

REGULATION OF SMART METERS AND AMM SYSTEMS IN ITALY

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SUMMARY

With completion of the liberalization of the electricity sector and the lowering of the eligibility threshold for residential customers as from 1 July 2007, in July 2006 the Italian Regulatory Authority for Electricity and Gas (Autorità per l'energia elettrica e il gas, AEEG) published the consultation document "Recommendations for the use of electronic meters and AMM systems with low voltage customers" [1], with the aim of promoting the use of electronic meters with low voltage (LV) domestic and non domestic customers and of AMM systems for all Distribution Network Operators (DNOs, 168 in Italy), mainly to promote the development of competition in the supply of electricity. After the consultation process, with Resolution 292/06 [2] of 18 December 2006, AEEG confirmed the mandatory installation of electronic meters, characterized by minimum functional requirements, for all LV customers. The mandatory replacement program will take place starting from 2008 and involves all DNOs, regardless the number of the customers served. As from 2007 investments in electronic meters and AMM systems will be recognized in the metering tariff only to DNOs that really invest in these technologies. Furthermore starting from 2008 financial penalties shall be applied to DNOs that do not reach the minimum yearly percentage of installation of electronic meters determined by AEEG.

REGULATORY FRAMEWORK OF THE METERING SERVICE

In Italy, in the electricity sector, the metering service is performed by DNOs. An accounting unbundling is currently required for this service, both from supply and from distribution. The reform of the unbundling of the metering service is planned in the first half of 2007. A specific metering tariff, separated from the distribution tariff, is differentiated per voltage level (HV, MV, LV) and for LV customers also for type of customer (domestic, non domestic) and covers investments and operation expenses related to the metering service. As said in the introduction, from 2007 investments in electronic meters and AMM systems, in particular for LV customers, will be recognized in the metering tariff only to DNOs that really make these investments. For final customers the owner of the meter is always the DNO that is also responsible for installation, maintenance, meter reading and data management activities. Obligations introduced with Resolution 292/06 follow those introduced with prior Resolutions of AEEG regarding the

mandatory installation of interval meters for HV and MV customers who, since the end of 2006, must be all equipped with interval meters. Historically all HV customers and MV customers with high contractual power or high consumptions have been equipped with interval meters since 80s. DNOs are compelled to make available metering data to customers and suppliers periodically and within given deadlines. To this aim AEEG is working in order to strengthen rules in force, for switching events as well. Finally it must be underlined that the choices of Enel distribuzione, and subsequently of other local DNOs (Acea Roma, Asm Brescia and more recently Aem Milano and Aem Torino), to replace electromechanical meters with electronic meters, have been autonomous decisions and have come in the absence of any regulatory obligations.

OBJECTIVES AND CRITERIA OF THE PROPOSALS

These circumstances have allowed AEEG to observe the significant potential of electronic meters and AMM systems, mainly in terms of the large quantity of information available at each LV withdrawal point and the many ways such information can be processed, and the major role they can play in the electricity market of today and tomorrow. In addition to metering, in fact, AMM systems are useful for other services such as power dispatching, distribution and supply and the aggregation of meter readings; they can also be helpful for quality regulation. Furthermore, the impact of electronic metering, together with a healthy degree of competition among electricity suppliers, can strongly influence customers behaviour to the benefit of the entire electrical system. Starting from these assumptions, in the consultation document of July 2006 AEEG stated to pursue three objectives.

1) The development of competition in the supply of electricity to LV customers; to achieve this, AEEG believes that:

1a) all LV customers should be equipped with remotely managed electronic meters that can accurately reflect consumption and provide information on the actual time of use (thereby incorporating the provisions of Article 13, paragraph 1 of European Directive 2006/32/EC of 5 April 2006 on energy end-use efficiency and energy services [3]) and allow retailers to offer two-tier and time of use price schemes, giving customers a price signal more in keeping with the cost of the electricity.

1b) AMM systems should share a unified standard for remote access to customers' withdrawal data by the retailer,

as well as a single standard for the format of this data in order to make it easier and faster for customers to switch retailers, and perform “one-off” tasks for the formulation of offers to potential customers and routine billing operations.

1c) AMM systems should have minimum functional and performance characteristics that are well suited to today's electricity market and offer the same benefits to all customers, whether they remain under the customer protection scheme or opt to switch to a new retailer.

2) Transfer to customers as much as possible of the benefit afforded by conducting business remotely, i.e. without the need for the DNO to access the meter physically.

3) Gathering of information useful for a cost/benefit analysis concerning the tracking, recording, and provision of the hourly load profile for each LV customer or for segments of the LV population, so that, if necessary, the scope of application of load profiling within the dispatching service could be revised and turned into a minimum requirement.

The criteria used by AEEG in developing the proposals are as follows:

a) Even smallest DNOs (e.g.: serving few customers) should also be obliged to install electronic meters, since customers served by small DNOs should have access to the free market with the same opportunities as those served by large ones.

b) Minimum requirements should apply at the system level rather than the equipment level, to render them independent from the architectures recommended by AMM system suppliers or already used by DNOs, thereby preventing the rejection of solutions whose architectures or philosophies may be different from those currently used but which may be just as efficient.

c) AMM systems should be qualified by performance levels rather than intervention in their architecture or in the size of the system or any of its parts, so as not to interfere with the decisions made by DNOs or recommended by system suppliers and to prevent holding back or limiting technological progress, consistently with letter b).

THE RESOLUTION 292/06 OF 18 DECEMBER 2006

Timetable for the installation of electronic meters

In the consultation document AEEG proposed an installation timetable in three phases, monitoring the percentage of power actually equipped with electronic meters: end of 2007 (5%), end of 2008 (25%) and end of 2009 (97%), under the expectation that it would not be possible to complete 100% of the replacement on schedule for reasons beyond the DNOs control. AEEG also proposed that the metering tariff were fully curtailed to the extent that they failed to meet the installation objectives specified. Finally AEEG proposed DNOs to be able to complete the commissioning of the electronic meters within three to four months after the installations. The consultation process

highlighted in particular two positions: on one side DNOs claimed that the required investments were too premature and that the installation timetable and the financial penalties, in case of failing to meet the installation objectives, were too severe; on the other side customer associations and retailers totally agreed with AEEG proposals. Considered all positions and the objectives to be pursued, AEEG decided to spread the installation timetable in four phases, during the third regulatory period (2008-2011), monitoring the percentage of the electronic meter actually installed instead of the percentage of the power actually equipped with electronic meters.

Phase	Percentage of electronic meters installed	By (date)
1	25%	31 December 2008
2	65%	31 December 2009
3	90%	31 December 2010
4	95%	31 December 2011

Table 1 - Plan for the installation of electronic meters with LV customers

Financial penalties in case of failing to meet the installation objectives specified in Table 1 have been confirmed, but they will be reviewed, with respect of the proposal put under consultation, and determined in 2007 during the consultation process for the third regulatory period. To the aim of dispatching purposes (interval metering) DNOs are obliged to install electronic meters for the 100% of LV customers with contractual power higher than 50 kW within 31 December 2008. DNOs are allowed to keep interval meters (the same as those mandatory for MV and HV customers) already installed, voluntarily, for LV customers with high contractual power or high consumption. Besides, as from 1 January 2008 DNOs are compelled to install only one bi-directional electronic meter for active energy for customers who, following this date, request to inject active energy into the network (distributed generation): one single-phase bi-directional electronic meter for a single-phase application and one three-phase bi-directional electronic meter for a three-phase application). Decisions concerning the commissioning time of the electronic meters after the installations will be taken with further Resolutions.

Minimum functional requirements of electronic meters

In the consultation document AEEG proposed the introduction of functional and performance requirements, the first defined as the presence of certain functions within the electronic meters and AMM systems and the second as the AMM system's ability to render available those functions, in some cases according to success rates or specific deadlines. The identification of functional requirements was made possible by AEEG's data collection activity during the first half of 2006. Main suppliers of these technologies, along with DNOs that are already using or

installing electronic meters and AMM systems, were asked for information on the following:

- the characteristics and functions of single-phase and three-phase electronic meters for LV customers;
- the characteristics and functions of the intermediate equipment used to concentrate data;
- the characteristics, functions and architecture of the AMM systems and control centres, the telecommunications systems used, and, where available, the performance of the AMM systems.

Comments received to the consultation document suggested AEEG to deepen with following consultations the introduction of performance requirements for AMM systems. AEEG agreed to this proposal and in Resolution 292/06 it determined only minimum functional requirements for electronic meters which, nevertheless, must be installed ready and preset to be remotely managed in following phases. In other words, even if Resolution 292/06 focuses only on meters, AEEG decided to set minimum requirements geared mainly towards the system as a whole rather than being limited to the meters or other individual parts of the system. As said above, with following Resolutions AEEG might qualify AMM systems by setting performance levels. This approach is considered a necessity if AEEG will assess the performance of AMM systems too poor and not satisfactory for customers. Hereafter are described minimum functional requirements for single and three phase meters introduced with Resolution 292/06:

- *Metered energy*. Active energy withdrawn regardless the type of meter, reactive energy withdrawn for three-phase meters.

- *Weekly profile*. Four price bands; at least five intervals throughout the day in which to apply the four price bands; weekly programming including holidays (the local patron saint's holiday as well). For all meters, there must be totalizers for active energy withdrawn per price band, plus a comprehensive totalizer. For three-phase meters only, there must be totalizers for reactive energy withdrawn per price band, plus a comprehensive totalizer, as well as a register indicating the quarter-hourly peak active power withdrawn per price band. At least two changes of the price scheme a year per meter must be allowed.

- *Hourly load profiles (interval metering)*. Each type of meter must record active energy withdrawn in the form of hourly load profiles, with a depth of 36 days; three phase meters also for reactive energy withdrawn.

- *Direct demand control*. Meters equipped with circuit breakers must allow withdrawals (for active energy) that exceed contractual power by up to 10% for an indefinite length of time. If withdrawal exceeds contractual power by more than 10%, the meter must have a tolerance band allowing the customer said withdrawal for a limited amount of time, sufficient to reduce it before the circuit breaker intervenes, striking an appropriate balance between the amount of power demanded and the length of time spent within the band. Before the circuit breaker takes effect, an alarm message must appear on the meter's display. Meters

not equipped with circuit breaker do, however, record quarter-hourly peak active power withdrawn for each price band in effect.

- *Security of withdrawal data*. Memory areas containing withdrawal totalizers and registers must be protected at least by checksums or CRCs (Cyclic Redundancy Checks), even during their transmission to the AMM control centre. If a protected memory area is corrupted and cannot be recovered from the backup (if present), an alarm should be sent to the AMM control centre. Meters must also be equipped with a program status word, read continuously, that signals with timeliness any errors to the control centre.

- *Synchronization of meter clocks/calendars*. Meters must have a clock/calendar function with seconds capability and, if they are not equipped with GPS (Global Positioning System) instrumentation, they must be synchronized at least once a day. If the clock/calendar malfunctions, the meter must assign the energy withdrawn to the price band most favourable to the customer.

- *Remote transactions*. Meters must be ready and preset, once installed, to perform the following remote transactions:

- a) periodic readings of withdrawal data (totalizers and registers described in the above *weekly profile*) for billing purposes (flexible billing cycles whereby customers and retailers can agree on billing frequencies different from those currently in force for customers in the captive market, determined by AEEG with prior Resolution, are required);
- b) reading of hourly load profiles;
- c) contractual changes, namely:
 - c1) meter activation (including for succession) and deactivation;
 - c2) name change (without interruption of supply);
 - c3) change in contractual power;
 - c4) change in price scheme;
 - d) reduction, suspension and reactivation of contractual power;
 - e) meter reparameterization;
 - f) synchronization of meter clocks, for those without GPS instrumentation;
 - g) transmission of messages on the meter display;
 - h) continuous reading of the status word;
 - i) reading information related to the rms voltage value (max, min value in a week; number of samples in the range +/- 10% of the nominal voltage in a week, according to EN 50160 [4]).

- *Freezing of the withdrawal data*. "Freezing" of the withdrawal totalizers and registers, consistently with the type of meter (single-phase or three-phase) are required when withdrawal data are read for billing purposes and upon switching or contractual changes (power, price scheme).

- *Meter display*. The meter must have a display which at the press of a button shows at least the running and frozen totalizers of active energy withdrawn for single-phase meters and also of reactive energy withdrawn and quarter-hourly peak active power withdrawn for three-phase meters per price band; the price band in effect; the date and time;

the instantaneous active power withdrawn. The meter must be able to display messages generated on its own (e.g. warnings) or transmitted by the AMM control centre.

- *Rms value of the voltage.* The meter must measure the rms value of the voltage according to EN 50160.

- *Upgrade of the software.* Meters must be enabled for remote upgrade of the program software. Upgrades must preserve the withdrawal totalizers and registers that have been recorded up to that time, and the meter's existing contractual settings (price scheme, contractual power, etc.). During upgrades, the meter must be able to measure and record in the appropriate registers the active energy withdrawn (and the reactive energy withdrawn in the case of three-phase meters), and keep up the clock/calendar function. If, during an upgrade, the meter cannot differentiate the energy withdrawn according to the price scheme setting, the meter must assign the energy to the price band most favourable to the customer, as proposed for synchronization. The upgrade must take place in accordance with current measuring regulations, in particular articles 7.6 and 8.1 of Annex 1 to European Directive 2004/22/EC [5].

As far as single and three phase bi-directional meters are concerned, for active energy injected into the grid there must be totalizers per price band plus a comprehensive totalizer; hourly profiles; the same rules apply to the totalizers for security, freezing, display, in case the clock/calendar malfunctions and during software upgrades.

USE OF ELECTRONIC METERS AND AMM SYSTEMS FOR CONTINUITY OF SUPPLY REGULATION PURPOSES

With Resolution 122/06 of 20 June 2006 [6] AEEG introduced new rules aimed at recording interrupted LV customers. Starting from 2008, gradually depending on the size of DNOs, the obligation to record the number and the list of the LV customers actually involved in each long unplanned interruption shall come into force. This mandatory rule shall replace the current one in force based on the estimate of interrupted LV customers. To this purpose DNOs are allowed to use information systems, characterized by minimum requirements determined by AEEG, or electronic meters and AMM systems. This second type of system has been considered by AEEG the *optimal* system as it is more precise than information systems when calculating the interrupted LV customers in case of mono-phase or bi-phase faults and when recording the beginning instant of the interruptions with origin on LV network. For this reason AEEG, with Resolution 292/06, provided a financial incentive for DNOs that will use electronic meters and AMM systems to this purpose. According to this principle AEEG decided to not introduce any functional requirements regarding capabilities of electronic meters to record information related to interruptions of supply (e.g.: number and duration of interruptions).

FUTURE STEPS

In the consultation document AEEG faced other important subjects, in particular the access to withdrawal data by retailers. AEEG made proposals concerning the data contents (differentiated for domestic and non domestic customers, for both periodic billings and finalization of commercial offers for potential customers), the data format and the communication channel. Because of its importance this subject will be put again under consultation in early 2007. DNOs, retailers and customer associations should be involved in the decision-making process.

Other subjects AEEG is willing to deepen again in the future are:

- performance requirements of AMM systems (e.g: failure rates for billing purposes, success rates for commercial transactions within 24/48 hours, meter reparameterization time, etc) if necessary (see above);
- the obligation of installing only bi-directional meters, for active energy, starting from 2012;
- the use of standard protocols for the communication towards the control centre (meter interoperability), for domestic purposes (demand response) and for the development of added value services;
- the systemic use of the rms value of the voltage for quality of supply regulation purposes.

REFERENCES

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