Smart metering
Cost-benefit analysis: experience in Italy

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METERING REGULATORY FRAMEWORK

	Electricity	Gas
Regime	Regulated	
Operator responsible for metering services	DNO	DNO (until 2008 Retailers could carry out meter reading)
Accounting separation	2001	
Unbundling reform	2007	
Separation of the metering tariff	2004 (from the distribution tariff)	2009 (from the distribution tariff and from the retail tariff component)
Functional unbundling in force	2010	2012

SMART METERING REGULATORY FRAMEWORK

- Both electricity and gas sectors are covered by smart metering (and metering) regulations (r.o. 292/06 for electricity – r.o. ARG/gas 155/08 for gas)
- In both cases minimum functional requirements and deadlines (with penalties) for installation/commissioning have been introduced

SMART METERING - REGULATORY APPROACH

Two different approaches:

- Gas: impact assessment (cost-benefit analysis, technical survey, …)
- Electricity: judged unavoidable the implementation of smart metering at Country level (that's for all DNOs) after the ENEL choice

GAS

THE GAS DISTRIBUTION IN ITALY (Snapshot 2007)

DNO	No. of customers	% of customers
• Italgas (ENI group)	4,715,000	24.0%
• Enel Rete Gas	1,997,178	10.2%
• Hera	976,717	18.7%
• Aem Distr. Gas (MI)	822,864	
• Comp. napoletana	698,373	
• Italcogim	595,725	
• Toscana energia	589,291	
• 22 DNOs with no. of customers between 100,000 and 500,000	4,356,618	22.1%
• 170 DNOs with no. of customers between 5,000 and 100,000	4,651,503	23.6%
• 115 DNOs with no. of customers < 5,000	267,074	1.4%

GAS: TIMETABLE FOR THE COMMISSIONING OF SMART METERS

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

GAS: TOWARDS THE ROLL-OUT (1/2)

Carried out in 2007:

- a survey on the use of gas AMR/AMM systems in Europe, found:
  - projects running (in some cases combining electricity and gas)
  - different technologies of involved meters in the system (traditional+data logger module/new generation meters)

GAS: TOWARDS THE ROLL-OUT (2/2)

Carried out in 2007:

- a benchmark on gas smart meters, found:
  - availability of new functionalities
  - availability of new measurement technologies (mature, but with low level of industrialization) with correction of temperature and temperature+pressure
  - some models already MID certified for both pressure and temperature correction or only for temperature correction
  - availability of solutions with electrovalve on board
  - problems coming from the battery life: depends on environmental conditions, on the frequency and the amount of data to be transmitted by the meter, on the use of the display, etc

GAS: SOME *EX-ANTE* DECISIONS

- Quantitative cost-benefit analysis to be done DNO side, that's the actor that will make investments and meter reading activities
- Quantitative cost-benefit analysis to be differentiated according to the size of DNOs. Large (>500,000 consumers), Medium (50,000-500,000 consumers) and Small (<50,000 consumers)
- To be assessed both AMR and AMM (*) for household consumers (annual consumption < 5,000 m^3) and only AMR for the others (annual consumption >5,000 m^3)
- Pointed out a difficulty in carrying out a quantitative cost-benefit analysis consumer side in particular for households

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

GAS: SOME *EX-ANTE* HYPOTHESES

- No extra-charges for customers were assumed to obtain the NPV shown in the following
- Costs did not include the residual depreciation of traditional meters due to be replaced by smart meters
- 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 m^3/year and every two years for smart meters in the consumption band over 5,000 m^3/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

GAS: FINDINGS OF THE COST-BENEFIT ANALYSIS (1/4)

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	1 – 1.18	1.27 – 1.46	3.14 – 3.35
Case 2: < 5,000 m^3, AMR	1	1.26	3.33
Case 3: 5,000–200,000 m^3, AMR	1	1.16	1.89
Case 4: > 200,000 m^3, AMR	1	1.12	1.43
Case 5: < 5,000 m^3, AMM (Case 1) ≥ 5,000 m^3, AMR (Cases 3 and 4)	1 – 1.17	1.26 – 1.44	3.05 – 3.25

Cost of a single commissioned measurement point normalised to the cost of a large DNO

GAS: FINDINGS OF THE COST-BENEFIT ANALYSIS (2/4)

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	1	1.19	1.43
Case 2: < 5,000 m^3, AMR	1	1.32	1.69
Case 3: 5,000–200,000 m^3, AMR	1	1.09	1.19
Case 4: > 200,000 m^3, AMR	1	1.06	1.13
Case 5: < 5,000 m^3, AMM (Case 1) ≥ 5,000 m^3, AMR (Cases 3 and 4)	1	1.17	1.37

Annual benefit for a single measurement point normalised to the cost of a large DNO

GAS: FINDINGS OF THE COST-BENEFIT ANALYSIS (3/4)

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[1]	-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: > 200,000 m^3, AMR	1,151	1,227	1,182
Case 5: < 5,000 m^3, AMM (Case 1) ≥ 5,000 m^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.

GAS: FINDINGS OF THE COST-BENEFIT ANALYSIS (4/4)

- Quantified benefits (in Euros) were found for suppliers as well
- Those benefits were not used to assess the NPV shown in the previous slide
- From a qualitative point of view several benefits were assessed also for the "gas-system" as a whole

GAS: FOCUS POINTS

- Compensation of Temperature and Pressure (the latter not adopted for household customers)
- Electrovalve on board of meters for household customers (AMM for G4/G6)
- Parametrizeable interval metering (minimum interval: 1h for >= G10, 1 day for G4/G6)
- TOU withdrawal schemes
- Standardization and interoperability
- Battery life (and limitations implied by it)
- Communication between data concentrators and meters
- Installation of data concentrators (power supply, location)
- Potential displacement of meters

GAS: MIN. FUNCTIONAL REQUIREMENTS ADOPTED

Minimum functional requirement	≥ G10 (AMR)	< G10 (AMM)
Metering units' clock/calendar capable of managing seconds; synchronised with the same reading frequency; maximum monthly drift shall not exceed:	3 min.	5 min.
Temperature adjustment. Measure of the gas withdrawn at standard temperature conditions (15°C).	Yes	Yes
Pressure adjustment. Measure of the gas withdrawn at standard pressure conditions (1,01325 bar).	Yes	No
Withdrawal totaliser register. One single incremental totaliser register.	Yes	Yes
Time-of-use withdrawal totaliser registers. Three separate totaliser registers, three types of day, up to five intervals a day. Schedule updatable twice a year.	Yes	Yes
Interval metering. 70-day capacity, minimum interval:	1 hour	1 day
Saves and backups of withdrawal totaliser register. Min. six-monthly, max monthly; whenever a new TOU schedule comes into operation. Withdrawal registers must be kept after the battery has been replaced or has run out.	Yes	Yes
Withdrawal data security. Mechanisms to protect and monitor withdrawal registers.	Yes	Yes
Diagnostics. Self-diagnosis checks, including one on the maximum monthly drift. Result recorded in a status word for transmission to the remote management centre.	Yes	Yes
Display. At the customer's request: date and time, current and last save withdrawal registers, the register active at the time of display, any alarm showing that the metering unit has recorded an anomaly.	Yes	Yes
Electrovalve. Available on meters, cannot be opened remotely. During any power-supply failures it retains its state.	No	Yes
Up-dating of the metering unit software programme.	Yes	Yes
Information on real-time withdrawal. At customer's request only (see the paragraph "Compliance with European Directive 2006/32/EC").	Pulse emitter output	Additional physical or logical communication gate (regulatory framework still to be defined)

ELECTRICITY

ELECTRICITY – LV DISTRIBUTION

DNO	No. of LV customers	% of LV customers
• Enel distribuzione	30,063,172	85.8%
• Acea Roma	1,552,054	
• A2A Milano	856,278	
• Aem Torino	554,992	
• Set distribuzione	227,255	
• A2A Brescia	220,893	
• Hera Bologna	163,728	12.1%
• Agsm Verona	159,328	
• Acegas Trieste	140,676	
• Ae-Ew Bolzano	124,770	
• Deval Aosta	122,531	
• Enìa Parma	117,246	
• 31 DNOs with no. of LV customers between 5,000 and 100,000	597,277	1.7%
• 125 DNOs with no. of LV customers < 5,000	150,000	0.4%

ELECTRICITY: SMART METERS FOR LV CUSTOMERS

Current status of the commissioning plan

Snapshot at 30 June 2009 for major DNOs

DNO	No. of LV customers	% of LV customers equipped with commissioned smart meters
Enel distribuzione	30,063,172	95.4%
Acea Roma	1,552,054	57.8%
A2A Milano	856,278	28.2%
Aem Torino	554,992	31.0%
Set distribuzione	227,255	27.6%
A2A Brescia	220,893	92.4%
Hera Bologna	163,728	32.6%
Agsm Verona	159,328	31.3%
⋮	⋮	⋮

> 90% at Country level

ELECTRICITY: 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 has been less than 2 Euros per year
- **2008-2013**:
  - the X factor will be 5% for metering activities (vs 1.9 % of distribution activities)
  - the metering tariff is/will be adjusted every year
- An equalization mechanism is envisaged in order to recognize higher costs to smaller DNOs

Thank you for your attention!

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