to Question 6 on the HAN as a critical to success of any IHD rollout.

Smart Metering Implementation Programme: **Data Privacy and Security**

Question 1: Do you have any comments on our overall approach to data privacy?

Question 2: We seek views from stakeholders on what level of data aggregation and frequency of access to smart metering data is necessary in order for industry to fulfil regulated duties.

Question 3: Do you support the proposal to develop a privacy charter?

Question 4: What issues should be covered in a privacy charter?

While supporting consumer privacy, CURRENT does not provide consumer products and thus has no comments for Questions 1 to 4. We do believe it is important that the DNOs have access to the Smart Metering Data for the Smart Grid purposes without needing consumer consent.

Question 5: Do you agree with our approach for ensuring the end-to-end smart metering system is appropriately secure?

While we generally support the security requirements, there appears to be the general assumption that the HAN is an unmanaged network and we believe there is the need to increase the reliability and customer experience of In-Home Display (IHD) through use of integration of an upgradable HAN and WAN “gateway” which can be remotely managed and secured by the DCC or its communication providers.

While not specifically addressed, it appears the present plan includes the following assumptions: a) the electric meter is the gateway for the HAN; b) one HAN technology will work for all types of deployment; and c) HAN technology is more mature and doesn’t need to be upgraded or remotely managed.^{xxxv} This does not appear to reflect the current state of the market. For example a recent article on HAN technology provided a good history of the various computer LAN technologies and listed ten different emerging HAN technologies and within one, Zigbee, pointed out four or five changes in the standard in the last six years, none of which were backwards compatible.^{xxxvi}

We believe a more flexible and secure approach would be to treat the WAN module as the equivalent of a router or a gateway in an internet based solution. This gateway would also contain a HAN interface to the electric and gas meter as well as a HAN interface to the IHD. Initially, in many cases, this could be the same HAN technology, although it is highly unlikely one HAN technology will work for all of the UK. For example, in the case of multi tenant buildings or hard to reach locations, the connection to the IHD could require a different more robust technology (i.e., power line, Wi-Fi) than the low power wireless technology used to connect to the gas meter. In addition, by adding additional memory and processing capability to this gateway, it could act as upgradable storage capability and act as one gateway to enable one IHD for both gas and electricity. Any additional cost of this device would likely be paid for by reducing the cost of the meter which would be required to provide less functionality - this is especially true in multi tenant situations where one gateway could communicate to multiple meters.

The benefits of this approach would easily facilitate adding new capabilities like water metering and provide an upgraded communications option as IHD innovation occurs without needing to change the meter. This structure would also facilitate the remote network management, security and troubleshooting of the HAN technology which would appear to be highly desirable given the critical nature of the HAN.

The present plan also assumes that the individual Suppliers should acquire the WAN module based on specifications prepared by two expert groups.^{xxxvii} Given that it is likely there will be at least two different WAN communications technologies (wireless and power line) and at least two different HAN technologies (wireless and power line), with at least six major suppliers, it would be possible to end up with 24 different WAN modules for the DCC to integrate with and to be responsible for the security of. History has shown that despite best intentions, different manufacturers working to newly developed specifications often face challenges in achieving interoperability. We believe a better approach would be for the DCC to be responsible for the WAN module initially to limit the potential difficulties in achieving interoperability, similar to how the telecom vendors, in rolling out DSL, chose one or two modem manufacturers. It is possible for the DCC to be responsible for supplying the module to the supplier or the installer who could be responsible for the installation and field maintenance.

END NOTES

ⁱ Ofgem, 'Smart Metering Implementation Programme: Regulatory and Commercial Framework', July 2010 pg 20.

ⁱⁱ At v and viii

ⁱⁱⁱ GB-wide smart meter roll out for the domestic sector Impact Assessment, July 2010 at 27,28

^{iv} Erhardt-Martineaz, Donnelly, Laitner, Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities, June 2010 at 76-81

^v See <http://www.openmeter.com/> for additional information. The Open Meter project is the result of an initial project led by Iberdrola called PRIME. Meters utilizing this standard are presently being deployed in Spain.

^{vi} Vodafone and Accenture, "Carbon Connections: Quantifying mobile's role in tackling climate change" July 2009 at 16

^{vii} Ofgem, 'Smart Metering Implementation Programme: Regulatory and Commercial Framework', July 2010 pg 20.

^{viii} For example the Statement of Design Requirements states "The WAN hardware carries a greater obsolescence risk than the HAN because it is dependent on an external infrastructure that is also evolving, for example from cellular 2G to 3G. . The HAN hardware carries less obsolescence risk in that it has no dependence on other infrastructure becoming obsolete." (Ofgem, Smart Metering Implementation Programme:Statement of Design Requirements, July 2010 pg. 34)

^{ix} Haaser, Bary, 'Industry Dilemma: Modular vs. Embedded Communications', September 2010, available at <http://smart-grid.tmcnet.com/topics/smart-grid-fa/articles/101260-industry-dilemma-modular-vs-embedded-communications.htm>

^x "The specification for the WAN communications module will initially be developed by the programme, through the two Expert Groups, to enable the roll out of smart meters prior to DCC commencing its operation under the staged implementation approach." (Ofgem, Smart Metering Implementation Programme: Communications Business Model, July 2010 at 20)

^{xi} Ofgem, 'Energy Demand Research Project (EDRP) Review of progress for the period

March 2009 – September 2009, March 2010 at 10.

^{xii} Secretary of State for Energy and Climate Change Presentation to Parliament, ‘*The UK Renewable Energy Strategy*’ July 2009 at 101

^{xiii} DECC Presentation to Parliament pursuant to Sections 12 and 14 of the Climate Change Act 2008, ‘*The UK Low Carbon Transition Plan: National Strategy for Climate & Energy*’, 2009 at 45,70. Also, “In our 2007 Report on local energy we considered the implications of a changing energy mix for the UK’s electricity networks. We noted that much of our existing infrastructure is coming to the end of its design life, and that about two-thirds of the network will need to be replaced in the near future. The current system is optimised for centralised electricity generation, with power flowing in one direction from generating plants through the transmission network to lower voltage distribution networks, from which it is delivered to homes, offices and factories. . . . More decentralised generation will need technologies that allow more ‘active’ management of the electricity networks.” (House of Commons Business and Enterprise Committee ‘*Energy policy: future challenges*’ First Report of Session 2008–09, December 10, 2008)

^{xiv} Xcel Presentation to Colorado Public Utilities Commission, ‘*SmartGridCity™ Update: Project Status and Early Benefits*’, , July 2009 (available at http://www.dora.state.co.us/PUC/presentations/InformationMeetings/SmartGrid/07-07-09CIM_SmartGridCityUpdate-ProjectStatusEarlyBenefits.ppt)

^{xv} Vodafone and Accenture, “Carbon Connections: Quantifying mobile’s role in tackling climate change” July 2009 at 16

^{xvi} Ofgem, ‘Energy Demand Research Project (EDRP) Review of progress for the period March 2009 – September 2009, March 2010 at 10.

^{xvii} Ofgem, ‘Energy Demand Research Project (EDRP) Review of progress for the period March 2009 – September 2009, March 2010 at 10.

^{xviii} Ofgem, ‘Smart Metering Implementation Programme: Regulatory and Commercial Framework’, July 2010 pg 20.

^{xix} For example the Statement of Design Requirements states “The WAN hardware carries a greater obsolescence risk than the HAN because it is dependent on an external infrastructure that is also evolving, for example from cellular 2G to 3G. . .The HAN hardware carries less obsolescence risk in that it has no dependence on other infrastructure becoming obsolete.” (Ofgem, Smart Metering Implementation Programme: Statement of Design Requirements, July 2010 pg. 34)

^{xx} Haaser, Bary, ‘Industry Dilemma: Modular vs. Embedded Communications’, September 2010, available at <http://smart-grid.tmcnet.com/topics/smart-grid-fa/articles/101260-industry-dilemma-modular-vs-embedded-communications.htm>

^{xxi} “The specification for the WAN communications module will initially be developed by the programme, through the two Expert Groups, to enable the roll out of smart meters prior to DCC commencing its operation under the staged implementation approach.” (Ofgem, Smart Metering Implementation Programme: Communications Business Model, July 2010 at 20)

^{xxii} Smart Metering Implementation Programme: Rollout Strategy at 25

^{xxiii} Ofgem, ‘Energy Demand Research Project (EDRP) Review of progress for the period March 2009 – September 2009, March 2010 at 10.

^{xxiv} Vodafone and Accenture, “Carbon Connections: Quantifying mobile’s role in tackling climate change” July 2009 at 16

^{xxv} For example the Statement of Design Requirements states “The WAN hardware carries a greater obsolescence risk than the HAN because it is dependent on an external infrastructure that is also evolving, for example from cellular 2G to 3G. . .The HAN hardware carries less obsolescence risk in that it has no dependence on other infrastructure becoming obsolete.” (Ofgem, Smart Metering Implementation Programme: Statement of Design Requirements, July 2010 pg. 34)

^{xxvi} Haaser, Bary, ‘Industry Dilemma: Modular vs. Embedded Communications’, September 2010, available at <http://smart-grid.tmcnet.com/topics/smart-grid-fa/articles/101260-industry-dilemma-modular-vs-embedded-communications.htm>

^{xxvii} “The specification for the WAN communications module will initially be developed by the programme, through the two Expert Groups, to enable the roll out of smart meters prior to DCC

commencing its operation under the staged implementation approach.” (Ofgem, Smart Metering Implementation Programme: Communications Business Model, July 2010 at 20)

xxviii Smart Metering Implementation Programme: Rollout Strategy at 25

xxix Vodafone and Accenture, “Carbon Connections: Quantifying mobile’s role in tackling climate change” July 2009 at 16

xxx Ofgem, ‘Energy Demand Research Project (EDRP) Review of progress for the period March 2009 – September 2009, March 2010 at 10.

xxxi Ofgem, ‘Smart Metering Implementation Programme: Regulatory and Commercial Framework’, July 2010 pg 20.

xxxii For example the Statement of Design Requirements states “The WAN hardware carries a greater obsolescence risk than the HAN because it is dependent on an external infrastructure that is also evolving, for example from cellular 2G to 3G. . .The HAN hardware carries less obsolescence risk in that it has no dependence on other infrastructure becoming obsolete.” (Ofgem, Smart Metering Implementation Programme: Statement of Design Requirements, July 2010 pg. 34)

xxxiii Haaser, Bary, ‘Industry Dilemma: Modular vs. Embedded Communications’, September 2010, available at <http://smart-grid.tmcnet.com/topics/smart-grid-fa/articles/101260-industry-dilemma-modular-vs-embedded-communications.htm>

xxxiv “The specification for the WAN communications module will initially be developed by the programme, through the two Expert Groups, to enable the roll out of smart meters prior to DCC commencing its operation under the staged implementation approach.” (Ofgem, Smart Metering Implementation Programme: Communications Business Model, July 2010 at 20)

xxxv For example the Statement of Design Requirements states “The WAN hardware carries a greater obsolescence risk than the HAN because it is dependent on an external infrastructure that is also evolving, for example from cellular 2G to 3G. . .The HAN hardware carries less obsolescence risk in that it has no dependence on other infrastructure becoming obsolete.” (Ofgem, Smart Metering Implementation Programme: Statement of Design Requirements, July 2010 pg. 34)

xxxvi Haaser, Bary, ‘Industry Dilemma: Modular vs. Embedded Communications’, September 2010, available at <http://smart-grid.tmcnet.com/topics/smart-grid-fa/articles/101260-industry-dilemma-modular-vs-embedded-communications.htm>

xxxvii “The specification for the WAN communications module will initially be developed by the programme, through the two Expert Groups, to enable the roll out of smart meters prior to DCC commencing its operation under the staged implementation approach.” (Ofgem, Smart Metering Implementation Programme: Communications Business Model, July 2010 at 20)