

Summary of a cost-benefit analysis conducted for implementing remote management and reading functionality in natural gas distribution and related technical benchmark

This document sums up a study conducted by the Autorità per l'energia elettrica e il gas (hereinafter: Autorità) in the course of 2007 which investigated the key issues related to the introduction of remote reading and remote management functionality in the gas metering units associated with natural gas distribution, in particular:

- available solutions to be adopted for gas metering units among those normally used in Europe;
- AMR and AMM¹ systems operating in Europe;
- a quantitative analysis of costs and benefits associated with the implementation of remote management/reading in relation to the size of the distribution company and type of consumptions.

Solutions available and used in Europe for gas metering units

Reference framework

The market of gas metering units is going through a highly dynamic period. After years of substantial immobility, for a number of factors (i.e. the development of AMM systems in electricity, increase in gas consumptions, and market liberalisation) a complete change seems now under way for products designed for the domestic market.

The major world and European manufacturers of gas metering units have recently:

- introduced in their product range 'intelligent' metering units – i.e. units with richer functionality combining traditional mechanics with electronics;
- shifted the focus from metering units as stand-alone elements to integrated systems (AMR-AMM);
- acquired system integration companies to improve their offer and skills at system level.

Although technologies are now ripe and innovative products are already on the market, sales volumes are still low but growing. The product industrialisation level is still low and current selling prices are high.

As a consequence of such considerations, the focus must be put on two aspects:

- a picture of the existing situation and related market prices;
- a medium-term forecast of what could be realistically placed on the market by manufacturers and the price levels reachable through significant volumes – i.e. volumes consistent with a massive solution (or massive upgrade) of metering units.

Diaphragm meters for domestic customers (G4)

As of today's date, there are at least three international manufacturers offering a range of multi-tariff, remotely managed, diaphragm gas meters. Products available on the market meet the functional requirements established by the Autorità in its consultation document of 9 July 2007 "Remote reading of consumptions of end users connected to natural gas distribution systems", act no. 27/07. However manufacturers have advised against the introduction of requirements to the effect of implementing the transmission of a large quantity of data (transmission of the hourly consumption curve, download of application software, etc.) in case of meters powered by batteries, owing to the impact that such amount of data would have on the battery life.

In case of a new installation the metering unit can be upgraded to remote management through an integrated electrovalve. Such function is not integrated when the installed metering unit is retrofitted.

¹ AMR stands for Automated Meter Reading while AMM stands for Automated Meter Management i.e. control of the electrovalve that interrupts or activates gas supply).

Exclusively in case of a new installation (and not when the installation is retrofitted), the additional functions of temperature and pressure conversion and system sealing check after manual reactivation of the electrovalve may be envisaged. Such optional functions are obtained through the addition of HW devices and SW processing tools.

Static meters² for domestic customers

A few more innovative, fully electronic “static” products were considered which are already on the market or will be soon placed on the market or are in their development/testing phase in view of their subsequent placement on the market, and whose interest lies in their future potential:

- ultrasound metering technology;
- micro-heat generation technology;
- transit time technology;
- pressure sensor technology.

The described static metering technologies and products using them differ from traditional diaphragm technologies for four aspects:

- reading requires no further corrections in relation to the actual temperature or pressure values;
- there is a higher incidence in costs of electronic technology which, unlike mechanical technology, is very volume-sensitive;
- costs may be cut by half when shifting from 100 to 100,000 pieces;
- their richer functionality (radio frequency communication, electrovalve management, withdrawal curve storage, time-of-use tariffs, etc.) has minimum costs if it relies on a basic electronic architecture (in such case too, manufacturers have voiced their concern for data-intensive requirements which make battery duration critical).

A specific type of gas metering units was approved in August 2007 with regard to correction related to temperature and pressure, pursuant to directive 22/2004/EC on measuring instruments. For a second set of metering units, a type test exclusively with regard to temperature correction is planned to be made, pursuant to the same directive 22/2004/CE, in the period between May and August 2008.

Battery power supply and useful life of the metering unit

All existing metering units equipped with an electronic device are powered by an internal battery. The battery is sized for a useful life in ordinary operating conditions of 10 to 15 years, however manufacturers reported a high degree of variability of the actual value of the useful life depending on the real conditions of use, frequency of operation, i.e. data upload and operation of electrovalve controls. A realistic prospect is replacing the battery after 10 years of operation. As for the metering unit, similarly to any electronic equipment integrating a display, its useful life under manufacturer’s warranty is nearly 15 years.

Communication technology

The communication technologies for interfacing the metering unit to the data concentrator – and virtually taken up by all major manufacturers are the following :

- Radio Frequency 433 MHz: the most outdated technology, but with low quantities of data to be transmitted, it covers the highest communication distance and presents a high degree of permeability of reinforced concrete walls. This reduces the number of data concentrators needed for comparable area coverage.
- Radio Frequency 868 MHz: this standard provides a higher communication speed but also covers a shorter distance as opposed to the previous solution.
- Radio Frequency ZigBee: this new emergent standard offers reduced costs related to volume - given its numerous applications. Its high frequency (2.4 GHz) implies a low degree of penetration through reinforced concrete walls, which in turn increases the number of data concentrators

² By a static meter is meant an electronic meter measuring gas without using moving parts in accordance with principles typically not based on volume.

required. However, in gas applications a number of manufacturer are now moving towards the use of ZigBee at a frequency of 868 MHz.

- Hard wired M-Bus connection: the meter is connected to a data concentrator through a cable.
- GSM modem (transmits directly to the central system, without a data concentrator): this technology consists of strings of SMS messages for communication. The industrial cost of a GSM modem is still high and, consequently, considerably increases the cost of a metering unit.

Static metering units for customers with consumptions >5,000 Sm³/year³

In comparison with the past, in the range of metering units for users with higher consumptions, i.e. substantially G10 to G100⁴ and beyond, development dynamics is lower, whether units are of the diaphragm, piston or turbine types.

Manufacturers generally tend to manufacture meters that only retain the functions of pure metering combined with the use of integrated pulse generators so as to interface with external units. All additional functions (conversion of readings into temperature and pressure values, data logging and transmission modem functionality) are performed by external units.

Current products are intended for high consumption levels and have so far been introduced in a very limited number of cases. Prices are affected by these factors and – as such – are not indicative of large-scale introduction.

If the use of this equipment and remote reading should be extended to all types of metering units with annual consumptions in excess of 5.000 Sm³, volumes would substantially differ from the current ones.

AMR and AMM systems operating in Europe

10 projects were considered in 7 countries, of which 6 in Europe and one outside Europe. For each of these projects, the most important characteristics were underscored: i.e. targets in terms of functions and volumes, communication technologies and technology suppliers involved. In the following table A2.1 projects are analysed schematically.

Today's total count of electronic gas metering units equipped with communication devices exceeds 500,000 units, and is expected to grow considerably (x 6) in the next two years.

In two countries (P4 and P6), projects seem pushed by the institutional activity (i.e. are carried out by the competent ministry or regulatory authority), which requires the replacement of the total number of gas metering units in a period between 6 and 10 years. In P6 a check has been envisaged on completion of a "pilot" project.

Five of the projects considered are of AMM type, four are of AMR type and only one is of the pre-payment type with the opportunity to identify consumption profiles through a Smart Card during reload operations.

Two of these projects (one in country P4 and the other in the Extra-European country of the sample) use innovative metering technologies and ultrasound static metering units.

As for the technology ensuring communication between gas metering units and a data concentrator (in some cases communication to an electric meter acting as a real gateway):

- 6 of these projects use radio communication; 3 use wire communication, mainly of M-Bus type to the electric meter (gateway);

³ By Sm³ is meant standard cubic meters, that's cubic meters corrected for both actual temperature and pressure.

⁴ By GX is meant a gas meter with nominal hourly flow equal to X m³/h.

- no standard protocol exists; manufacturers in different countries have adopted solutions differing greatly from each other.

Market	Country	Application	Gas functions	Gas project size		Communication technology	Metering unit manufacturer
				today	potential		
Res.	P1	Ele + Gas	Prepayment	25,000 G	100,000 G	Smart card two-way reader	C1
Res.	P2	Gas	AMM with anti-tamper devices	25,000 G	1.8 Mio	Radio 868Mhz ISM with 2-level concentration	C1 C2
Res.	P3	Gas	AMR	15,000 G		433 MHz Radian	C1 C2
			AMR	230,000 G		Euridis filaire MAEC	
			AMR	50,000 G		MAEC	
Res.	P4	Ele + Gas	AMM with electrovalve	60,000 E 60,000 G	1.9 Mio	Radio (Xemex or wireless MBus) via electric meter	C3 C4
Res.	P4	Ele + Gas	AMM with electrovalve and leak detection	60,000 E 10,000 G	4 Mio	Wired Mbus (via electric meter)	C1 C2 C4
Res.	P4	Ele + Gas	AMM	50,000 E 50,000 G		Radio 433Mhz RADIAN (via electric meter)	C1
Indus.	P5	Ele + Gas	AMR	11,000 G		Coronis RF 868 MHz Wavecom	C1
Res.	P6	Gas	AMR + Prepayment	40,000 G		BCN Datasystems	
Res. Comm. Indus.	P6	Ele + Gas	AMR	RFQ Phase	21 Mio	Wireless (RF) or wired M-Bus	C1 C2 C5
Res.	Extra-Eur.	Gas	AMM with electrovalve; pressure detector; seismic sensor	12,000 G	22 Mio		C6 C7 C8

Table A2.1 – List of gas AMR/AMM projects operating in Europe (2007)

For the five AMM projects, the inexpensiveness of the investment is based on the opportunity to remotely deactivate and reactivate service after a safety check on the system downstream of the metering unit. The check is made by controlling flows in the first 20-30 seconds after reopening the electrovalve. On these projects, and especially in the Extra-European project, gas meeting units have numerous safety functions.

Quantitative cost-and-benefit analysis on the implementation of remote management/reading in relation to company size and consumption class

In quantitative terms, the Autorità performed a cost-and-benefit analysis related to the implementation of remote management/reading functions depending on the size of companies and the level of annual consumptions of customers. In particular, the following aspects were investigated:

- assessment and comparison of the amount of costs to distributors for implementing remote management/reading functions;
- assessment and comparison of the amount of induced benefits to distributors and retailers in terms of avoided costs;
- analysis of the ability of investments in remote management/reading systems to create value for a distributor, to be quantified in relation to the net present value of its flows (investment and

maintenance costs and benefits in terms of avoided costs), assuming a useful life of metering units of 15 years.

With regard to cost and benefit items, the decision was made not to publish absolute monetary values in order to avoid the risk of distortions in the market of gas metering units and related remote management/reading systems.

The division of customers into classes of annual consumptions is shown in the following table A2.2.

Consumption class	Annual consumption (Sm³)	% of customers on total	% of consumptions on total
F1	< 5,000	97.64	50
F2 ⁵	5,000 – 200,000	2.32	30
F3	> 200,000	0.04	20

Table A2.2 – Division of customers into consumption classes on an annual basis

The decision was made not to divide class F1, which represents the mass-market, into subclasses (e.g. cooking only, cooking + hot water, cooking + hot water + heating), since an introduction of partial remote management functions (e.g. 40% of customers) on a single geographical area is scarcely advantageous in management and economic terms. Indeed, the coexistence of two methods of data collection and processing implies a drastic fall in benefits (e.g. need to retain meter-reading rounds) against investments (in infrastructures and systems), which in any case remain important – and further implies inequality of customer treatment (for instance, abolition of presumptive billing or introduction of a multi-tariff regime) and a reduction of qualitative benefits for the full system.

Distributors were divided based on the number of customers served⁶, as illustrated in table A2.3 below.

Distributor class	Number of distributors	Total number of customers	Average number of customers (an_customers)
Small (up to 50,000)	255	2,774,222	10,879
Medium (50,000 to 500,000)	53	6,315,226	119,155
Large (>500,000)	7	9,910,136	1,415,734

Table A2.3 – Division of distributors into classes based on the number of customers served

The solution adopted in this analysis of segmenting end users based on their annual consumption may seem inconsistent with the previous choice of differentiating compulsory terms for the commissioning of meters depending on the metering unit class as adopted on the completion of proceedings of workgroup 071 (see Table 3 under section 9). As a matter of fact, the two approaches are virtually convergent, as the choice of metering unit class is normally based on the annual consumptions of end users.

⁵ Such class was initially divided into two subclasses (5,000-50,000 and 50,000-200,000 Sm³), but it has become clear that their underlying assumptions and model structure were very similar.

⁶ As on 2006.

The assumptions made in our analysis of remote management/reading implementation, which was assessed depending on distributor size – were analysed with reference to the following cases:

- case 1. TG –F1: remote management for customers belonging to consumption class F1;
- case 2. TL – F1: remote reading for customers belonging to consumption class F1;
- case 3. TL – F2: remote reading for customers belonging to consumption class F2;
- case 4. TL – F3: remote reading for customers belonging to consumption class F3;
- case 5. mix of customers (TG –F1, TL – F2 e TL – F3) remote management for customers in class F1 and remote reading for customers in classes F2 and F3, assuming that the company serves a customer mix unrelated to the company’s size and in line with the national average mix, in which the weights of individual consumption classes are represented by the percentages of customers on total as shown in Table A2.2.

Remote management for customers in consumption classes F2 and F3 seems unviable since there are strong perplexities on the interruptibility of non-domestic customers, for which procedures are envisaged that require the presence of an operator for safety to be guaranteed in the downstream installation.

It is to be considered that the correction of volumes as a function of temperature or pressure values has always been assumed in the analysis. Such requirement is considered indispensable by the Autorità.

Remote management and reading system implementation costs

With reference to the amount of costs related to the implementation of remote management/reading systems, the following assumptions were made:

- remote management - hypothetically designed for class F1 only - requires the replacement of the full number of metering units installed;
- remote reading may be implemented, for installed metering units already preset, by retro-fitting the installed units, i.e. by adding to each meter an additional electronic unit for consumption data recording and communication, whereas others not present will be replaced:
 - for class F1, the assumption was made that 75% of the installed units should be replaced and that the remaining 25% may be remotely read through the installation of a retrofit – and further that the temperature and pressure conversion function may be more costly to be implemented on the retrofitted portion of metering units;
 - for F2 and F3 it was assumed that 80% of metering units may be retrofitted because they have already been preset for remote reading, whereas 20% of metering units need replacement; it was also assumed that all meters should be fitted with an electronic units with retrofit functions – which will incorporate the functions for the conversion of temperature and pressure;
- in the case of remote reading in class F2 (case 3), it was assumed that 90% of metering units could be managed through a data concentrator and the remaining 10% through a point-to-point connection to the central system;
- in case of remote reading in class F3 (case 4), it was assumed that, in 100% of cases, a point-to-point communication should be established between the central system and the metering unit;
- in costs associated with the central system, the costs of interfacing it to the commercial billing system were also considered;
- costs do not include the residual depreciation of decommissioned metering units following the implementation of the remote management/reading functionality, supposing such depreciation continues to be recognised to the distributor – similarly to what was done in the electricity sector;
- based on the analysis of 16 “sample” installation types, 8 of which were typical of urban environments, 8 of rural environments, and following a simulation of RF communication on various types of installations, the average ratio was assessed between data concentrators and metering units. A ZigBee technology was assumed – which exploits relays – and a frequency of 868 MHz was also assumed for its better coverage as opposed to higher frequencies. Considering the presence of obstacles and related shielding effect, such as reinforced concrete walls and further considering the communication distance to be effectively covered, it seems realistic to think, as a whole, that the ratio could be 1:12.

It was also assumed that all external costs (e.g. reading service under contract or procurement of materials) are higher for small and medium sized distributors – whose contractual power may be lower than that of a large company. On average, in comparison with the external costs incurred by a large distributor, an increase of 10% was assumed for medium-sized companies and of 20% for small companies.

The “internal” replacement costs of metering units and data concentrator installations (e.g. field activities performed by the internal personnel or customer service function) normally undergo no variations based on the size of the customer base to be managed.

Below are some specific assumptions of the foregoing cases and a few results related to costs for implementing remote management/reading systems.

Case 1 - TG –F1: remote management for customers in consumption class F1

The considered cost items for the implementation of a remote management system are the following:

Cost item	Cost ratio with metering points
Metering unit for domestic use G4, inclusive of electrovalve, temperature and pressure correction and RF data transmission device	1:1
Data concentrator with GPRS modem for data transmission to the central system and RF data transmission device for communication with metering units	1:12
Turnkey central system – unit HHU (inclusive of communication front-ends to data concentrators, commissioning activities for metering units and system maintenance)	1: <i>an_customers</i>
Interfacing with legacy systems	1: <i>an_customers</i>
Metering unit replacement	1:1
Data concentrator installation	1:12

Table A2.4
Remote management in class F1 (annual consumptions < 5,000 Sm³): cost items of an installed and commissioned metering point

As already observed, such assumption implies the replacement of all metering units since for those installed and preset for remote reading, the installation of an electrovalve is not technically feasible. With regard to the cost of the metering unit – the same price ranges were assumed, whether a conventional diaphragm meter (equipped with all the functions needed for remote management and those shown in table A2.4) or a static meter are considered.

If by convention the cost of a metering point is considered equal to 1 for a large sized distributor, the cost of the same metering point for a medium sized distributor is calculated to be equal to 1.27 while for a small distributor 3.14 (see table A2.8).

For class F1 in remote reading – a cost sensitivity analysis was also made with reasonable variations of the metering unit and data concentrator costs so as to assess, based on a range of values, the effect of the metering point on the unit cost. Table A2.8 substantially confirms the cost ratio of companies of various sizes.

Case 2. TL – F1: remote reading for customers in consumption class F1

The considered cost items for the implementation of a remote reading system are the following:

Cost item	Cost ratio with metering points
Metering unit retrofit inclusive of temperature and pressure correction and RF data transmission device	0.25:1
Metering unit for domestic use G4, inclusive of temperature and pressure correction and RF data transmission device	0.75:1
Data concentrator with GPRS modem for data transmission to the central system and RF data transmission device for communication with metering units	1:12
Turnkey central system - HHU Unit (inclusive of communication front-ends to data concentrators, commissioning activities for metering units, and system maintenance)	1: <i>an_customers</i>
Interfacing with legacy systems	1: <i>an_customers</i>
Retrofit installation	0.25:1
Metering unit replacement	0.75:1
Data concentrator installation	1:12

Table A2.5
Remote reading in class F1 (annual consumptions < 5,000 Sm³): cost items of an installed and commissioned metering point

If by convention the cost of a metering point is considered equal to 1 for a large sized distributor, the cost of the same metering point for a medium sized distributor is calculated to be equal to 1.26 while for a small distributor 3.33 (see table A2.8).

Case 3. TL – F2: remote reading for customers in consumption class F2

The considered cost items for the implementation of a remote reading system are the following:

Cost item	Cost ratio with metering points
Metering unit retrofit G10-G65 inclusive of temperature and pressure correction and RF data transmission device	0.9:1
Metering unit retrofit G10-G65 inclusive of temperature and pressure correction and GPRS data transmission device	0.1:1
New metering unit G10-G65 (average weighted cost)	0.2:1
Data concentrator with GPRS modem for data transmission to the central system and RF data transmission device for communication with metering units	0.9:12
Turnkey central system - HHU Unit (inclusive of communication front-ends to data concentrators, commissioning activities for metering units, and system maintenance)	1: <i>an_customers</i>
Interfacing with legacy systems	1: <i>an_customers</i>
Retrofit installation	1:1
Metering unit replacement	0.2:1
Data concentrator installation	0.9:12

Table A2.6

Remote reading in class F2 (annual consumptions between 5,000 Sm³ and 200,000 Sm³): cost items of an installed and commissioned metering point

If by convention the cost of a metering point is considered equal to 1 for a large sized distributor, the cost of the same metering point for a medium sized distributor is calculated to be equal to 1.16 while for a small distributor 1.89 (see table A2.8).

Case 4 TL – F3: remote reading for customers in consumption class F3

The considered cost items for the implementation of a remote reading system are the following:

Cost item	Cost ratio with metering points
Metering unit retrofit G65-G100 inclusive of temperature and pressure correction and GPRS data transmission device	1:1
New metering unit G65-G100 (average weighted cost)	0,2:1
Turnkey central system - HHU Unit (inclusive of communication front-ends to data concentrators, commissioning activities for metering units, and system maintenance)	1: <i>an_customers</i>
Interfacing with legacy systems	1: <i>an_customers</i>
Retrofit installation	1:1
Metering unit replacement	0,2:1

Table A2.7

Remote reading in class F3 (annual consumptions above 200,000 Sm³): cost items of an installed and commissioned metering point

If by convention the cost of a metering point is considered equal to 1 for a large sized distributor, the cost of the same metering point for a medium sized distributor is calculated to be equal to 1.12 while for a small distributor 1.43 (see table A2.8).

Case 5. customer mix (TG –F1, TL – F2 and TL – F3) and summary of costs related to other cases

In referring back to cases already considered, this customer-mix case also covers the assumptions illustrated above, including a cost sensitivity analysis exclusively performed on remote management for consumption class F1 (case 1). The table below shows the case of a customer mix which is virtually in line with ratios related to class F1, and sums up cost ratios as a function of distributor size and of the type of customer’s consumptions as illustrated above.

The analysis of costs related to the implementation of remote management/reading systems indicates high economies of scales; indeed, as the distributor size becomes smaller, the cost of the central system and the purchase price of metering points and data concentrators impacts on the individual metering point.

Customer types	Distributor size		
	Large	Medium	Small
Class F1 in remote management	1 – 1.18	1.27 – 1.46	3.14 – 3.35
Class F1 in remote reading	1	1.26	3.33
Class F2 in remote reading	1	1.16	1.89
Class F3 in remote reading	1	1.12	1.43
Customer mix: Class F1 in remote management, Classes F2 and F3 in remote reading	1 – 1.17	1.26 – 1.44	3.05 – 3.25

Table A2.8

Ratio of the standardised cost of an installed and commissioned metering point to the cost incurred by a large distributor

Benefits to be obtained with remote management or reading systems

With reference to the quantification of benefits related to the implementation of remote management/reading systems, on top of the approach adopted in the cases already described for costs, the following detailed assumptions were considered:

- reading costs, hence the benefits arising from remote management or reading functionality on such cost items, were attributed to distributors;
- the replacement of power supply batteries of the metering unit was envisaged once in the life cycle of metering units for the first consumption class; while the same is assumed to take place every two years for the second and third consumption classes;
- benefits were assessed on the costs related to processes already managed by distributors and, separately, by retailers;
- the financial benefits linked to the reduction of billing and collection times were time-discounted at 7.2%;
- in the case of remote management, it was assumed that metering units automatically check plant safety downstream of the electrovalve when opened (normally manually on site), after remotely enabling for opening;
- benefits were assessed separately on distributors' and retailers processes and costs.

The following tables show cost macro-items considered in aggregate, each one of which was disaggregated into a number of subitems, which were each assessed quantitatively in terms of annual benefit for the customer.

The analysis of benefits, in terms of avoided costs, induced by the implementation of remote management/reading systems, which was performed separately equally with reference to retailers, showed that these benefits are substantially independent of the distributor size. In the following analysis, retailers' benefits are shown in the cases under review and are compared to the benefits deriving from the lower costs incurred by distributors, in the latter case depending on the size of the company.

Below are some specific assumptions of the cases specified above with the further illustration of the resulting benefits arising from the introduction of remote management/reading functionality.

Case 1 - TG –F1: remote management for customers in consumption class F1

Activity	Cost macro-item	Reduction of costs to a:
Reading	Performance of manual reading (on a regular basis and in conjunction with a supplier switch) ⁷	Distributor
	Processing of reading errors and billing adjustments	
	Removal of the self-reading process	
Field	Service activation/deactivation	Distributor
	Inconclusive visits (i.e. absent customer, inaccessible metering unit)	
Billing and collection	Financial charges related to presumptive billing or the time intervening between manual reading and billing	Distributor Retailer
	Management of defaulting customers	
Customer service	Management of claims and adjustments on presumptive billing	Distributor Retailer
Unreported gas consumption	For faults	Distributor Retailer
	For irregular withdrawals	

Table A2.9
Remote management in consumption class F1 – cost macro-items considered for benefit quantification (per customer per annum)

If the benefit for a large sized distributor is considered equal to 1, then the benefit for a medium sized distributor is calculated to be equal to 1.19 while for a small distributor 1.43 (see table A2.11).

The ratio between benefits arising from lower costs to a distributor vs. to a retailer is equal to:

- 2.21 for a large-sized distributor;
- 2.63 for a medium-sized distributor;
- 3.15 for a small-sized distributor.

Case 2. TL – F1: remote reading for customers in consumption class F1

Activity	Cost macro-item	Reduction of costs to a:
Reading	Performance of manual reading (on a regular basis and in conjunction with a supplier switch)	Distributor
	Processing of reading errors and billing adjustments	
	Removal of the self-reading process	
Billing and collection	Financial charges related to presumptive billing or the time intervening between manual reading and billing	Distributor Retailer
	Management of defaulting customers	
Customer service	Management of claims and adjustments on presumptive billing	Distributor Retailer
Unreported gas consumption	For faults	Distributor Retailer
	For irregular withdrawals	

Table A2.10
Remote reading in consumption class F1 – cost macro-items considered for benefit quantification (per customer per annum)

⁷ This takes account of minimum obligations fixed by resolution no. 229/01 of 18 October 2001 i.e. an annual minimum supplier-switch percentage of 5%.

If the benefit for a large sized distributor is considered equal to 1, then the benefit for a medium sized distributor is calculated to be equal to 1.32 while for a small distributor 1.69 (see table A2.11).

The ratio between benefits arising from lower costs to a distributor vs. to a retailer is equal to:

- 2.40 for a large-sized distributor;
- 3.17 for a medium-sized distributor;
- 4.06 for a small-sized distributor.

With regard to consumption class F1, in order to identify the higher advantages arising from remote management, it might be interesting to compare and contrast the benefits obtainable by distributors in the remote management case considered above (case 1) with those obtainable through remote reading (case 2) with reference to the same the distributor size (refer to data in Table A2.12):

- for large-sized distributors, ratio is equal to 1.57;
- for medium-sized distributors, ratio is equal to 1,41;
- for small-sized distributors, ratio is equal to 1.32.

As regards retailers, the ratio between benefits to be obtained with remote management vs. remote reading is equal to 1.70 and, as already observed, does not depend on the size of the distributor.

Case 3. TL – F2: remote reading for customers in consumption class F2

For consumption class F2, cost macro-items are the same as those shown in the previous table A2.10. If the benefit for a large sized distributor is considered equal to 1, then the benefit for a medium sized distributor is calculated to be equal to 1.09 while for a small distributor 1.19 (see table A2.11).

The ratio between benefits arising from lower costs to a distributor vs. to a retailer is equal to:

- 13.41 for a large-sized distributor;
- 14.67 for a medium-sized distributor;
- 15.89 for a small-sized distributor.

Case 4 TL – F3: remote reading for customers in consumption class F3

For consumption class F3, cost macro-items are identical to those stated in the previous table A2.10. If the benefit for a large sized distributor is considered equal to 1, then the benefit for a medium sized distributor is calculated to be equal to 1.06 while for a small distributor 1.13 (see table A2.11).

The ratio between benefits arising from lower costs to a distributor vs. to a retailer is equal to:

- 0.83 for a large-sized distributor;
- 0.88 for a medium-sized distributor;
- 0.94 for a small-sized distributor.

The clear difference with consumption class F2 (case 3) exclusively depends on the fact that class F2, compared to class F3, weights benefit values for metering units and consumptions belonging to a more heterogeneous consumption class, which is characterised by relatively low consumptions (even slightly above 5,000 Sm³ per annum) as well as by decisively high consumptions (close to 200,000 Sm³ per annum).

Case 5. customer mix (TG –F1, TL – F2 e TL – F3) and tables summing up benefit values related to other cases

In referring back to cases already considered, this customer-mix case also covers the assumptions illustrated above. Table A2.11 shows therefore the customer mix case and sums up cost ratios as a function of distributor size and of the class of customer's consumptions as illustrated above.

In standardising benefit values related to case 1, i.e. consumption class F1 in remote management, table A2.12 identifies – for each distributor – higher benefits linked to customers with higher consumptions (of up to 27 times).

Finally, in analysing the ratio of benefits arising from lower costs to a distributor vs. to a retailer, table A2.13 shows the customer mix case and sums up the values stated above for the foregoing cases.

Customer types	Distributor size		
	Large	Medium	Small
Case 1: Class F1 in remote management	1	1.19	1.43
Case 2: Class F1 in remote reading	1	1.32	1.69
Case 3: Class F2 in remote reading	1	1.09	1.19
Case 4: Class F3 in remote reading	1	1.06	1.13
Case 5: customer mix – Class F1 in remote management, Classes F2 & F3 in remote reading	1	1.17	1.37

Table A2.11

Benefits arising from lower costs to distributors following the implementation of remote management or reading standardised in relation to the benefit of a large sized distributor

Customer types	Distributor size		
	Large	Medium	Small
Case 1: Class F1 in remote management	1	1	1
Case 2: Class F1 in remote reading	0.64	0.71	0.76
Case 3: Class F2 in remote reading	12.54	11.52	10.42
Case 4: Class F3 in remote reading	26.62	23.77	21.04
Case 5: customer mix – Class F1 in remote management, Classes F2 & F3 in remote reading	1.28	1.25	1.23

Table A2.12

Benefit arising from the implementation of remote management or reading standardised in relation to the benefit of Class F1 in remote management

Customer types	Distributor size		
	Large	Medium	Small
Case 1: Class F1 in remote management	2.21	2.63	3.15
Case 2: Class F1 in remote reading	2.40	3.17	4.06
Case 3: Class F2 in remote reading	13.41	14.67	15.89
Case 4: Class F3 in remote reading	0.83	0.88	0.94
Case 5: customer mix – Class F1 in remote management, Classes F2 & F3 in remote reading	2.69	3.14	3.68

Table A2.13

Ratio between benefits arising from lower costs to a distributor and benefits to a retailer following the implementation of remote management or reading

Final evaluations

Lastly, the Autorità assessed the discounted flows related to investment and maintenance costs and to benefits in terms of avoided costs assuming a useful life for electronic metering units of 15 years and a discount rate of 7.2%, so as to analyse the capacity of investments in remote management/reading to create value for a distributor, i.e. in order to check whether the net present value of the foregoing flows is positive.

The analysis was made in a prospect of costs and benefits exclusively related to distributors, i.e. companies required to: invest in metering units and remote management/reading systems, perform the installation and commissioning of metering units and systems for their remote management and, at least provisionally, perform periodical reading data collection and recording for billing consumptions to end users.

Table A2.14 shows the net present values⁸ for the different consumption classes and cases considered, from which it may be concluded that:

- a) the net present value is always negative, even for a large company, if only customers in class 1 are served;
- b) the net present value returns to be positive only for a medium or large sized company with a customer mix, which also includes classes F2 and F3 (case 5), enjoying extremely sizeable benefits from the implementation of remote reading (see Table A2.12);
- c) if the company size is kept constant, when present net values are compared between the various cases considered, it is clear that the implementation of remote management for customers with consumptions in class F1 (case 1) is preferable as opposed to remote reading for the same class of customers (case 2), as already observed above in relation to benefits; the reason for this is that, against a similar level of investment, the economic benefits of remote management are higher especially if such events as service activation and deactivation, takeovers, avoidable inconclusive visits, technical and commercial management of defaulting customers are also considered.

Over and above the foregoing net present values calculated as stated above, it should also be considered that, since the analysis is concentrated on the implementation of the remote management/reading functionality, it takes no account of the rate of replacement of existing meters, which is in any case required given their obsolescence, and therefore if these were to be also considered in terms of avoided costs, they would imply even higher net present values.

Customer types	Distributor size		
	Large	Medium	Small
Case 1: Class F1 in remote management	-8	-11	-130
Case 2: Class F1 in remote reading	-26	-23	-99
Case 3: Class F2 in remote reading	613	685	633
Case 4: Class F3 in remote reading	1151	1227	1182
Case 5: customer mix – Class F1 in remote management, Classes F2 & F3 in remote reading	7	6	-112

Table A2.14
Net Present Value (NPV) for the different consumption classes and cases considered [€/customer]

⁸ For case 1, for which a cost sensitivity analysis was made, the table shows the net present value resulting from the average value of the metering point cost (i.e. case 5).