

Introduction: Publication of British Gas functional specification

British Gas has today announced the publication of its specification of requirements for electricity and gas smart meters.

We think this is a helpful step forward in accelerating smart metering in the UK, bringing forward customer and environmental benefits.

The specification has been designed to align with industry requirements by following the high level requirements in the DECC December 2nd 2009 document (A to H requirements) and the collaborative work undertaken by suppliers over the last three years, under the auspices of the Energy Retail Association. British Gas has advanced the process by taking these common requirements to a level of detail that enables the design and manufacture of smart meters to progress. Meter manufacturers and other suppliers are free to use this specification for their own purposes.

British Gas has been running smart meter trials for several years but has been unable to procure a metering system suitable for larger scale trialling. Having developed our specification, we will soon have a fully-specified meter that will be available for UK customers.

We are very happy to share our rationale for any aspect of the specification. Furthermore, with industry bodies, we will arrange a technical forum where suppliers, manufacturers and key stakeholders can ask questions of our technical team.

The British Gas specification is broken down into 5 documents:

- Part 1: General System Architecture
- Part 2: Gas Meter
- Part 3: Electricity Meter
- Part 4: Telecommunications Hub
- Part 5: In Home Display

These documents make up a commercial product specification that meter manufacturers can use to produce technical specifications.

The scope of the specification is for dual fuel (electricity and gas) metering systems for domestic customers, and includes the provision of an In Home Display (IHD). The specification is 'UK requirements' (DECC and ERA SRSM) compliant, and incorporates our understanding of likely ENA (Electricity Networks Association) future requirements. As industry plans are not fully developed today we have developed this specification so that it can adapt to future requirements:

- GPRS communication means that the whole firmware stack on both meters can be re-written, allowing security and encryption standards (for example) to be upgraded and maintained
- Alerts and alarms can be reconfigured in the market to support future grid management
- Customer rules controlling supply interruption and the management of prepayment are also configurable

Our tariff structure has been specified to support future tariff development. We will not implement the full structure on day 1 but have the ability to remotely upgrade the meters as needed.

Smart Metering – Outline Specification Summary

Architecture

The general system architecture is as follows:

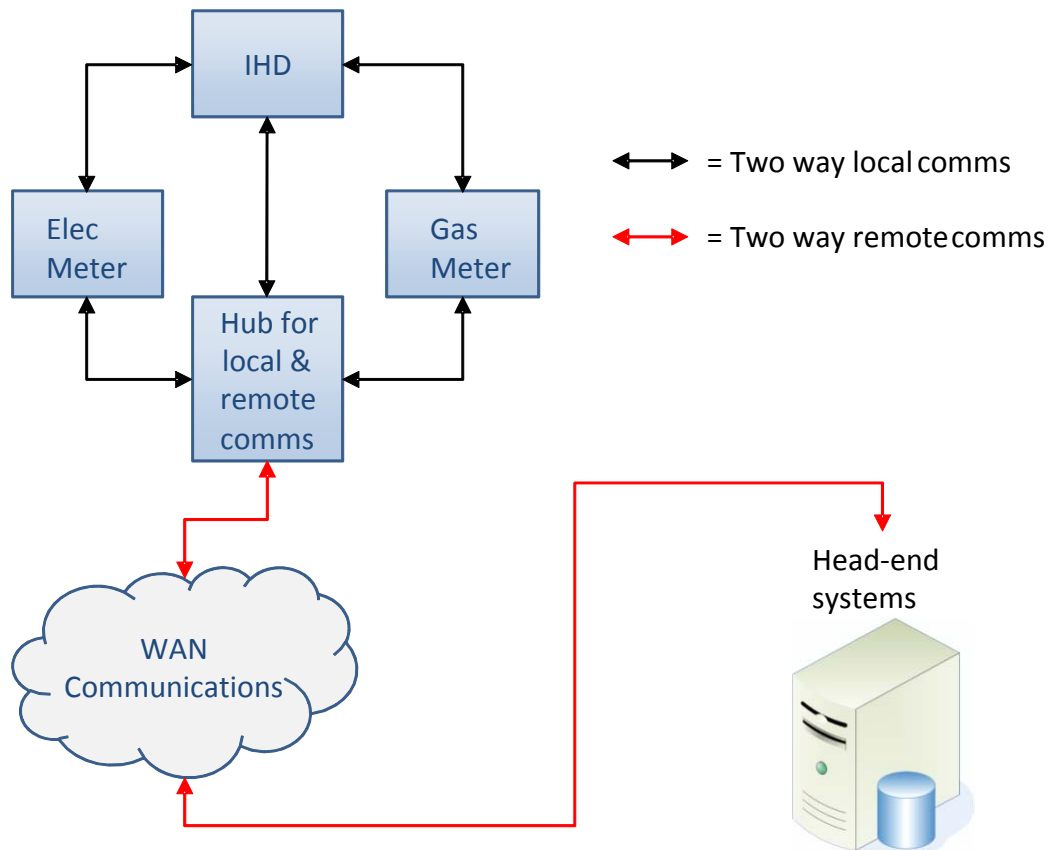


Figure 1: General System Architecture

The in-home system architecture has 4 main components:

1. Gas Meter
2. Electricity Meter
3. Telecommunications Hub (comms hub)
4. In home display unit (IHD)

The Head End system is the interface between the smart metering set and the British Gas back-end system.

These components can be communicated with remotely (over the air) via a GPRS modem, which is similar to that in a mobile phone. This communication allows British Gas (or other suppliers) to read meters, update information held on them, and also send messages. The meters and IHD 'talk' to the comms hub via low power radio (2.4 GHz Zigbee) and the hub 'talks' to the British Gas Head End system via GPRS.

For customers, a smart meter set will mean accurate billing, flexible payment options (monthly, quarterly, pay as you go), and an IHD unit. This unit will show customers the amount of energy they are using, and how much it is costing them.

This metering arrangement is different from current smart metering systems as the comms hub is an independent component, and is not integrated into the electricity meter. This gives the assurance that if a different technology is required for WAN communications, this component can be exchanged without changing the meters. In addition, having this component as a separate device will allow for interoperability by having two energy suppliers directed to their meters respectively. Where this component shall be wired has not been confirmed, but the British Gas preference is upstream of the electricity meter.

The meters can operate in both credit and pay as you go (PAYG) modes, and can be remotely switched between modes without the need for a site visit.

The metering system has been designed so that the functionality is rich at the meter – this is to ensure that on loss of comms, the meter can still maintain all tariff and display ability and operate in PAYG mode. The PAYG functionality will enable mobile and online top up via central systems. The meter system will therefore give a real-time and reasonably accurate view of consumption in both kWh and £, including real-time reduction of credit balances. Having rich functionality at the meter will also have the added benefit of reducing the comms cost per meter.

Tariffs

The metering system has been built to accommodate future tariff developments, since all tariff information is loaded onto the metering set. Given that the meters will have a design life of up to 15 years, the registers on the meter will need to support all the existing tariffs we have today, and also be flexible enough to support unknown tariffs of the future.

British Gas will use these to tailor advanced tariffs for customers. There are currently two main concepts, time of use (ToU) and tiers/blocks.

A ToU meter has different registers active for different times of the day (i.e. consumption at active times will clock up consumption against that particular register). Each ToU register will have a price rate associated with it (i.e. the consumption registered against a ToU register will have a £ per kWh value). Current meters (such as the Economy 7 meter) have up to 2 ToU registers. One is active during the daytime, and the other is active at night time. The meter can have up to 48 ToU registers, giving full flexibility for future tariff creation.

A tier or block is a threshold rule that can be applied to a meter. When consuming in a tier, there is an associated rate that is active during consumption, and this will be the case until the consumption reaches the threshold value contained in the rule. Once this has been passed, consumption is recorded against the second tier. The meter can have up to 8 tiers, and will combine this with 8 ToU registers giving a tariff structure of 8 x 8.

The meters will be capable of supporting either an 8x8 (ToU against Tiers/blocks) or 48x1 ToU registers - this functionality is more than we want today, and British Gas will not deploy the capability until needed.

The 48x1 structure gives us the ability in the current regulatory environment to deliver a cost pass through tariff that aligns with our current energy purchasing activities. However, we also expect industry change to allow billing to be done using logical register reads, which will give much more tariff flexibility in the future.

Interruption and Reconnection

The meter set will be capable of remote interruption (in addition to interruption when running out of credit) and also remote reconnection. The meter set will use an interlock system that will require a manual button press to reconnect the supply after interruption, as British Gas believe this is the only way to allow interruption and reconnection to occur safely. Note that the manual button will not have to be pushed to restore electricity supply after a power failure.

Gas Meter

The gas meter will look much like current gas meters installed in UK homes. They will measure the volume of gas that passes through them (in m³) and convert this reading into an energy value (as customers are billed by the amount of energy used).



Figure 2: Smart Gas Meter

The gas meter can be either an ultrasonic or diaphragm meter, provided there is a means for interruption. We intend the module to be battery powered, logging reads every 30 minutes to conserve battery life. The operational life of this meter is expected to be 10 years before needing battery replacement. There will be alerts to notify British Gas when the battery is running low so that replacements can be scheduled. The gas meter will have a configurable calorific value and will support complex tariffs (8x8 and 48x1).

Electricity Meter



Figure 3: Smart Electricity Meter

The electricity meter will support both import and export measurement. This will enable the meter set to support Feed in Tariffs (FIT) and additionally, generation meters can be connected to the HAN. The meter will use 4 quadrant measurement and the configurable alerts can be used to support DNO requirements for smart grid development. The electricity meter supports complex tariffs (8x8 and 48x1) and will support 'critical peak pricing' events that can help reduce peak demand.

Critical peak pricing events are optional events that can be accepted or rejected locally at the meter system. The event will occur at a time of peak demand (only for short time periods) and will be at an elevated rate to encourage customers to turn off appliances at that time.

The electricity meter will have the ability to apply load limiting and load switching using an auxiliary control. A limit is set on the meter for consumption, and once that value has been exceeded, a disconnection is carried out. This can be configurable locally within the home or centrally. Customers will have the option of configuring an audible alarm to warn their consumption is nearing their load limit.

Telecommunications Hub (comms hub)

Wide Area Network (WAN): The comms hub will connect to the Head End System over the WAN via GPRS, and will use DLMS communication protocols. DLMS is a well developed open standard with tight security standards that can be adopted by other suppliers. The comms hub uses roaming SIMs to maximise coverage.

Home Area Network (HAN): The comms unit will set up a HAN using low power radio (Zigbee 2.4 GHz). While 2.4GHz is untested for this application, British Gas believes it will be sufficient for most UK homes. The standard can be readily extended to support other devices and appliances. Zigbee supports over the air upgrade and anticipates the move to IP networking, which British Gas will support. Zigbee has been selected as it is a secure and open standard, and is currently seeking UK/EC approval. We anticipate that Zigbee may not be suitable for all homes, and that developments or other methods may be needed to establish a HAN .

Over the air (OTA) firmware upgrades: The meter set will be able to upgrade the firmware held in the meters, comms hub, and IHD remotely. This firmware (software) controls the application that is contained on each device. A firmware upgrade involves downloading new firmware, and then on successful completion of the download, the new firmware is appointed. A firmware upgrade will not change the metrology of the meters.

In Home Display Unit

Each smart metering system will be installed with an IHD to give every customer the benefits of having sight of energy consumption and associated cost.



Figure 4: In Home Display (IHD) Unit

The IHD will show customers their current and previous energy consumption profiles. It will show estimated bills, and additional information for PAYG. The IHD will show the status of the interrupt devices, and additionally will show the customer what debt, if any, is outstanding.

The IHD will also display what mode the meter is in, the status of the interrupt device, if the electricity meter is exporting energy, the carbon emissions for the property, and much more.

Security and data security

All data transactions are encrypted, and can only be accessed by authorised personnel. The smart metering system has been set up so that even with loss of communication, continuity of supply will be ensured. British Gas will not disclose personal data to any third party without the consent of the customer. Open standard protocols of encryption have been used throughout the smart metering system, ensuring that customer and supplier data is secure at all times.

Modes of payment

The smart meter will normally operate in one of two modes, credit or PAYG. In credit, the billing is calculated at the end of the billing cycle by the British Gas billing system (based on consumption during that billing period, calculated using remotely collected reads). PAYG is based on up front payment (or credit) that is added to meters, and during consumption, the balance reduces based on the rate register currently active.

PAYG mode

The smart PAYG option allows customers to top up credit levels on meters without having to take a key or card to a retail outlet. The top up can be completed over the phone, mobile, or online, with credit remotely added to the meter. When the customer's credit is running low, the IHD will display a warning message informing that they should top up soon. When the credit is about to run out, another warning will be issued, with the option to accept emergency credit. If emergency credit is not accepted, nor credit added, the meter will interrupt the supply. The normal non-interrupt rules apply to the smart metering system; e.g. if credit runs out in the middle of the night supply will not be interrupted, the customer will be able to top up in the morning.

If the meter has interrupted the supply, and then credit is added, the meter will 're-arm' itself ready for when the customer wants the supply to be reconnected. If the WAN connection has failed, a vend code can still be manually entered onto the meter to add credit.

If a customer has debt, the smart metering system will allow them to monitor their outstanding debt, when debts are recovered (e.g. Weekly at a certain time), and present this data on the IHD.

Credit mode

Credit mode is where payments are made after consumption. The remote collection of meter reads ensures that each bill is accurate, and therefore whether the customer wants to pay their bill monthly, or quarterly, they can keep on top of their consumption. The IHD will show consumption profiles, and for the first time, credit customers will have a true and accurate view of the costs incurred as a result of energy consumption.