

ESMA & JRC WORKSHOP ON SMART METERING

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Smart metering regulation in Italy, energy efficiency and demand response

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SMART METERING REGULATORY FRAMEWORK

- **Both electricity and gas sectors** covered by smart metering (and metering) regulation
- **Minimum functional requirements + deadlines + penalties** for installation/commissioning
- **Electricity:** Regulatory Orders n. 292/06 and n. 235/07, following public consultation (in English at <http://www.autorita.energia.it/docs/06/292-06allengnew.pdf>)
- **Gas:** Regulatory Order ARG/gas 155/08, following public consultation (in English at <http://www.autorita.energia.it/docs/08/155-08alleng.pdf>)



METERING SERVICE REGULATORY FRAMEWORK

- In Italy the **metering service** is performed by DNOs (in both the electricity and the natural gas sector)
- The **accounting separation** has been into force since 2001 and was reformed in January 2007 (both sectors)
- The **metering tariff** has been separated from the distribution tariff since 2004 for electricity and in 2009 for natural gas
- **Functional unbundling** is required for vertically integrated companies as from 2010 for electricity and 2012 for natural gas



SMART METERING - REGULATORY APPROACH

Two different approaches:

- **Electricity**: judged **unavoidable** the implementation of smart metering for all DNOs after ENEL and other major DNOs took autonomously the decision to replace electromechanical meters with SM, in the absence of any regulatory mandate
- **Gas**: following an **in-depth impact assessment** (e.g. CBA, technical survey)

Drivers:

- completion of the **liberalisation** (01/07/2007) + **high differences among DNGs** (AAM system vs electromechanical) + **prevention of free-riding (unique national tariff)** + potential role of AMM systems at present and in the future
- **Directive 32/2006/EC** (transposed to the Italian legislation in May 2008 - decree n. 115/08)



CRITERIA

Minimum functional requirements should:

- guarantee the pursuance of **regulatory objectives**
- guarantee the **same options to all customers** (household/non household; free/in the “protection scheme” with prices regulated by AEEG)
- guarantee **interoperability and standardization**
- be **defined at system level**
- **not act as a barrier to technological innovation** (e.g. should be independent from the architectures used by DNOs or recommended by AMM system suppliers as well as from telecommunication systems)



Electricity



REGULATORY OBJECTIVES

- To help ensure **competitiveness** in the supply of electricity to residential and non-residential customers
- To establish the functional and technological conditions to make it possible to **extend hourly metering also to low-voltage withdrawal points**
- To **improve the quality** of service for LV consumers in electricity metering, supply and distribution + **ensure the same functional and performance levels** both for customers in the free market and those in the universal service
- **NB until recently no specific attention paid to energy efficiency or demand-response** (i.e. load management) regulatory objectives (e.g. remote display, home and building automation)



REGULATION

- **R.O. n. 292/06** introduced:
 - replacement obligations
 - minimum functional requirements
- **R.O. 235/07** introduced **performance indicators** for smart metering systems, only for monitoring purposes



COMMISSIONING TIMETABLE

		Installation	Commissioning	Penalty (*)
Household customers and non household customers with $P \leq 55\text{kW}$	25%	31-Dec-08	30-Jun-09	
	65%	31-Dec-09	30-Jun-10	
	90%	31-Dec-10	30-Jun-11	
	95%	31-Dec-11	30-Jun-12	
Customers with $P > 55\text{kW}$	100%	31-Dec-08	30-Jun-09	

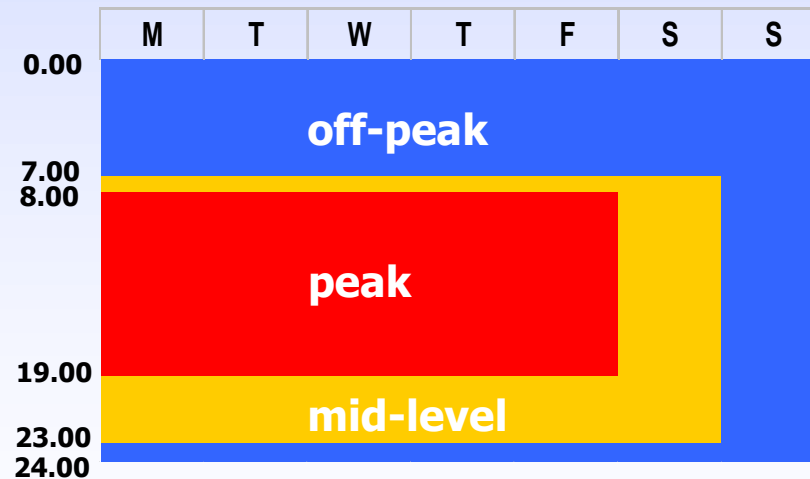
(*) not recognized CAPEX for electromechanical meters not replaced



PARAMETRIZATION OF SMART METERS

- **Gradually:**

- Required **interval metering** (1 hour) for all LV customers with available power > 55 kW
- Required the **parametrization per band** for all LV customers with available power ≤ 55 kW



- “Freezing” of consumption data must coincide with solar months (monthly or bimonthly)



THE METERING TARIFF

- 2004: **separated** the metering tariff from the distribution tariff
- 2004-2007: the “**extra-charge**” for each **household customer** due to smart meters **<2 €/year**
- 2008-2013:
 - **5% X factor** for metering activities, vs 1.9 % for distribution activities
 - **yearly adjustment**



"DAILY" USE

Functions available today for roughly 30 ml customers:

- supply activation/deactivation
- monthly/bimonthly readings (-> billings)
- change of the contractual power
- reduction of the contractual power (bad payers)
- disconnection/reconnection (bad payers)
- switching

4,5 Million customers have their consumptions recorded according to the three bands (peak/off-peak/mid-level):

- 2,5 Millions are in the free market with TOU prices
- 2 Millions are in the protection scheme; 0,17 Millions have chosen the TOU tariff regulated by AEEG



DEMAND-RESPONSE

- **The present:**

- **weak requirements** (breaker and demand control algorithm on board, remote reduction of the available power until disconnection, display on board)
- strengthened by **interval metering** ($> 55\text{kW}$) and by **TOU** (peak/off-peak/mid-level for $\leq 55\text{kW}$)

- **The future?**

- **study carried out in 2008** to assess the possibility to integrate smart meters with remote display and home/building automation



THE NEAR FUTURE

AMM systems and smart meters will be used:

- starting from 2010, to record LV customers involved in interruptions of supply (on a voluntary basis; regulatory financial incentive)
- according to timetable and rules to be defined, to record slow voltage variations



NEXT STEPS

- New requirements
- **DSM issues (both energy efficiency and demand-response)**
- Standardization and interoperability
- Smart grids development
- Potential synergies with gas smart metering systems



Natural Gas



REGULATORY OBJECTIVES

- To make it easier to **eliminate any inefficiencies and discriminatory features** by improving the process of recording and accounting for the natural gas withdrawn by consumers and by introducing technological innovations to metering units
- To create the functional and technological **conditions for the introduction of mechanisms to develop a market system** for natural gas and support the definition of the regulated market and the new balancing service
- To improve the **quality** of service in metering, sales and distribution, while **ensuring the same functional and service levels** irrespective of the operator responsible for the metering service
- Promoting **greater awareness of consumption levels**



CBA: major hypothesis

- No extra-charges for customers were assumed to obtain the NPV shown in the previous slide
- Costs did not include the residual depreciation of traditional meters due to be replaced by smart meters (as the intention was to continue making a tariff allowance for DNOs to compensate this)
- The periodical replacement of the power supply batteries was considered (once in the life-cycle of smart meters in the consumption band up to 5,000 m³/year and every two years for smart meters in the consumption band over 5,000 m³/year)
- The installation, on average, of one data concentrator every twelve smart meters was assumed (more than 95% of smart meters will be managed through data concentrators)
- The costs needed to interface smart metering systems with billing systems were considered
- Financial benefit to retailers (found out to be significant) were not included in the NPV calculation (and will be considered by AEEG as part of the actions to benefit consumers)



CBA: major findings/ 1

- **for annual consumption up to 5,000 m³:**
 - neither AMR nor AMM seem justifiable, regardless of the size of the DNO
 - AMM implementation is relatively more profitable than AMR
- **for annual consumption of over 5,000 m³ : AMR implementation entails undoubted financial benefits**, even just a few years after the investments made, irrespective of the size of the DNO;
- **if the three bands of annual consumption (AMM for annual consumption up to 5,000 m³) are analysed simultaneously:** for large and medium sized DNOs, the NPV is positive; this reflects the high benefits deriving from consumption of over 5,000 m³ .



CBA: major findings/2

Annual consumption bands	Size of DNO (no. of customers)		
	Large (> 500,000)	Medium (50,000-500,000)	Small (< 50,000)
Case 1: < 5,000 m ³ , AMM (*)	-8	-11	-130
Case 2: < 5,000 m ³ , AMR	-26	-23	-99
Case 3: 5,000–200,000 m ³ , AMR	613	685	633
Case 4: > 200,000m ³ , AMR	1,151	1,227	1,182
Case 5: < 5,000m ³ , AMM (Case 1) ≥ 5,000m ³ , AMR (Cases 3 and 4)	7	6	-112

NPV at year 15 for different annual consumption bands [€/meter]

(*) AMM = AMR + electrovalve on smart meter devices that cannot be opened remotely.



COMMISSIONING SCHEDULE

(Regulatory Order ARG/gas 155/08)

	Commissioning deadline	%	Penalty [€/meter non commissioned]
> G40	31 December 2010	100%	54
\geq G16 and \leq G40	31 December 2011	100%	21
> G6 and < G16	31 December 2011	30%	12
	31 December 2012	100%	
\leq G6	31 December 2012	5%	4
	31 December 2013	20%	
	31 December 2014	40%	
	31 December 2015	60%	
	31 December 2016	80%	



MIMINUM FUNCTIONAL REQUIREMENTS (MFR)

- **Two categories of requirements:** AMM for smart meters $< G10$ and AMR for smart meters $\geq G10$
- **MFR:**
 - Metering unit's clock/calendar
 - Compensation of Temperature and Pressure (the latter not adopted for household customers)
 - Electrovalve on board of meters for household customers (AMM for G4/G6)
 - Interval metering (minimum interval: 1h for $\geq G10$, 1 day for G4/G6)
 - **TOU withdrawal totaliser registers**
 - **Saves and backups of withdrawal totaliser register** (... whenever a new TOU schedule comes into effect)
 - Withdrawal data security
 - Diagnostics
 - **Display** at customer's request
 - **Information on real-time withdrawal** at customer request (cf. following slide)
 - Standardization and interoperability



NEXT STEPS RELEVANT FOR END-USE ENERGY EFFICIENCY

- (Access to the low voltage distribution network)
- **Regulatory framework regarding the remote display:**
 - for customer equipped with smart meters <G10: additional physical or logical communication gate on smart meter device, installed **at customers' request at a charge** still to be defined
 - for customers equipped with smart meters > G10: pulse emitter output installed **at customers' request, at a cost** still to be defined
 - ➔ compliance with Directive 32/2006/EC as transposed by Decree n. 115/08: *"information on actual time of use and energy consumption must be provided to customers both through suitable remote displays and through standard instruments already available to the them (e.g. bills, the Internet, etc.)"*
- The new **meter-reading frequencies**



SMART METERS; DEMAND RESPONSE AND ENERGY SAVINGS/1

- Smart meters also allow the implementation of demand response programs thus delivering load reductions via load shifting or curtailment
- But the extent to which Demand Response programs also affect energy use during off-peak periods and overall building/facility energy use and energy efficiency is unclear



SMART METERS; DEMAND RESPONSE AND ENERGY SAVINGS/2

- **There are potential synergies**
 - DR can help identify inefficient and non-essential energy uses that could be reduced at other times
 - technologies that can enable DR also can be used effectively to manage energy use year-round
 - experience from DR can lead to greater awareness of energy savings opportunities via improved energy efficiency



SMART METERS; DEMAND RESPONSE AND ENERGY SAVINGS/3

- **But there are also potential conflicts**
 - room for confusion in marketing messages
 - participating in a DR program could tend to lessen customer interest in pursuing broader energy efficiency
 - (Reliability-based programs): possible perverse incentive to take the baseline 'high' and not take permanent energy efficiency actions that might reduce it (example)
 - (Price-base programs) possible disincentive to pursue non-peak energy efficiency measures (example)



SMART METERS; DEMAND RESPONSE AND ENERGY SAVINGS/4

- With DR customers gain **awareness and understanding** of their energy use and can use this information to manage their energy use at all times
- **However information alone is generally not sufficient** to produce significant changes
 - Customers must have both motivation and ability to enact changes
 - DR technologies can provide the means to enact certain changes
 - But additional investment and actions may be needed
 - Customers **may lack information, financial and other resources and/or sufficient incentives** to capitalize in the opportunities to improve energy efficiency of end-use equipment of which they have become aware via DR programs



THANK YOU

For smart metering, energy efficiency and demand response at Autorità per l'energia elettrica e il gas-AEEG (Regulatory Authority for Electricity and Gas):

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