

TOR point (iii): Smart meter data and delivery of consumer benefits

- Based on the list compiled under TOR(ii), develop high-level use cases on how smart meter data can be used to deliver benefits directly to customers?
- This includes establishing what smart meter data, at what granularity, are required to achieve benefits?

Smart Meter Benefit	Description
Proactive planning of HV & LV networks	Better informed load related investment
Voltage monitoring and sag/swell alarms	Avoided voltage complaints and admin costs
Proactive planning of HV and LV networks	Reduced investments to serve new connections
Power outage management	Reduced duration of LV interruptions
Power outage management	Reduced Guaranteed Standards failure payment
Active network management	Optimising LV network voltage and power flows informed by smart meter data
Responsive demand TOU tariffs – Distribution Use of System (DUoS) time of use (TOU) charging	Reduced need for distribution network reinforcement to meet peak demand
Responsive demand load control	Remote controlled or smart appliance managed response
Management of network losses	Losses management
New SM benefits identified by SMSG (relate to potential use of load control switches by DNOs)	
Use of SM load control switches to mitigate the need for global demand control actions under ESEC and potentially Grid Code OC6	Reduced requirement for global demand control actions
Use of SM demand control to mitigate the number of customers remaining off supply during network fault events.	Reduction in number of customers remaining off supply during periods of severe network depletion

Question	Q&A template for Smart Meter Working Group – TOR point (iii)	
	Name of benefit: Voltage Monitoring and Voltage Anomaly Alerts	
Who receives the benefit?		
1	Brief description of the benefit(s)	<p>The voltage monitoring integral within smart meters will provide Network Operators with an early warning of emerging power quality problems.</p> <p>In the case of more significant voltage excursions, Network Operators will be able to provide a proactive response thereby mitigating the number of voltage complaints received. Whilst this approach is also possible for less significant voltage excursions, it may be that Network Operators continue with the present day reactive approach (i.e. waiting for a customer to make a voltage complaint) until they have gained a sense of the likely volume of voltage anomaly alerts, and acquired an understanding of their various patterns, relationships and recurrences.</p> <p>In both cases Network Operators will be able to monitor voltage remotely, which may[#] remove the need to visit Consumers premises to investigate voltage complaints.</p> <p>[#] <i>Smart meters monitor voltage only. Where it is possible that Consumers electrical equipment (either at the complainant's or a nearby premise) is the source of the problem it may be necessary to monitor customer load current in addition to voltage so as to establish/eliminate the link.</i></p>
2(i)	Does benefit flow directly to consumers?	<p>In part. The main benefit to Consumers is one of reduced inconvenience.</p> <p>Early warning of emerging power quality issues enable Network Operators to intervene before the problem becomes sufficiently acute as cause Consumers to contact the Network Operator or before there is potential damage to electrical appliances.</p> <p>In the event that power quality investigations are required, the remote voltage monitoring capabilities of smart meters means that Consumers may not always have to provide Network Operators with access to their premises in order to carry out those investigations (see proviso in Q1 above).</p>

2(ii)	If 2(i) No - Who does it flow to (eg DNOs)?	<p>Any remaining benefit flows to Network Operators, although there is the potential for this to be a liability rather than a benefit.</p> <p>Early warning of emerging power quality issues enable Network Operators to intervene before the problem becomes sufficiently acute as cause Consumers to contact the Network Operator, thereby mitigating complaint management costs.</p> <p>The unit cost of investigating voltage complaints is likely to reduce as a consequence of it not always being necessary to visit Consumers premises in order to install and remove voltage recorders / power quality monitoring equipment (see proviso in Q1 above). It is doubtful that investigations will become solely a desktop exercise as Network Operators will probably wish to check voltages at strategic positions on their network (i.e. at locations other than metering points) as part of any investigation.</p> <p>Currently Network Operators have very limited visibility of voltage levels on lower voltage networks and consequently tend to have a reactive approach to power quality issues i.e. wait for Consumers to make voltage complaints. The installation of smart meters will provide a much greater visibility of the voltages compared to the current limited view and it is unclear what effect this will have on the volume of power quality “episodes” requiring analysis. There is a distinct possibility that there will be an increase, especially in the early days when Network Operators are acquiring an understanding of the various patterns and relationships of voltage anomaly alerts.</p> <p>Benefit or liability is dependent upon whether Network Operators will see a reduction or an increase in the overall cost of carrying out power quality investigations i.e. how the product of volume and unit cost will compare between the present day and the future.</p>
2(iii)	If 2(i) No - How do benefits flow through to consumers (eg incentive mechanisms, cost reductions)?	Network Operators would be expected to pass on any reduction of operating cost in the form of reduced use of system charges. In turn, Suppliers would be expected to pass on this benefit to consumers.
3	When might benefits start to be realised (eg start, during or after full Smart Meter rollout)?	Benefit can be realised once the systems needed to deliver these benefits (see Q7 below) are in place. This is likely to transpire at some point during the smart meter rollout.
Types of data required?		

4(i)	What type of data may be required from the Smart Meter?	<p>Average RMS voltage measurement</p> <ul style="list-style-type: none"> The average value of RMS voltage measured over a configurable period <p>Average RMS under voltage detection</p> <ul style="list-style-type: none"> The number of periods that the average RMS voltage is below an Average RMS Under Voltage Threshold An alert that the average RMS voltage has fallen below an Average RMS Under Voltage Threshold. A subsequent alert that the average RMS voltage has returned above the Average RMS Under Voltage Threshold <p>Average RMS over voltage detection</p> <ul style="list-style-type: none"> The number of periods that the average RMS voltage is above an Average RMS Over Voltage Threshold An alert that the average RMS voltage has risen above an Average RMS Over Voltage Threshold. A subsequent alert that the average RMS voltage has returned below the Average RMS Over Voltage Threshold <p>RMS extreme under voltage detection</p> <ul style="list-style-type: none"> An alert that the RMS voltage has fallen below an RMS Extreme Under Voltage Threshold for a defined measurement period. A subsequent alert that the RMS voltage has returned above the RMS Extreme Under Voltage Threshold for a defined measurement period <p>RMS extreme over voltage detection</p> <ul style="list-style-type: none"> An alert that the RMS voltage has risen above an RMS Extreme Over Voltage Threshold for a defined measurement period. A subsequent alert that the RMS voltage has returned below the RMS Extreme Over Voltage Threshold for a defined measurement period <p>RMS voltage sag detection</p> <ul style="list-style-type: none"> An alert that the RMS voltage has fallen below an RMS Voltage Sag Threshold for a defined measurement period. A subsequent alert that the RMS voltage has returned above the RMS Voltage Sag Threshold for a defined measurement period <p>RMS voltage swell detection</p> <ul style="list-style-type: none"> An alert that the RMS voltage has risen above an RMS Voltage Swell Threshold for a defined measurement period. A subsequent alert that the RMS voltage has returned below the RMS Voltage Swell Threshold for a defined measurement period
4(ii)	What granularity of Smart Meter data may be required to achieve benefits(eg substations, half hourly)?	Both average RMS voltage measurements and voltage anomaly alerts are required from smart meters in order to achieve the benefits.
4(iii)	How often do you need to receive the Smart Meter data (eg near real time, monthly, as required)	
5	What data may be required from other sources	Network connectivity data will be required in order to associate each metering point to particular LV, HV and EHV circuits. This is necessary in order to spot relationships between voltage anomaly alerts from discrete meters and hence to pinpoint a likely root cause.

6	Are there barriers on accessing the desired data under the current policy?	There are no restrictions on accessing voltage monitoring data under the current data privacy policy.
What processes are required?		
7	What systems (eg IT and comms) are needed to deliver these benefits?	Apart from the smart metering infrastructure and the data communication link between a Network Operator and the Data & Communications Company (DCC), it will also be necessary for Network Operators to install a "Data Historian" system for storing historical average RMS voltages plus voltage anomaly alerts for each metering point. The system should store data for a reasonable time period, with data being overwritten on a first-in first-out basis.
8	What relationships are required between DNOs, suppliers, consumers, others?	Whilst Network Operators are responsible for configuring the voltage monitoring aspects of smart meters, it would be advantageous if they were able to agree on "standard" voltage thresholds and measurement periods which could be applied universally by Suppliers on their behalf during the initial installation of the meter. This would mitigate the need for each meter to be accessed separately by both parties during the rollout period. The mechanism for configuring the voltage monitoring aspects of SMETS1 meters is not clear cut. Whilst there is an aspiration for Network Operators to be able to do this remotely via the DCC (i.e. in the same way as for SMETS2 meters), it is not clear whether this will be achievable in practice. Worst case scenario is that Suppliers have to perform this task on behalf of the Network Operators.
Barriers and Enablers		
9	Are there barriers, or enablers required, in the current regulatory arrangements to fully realise consumer benefits?	
10	Are there barriers, or enablers required, in the commercial arrangements to fully realise consumer benefits?	
11	Are there any other barriers, or enablers required, outside of the regulatory and commercial arrangements (eg technical barriers) that should be considered?	Agreement on initial configuration of alarm levels needed between DNOs and between all DNOs and Suppliers. Issues being taken forward by ENA smart metering group.
12	Based on your answers to 9, 10 and 11, should any of these barriers or enablers be considered now?	
Evidence of how benefits may be realised from other sources		
13	Please highlight any studies that may help inform what benefits are realised and how (e.g evidence from other countries roll out of SMs or from DNO innovation projects)	

Question	Q&A template for Smart Meter Working Group – TOR point (iii)	
	Name of benefit: Active Network Management	
Who receives the benefit?		
1	Brief description of the benefit(s)	Increasing network thermal capacity and voltage headroom through optimising circuit load sharing, network voltage levels and power factor.
2(i)	Does benefit flow directly to consumers?	Insofar as the benefit has been embedded within DNOs’ ED1 Business Plans – yes. Any outperformance over assumptions in terms of further avoided network reinforcement will be a shared benefit (IQI).
2(ii)	If 2(i) No - Who does it flow to (eg DNOs)?	As above, outperformance benefit shared through IQI.
2(iii)	If 2(i) No - How do benefits flow through to consumers (eg incentive mechanisms, cost reductions)?	
3	When might benefits start to be realised (eg start, during or after full Smart Meter rollout)?	During smart meter rollout, subject to access to hh 4Q flows and rms voltage data and sufficient critical mass. However, the benefit available during ED1 is highly dependent on the take-up rate of electric vehicles (home chargers), heat pumps and rooftop solar PV being sufficient, in the absence of ANM, to trigger reinforcement (the counterfactual). Low take-up rates during ED1 are unlikely to give rise to a need for widespread ANM interventions. ENA’s analysis predicts ANM benefits being heavily weighted towards ED2.
Types of data required?		
4(i)	What type of data may be required from the Smart Meter?	See 3 above. Aggregated half-hourly flows will help determine network loading profiles and hence opportunities for better load sharing between circuits (including potentially through intra-day dynamic switching using remote controlled switches in LV link boxes). Half hourly voltage (rms) data will enable the derivation of time-series and linear voltage profiles (i.e. voltage profile along a circuit) and will enable optimised DTF tap positions and/or Primary substation AVC set points (and in future DTF AVC set points). 4Q flow data will also enable power factor to be determined.
4(ii)	What granularity of Smart Meter data may be required to achieve benefits(eg substations, half hourly)?	Half-hourly flow data is sufficient for optimising LV NOPs or intra-day active load switching. Half-hourly 4Q readings would also identify periodic instances of poor power factor and reverse power flows. Half-hourly rms voltage, whilst much less granular than voltage data used for primary substation AVC schemes, is nevertheless sufficient to determine daily / seasonal voltage profiles and hence inform AVC set points and DTF tap positions. In future, it would allow periodic within-day voltage adjustments where DTFs are equipped with on-load tap changing (or other means of voltage output control). This would be of particular benefit in accommodating day-time voltage rise due to solar PV, and evening voltage drop due to EV charging and/or heat pump load. An important benefit is that voltage readings would be available from all exit nodes (i.e. at meter positions) where the statutory voltage limits apply, hence enabling voltage set points to be optimised.

4(iii)	How often do you need to receive the Smart Meter data (eg near real time, monthly, as required)	For active voltage control, 'real time' half-hourly smart meter voltage data (i.e. half-hour average rms values transmitted every half hour) would be required (provision has been included in DNOs' data flow analyses shared with DECC). For active load switching it might be possible to design schemes based on 'characteristic' daily and seasonal powerflow patterns derived from hh time series data downloaded periodically (e.g. 3 monthly). However, given the anticipated volatility in daily power flows once high volumes of low carbon technologies (solar PV, EV chargers and heat pumps) are installed, the need for 'real time' half hour average data is likely to increase over time. Similarly for active power factor management (e.g. switched capacitors).
5	What data may be required from other sources	HV/LV substation monitoring (which is not an easy retrofit solution) would be complementary but not essential. For example, phase and neutral current data for phase balancing, and harmonic distortion data to identify priorities for intervention would be useful for overall network management purposes but would not greatly enhance ANM functionality (phase balancers and switched harmonic filters would generally work independently of smart meter data). However, smart meter data will enable loadings on individual branches of LV networks to be estimated and (of particular benefit) rms voltage to be monitored at all points along an LV circuit. Some state-estimation capability may be required to cover any gaps in smart meter data (e.g. unmetered supplies and premises with Advanced or conventional meters).
6	Are there barriers on accessing the desired data under the current policy?	Access to hh consumption (real power import) data is subject to DNOs meeting requirements in respect of data privacy (including in respect of anonymity and aggregation). Subject also to data from SMETS1 meters being readily accessible via DCC. Data from Advanced meters (SMEs) may not be accessible or meet requirements (and hence some state estimation may be required).
What processes are required?		
7	What systems (eg IT and comms) are needed to deliver these benefits?	DNOs will need to have systems to access data from DCC and be able to meet security and privacy requirements. Accurate aggregation will depend on connectivity models linking MPANs to LV network nodes. Event processing software is likely to be required to identify triggers from the very high volumes of smart meter data processed. ANM solutions might deploy centralised or distributed network management systems and appropriate communications technologies. For example localised voltage control based on smart meter data could ultimately take data from smart meters directly to local substation voltage control schemes (by-passing DCC). Other ANM solutions might utilise the inherent automation capability built into systems such as GE PowerOn Fusion deployed in most DNOs' Control Centres.
8	What relationships are required between DNOs, suppliers, consumers, others?	ANM solutions are not inherently dependent on other parties. However, ANM and DSM are compatible solutions which would work best in harmony. Similarly, demand side power factor correction would complement ANM based pf management.
Barriers and Enablers		

9	Are there barriers, or enablers required, in the current regulatory arrangements to fully realise consumer benefits?	<p>The 'regulatory arrangements' must include appropriate cost allowances in the final price control determinations to support the necessary investment in IT, telecoms and network hardware (see questions 7 and 15).</p> <p>A key enabler is that DNOs have access to hh consumption data and there is therefore a key regulatory dependency on either DECC or (more likely) Ofgem (depending on timing) agreeing the aggregation methodology. This also assumes that concerns over privacy are addressed and don't present a barrier to DNOs using sufficiently granular aggregated consumption data. Note: privacy might be an issue where aggregation involves relatively few consumers (e.g. some rural pole-mounted substations where a local ANM solution is proposed). In some isolated cases access to individual consumer hh profiles might be necessary (which is allowable provided permission is granted by the consumer).</p>
10	Are there barriers, or enablers required, in the commercial arrangements to fully realise consumer benefits?	No
11	Are there any other barriers, or enablers required, outside of the regulatory and commercial arrangements (eg technical barriers) that should be considered?	<p>A key enabler is that SMETS1 (as well as SMETS2) meter data is available through DCC.</p> <p>A potential complication is where an IDNO network is connected to a DNO network where an ANM solution is proposed. The issue is that data from smart meters installed at premises supplied by the IDNO network can be accessed only by the IDNO. This could be a barrier to (say) an active voltage control scheme if voltage measurements on the IDNO network could not be incorporated.</p>
12	Based on your answers to 9, 10 and 11, should any of these barriers or enablers be considered now?	<p>There is on-going work to address the necessary DNO access to hh data, and use by DNOs of sufficiently granular aggregated data, so no further consideration is required at this time.</p> <p>Consideration might be given to how the IDNO network issue might be resolved but this is likely to be a niche issue (i.e. where IDNO activity is high) at least until ANM schemes become more prolific (e.g. in ED2).</p>
Evidence of how benefits may be realised from other sources		
13	Please highlight any studies that may help inform what benefits are realised and how (e.g evidence from other countries roll out of SMs or from DNO innovation projects)	
Other points?		
Please feel free to add other questions and answers to this template. The questions above are not definitive and we can look to rollout any additional questions you raise to everyone's template		

14	How sensitive is the ANM benefit to assumptions on LCT take-up trajectories?	ANM benefit is especially sensitive to assumptions on LCT take-up. A number of studies have concluded that solar PV, EV chargers and heat pumps deployed in volumes consistent with DECC's 4 th carbon budget scenarios would give rise to higher peak demands, wider voltage variations, reverse power flows, and generally more volatile network loadings. The value of ANM is in its potential to more actively control LV networks to accommodate these anticipated loading characteristics and hence minimise need for conventional reinforcement. The wide range in the estimated cost benefit reported in ENA's analysis reflects this sensitivity, and particularly the back-loaded (to ED2) weighting.
15	Is the solution dependent on investment in new network hardware, in addition to the IT and telecomms described in 7 above?	Whilst LV ANM solutions can release capacity and avoid conventional (and disruptive) LV reinforcement, full exploitation will nevertheless require investment in (for example) distribution transformers with on-load tap changers (or power electronics equivalents), automated voltage control equipment, remotely controlled link box switches, switched capacitors, in-line voltage regulators, phase balancers, etc.

Q&A template for Smart Meter Working Group – TOR point (iii)		
Name of benefit: Responsive demand tariffs - Distribution Use of System (DUoS) time of use (TOU) charging		
Who receives the benefit?		
1	Brief description of the benefit(s)	<p>This template covers the potential for deploying TOU tariffs via smart meters, where prices charged to consumers change to reflect the costs of providing high peak network capacity, and thus incentivise reductions in network peak demand. These tariffs may align, or conflict, with TOU tariffs aiming to achieve benefits in other areas, such as suppliers deploying tariffs to reflect the time varying cost of generation, and thus may involve benefits, requirements, or barriers and enablers different to those described in this template.</p> <p>A tariff that reflects differentiated DUoS TOU charging rates has the potential benefit for DNOs and the TNO to reduce or defer load-related infrastructure investment while still meeting the network user requirements, as peak demand could be lower (subject to aligned objectives in the respective markets). These reductions in peak demand may also contribute to benefits to Generators and the wholesale market, such as increasing energy delivery with a relatively lower requirement for increasing peak transmission and distribution capacity.</p> <p>For differentiated DUoS TOU charges, DNOs, and to a lesser degree the TNO, will benefit provided that the DUoS price signal is fully reflected in the Suppliers' ToU tariffs, and is perceived by consumers to be sufficiently strong to materially impact electricity usage behaviour.</p> <p>Consumers will benefit from lower DUoS charges, where they are able to see and respond to DUoS pricing signals by shifting consumption, i.e. provided that they can also avoid high (peak demand) price periods as well as taking advantage of low price periods. In practice, it might require investment in smart appliances to achieve a material change in load patterns.</p> <p>Any such reductions in peak demand will have minor secondary benefits from reducing transmission system peak, wholesale market peak period pricing, and network losses, all of which benefits should be conferred on consumers through lower energy charges.</p> <p>The potential benefits outlined above assumes broad correlation between DUoS and energy ToU charges (the latter driven by market price and short-run marginal cost of generation rather than network investment costs). However, there may be conflicts between the two. For example, an abundance of wind power may result in very low electricity prices. From an energy TOU charge perspective it would be beneficial to incentivise consumers to increase their consumption. However, doing so might cause unanticipated stress on the distribution network.</p>

2(i)	Does benefit flow directly to consumers?	(a) Any DUoS ToU benefits will flow directly to consumers via their DUoS charges incorporated within the Supplier ToU tariffs. (b) In addition, any avoided network investment savings will be shared between DNOs and consumers through the RIIO-ED1 Totex Incentive Mechanism.
2(ii)	If 2(i) No - Who does it flow to (DNOs)?	For point (b) in Q2(i), DNOs will share the benefit with consumers through the RIIO-ED1 Totex Incentive Mechanism. This will benefit will flow indirectly to consumers through lower DNO allowed revenue and ultimately DUoS charges in the energy bill.
2(iii)	If 2(i) No - How do benefits flow through to consumers (eg incentive mechanisms, cost reductions)?	Flows through the RIIO-ED1 Totex Incentive Mechanism on annual basis through the annual iteration of the RIIO-ED1 Price Control Financial Model.
3	When might benefits start to be realised (eg start, during or after full Smart Meter rollout)?	Following full Smart Meter rollout and assuming that Suppliers offer ToU tariffs which incorporate ToU differentiated DUoS charges. Full household (hh) settlement (i.e. not relying on super-customer profiling is a prerequisite for Suppliers to be incentivised to introduce new ToU tariff products (as recognised by Ofgem Smarter Market's paper: Electricity Settlement Reform – moving to hh settlement – April 2014) Note that profiling assumes all consumers have similar load patterns so there is no benefit to Suppliers if consumers adopt more efficient load patterns.
Types of data required?		
4(i)	What type of data may be required from the Smart Meter?	Tariff registers – both import and export power
4(ii)	What granularity of Smart Meter data may be required to achieve benefits (eg substations, half hourly)?	Half hourly data for use in settling TOU customers would be the basis of ToU period pricing
4(iii)	How often do you need to receive the Smart Meter data (eg near real time, monthly, as required)	According to settlement process cycles within chosen settlement regime.
5	What data may be required from other sources	It may be that data from the responsive demand 'item' (i.e. HAN controlled appliance or consumer access device) would be useful in planning for and observing the performance of the pricing signals, though it is more likely that active network management benefits are delivered through such device-level control). The effect of DUoS pricing signals is most likely going to be monitored at the premises level.
6	Are there barriers on accessing the desired data under the current policy?	The responsive demand 'item' is likely to be an un-trusted device from a smart meter perspective. This could affect the feasibility of using smart appliances / applications being controlled by the smart meter derived price change signal.
What processes are required?		

7	What systems (eg IT and comms) are needed to deliver these benefits?	<p>Potentially significant IT changes to effect full hh settlement, with notable IT changes still potentially required for other settlement options with the required accuracy and configurability.</p> <p>Additionally, for changing DUoS charges:</p> <ul style="list-style-type: none"> • new communications materials to inform Suppliers and customers of the role and rates • new levels of disaggregation of consumer populations may be required during settlement to allow TOU DUoS programmes to be implemented in specific network areas where network benefits can best be achieved. Suppliers would need to create and publish zonal tariffs
8	What relationships are required between DNOs, suppliers, consumers, others?	For changing DUoS charges, the main relationship is between the supplier and DNO in order to coordinate its implementation of differentiated DUoS charges. However, clear understanding of the DUoS TOU rates will need to be communicated directly to the consumers, likely through the supplier.
Barriers and Enablers		
9	Are there barriers, or enablers required, in the current <u>regulatory arrangements</u> to fully realise consumer benefits?	<p>Half hourly HH settlement, or similar, functionality is required for the success of TOU DUoS programmes. While other settlement options for TOU tariffs could be considered beyond full HH settlement, such as deriving new settlement profile classes for static TOU tariffs, any configuration would need to be based on actual measured HH consumption or it would not accurately reward and charge customers for their demand flexibility. Additionally, as the range of TOU tariff options needed to fully access TOU benefits becomes more complex and variable with time of year, network types and locations, or introduces dynamic TOU components full HH settlement is likely to become the most cost effective settlement option.</p> <p>Critically, the DUoS component of consumer bills remains a relatively small component of energy costs and suppliers currently are not required and have minimal incentive to communicate to customers TOU DUoS rates, and instead may benefit from increasing simplicity in communications with customers or through preserving price signals that benefit the supplier at the expense of price signals that benefit the DNO. The immediate barrier this creates is a lack of visibility customers have on their current bill of what the DUoS charge is. An initial step to approach this would be to review the billing specifications within the supplier licence and have the Distribution Charging Methodology Forum review any change proposal. Additionally the adequate communication requirements would need to be established and implemented across all suppliers.</p>
10	Are there barriers, or enablers required, in the <u>commercial arrangements</u> to fully realise consumer benefits?	The relative values of DUoS rates vs. energy purchasing rates means that even where consumers have clear visibility of pricing signals that any conflict between the two cost components, e.g. high DUoS rates coinciding with low wholesale rates, will result in much greater incentive to respond to the energy purchasing signal. This will impact the benefits achieved by the DNO. Commercial arrangements between suppliers and DNOs would need to specify the conditions of the TOU and location details.

11	Are there any other barriers, or enablers required, outside of the regulatory and commercial arrangements (eg technical barriers) that should be considered?	Consumers must demonstrate a level of participation and behavioural flexibility in order for benefits to be achieved. UKPN's Low Carbon London (LCL) project showed that consumers were responsive, highly engaged and enthusiastic to a TOU reflecting DNO local constraints, however, uptake of the tariff must be consistent throughout the specific substation constrained (i.e. several suppliers) to address the network constraint.
12	Based on your answers to 9, 10 and 11, should any of these barriers or enablers be considered now?	All are critical to achieving benefits through TOU DUoS rates.
Evidence of how benefits may be realised from other sources		
13	Please highlight any studies that may help inform what benefits are realised and how (e.g evidence from other countries roll out of SMs or from DNO innovation projects)	LCL and Customer Led Network Revolution (CLNR)

Question	Q&A template for Smart Meter Working Group – TOR point (iii)	
	Name of benefit: Proactive planning of HV & LV networks – New Connections	
Who receives the benefit?		
1	Brief description of the benefit(s)	Reduced investment reinforcing networks to accept new connections/demand enabled by detailed information about existing consumers demand allowing most cost-efficient solution.
2(i)	Does benefit flow directly to consumers?	The financial benefit is typically split between reduced DNO network investment costs which flows through reduced DUOS charges to suppliers and reduced connection charges which flow directly to connectees. There is also an indirect benefit to customers of less disruption installing new equipment etc.
2(ii)	If 2(i) No - Who does it flow to (eg DNOs)?	The DNO element of savings in network investment result in reduced DUOS charges to Suppliers.
2(iii)	If 2(i) No - How do benefits flow through to consumers (eg incentive mechanisms, cost reductions)?	DUOS charges to Suppliers are reduced via the IQI sharing mechanism and this should be passed on to energy consumers by Suppliers in their bills.
3	When might benefits start to be realised (eg start, during or after full Smart Meter rollout)?	Generally benefits will only become available after full roll-out as a high population of smart meters will be required to obtain usable data covering a long enough period to address the enquiry, eg may need summer or winter peak demand. However if locations have high penetration of smart meters installed early in the programme then some benefits would be achievable earlier in these areas.
Types of data required?		
4(i)	What type of data may be required from the Smart Meter?	The type of data will be governed by the nature of the new load being connected. To address the full range of enquiries a combination of active and reactive import and export data will be needed. Some enquiries may also require with voltage profile data. One area of connection planning that SM data will enhance is the diversity assessments made by DNOs that help determine the amount of additional peak demand capacity that the network must be able to provide once a customer is connected.
4(ii)	What granularity of Smart Meter data may be required to achieve benefits(eg substations, half hourly)?	Half-hourly data for each individual premise to achieve maximum flexibility and benefits.
4(iii)	How often do you need to receive the Smart Meter data (eg near real time, monthly, as required)	Some new connections will be planned on the basis of historic smart meter data that has been read from meters at 90 day intervals. If more recent data is necessary this may be read from the relevant meters when required via service requests.
5	What data may be required from other sources	May require data from non-smart-meter premises eg half-hourly metered.
6	Are there barriers on accessing the desired data under the current policy?	Restricted by data privacy requirements and allied DNO licence conditions . Some benefits achievable using Maximum Demand data but to achieve full benefit requires consumption data.

What processes are required?		
7	What systems (eg IT and comms) are needed to deliver these benefits?	Network Operator access to smart meter data via DCC Gateway and applications to store and manage data.
8	What relationships are required between DNOs, suppliers, consumers, others?	DNO's might require consumption data from IDNO's operating embedded LV networks.
Barriers and Enablers		
9	Are there barriers, or enablers required, in the current regulatory arrangements to fully realise consumer benefits?	Achieving maximum benefit requires access to disaggregated consumption data which is currently outside the scope of DNO licence conditions. Switching customer demand via smart meters to enable DSR outside scope of DNO.
10	Are there barriers, or enablers required, in the commercial arrangements to fully realise consumer benefits?	Delivering benefits via demand management is currently only available via suppliers which is likely to be extremely complex to deliver in reality. Direct management of DSR by DNO's would require new commercial arrangements.
11	Are there any other barriers, or enablers required, outside of the regulatory and commercial arrangements (eg technical barriers) that should be considered?	<p>Capability of DCC infrastructure to handle required volumes of data unproven. Consumption data for embedded IDNO LV networks may not be available. Under existing rules, DNOs cannot access independent connection providers' meter data. SC noted that this may reduce DNOs' ability to realise the benefits.</p> <p>SM data is seen as an enabler to realising this SM benefit, by helping to improve demand diversity assessment that a key part of DNOs' connection planning process. For additional information on this see "TOR (iii) PART 3: Focus on demand diversity related to the DNO SM benefit of proactive planning of HV & LV networks – New Connections."</p>
12	Based on your answers to 9, 10 and 11, should any of these barriers or enablers be considered now?	The acquisition and storage of disaggregated data should be addressed to enable DNO's to specify suitable capabilities within their ongoing IT system development.
Evidence of how benefits may be realised from other sources		
13	Please highlight any studies that may help inform what benefits are realised and how (e.g evidence from other countries roll out of SMs or from DNO innovation projects)	Two relevant DNO Innovation Projects are the CLNR (NPG) and NTVV (SSEPD).
Other points?		
Please feel free to add other questions and answers to this template. The questions above are not definitive and we can look to rollout any additional questions you raise to everyone's template		

Question	Q&A template for Smart Meter Working Group – TOR point (iii)	
	Name of benefit: Responsive demand load control	
MORE DETAILED INFORMATION ON THIS CAN BE FOUND IN THE NOTE – ‘TOR (V): LOAD CONTROL’ PRODUCED BY THE SMSG		
Who receives the benefit?		
1	Brief description of the benefit(s)	Ability to remotely control responses to changes in the network (load shifting); or ability to program smart appliances to respond to such changes.
2(i)	Does benefit flow directly to consumers?	Primary benefits are to network operators (smoother loads). Benefits to consumers will be realised by the mechanism that flexible ToU tariffs will reflect network load shifting needs.
2(ii)	If 2(i) No - Who does it flow to (eg DNOs)?	DNOs
2(iii)	If 2(i) No - How do benefits flow through to consumers (eg incentive mechanisms, cost reductions)?	Flexible ToU tariffs will reflect network load shifting needs. Furthermore, load shifting will increase the resilience of the network – an indirect consumer benefit.
3	When might benefits start to be realised (eg start, during or after full Smart Meter rollout)?	During smart meter rollout
Types of data required?		
4(i)	What type of data may be required from the Smart Meter?	Aggregated half-hourly flows
4(ii)	What granularity of Smart Meter data may be required to achieve benefits (eg substations, half hourly)?	Half-hourly flows should be sufficient to optimise load control
4(iii)	How often do you need to receive the Smart Meter data (eg near real time, monthly, as required)	Most meters will function using frequencies of 2.4GHz and/or ~868MHz. The defined benefits do not depend on these being the frequencies used, however. UK default demand period of 30 minutes.
5	What data may be required from other sources	Collating the end point data with substation data from the DNO networks smart meters brings considerable benefit
6	Are there barriers on accessing the desired data under the current policy?	DNOs will need to meet data privacy requirements, and any other requirements under the SEC. Data from meters that are not compliant with SMETS2 but are still “smart” (e.g. SMETS1 meters and “advanced meters” may not be accessible for DNOs in the same way as data from SMETS2 meters, if at all.
What processes are required?		
7	What systems (eg IT and comms) are needed to deliver these benefits?	An end-to-end smart metering system with a means of extracting and displaying the energy use data from the meter – i.e. a consumer access device – plus a Han-connected auxiliary load control switch (HCALCS). The DNOs will require data analytics tools to draw the benefits. The tools can take a variety of forms.
8	What relationships are required between	

	DNOs, suppliers, consumers, others?	
Barriers and Enablers		
9	Are there barriers, or enablers required, in the current regulatory arrangements to fully realise consumer benefits?	The scope of the DNO licence conditions may not give them access to sufficiently detailed consumption data, which they would need to adjust tariffs in accordance with fluctuations in demand. Also, are all the appropriate safeguards for consumers in place?
10	Are there barriers, or enablers required, in the commercial arrangements to fully realise consumer benefits?	Giving DNOs the ability to directly manage and control loads and flows in response to fluctuating demand would require new commercial arrangements.
11	Are there any other barriers, or enablers required, outside of the regulatory and commercial arrangements (eg technical barriers) that should be considered?	Can the DCC infrastructure handle the required volumes of data? Do the DNOs and other stakeholders want the additional responsibilities / liabilities that could accompany the enabling commercial and regulatory arrangements?
12	Based on your answers to 9, 10 and 11, should any of these barriers or enablers be considered now?	The ability of the DCC infrastructure to manage required volumes of data: there should be a plan and timeline for the assurance of this.
Evidence of how benefits may be realised from other sources		
13	Please highlight any studies that may help inform what benefits are realised and how (e.g evidence from other countries roll out of SMs or from DNO innovation projects)	

Question	Q&A template for Smart Meter Working Group – TOR point (iii)	
	Name of benefit: Proactive planning of HV &LV networks - Better informed load related investment	
Who receives the benefit?		
1	Brief description of the benefit(s)	Better understanding of actual loading on HV and LV networks will allow tighter safety margins to be used when reinforcing networks. As reinforcement expenditure will be targeted where it is needed, and not where it is not, this is expected to save money both in avoiding unnecessary expenditure and avoiding the consequences of overloading. Depending on a network operator’s historic risk tolerance with regard to the safety margin associated with overloading of equipment the savings will be biased more to one area or the other. In a British context this will generally mean avoided reinforcement expenditure.
2(i)	Does benefit flow directly to consumers?	Partially. Savings made during the connections process will form a large part of these savings and that benefit will generally flow directly to the connecting customer, mainly as reduced sole-use charges. The connections reinforcement cost to DNOs will be raised marginally in some cases while there may be some saving to DNOs some other cases; in this latter case the connecting customer will also benefit via reduced contributions to connections reinforcement.
2(ii)	If 2(i) No - Who does it flow to (eg DNOs)?	Savings during the general reinforcement process will flow to DNOs in the first instance. A mix of increase and reduced costs will flow to DNOs as part of connections reinforcement.
2(iii)	If 2(i) No - How do benefits flow through to consumers (eg incentive mechanisms, cost reductions)?	During a given regulatory period these DNO savings are recovered via the IQI sharing mechanism which reduce use of system charges to suppliers. It is expected, though not guaranteed, that suppliers would pass this on to consumers. Effective benchmarking at the regulatory reviews would capture the ongoing benefits, again reducing use of system charges to suppliers.
3	When might benefits start to be realised (eg start, during or after full Smart Meter rollout)?	The benefits will start to be realised during roll-out, but probably towards the later stages as there will need to be a significant mass of meters installed before this benefit will be realised. Full benefits will not be realised until a year or more after the completion of roll out as those meters will need to have built up a reserve of historic data in order to be useful. <ul style="list-style-type: none">• Sufficient meters will need to be installed in the area being considered for reinforcement such that meeting data aggregation rules are met and provide meaningful data.• Sufficient meters will need to be installed in the area being considered for reinforcement such that smart meter data forms a meaningful part of the overall data used for reinforcement considerations.• Sufficient smart meter data history will be required to capture the critical loading periods; typically the summer minima and winter maxima, but other periods might be of interest particularly when connecting new loads.
Types of data required?		
4(i)	What type of data may be required from the Smart Meter?	<ul style="list-style-type: none">• Load maxima (import) and minima (export)• Voltage maxima and minima• Time of occurrence

		<ul style="list-style-type: none"> Voltage and current angles to allow accurate summation would be desirable to achieve full benefits
4(ii)	What granularity of Smart Meter data may be required to achieve benefits (eg substations, half hourly)?	<p>The degree of benefit will vary with the granularity of data. This varies with both granularity of time and network segmentation.</p> <p>Network segmentation</p> <ul style="list-style-type: none"> Some benefit will be achieved by HV/LV substation level data For traditional load, significant benefit will be achieved at LV feeder level for traditional load For load containing a significant mix of generation and demand, significant benefit will require the LV feeder to be segmented in a meaningful way to capture load transfers between feeder segments that do not register at the feeder outlet. For full benefit individual meter position data would be required. <p>Granularity of time</p> <ul style="list-style-type: none"> Simple annual maxima and minima will achieve some benefit Half-hourly averages would improve this Half-hourly maxima, minima and averages would improve the benefit further A granularity sufficient to allow accurate addition of the various network segments would allow full benefits to be realised. <p>Voltage and load data must be identifiable as relating to the same time or time period.</p>
4(iii)	How often do you need to receive the Smart Meter data (eg near real time, monthly, as required)	This will depend on the length of historical data available. If long histories are available then receipt as required of the specific network areas under consideration would be sufficient. If only short histories are available then regular downloads of all meter data will be required. The frequency of download required is related to the length of history available – ie if a month's history is available then monthly or fortnightly (to allow for some redundancy in the download process) would be required, whereas if the history is a year long then annual or six-monthly downloads would be acceptable.
5	What data may be required from other sources	<p>Data from half-hourly non-smart meters, DNO's SCADA systems, NGET's SCADA system and certain large customers will be required at times to make full use of the data.</p> <p>In particular monitoring actual load at HV/LV substations will be required to understand and correct for the error introduced by the smart meter data aggregation process.</p>
6	Are there barriers on accessing the desired data under the current policy?	While there are no envisaged barriers to accessing some level of benefit, the data aggregation rules are likely to prove a barrier to the highest level of benefits; the interpretation of the data aggregation rules will influence the degree of barrier to the benefits.
What processes are required?		
7	What systems (eg IT and comms) are needed to deliver these benefits?	Network Operator access to smart meter data via DCC Gateway and applications to store and manage data.
8	What relationships are required between DNOs, suppliers, consumers, others?	DNO's might require consumption data from IDNO's operating embedded LV networks.
Barriers and Enablers		

9	Are there barriers, or enablers required, in the current <u>regulatory arrangements</u> to fully realise consumer benefits?	
10	Are there barriers, or enablers required, in the <u>commercial arrangements</u> to fully realise consumer benefits?	
11	Are there any other barriers, or enablers required, outside of the regulatory and commercial arrangements (eg technical barriers) that should be considered?	Consumption data for embedded IDNO LV networks may not be available.
12	Based on your answers to 9, 10 and 11, should any of these barriers or enablers be considered now?	
Evidence of how benefits may be realised from other sources		
13	Please highlight any studies that may help inform what benefits are realised and how (e.g evidence from other countries roll out of SMs or from DNO innovation projects)	

Question	Q&A template for Smart Meter Working Group – TOR point (iii)	
	Name of benefit: Reduce Guaranteed Standards Failure Payment	
Who receives the benefit?		
1	Brief description of the benefit(s)	Availability of pinging functionality from smart meters can have a great impact in helping DNOs avoid GS failures. Pinging involves the DCC head end system checking regularly the meter energisation and communication link status. Pinging has a specific role during severe storm conditions, where last gasp functionality is less useful due to the large volume of data that is likely to be received. The basis for customer and DNO benefit from pinging functionality is that under severe storm conditions (multi outage incidents), the average duration of LV interruptions will increase in general, and for some customers may exceed 18 hours. The ability to ping meters to check their energisation status would increase the visibility of such potential GS failures, thus enabling the DNO to target their resources to help minimise the number of customers who experience interruptions of over 18 hours and hence reduce ‘Guaranteed Standard of Performance’ failures.
2(i)	Does benefit flow directly to consumers?	Benefit for consumer will be in the form of improved service and reduced volume of energy not served.
2(ii)	If 2(i) No - Who does it flow to (eg DNOs)?	DNOs will benefit financially from a small reduction in GS failures as a result of having a greater awareness of the scope of faults to ensure all customers are restored. These costs are not funded by the customer so do not offer additional benefits to the customer in the form of reduced DUOS.
2(iii)	If 2(ii) No - How do benefits flow through to consumers (eg incentive mechanisms, cost reductions)?	N/A
3	When might benefits start to be realised (eg start, during or after full Smart Meter rollout)?	Benefits from pinging functionality will emerge gradually as smart meters are being rolled out. On the basis that some of the incremental benefits of pinging functionality may be lost because of the existence of first breath functionality, and because physical or resource constraints may sometimes prevent even longer interruptions to be resolved in time, we estimate that pinging might contribute to avoid around 80% of GS failures in the future. In calculation of the overall benefit over RIIO ED1, the trend in the rollout of the domestic smart meters based on suppliers’ latest expectations needs to be followed. We expect most benefits to be realised from around 2019 once 80% of meters are installed.
Types of data required?		
4(i)	What type of data may be required from the Smart Meter?	First Breath message and Pinging functionality will be required from the meter to achieve these benefits to give the DNO information as quickly as possible about when a customer is off supply, and subsequently restored.
4(ii)	What granularity of Smart Meter data may be required to achieve benefits (eg substations, half hourly)?	Access will be required to each meter to check the energisation status to determine if it is on or off. Coordination and accuracy of data is extremely important.
4(iii)	How often do you need to receive the Smart Meter data (eg near real time, monthly, as required)	All information will be required on a near Real time basis to be meaningful.

5	What data may be required from other sources	Information directly from customers on other information such as flashes from poles or bangs is extremely helpful to identifying faults and reducing the restoration time. Data will also be required from network SCADA systems to complement the smart metering data.
6	Are there barriers on accessing the desired data under the current policy?	None that we are aware of.
What processes are required?		
7	What systems (eg IT and comms) are needed to deliver these benefits?	Current outage management systems, PowerOn, are not capable of handling SM data; they will require significant enhancement. Smart Gateway & Security – connection to DCC. Smart Meter Data Management systems (including Outage Management System modification). Network Data Store.
8	What relationships are required between DNOs, suppliers, consumers, others?	Proactive communication with customers is dependent on us having accurate and up to date contact details. DNOs rely on the Central Delivery body to ensure that customers are fully informed of the realistic capabilities of smart meters at initial rollout and the DNO requirements to use data.
Barriers and Enablers		
9	Are there barriers, or enablers required, in the current regulatory arrangements to fully realise consumer benefits?	None that we are aware of.
10	Are there barriers, or enablers required, in the commercial arrangements to fully realise consumer benefits?	Commercially, DNOs have DCC fixed costs which are unknown and unlimited. These could theoretically remove DNOs benefits if they rise.
11	Are there any other barriers, or enablers required, outside of the regulatory and commercial arrangements (eg technical barriers) that should be considered?	*Smart meter data should be of sufficient coverage and quality and should arrive in the established time frame for it to be beneficial. DNO requirements need to be perfectly mirrored in the SMETS specification and with the manufacturers to enable interaction with the smart meters in a way that allows them to utilise pinging functionality. Time stamping is included in the SMETS specification, so this should be monitored. *DNO outage management systems will need to be capable of handling the smart meter data and will require significant enhancements to be to coordinate alerts to avoid false reporting, manage scope of incident during life of incident and be able to add first breath message directly to PowerOn and avoid using the receipt time from field staff.
12	Based on your answers to 9, 10 and 11, should any of these barriers or enablers be considered now?	The charging arrangements levied by the DCC may need to be considered in the short term as they risk impacting the business case for this functionality.
Evidence of how benefits may be realised from other sources		
13	Please highlight any studies that may help inform what benefits are realised and how (e.g evidence from other countries roll out of SMs or from DNO innovation projects)	SPEN has contacted wider Iberdrola Group for evidence of benefits from Smart Meters rollout in Spain and USA. DNV study: 'KEMA DNO Reviewing Network Benefits of Smart Meter Message Flows'.

Question	Q&A template for Smart Meter Working Group – TOR point (iii)	
	Name of benefit: Reduced duration of LV interruptions / Avoided investigation costs through being able to understand the source of the fault	
Who receives the benefit?		
1	Brief description of the benefit(s)	<p>Availability of data from smart meters can be of benefit to the customer as it can improve the ability of a DNO to identify the nature and scope of incidents and reduce overall time needed to resolve the incident, primarily by reducing the detection time.</p> <p>Last Gasp functionality could provide DNOs with the data needed to carry out an initial analysis of incidents, without the need for customers calling in, allowing for faster detection of outages (assuming that communication between DCC and DNOs will be near real time).</p> <p>The time it will take to rectify the fault will stay the same and the reduction in restoration time comes from the reduced detection time. This reduction is heavily dependent on the smart meters performing to the correct specifications: last gasp message after 3 minutes.</p> <p>Customers could potentially experience an improved fault identification time of approximately 10 minutes as it reduces the need for DNOs to await customers calling to report incidents.</p> <p>Also, the number of abortive site visits that are made each year could be reduced as customer contact could be proactive to confirm that it is a supply failure rather than the customer’s equipment as calls are regularly received for problems with consumer units or meters.</p>
2(i)	Does benefit flow directly to consumers?	<p>Customers will benefit from an overall reduction in the time off supply as fault detection will be automated and faster. The time it will take to rectify the fault on site will stay the same and the reduction in restoration time comes from the reduced detection time. This reduction is heavily dependent on the smart meters performing to the correct specifications: last gasp message after 3 minutes.</p> <p>Customers could potentially experience an improved fault identification time of approximately 10 minutes as it reduces the need for DNOs to await customers calling to report incidents.</p>
2(ii)	If 2(i) No - Who does it flow to (eg DNOs)?	We do not consider there to be a material saving within this improvement other than to customer service.
2(iii)	If 2(i) No - How do benefits flow through to consumers (eg incentive mechanisms, cost reductions)?	N/A
3	When might benefits start to be realised (eg start, during or after full Smart Meter rollout)?	<p>Benefits from last gasp functionality will emerge gradually as smart meters are being rolled out.</p> <p>In calculation of the overall benefit over RII0 ED1, the trend in the rollout of the domestic smart meters based on suppliers’ latest expectations needs to be followed. The latter assumes 10% completion in 2015 and rises to 100% by 2019. On this bases and taking into account that financial benefits will be lagging the rollout, the profile of potential savings over RII0 ED1 is as follows:</p>

		RIIO ED1 Year	1	2	3	4	5	6	7	8
		Year starting	Apr-15	Apr-16	Apr-17	Apr-18	Apr-19	Apr-20	Apr-21	Apr-22
		Estimated % of domestic meters installed at year end	10%	30%	50%	80%	100%	100%	100%	100%
		Share of benefits available	0.0%	10.0%	30.0%	50.0%	80.0%	100.0%	100.0%	100.0%
		Profile of Benefits from Last Gasp Functionality for RIIO ED1								
Types of data required?										
4(i)	What type of data may be required from the Smart Meter?	Last Gasp message from Smart Meter needs to be received after 3 minutes by the DNO to allow network automation to complete it’s cycles before a formal notification is sent to the DNO. Alerts caused by the same fault may come with a time delay between them, with each alert opening a new incident in the outage management system; the coordination of all incoming alerts and managing the scope of incident life, extending outbound messaging when necessary, is needed to avoid false reporting.								
4(ii)	What granularity of Smart Meter data may be required to achieve benefits (eg substations, half hourly)?	Data will be required from every meter. Built in aggregation by the CSPs for outage alerts has been specified to prevent a major fault from creating an avalanche of alerts as any event affecting more than c.1000 customers is likely to be detected by SCADA rather than relying on smart meter alerts.								
4(iii)	How often do you need to receive the Smart Meter data (eg near real time, monthly, as required)	For Operational Systems, a real-time feed is required. If the Last Gasp from the Smart Meter is not received after 3 minutes as per DNO specifications, foreseen benefits will not be applicable. Coordination and accuracy of data is extremely important.								
5	What data may be required from other sources	Other data will be gathered from SCADA systems and network monitoring to help identify fault location. DNOs will experience a loss of incoming information directly from customers regarding fault environment (flashes, smoke, fire signs seen) which would be a traditional input from customer calls.								
6	Are there barriers on accessing the desired data under the current policy?	None that we are aware of.								
What processes are required?										
7	What systems (eg IT and comms) are needed to deliver these benefits?	Current outage management systems, PowerOn Troublecall, are not capable of handling SM data; they will require significant enhancement and processing capability. Smart Gateway & Security – connection to DCC. Smart Meter Data Management systems (including Outage Management System modification). Network Data Store.								
8	What relationships are required between DNOs, suppliers, consumers, others?	Proactive communication with customers is dependent on us having contact details. DNOs rely on the Central Delivery body to ensure that customers are fully informed of the realistic capabilities of smart meters at initial rollout and the DNO requirements to use data.								
Barriers and Enablers										

9	Are there barriers, or enablers required, in the current <u>regulatory arrangements</u> to fully realise consumer benefits?	No
10	Are there barriers, or enablers required, in the <u>commercial arrangements</u> to fully realise consumer benefits?	No
11	Are there any other barriers, or enablers required, outside of the regulatory and commercial arrangements (eg technical barriers) that should be considered?	DNO outage management systems will need to be capable of handling the smart meter data and will require significant enhancements to be to coordinate alerts to avoid false reporting, manage scope of incident during life of incident and be able to add first breath message directly to PowerOn and avoid using the receipt time from field staff.
12	Based on your answers to 9, 10 and 11, should any of these barriers or enablers be considered now?	No
Evidence of how benefits may be realised from other sources		
13	Please highlight any studies that may help inform what benefits are realised and how (e.g evidence from other countries roll out of SMs or from DNO innovation projects)	SPEN has contacted wider Iberdrola Group for evidence of benefits from Smart Meters rollout in Spain and USA. DNV study: 'KEMA DNO Reviewing Network Benefits of Smart Meter Message Flows'.

Question	Q&A template for Smart Meter Working Group – TOR point (iii)	
	Name of benefit: Management of Network Losses	
Who receives the benefit?		
1	Brief description of the benefit(s)	<p>Visibility of real power consumption across the LV network, and linking this data with LV network monitoring, will allow for more effective visibility of where losses occur to allow the tracking of technical and non-technical (including theft) losses. Visibility of this information will allow proactive measures to be taken to reduce these losses by having an improved understanding of where they occur.</p> <p>Control of load (through TOU incentives or direct control) to minimise peaks in demand will also contribute to reducing losses. High peak demand leads to higher I²R losses which is likely to require peaking plant to serve, which is generally fossil fuel based.</p> <p>ToU tariffs will be offered by Suppliers (and may, or may not, include a ToU based DUoS charge) but these are more likely to be designed to reflect time-varying energy charges (marginal costs of generation) rather than periods of high or low demand per se.</p>
2(i)	Does benefit flow directly to consumers?	<p>Losses result in additional generation being required which is funded by consumers. Thus the reduction of losses will reduce this cost which is included within consumers’ electricity bill.</p> <p>Minimising network losses will also help to reduce investment need in the network which is funded by DUoS. (though to put this into perspective, the scope for reducing losses will generally be greatly overshadowed by variations in electricity demand).</p>
2(ii)	If 2(i) No - Who does it flow to (eg DNOs)?	DNOs have a licence obligation to take steps to minimise networks losses. Reducing peak demands will also help DNOs by avoiding network investment and the consequential DUoS. (though to put this into perspective, the scope for reducing losses will generally be greatly overshadowed by variations in electricity demand).
2(iii)	If 2(i) No - How do benefits flow through to consumers (eg incentive mechanisms, cost reductions)?	N/A
3	When might benefits start to be realised (eg start, during or after full Smart Meter rollout)?	<p>Benefits are unlikely to be realised until towards the end of the roll out (2020) as complete visibility of energy consumption is required to track where losses are taking place. Without the complete rollout, it will be unclear the level of losses as not all entry and exit points will be covered.</p> <p>Extensive roll out is also required before material management of load will allow for the reduction in losses.</p>
Types of data required?		
4(i)	What type of data may be required from the Smart Meter?	<p>4-quadrant measurements (hh interval kWh & kVArh / import and export)</p> <ul style="list-style-type: none">•Maximum demand (hh avg. kW) <p>–derivation of time-series demand profiles at individual LV circuit level (by aggregation of time-synchronised MD or hh</p>

		<p>demand profiles)</p> <ul style="list-style-type: none"> –enables highly loaded (or overloaded) circuits to be identified –enables circuits with poor power factor to be identified •Half-hourly average rms voltage –derivation of LV circuit voltage at selective individual nodes enables excessive voltage regulation (suggesting high loading or poor phase balance) to be identified –helps to optimise primary substation AVC voltage set points and/or distribution transformer tap positions (reduce resistive demand and improve circuit load factor) –potential input to a localised active network management (voltage control) scheme •Consumer appliance load switching (basic level – access currently limited to Suppliers) to enable load shifting from peak demand periods and hence improve circuit load factor
4(ii)	What granularity of Smart Meter data may be required to achieve benefits (eg substations, half hourly)?	<p>Half hourly data will be required from all meters to provide a comprehensive view and track all power flows.</p> <p>For load management, communication to all meters will be required on demand.</p>
4(iii)	How often do you need to receive the Smart Meter data (eg near real time, monthly, as required)	<p>For tracking load flow, this can be undertaken retrospectively as a regular or occasional exercise rather than tracking for changes on a daily or more frequent basis. Monthly or quarterly communication of this data is likely to be sufficient for measuring and identifying the source of losses.</p> <p>For load management, real time data flows will be required to send signals to consumers to control appliances.</p>
5	What data may be required from other sources	<p>Network data at a substation level will be required to allow metering data to be reconciled and compare entry and exit points on the network.</p> <p>Information on the controllable loads at consumers disposal would also be useful (where consumers agree) to know what loads are available to control.</p>
6	Are there barriers on accessing the desired data under the current policy?	The arrangements for controlling/incentivising participation in DSM are still being developed.
What processes are required?		
7	What systems (eg IT and comms) are needed to deliver these benefits?	<p>Network monitoring to track entry and exit points on the network.</p> <p>IT systems to process and model power flows to identify losses.</p>
8	What relationships are required between DNOs, suppliers, consumers, others?	<p>Suppliers also have a vested interest in minimising losses as they carry this as an overhead. Collaboration between suppliers and DNOs is desirable to identify and take steps to mitigate non-technical losses.</p> <p>Arrangements with consumers will also be required to allow for load control.</p>
Barriers and Enablers		
9	Are there barriers, or enablers required, in the current regulatory arrangements to fully realise	No

	consumer benefits?	
10	Are there barriers, or enablers required, in the commercial arrangements to fully realise consumer benefits?	Commercially, DNOs have DCC fixed costs which are subject to change. Any change of these could negate the business case for DNOs should they rise significantly.
11	Are there any other barriers, or enablers required, outside of the regulatory and commercial arrangements (eg technical barriers) that should be considered?	<p>Comprehensive visibility of meters and network entry/exit points is required to track all power flows in order to identify losses. Processing this information will be a significant technical challenge and will require extensive modelling to accurately identify where losses are occurring.</p> <p>Availability of hh data to DNOs will be important to determining locations where higher than average network losses are occurring – ideally before the consumption data is aggregated.</p> <p>Export volumes due to G83 protection are currently estimated. In order to reconcile entry and exit volumes accurately it will be important to use actual metered export (from smart meters). Should Suppliers be required by licence to base FIT export payments on actual exported volumes, that would provide a more accurate data set for also determining losses</p>
12	Based on your answers to 9, 10 and 11, should any of these barriers or enablers be considered now?	Yes
Evidence of how benefits may be realised from other sources		
13	Please highlight any studies that may help inform what benefits are realised and how (e.g evidence from other countries roll out of SMs or from DNO innovation projects)	
Other points?		
Please feel free to add other questions and answers to this template. The questions above are not definitive and we can look to rollout any additional questions you raise to everyone's template		
14	Considerations for deriving distribution network losses using smart metering data	<p>The principle of calculating network losses is to calculate the difference between the energy fed into the network, summed from all sources, and the useful energy exiting the network, summed for all network exist points.</p> <p>Sum of network energy in-feeds – sum of outgoing energy = technical & non-technical losses</p> <p>Smart metering consumption data (described above in 4) provides additional data on the useful energy exiting the network for small customer connections and thus has the potential to improve the accuracy of such calculations.</p> <p>In order to complete such a calculation, a sampling period would need to be set, over which incoming and outgoing energy will need to be summated. This would need to be summed for all in-feeding and out-going energy sources in GWh over a pre-defined time-synchronised time period, such as quarterly in the year. Critically, all sources of data must be time-</p>

		<p>stamped in order to align the measurement periods for each sum. Any error introduced by misalignment or interpolation methods will directly introduce that error into the final calculation result.</p> <p>In order to measure and sum all of the energy fed in to the network, the following sources will need to be captured:</p> <ul style="list-style-type: none"> • The energy fed into the distribution network from the Transmission system, via the Grid supply points - This would be obtained via network measurement equipment at high relative resolution and accuracy. • The energy fed into the distribution network by distribution connected large generators (e.g. G59 connected units) - This data will typically be captured at reasonable resolution and accuracy; however, there is a large volume of such connections where the data is not currently available to the DNO. • The energy fed into the distribution network by distribution connected small scale generators (e.g. G83 connected units) - Some of these will be dedicated network connections but the vast majority will be connected within an existing load connection with the potential to export (which in the case of solar PV is likely to be significant during summer time light load periods). Where this data currently does exist it is generally not available to the DNO and there are also sites with un-metered small-scale embedded generation connections. Export data will be available following the smart metering rollout where smart meters capable of measuring import and export are installed at the point of connection with the network. There will still remain a large volume of dedicated small scale export connections where the data is not currently available to the DNO and smart metering equipment will not be targeted for installation. • Note that the current FIT default position is that G83 generators are assumed to export 50% of the electricity produced. This assumption is purely for the purposes of determining payments and in no way represents a reasonable estimate of actual energy exported which (for rooftop solar PV) will depend on the number and capacity of solar panels installed and the electricity consumed at the property. It follows that energy actually exported will vary significantly across seasons. Should Suppliers in future be obliged by licence to calculate FIT payments based on smart metered export, this would provide a data set that could be used in the calculation of losses. <p>In order to measure and sum all of the useful energy exiting the network, the following sources will need to be captured:</p> <ul style="list-style-type: none"> • The energy imported by domestic and small enterprise customers' demand – following the full scale national deployment of smart metering equipment, half-hourly resolution data will be available for a large population of these connections; however, there will still remain some number of non-smart metered customers where this resolution of data will not be available. • The energy imported by larger, non-half-hourly metered customers (e.g. profile classes 5-8) – half-hourly or greater resolution import data is not currently available to DNOs and large volumes of these customers are expected to not have smart metering equipment installed as part of the planned national deployment. • The energy imported by large industrial & commercial customers with existing half-hourly metering. This data is
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		<p>currently available to the DNO via the existing settlement data flows.</p> <ul style="list-style-type: none"> • The energy imported by un-metered supplies such as street lighting and public street furniture which relies on estimated consumption based on local street lighting authority or Highways Agency equipment inventories – there is no actual recorded consumption data for these connections and there are no plans to introduce further monitoring or metering. <p>Some additional caveats in completing such a calculation are listed below; however the primary point to note is that any source of in-feed or outgoing energy with missing, aggregate, or assumed data must be corrected for in some way, through estimation or other means, and the degree of likely error introduced should be understood.</p> <p>Other points to consider:</p> <ul style="list-style-type: none"> • Due to the relative magnitudes of the summed in-fed and outgoing energy and the comparatively small magnitude of the incurred losses, any limitations on data availability will have a significant impact on accuracy which should be fully understood • All metering and measurement data is subject to equipment accuracy limitations • Smart metering equipment and associated communications devices also consume energy in their operation • Finally, the value of losses resulting from this calculation will be the aggregate value across: <ul style="list-style-type: none"> ○ The time period of the sample ○ Technical and non-technical losses <p>All three phases and all network assets</p>
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Question	Q&A template for Smart Meter Working Group – TOR point (iii)	
	Name of benefit: Use of SM load control switches to mitigate the need for global demand control actions under ESEC and potentially Grid Code OC6.	
	MORE DETAILED INFORMATION ON THIS CAN BE FOUND IN THE NOTE – ‘TOR (V): LOAD CONTROL’ PRODUCED BY THE SMSG	
Who receives the benefit?		
1	Brief description of the benefit(s)	Smart Meters equipped with load control switches or auxiliary load control switches could be utilised to bring about a significant reduction in system demand under emergency network conditions. Under ESEC the SO may require DNOs to apply global demand reductions which are implemented via voltage reduction and then rota disconnection. The need for, frequency of and level of demand disconnection could be reduced over peak demand periods by use of the SM load control switches to reduce related demand as a pre-cursor to actual demand disconnection. The demand control action could be provided by allowing the SO access to the necessary data flows or via an ESEC obligation on suppliers or via the DNOs
2(i)	Does benefit flow directly to consumers?	Yes the number of customers subject to disconnection in such situations would be reduced. This benefit may be significant during future years when the penetration of electric heat has increased.
2(ii)	If 2(i) No - Who does it flow to (eg DNOs)?	N/A
2(iii)	If 2(i) No - How do benefits flow through to consumers (eg incentive mechanisms, cost reductions)?	N/A
3	When might benefits start to be realised (eg start, during or after full Smart Meter rollout)?	Benefits could emerge progressively as SM s are rolled out but will increase in proportion to the level of peak demand connected to load control switches.
Types of data required?		
4(i)	What type of data may be required from the Smart Meter?	To utilise the benefit reliably it would be necessary to have knowledge of the size of demand under load control switch control.
4(ii)	What granularity of Smart Meter data may be required to achieve benefits (eg substations, half hourly)?	Time and size of controllable demand over peak period
4(iii)	How often do you need to receive the Smart Meter data (eg near real time, monthly, as required)	Only on activation of ESEC – vey low frequency and could be provided by a supplier data flow and arguably could be to the SO not the host DNO.
5	What data may be required from other sources	N/A
6	Are there barriers on accessing the desired data	ESEC does not envisage such use of smart meter demand controls. This could be changed to place the obligation on

	under the current policy?	suppliers or enabled via the DNO or direct by the SO. A legal review of the application of ESEC would be required as existing powers may permit such use.
What processes are required?		
7	What systems (eg IT and comms) are needed to deliver these benefits?	Smart Gateway & Security – connection to DCC. Appropriate mass transmit applications and Network Data Store to hold anticipated demand levels.
8	What relationships are required between DNOs, suppliers, consumers, others?	The form of ESEC communications would need to be modified to take account of such usage. Proactive communication with customers would be via ENA web site and mass media communications.
Barriers and Enablers		
9	Are there barriers, or enablers required, in the current <u>regulatory arrangements</u> to fully realise consumer benefits?	ESEC
10	Are there barriers, or enablers required, in the <u>commercial arrangements</u> to fully realise consumer benefits?	If implement via ESEC no as activation suspends industry commercial arrangements
11	Are there any other barriers, or enablers required, outside of the regulatory and commercial arrangements (eg technical barriers) that should be considered?	The level and latency of such demand control would need to be understood by the SO so as to avoid excessive demand reduction.
12	Based on your answers to 9, 10 and 11, should any of these barriers or enablers be considered now?	Yes
Evidence of how benefits may be realised from other sources		
13	Please highlight any studies that may help inform what benefits are realised and how (e.g evidence from other countries roll out of SMs or from DNO innovation projects)	It is thought that emergency demand control is used in other countries but a search has not yet been completed. Action ENA.

Question	Q&A template for Smart Meter Working Group – TOR point (iii)	
	Name of benefit: Use of SM demand control to mitigate the number of customers remaining off supply during network fault events.	
	MORE DETAILED INFORMATION ON THIS CAN BE FOUND IN THE NOTE – ‘TOR (V): LOAD CONTROL’ PRODUCED BY THE SMSG	
Who receives the benefit?		
1	Brief description of the benefit(s)	Smart Meters equipped with load control switches or auxiliary load control switches could be utilised to bring about a reduction in network demand under emergency network conditions. During periods of severe network depletion N-2 etc, the NO may be unable to restore all customer supplies from the remaining network infrastructure. The ability to disconnect load under SM load control switch could; dependent upon the time of day and associated loading conditions, enable the DNO to restore more customer supplies hence potentially reducing CMLs and potential GS failures.
2(i)	Does benefit flow directly to consumers?	Yes in part
2(ii)	If 2(i) No - Who does it flow to (eg DNOs)?	In part to DNO through reduction ion CMLs
2(iii)	If 2(i) No - How do benefits flow through to consumers (eg incentive mechanisms, cost reductions)?	N/A
3	When might benefits start to be realised (eg start, during or after full Smart Meter rollout)?	Benefits could emerge progressively as SM s are rolled out.
Types of data required?		
4(i)	What type of data may be required from the Smart Meter?	To utilise the benefit reliably it would be necessary to have knowledge of the size of demand under load control switch control.
4(ii)	What granularity of Smart Meter data may be required to achieve benefits (eg substations, half hourly)?	Time and size of controllable demand on the load switch – it is not known if this is separately available?
4(iii)	How often do you need to receive the Smart Meter data (eg near real time, monthly, as required)	Very infrequently as n-2 events are extremely rare but during the event the data would be needed quickly – 30 minutes maximum latency
5	What data may be required from other sources	N/A
6	Are there barriers on accessing the desired data under the current policy?	DNO has no control of load switch or visibility of controlled demand
What processes are required?		
7	What systems (eg IT and comms) are needed to deliver these benefits?	Smart Gateway & Security – connection to DCC.
8	What relationships are required between DNOs, suppliers, consumers, others?	tbc

Barriers and Enablers		
9	Are there barriers, or enablers required, in the current <u>regulatory arrangements</u> to fully realise consumer benefits?	DNO access to load switch or suitable arrangements with suppliers
10	Are there barriers, or enablers required, in the <u>commercial arrangements</u> to fully realise consumer benefits?	Could be implemented via bilateral with supplier however such situations are extremely dynamic and this may be unworkable technically within the required timescales.
11	Are there any other barriers, or enablers required, outside of the regulatory and commercial arrangements (eg technical barriers) that should be considered?	No
12	Based on your answers to 9, 10 and 11, should any of these barriers or enablers be considered now?	Yes
Evidence of how benefits may be realised from other sources		
13	Please highlight any studies that may help inform what benefits are realised and how (e.g evidence from other countries roll out of SMs or from DNO innovation projects)	N/A