Sub Group 1:- Meter Data Storage

Short Description – A short paper to assess the materiality of the storage of 13 months of HH consumption data stored locally within the Smart Metering System.

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Options Paper

Introduction

There is a requirement for SMART metering system to store historical data in the electricity meter / on the gas mirror / as part of the HAN to enable the IHD to recover it for display of consumption data, credit (or bill) status, to act as a source for the host Supplier / Network operator and to be able to retrieve data via DCC. In addition, customers may see benefit in the ability to extract their individual consumption (the actually measurement quantities, means and mechanism still to be decided) data to enable external comparison over time and to enable potential take up of energy analysis, products and services. This paper incorporates the views of the SMDG Sub Group 1 expressed to date.
The purpose of this paper is to assess the materiality of a request from Consumer representatives that 13 months of consumption data be stored locally in the Smart Meter System so that it can be accessed by consumers directly without involving the DCC / Supplier / Network Operator.

Options

The following options have been discussed and agreed within the SG 1 Group. All options are supported by separate worksheets (Microsoft XL attachment). It has been assumed that the following options include a 10% uplift to deal with logs, configuration, etc that have not yet been defined in detail.

- **Option 1 Simple Tariff excluding price (Baseline in line with SRSM ERA SPEC)**

The baseline option 1 includes for;

- 3 months of Import HH kWh electricity consumption data and 6 months worth of gas consumption (M3) data stored locally for the consumers use. Note the gas data includes some headroom for other data requirements.
- 2 rate simple static electricity tariff.

Electricity	19 kBytes (active channels per element)
Gas	42 kBytes
Total	61 kBytes

Note: Figures rounded

- **Option 2 (All of option 1 with the addition of 13 months of Import kWh HH data and 13 months of Gas data and Network data)**

Option 2 includes for;

- This option increases the data stored locally for consumers use to 13 months – but is limited to import kWh for electricity and gas.
- Electricity network data based on 3 months of Import/Export HH kWh, 3 months of Import/Export HH kVArh, 3 months of microgen data, voltage,

From attached analysis it can be derived that this would amount to;

Electricity	199 kBytes
Gas	87 kBytes
Total	286 kBytes

Note: Figures rounded

- **Option 3 (future proof case, all of options 1&2 with 13 months of Gas data and Complex tariff and price allowances)**

This option provides for 13 months of consumer data stored locally including all the potential data streams e.g. import / export kWh / kVArh including one microgeneration, together with the associated potentially complex tariffs. Options should also include some additional gas data memory to support data analytics that could be beneficial for some consumers in the future. E.g. collection of 1 month of 6 minute data to support analysis of appliance performance. Note; long periods of such data collection and transmission on the network could have some impact on the projected battery life, the costs of which are outside the scope of this paper. The purpose of this option is to establish an upper boundary to the storage requirements. From analysis it can be derived that this would amount to;

Electricity	1.52 MBytes
Gas	286 kBytes
Total	1.8 Mbytes

Note: Figures rounded

- **Han Speed Transfer Rates (reference SGBI & COTE representatives)**

Data stored within meters can only be extracted via the HAN interface for display on the IHD or for forwarding to back end systems. The time taken will be determined by the network bandwidth and by operating standards. Low Power Radio (LPR) networks are governed by the IEEE 802 family of standards, 802.15.4 applies to sensor networks operating on the Industrial Scientific & Medical (ISM) band – these include ZigBee, Z-Wave, Wireless M-Bus and proprietary LPR solutions. Additionally, data could be extracted via the meter's OPTO port or a Universal Serial Bus USB port if fitted.
The table below shows typical transfer speeds for 1MByte for the most popular ISM band technologies together with FLAG optical port (IEC62056-21) at 9600 baud and USB for comparison purposes

ZigBee (2.4Mhtz)	1 MByte	16 hrs
IEEE 802.15.4 (868Mhtz) Inc Z-wave	1 MByte	28 hrs
FLAG (9600baud)	1 MByte	27 min
USB	1 MByte	½ sec

ZigBee also has a fast polling method which can be used for smaller volumes of data for up to 15 minutes. E.g. this should be able to transfer 64kBytes in 8-10 minutes and 128 kBytes in 16-20 minutes. However, transfers for data beyond the 15 minutes are recommended to be at the standard polling rate to ensure this does not compromise other ZigBee devices. Further details in Appendix 1.
Using these transfer rates for consumer data (HH consumption only kWh electricity / M3 gas) over a ZigBee HAN would result in the following;:

- Option 1 - 3 months HH data for 1 fuel one "hop" over the HAN (e.g. WAN Hub to consumers bridging device e.g. home PC) < 5 minutes
- Option 2 – 13 months HH data for 1 fuel over 1 "hop" of the HAN (e.g. WAN Hub to consumers bridging device (e.g. Home PC) in 12-15 minutes. Dual Fuel 13 month data would double this.

Dual fuel multi-hop transfers (e.g. meters to WAN Hub to consumer bridging device) could take over 1 hour, depending on gaps between the high data rate transfer periods.
Note; currently it is not clear where in the smart metering system the data should be stored or how the consumer is likely to want to extract the granular HH data.

- **Security**

There are a number of security questions that need to be considered surrounding privacy around display and utilisation of price/balance information. It is assumed that the HAN will carry data from any peripheral component to the meter.

Further security requirements for data storage at local level would include; (ref BGas)

- Sign meter measurement data (reading validation)
- Use of secure storage for keys
- Use DLMS low-security with robust passwords
- Use firmware signing and version control

The group do not believe that there should be restrictions on customers accessing their own data, in whatever format the meets the customer's expectations, but the way in which data is accessed securely requires further consideration – e.g. whether data is made available at the IHD; the meter; some alternative location within the SMS or via the secure web services and potentially whether access is facilitated by the DCC. However, in line with data protection principles, once a Supplier/Customer obtains and processes the data, it becomes data controlled by the Supplier/Customer and therefore subject to the rights and restrictions of the Data Protection Act.

- **Cost Implications (reference BEAMA paper)**

It is not solely the storage of data that is in question. It is also the circuitry surrounding and processing of the stored data required to enable extraction and presentation of the data in a form that is understood by the viewer or receiver of the data.
Manufacturers would suggest that 1Mb of additional storage to provide for the information requested would increase the cost of meters, over and above the £43 per electricity meter or £56 Gas meter stated in the last issued IA, by approx. £1 per meter for mains powered meters. Further explanation on the costs and issues of memory expansion in metering devices is included in Appendix 2.

- **Issues**

  - Data stored on the meter in the event of a change of Supplier – what rules should be in place for a new supplier gaining access to the data. This needs consideration with MID storage requirements in meters to support billing disputes and consumer privacy.

  - It will probably be cost effective to minimise the memory expansion on the gas meter and include additional historic gas data instead on the WAN Hub. This is mains powered and is likely to be buffering the gas data anyway, both for head end and IHD access.

  - Group needs to decide the levels of block tariff arrangement to be catered for, are 8X8 tariffs reasonable? Note no sizing assessment has been carried out on this option

- Consideration that there may be a call upon the gross generation for any embedded generation to be stored in a mirror in similar fashion to the Gas metering data. With the mirror holding tariff and price information.
- The actual means and methods by which the customer will extract or access data from the Smart Metering System e.g. flag port, USB, Web etc has still to be debated.

Recommendations

It can be seen within the options there is 109kBytes of a difference between the baseline (177kBytes) and the provision of 13 months kWh data (286kBytes). Option 3 would be the future proof scenario and provides Customers/Suppliers with a longer term vision of where SMART metering system functional capabilities and complex tariffs may stretch over time, thus preventing shortening of lifespan necessitating replacement in order to increase memory. An important consideration will be not to prejudice customers and their ability to benefit from further added functionality.

It must be recognised that data can reside elsewhere within the SMS resulting in reduced meter storage capacity, in this case then consideration should be given to storing customer data elsewhere, although this merely moves the cost to another component/device. For the gas meter data the additional memory costs could be reduced by including the memory on the WAN Hub and this will also improve access speeds whether the data is required via the HAN or routed to the internet via the DCC.

Summary

The Groups recommendation seeking endorsement from the SMDG Expert Group is that to accommodate customers and stakeholder needs the group would recommend additional storage within the smart metering system to an additional capacity of 1M Byte on the basis that this meets the Consumers requirements and provides some degree of future proofing. At this time the cost impact on the Smart Metering System would be in the order of £1.00 for the WAN Hub and possibly an additional £1.00 for the electricity meter if the electricity meter historic data cannot also be stored on the WAN Hub. This assumes that additional memory is not required for the gas meter beyond that assumed in the impact assessment based on the SRSM ERA specification.

The data transfer rates applicable to Option 1 - 3 months HH data for 1 fuel one "hop" over the HAN (e.g. WAN Hub to consumers bridging device e.g. home PC) would be < 5 minutes with Option 2 – 13 months HH data for 1 fuel over 1 "hop" of the HAN (e.g. WAN Hub to consumers bridging device (e.g. Home PC) within 12-15 minutes. Dual Fuel 13 month data would double this.

At this point the group have not costed any methods associated with the extraction of customer data from meters or smart metering components and consideration should be given as to whether access and the storage of data is facilitated via the DCC.

It is highlighted at this point that the original memory capacity within the £43 electricity and £56 gas meters will not have enough memory to deliver the Smart Design requirements. Should this recommendation not be accepted the smart metering system will not be in a position to deliver all customer, network and Supplier requirements. The additional costs in this paper are viewed as those solely due to the enhanced data storage requirements beyond the functionality assumed within the original impact assessment. This paper does not comment on the accuracy of the original impact assessment

Appendix 1

HAN speed assessment to support location of 13 month data requirement
Assumptions

- This is intended to inform SG1 on the order of magnitude for potential delays in transferring volumes of meter data to the hub/other devices via existing HAN / wireless metering technology.
- This is NOT intended as a ZigBee versus Wireless M-Bus comparison,
- Timings are based on 64Kbytes, 128Kbytes to support the memory sizing work for the 12/13months data being done by others.
- Wireless M-Bus (868MHz) and ZigBee (2.4GHz)
- Wireless M-Bus duty cycle constraint of 1% assumed to apply to short data transmissions.
- Subject to verification by other HAN experts

Estimates

Technology	**Transfer type**	**64Kbyte xfer**	**128Kbyte xfer**
ZigBee	Fast Poll	8-10 mins	16-20 mins
ZigBee	Normal	60-65mins	120-130 mins
Wireless M-Bus	1% duty cycle	16-18mins	32-36 mins

ZigBee has similar timings for Over The Air firmware upgrades from the hub to the meter as for fast poll above. There are limits to the maximum time for fast-polling.
Wireless M-Bus transfers can be quicker but will require tighter definition for large data transfers. Currently the maximum duty cycle is for an average of 1%. However the time period for the "average" is not defined.
If this could be 5% for short periods and 1% over longer periods the 64kByte time could come down to < 4 minutes.
Wireless M-Bus transfers are asymmetric, i.e. transfers from the meter are faster than transfers to the meter, so this data should be revisited for transfers to the meter e.g. OTA upgrades.

Appendix 2

Factors effecting memory costs within embedded metering products

Meter manufacturer members of BEAMA and SBGI do not believe comparisons with SD card GByte memory devices are a suitable price reference point for memory costs in meters. The following points support this view;

- Typically SD card technology is not built for the reliability required on metering products with a 15 year+ design life. SD Card technology also requires additional supporting circuitry on the main product which again is not included on metering devices currently.
- Most metering implementations today use micro-controllers with on chip memory for programme, non- volatile and temporary data storage. It is likely that, in many designs, requirements for 12 months+ HH data will cross a threshold requiring upgrades to a higher processor family or inclusion of additional circuitry to support external memory chips. Therefore the cost increment is not simply the memory chip itself.
- For gas meters such a requirement would typically be an upgrade to external serial EEPROM devices (e.g. 128Kbytes) to minimise additional circuitry and battery power drain. Mains powered devices (e.g. electricity meter and WAN Hub) are better placed to support external addressable memory.

The assessment by BEAMA members is that external memory of up to 1 MByte non-volatile memory could be included at an indicative incremental cost of £1.
Given the access response and the additional memory cost on a "sleepy" battery powered gas meter it is recommended that the historic gas data is buffered on the WAN Hub.