GAS SMART METERING SYSTEM

MARCOGAZ/FACOGAZ POSITION PAPER

FINAL

1. Introduction

Marcogaz Members representing more than 100 million installed domestic gas meter in Europe owned by Distribution System Operators and Meters Operators and Facogaz Members representing more than 90% of the gas meters manufactured in Europe are participating in the European debate considering the introduction of the gas smart metering system.

A policy concerning energy is under development in Europe. The main objectives of interest to gas industry and consumers are:

- energy efficiency and hence the consequential reduction of CO_2;
- competition for energy commercialization;
- distribution cost control;
- consumer protection and pricing transparency;
- improvements in customer service.

In order to support these policies, stakeholders are considering the development of new procedures and tools. One of these is the concept of a “Smart Meter”.

This paper gives the Marcogaz and Facogaz position on smart metering to residential consumers supplied by gas from the distribution grids.

We want also to ensure that additional functions to a gas meter do not prohibit the free movement of gas meters.

Although this paper concentrates on the issues associated with a gas meter it does consider its electrical equivalent and why there may be differences in the functionality required.

In writing this paper we want to make a positive contribution to introduction of smart metering and to ensure that all players are aligned to provide benefit to all stakeholders.

2. Comparison between gas and electricity systems and their impact on the Smart Metering concept

Gas networks store huge amounts of energy and therefore react slowly over time to changes in demand.

However electricity networks require real-time responses to changes in demand as electricity cannot be stored. Therefore there is great benefit for the electricity industry to use tariffs to reduce peak demand whereas for gas this opportunity is not foreseen.

The type of gas appliance is limited to mainly cooking, heating and hot water, which provide for fundamental human needs, whereas the multiplicity of electrical appliances could lead to complex optimization by customers of their electricity consumption.

As gas appliances tend to provide for basic needs (minimum ambient temperature, minimum water temperature and hot food), there is limited scope to reduce energy consumption because any reduction depends on the installed appliance's efficiency and the level of insulation in the home. There are many factors where the consumer has no short term influence (external environment such as a long cold winter, damp atmosphere…).

As most of gas systems react slowly to changes in operation, the consumer may not see instantaneous changes to the operations of their appliances, whereas the immediate response of electrical appliances would provide instantaneous information that could help the customer to rationalise their electricity consumption.

Therefore opportunities and benefits for smart metering systems are different for gas and electricity.

3. What is a Gas Smart Metering System?

There is no generally common accepted definition for a smart meter.

In terms of guiding principles, any smart metering system should be based on:

- helping the end user to manage its gas consumption by providing better quality information;
- facilitating the end users to switch energy suppliers;
- offering the right balance between cost and additional functionalities.

4. Possible additional functionalities

Marcogaz and Facogaz believe there are three main areas of possible additional functions to the gas meter:

- remote index reading to allow more frequent index reading;
- delivery and receiving of information, to facilitate the customer to reduce their energy consumption and manage their energy cost;
- consumer supply management (Switching, prepayment, shut-off valve…).

Additional functions are allowed by the 2004/22/EC directive (MID) but they shall not influence the metrological characteristics of the measuring instrument.

Note: Temperature compensation and volume conversion devices are covered by MI-002 of the MID and therefore not deemed as an additional function.

For residential use, the consumption is measured in volume, but the bill is given in energy units, taking into account the volume measured by the gas meter, the gas temperature,

gas pressure and the gas composition/calorific value of the gas. Currently there are no residential meters where the measurement result is given in energy.

5. What are the benefits of a Smart Metering System?

5.1. In order to understand what functionality is required from a smart meter it is necessary to understand how it may provide benefits.

5.2. The energy suppliers are looking for a system which:

- could help them differentiate their service from the services of other suppliers;
- is easy to customize;
- gives reliable results;
- gives accessible information to the customer;
- will allow the parameters to be easily changed, e.g. prepayment to credit switching, manage debt more effectively, etc.;
- will have no major adverse impact on distribution/metering charges.

5.3. The network/meter operators are looking for a standard and durable solution which should last at least 15 to 20 years with minimum maintenance and where the investment is guaranteed for the long term.

5.4. The end users are interested in:

- accurate billing;
- low prices;
- ease of supplier switching;
- minimum visits to their premises;
- systems that help them with their energy consumption management;
- systems which are easy to use;
- additional services that could be offered (offers, weather forecast…).

6. Current situation in residential gas metering

6.1. The traditional technology for residential gas meters has been available for a long time (>150 years) and is based on the measurement of the volume passing through the meter. This measurement technology is purely mechanical and does not need any external power source to function. The lifetime of these meters are 20 years or more and they do not require any maintenance.

6.2. Many improvements to this technology have been made but mainly on production capability, materials and dimensions of the meters.

Some of the recent residential meters are fitted with a contact that can be used for transmitting an electrical pulse output which is proportional to the volume of gas

passed through the meter. In order to use these pulses, additional electrical powered equipment is required which has to respect the electrical safety requirements. Meters fitted with pulse outputs allow remote meter reading either with a walk-by reading system or by a global one-way automatic meter reading system.

6.3. In a few Countries with extreme weather conditions, some meters are equipped with a mechanical temperature conversion device.

In other Countries, additional functionality devices are installed to residential meters for specific needs e.g.:

- in UK : prepayment devices, including a shut-off valve in the meter;
- in Japan : earthquake safety devices, including a shut-off valve in the meter.

Residential meters incorporating shut-off systems are not yet standardized on a European level (safety, functionality, design of valve, communication architecture…).

6.4. Previous field trials using “electronic” diaphragm meters with new functionalities (electronic display, shut-off valve, communication facility…) have provided the industry with a valuable insight into the needs of the customers and industry. For example, the display showing the results needs to be easily accessible to the consumer; the operation of any shut-off valve needs to be reliable.

The reader may ask why smart metering has not progressed faster; the issue has always been about the reliability and the cost benefits of the system. Since these initial trials and the current climate to increase energy efficiency, the cost benefits analysis and the reliability for a smart metering system need to be revisited.

6.5. To facilitate the addition of functionalities and trying to improve the metrological characteristics, new meter designs using an electronic platform were developed such as:

- ultrasonic meters;
- fluidic meters;
- thermal mass meters.

Ultrasonic meters have been used for more than 15 years. In the UK, they are now mainly purchased for prepayment purposes. An existing harmonized European standard is available for the base meter.

7. Technical considerations

7.1. At a time when some electricity companies are about to install huge quantities of smart meters, gas network/meter operators and gas meter manufacturers are very interested in this innovative project.

Notwithstanding that some of the drivers are different for the electricity and gas markets, and although the cost benefit analysis is different for the gas than for the electric system, the gas industry would like to benefit from the interoperability and the developments already undertaken and to realize the opportunities that gas smart metering systems could offer.

At the moment it is not clear, on European level, what a gas smart metering system should offer and what price is acceptable to the market.

Depending on the functionalities required, some important technical, safety, communication and metrological issues will have to be solved.

7.2. One technical feasible system to help the end user managing their gas consumption is to provide an output from the gas meter which represents the measured gas volume.

This output can be used by a 'home display unit'. This 'home display unit'; preferably common for gas, electricity, water, heat… consumption, can calculate and display the necessary data to manage the home consumption, for instance load profiles, comparisons of consumptions… and could even provide adaptive control to manage the energy consumption (e.g. to bring the heating on at the correct time or switch it off when no one is home). It is easily feasible to provide this 'home display unit' with a communication system (e.g. by internet) to provide the end user with more useful information.

7.3. The pulse output of a residential gas meter is already harmonized in Europe. The most recent residential meters are sometimes provided with a pulse output but a lot of the meters on the market would have to be changed. Consideration shall be given to the electrical safety and the fact that a lot of residential gas meters are installed outside. It should be noted that the output connector of the meter is not yet harmonized.

7.4. In contrast to electricity, the physics and metrological requirements do not allow instantaneous measurements of the gas energy at the point of delivery.

This is due to:

- small variation in gas quality;
- CV measuring stations being remote of the point of delivery;
- time taken for the gas molecules to reach the end user which varies on the flow at the particular point of time, e.g. ‹2 m/s in the summer and ›10 m/s in the winter.

It should be noted that the uncertainty on the determination of energy (taking into account CV) at the point of delivery, decreases as the time period of determination increases.

7.5. Whereas electricity meters measure the consumption in energy (kWh), with the result is given instantaneously, gas meters are indicating the gas volume passing through it at measuring condition (m^3). Currently there is no residential gas meter available on the market giving the results in energy.

There are technical obstacles to the development of such energy meters:

- temperature and pressure compensation

  It is technically possible under MID but it would require the replacement of all existing residential gas meters. It would be expensive to operate and maintain.

- calorific value

  Currently determined at the network level with very accurate but expensive equipment. **Use of such equipment at each residential metering point is not currently feasible for economic and safety reasons**.

7.6. Although precise energy determination at the meter may not be feasible, energy consumption information, may be provided to the end user by other means such as:

- indicative energy consumption displayed within the home smart metering system using calorific value sent on a periodic basis from the back-office;
- providing the end user with access to the energy calculation done in the back-office, for example, via a web portal.

7.7. With the exception of the few residential static gas meters installed, the gas meters do not have an electrical power supply which is necessary for additional functionalities. If electricity is used by the gas smart metering system, special care has to be given to the electrical safety as described in the relevant directives and European standards. Battery power seems to be the most suitable solution since most of the gas meters are not installed near the electricity meter. The lifetime of the battery depends on the environmental conditions, flow rate, number of operations of external communications devices and on the energy needed by the additional functionalities.

7.8. Once a safe electrical power supply, electronics, software, secured communication system that respects the metrological requirements is available, the price to pay for the system is dependent on the functionalities required.

7.9. Providing the electrical power supply associated with electronics and internal memory/data logging is available, adding:

- one way secured communication system allows **remote reading of the meter index and associated meter data.** It facilitates to deliver more information, avoids estimated bills and could smooth supplier switching process; or
- two way secured communication system allows integrating a clock/calendar metrological adjusted by remote control in the gas smart metering system which opens the door to **multiple tariffs**, to **time based load profiles**; or
- two way secured communication system and a valve, allows **remote shut-off** and **prepayment facilities**. For security reasons the valve may not be opened remotely without a safety feature; or
- a computer and a two way secured communication system allows transmitting **commercial data** between suppliers and end user.

Note: The internal/data logging system could be different depending on the complexity of the smart metering requirements.

Consideration needs to be given to frequency and volume of data recorded and transmitted and its impact on power requirement and data handling.

8. Financial considerations

The cost of replacing current gas meters with more expensive gas smart metering systems and of providing the necessary communications infrastructure has to be carefully assessed, especially if gas smart metering is to be introduced proactively, before the existing meter would normally be replaced.

The financial justification for smart meters is likely to vary significantly between Member States, depending on such factors as:

- the nature and cost of the meter reading service currently provided via (manual) metering;
- the remaining lifetime of the actual installed meters;
- the nature and speed of the roll-out program adopted;
- the typical location of the meter and ease of replacement;
- the amount of energy consumed and the extent of any energy saving among different customer groups as a result of greater energy awareness;
- the price difference between conventional and smart metering system;
- the national market structure for metering/billing activities.

Development of the business case for each Member State could be different and complicated by the different market models and how the costs and benefits are shared among different players in the energy value chain. A marked increase on distribution/metering cost could have an impact on competitiveness of gas against other energy sources.

9. Conclusion

Marcogaz and Facogaz are the two main recognized European Industry Organizations in the field of gas metering.

Experts from these two Organizations are active in the development of European legislations, regulations and standardizations.

Therefore the introduction and development of gas smart metering is an area where the Members of Marcogaz and Facogaz are the experts that should be central to any consultation concerning possible additional functionalities to the gas meters.

Our Organizations believe that the EC mandate M/441 for the standardization for gas smart metering system provides an opportunity to develop innovative products based on common European standards that are in line with the requirements of the MID directive (2004/22/EC) and the requirements of the ESCO directive (2006/32/EC).

Additional functions under national law shall not prevent a barrier to trade by restricting the free movement of goods or technical innovation.

Although the drivers and solutions could be different, our Organizations promote any industry synergies between all utility systems. Interoperability and ease of operation are essential. Interoperability should be sought but there is a risk of complexity.

Any gas smart metering system has to respect the specific gas safety issues.

There is the potential that a smart metering system could be integrated into a smart home. This may allow the home hub (a point of interface with the end user) to be used to manage the home security, electrical, gas usage including monitoring water usage and allow the end user to obtain greater benefit from the system. Such a system could affect customer behaviour resulting in lower energy use and take up of energy efficiency measures.

The introduction of standardized smart metering systems should provide a significant opportunity to improve customer service levels. The ability to have remote communications will positively affect the change of supplier processes and allow more frequent meter reads.

For smart metering to be adopted there has got to be benefits for the end user who directly or indirectly will pay the costs, and these benefits need to be appropriately valued to ensure a cost effective solution is provided. These costs for installation, maintenance and metrological verification of a gas smart metering system need to be balanced against the additional benefits.

Finally, if the industry does not get this right, then the customer experience will be poor and could be detrimental to the introduction of smart metering.

The following table provides a comprehensive but not exhaustive list of additional functions taking into account the advantages and disadvantages for the stakeholders.

Table: additional functions

Function	How does the function help the end user to manage his consumption?	Does the function help to facilitate supplier switching?	Does it improve end user service	Does the function help to manage the distribution / metering costs?	Technical feasibility
1 - Remote index reading (AMR)	More frequent reading could be used to provide more customer information and a more accurate bill.	Since there is no need to be on site to obtain a meter reading, it could help, by providing a reading at change of supplier, but this is subject to the local switching procedure.	The supplier will have up-to-date meter readings and other information from the meter, which will help him deal with billing and other customer enquiries, so improving customer service. The elimination of estimated billing should reduce the number of customer enquiries.	Increases the price of the metering system and could increase/decrease the cost of metering reading (though there are high initial costs). Could help in allocation and reconciliation processes (e.g.in the case of injection of non-conventional gases).	Needs a communication system and a data retrieving system. All meters will need to be visited and many meters will have to be replaced.
2 - Customer information (Energy consumption, tariff, promotion, price to pay)	When good quality and relevant data is frequently, easily interpreted, and readily available to the customer, it could help them to manage their consumption and hence their budget.	It could help if customer information contains commercial information which enables customer to compare between suppliers' tariff rates.	Ensures tariff changes can be applied at the correct time and date for all end user.	Further increases the cost if the metering system has to remotely transmit/receive this information (i.e. two-way).	The current metering systems available do not support all these functionalities. Depending on the kind of live information needed, could need a two-way communication system with access to a central data bank,
3 – Display data to the customer in the household	When the data is easily interpretable, frequently available and allows an easy comparison over equivalent periods.	The consumer can be given the possibility to compare and to simulate the consumption and the price to pay asked by the supplier(s)	Customer has better visibility of his consumption.	No direct advantage for the DSO or Meter Asset Managers (MAM). If required, it will increase costs.	Harmonization of data format is necessary between all stakeholders. Note: Many meters are installed outside.

Function	How does the function help the end user to manage his consumption?	Does the function help to facilitate supplier switching?	Does it improve end user service	Does the function help to manage the distribution / metering costs?	Technical feasibility
4 - Flexible tariffs	Could have a limited influence on operation of the installation by the customers. Would need long term investment (system design has to store gas energy consumption) May be greater complexity for the client to make choice when multiple and non comparable offers are available (see tariffs for telephone)	If offers are clearly different and comparable.	Promotes competition and innovation by suppliers by enabling new tariffs, products and propositions for customers.	No direct advantage for the DSO or MAM, if required it will increase the costs.	Harmonization of data format is necessary between all stakeholders. Need a standardized and harmonized interface and data retrieving system. Integration of flexible tariffs in the Smart Metering system is very difficult and has to be done with a two-way communication system.
5 - Load profile	Could provide relevant data for the customer to target energy reduction methods.		Could help the customer to select the appropriate tariff specific to his load profile.	If the information is made available to the DSO, it could assist in the efficient management of his network.	Need a communication system and a data retrieving system.

Function	How does the function help the end user to manage his consumption?	Does the function help to facilitate supplier switching?	Does it improve end user service	Does the function help to manage the distribution / metering costs?	Technical feasibility
6 - Prepayment	Could help some customers to manage their energy budget.	If this function is available, the customer can more readily be offered prepayment as an option when switching supplier, without cost and inconvenience of a meter change. Prepayment can be seen as part of a flexible tariff arrangement. If the system is interoperable between suppliers then there could be benefits.	Significantly reduces the cost of providing this type of service to (in particular, vulnerable) customers e.g. by avoiding need to change meter.	Increases the cost of the metering system but can avoid the replacement of the meters in some countries.	Consider the security and preventive maintenance of the shut-off valve. As with credit, needs a specific data retrieving system especially for balancing.
7 – Remote control or automatic shut-off (Customer switching, safety, non payment…)	Does not help the customer managing their consumption. Could have safety benefits.		The possibility of remote disconnection encourages reluctant customers to pay, preventing their debt from building up, and reducing overall debt management costs. Facilitates more sensitive/flexible debt policies by suppliers	Increased capital and maintenance costs. Expected savings if safety is guaranteed for remote operation cut-off and put on the supply.	Need for common rules for the remote control or automatic shut-off valve: communication, maintenance and technical requirements, especially regarding safety issues.
8 - Fraud Prevention			Prevention of fraud likely to improve customer safety generally.	Could help identify possible fraud.	Fraud prevention methods have to be subject to continue improvements.

Function	How does the function help the end user to manage his consumption?	Does the function help to facilitate supplier switching?	Does it improve end user service	Does the function help to manage the distribution / metering costs?	Technical feasibility
9 - Energy determination (kWh)	The m^3 could be used to manage consumption but this could be more effective if converted to energy units and cost.	Brings more transparency.	Could help if information conforms to the client expectation and is easily available and easily interpreted.	Increase of cost for higher frequency of delivering energy information.	CV measuring on site is very complex and expensive. Set up of communication is complex (bi directional) to « refresh » the caloric value.
10 - Temperature compensation	Does not help especially if Smart Meter is installed in the household (for the display).	No.		Increase of investment and maintenance cost for indoor installations but in some countries may deliver benefits for outdoor installations.	Is already available.