ITALY
THE CASE OF SMART METERS

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IEA Workshop

Transforming innovation into realistic market implementation programmes

Paris, 28 April 2010

AGENDA

- Electricity smart metering in Italy
- Gas smart metering in Italy
- Conclusions (answers to some questions addressed by IEA)

ELECTRICITY SMART METERING IN ITALY

SMART METER IMPLEMENTATION CURRENT SITUATION IN EUROPE

Smart meters are already installed	Smart meters are being installed	Roll-out plan is decided	Roll-out plan is under discussion	There is no roll-out planned
Denmark (15%)	Iceland (15%)	Finland	Austria	Hungary
Italy (90%)	Denmark (35%)	Greece	Czech Republic	Luxembourg
Sweden (99%)	Italy (5%)	Italy	Denmark	
	The Netherlands (4%)	Spain	France	
			Germany	
			Great Britain	
			Ireland	
			The Netherlands	
			Norway	
			Poland	
			Portugal	
			Slovak Republic	

ERGEG Status review report on smart metering (2009) available at www.energy-regulators.eu

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30 millions installed at mid-2009

ERGEG Status review report on smart metering (2009) available at www.energy-regulators.eu

ITALY METERING CHARACTERISTICS

- Electricity DSOs
  - Enel D. 85%
  - Acea Roma 5%
  - A2A Milano-BS 3%
  - Others middle-size* 3%
  - Others small-size** 4%

  * each between 1 M and 100 k cust.
  ** each less than 100 k cust.
- Scale of LV market
  - 35 Millions LV meters, of which:
    - 28 M household
    - 7 M small business
  - 137 TWh energy distributed at LV, of which:
    - 90 TWh univers.supply *(of which 60 TWh household)*
    - 47 TWh free market *(of which 2.5 TWh household)*

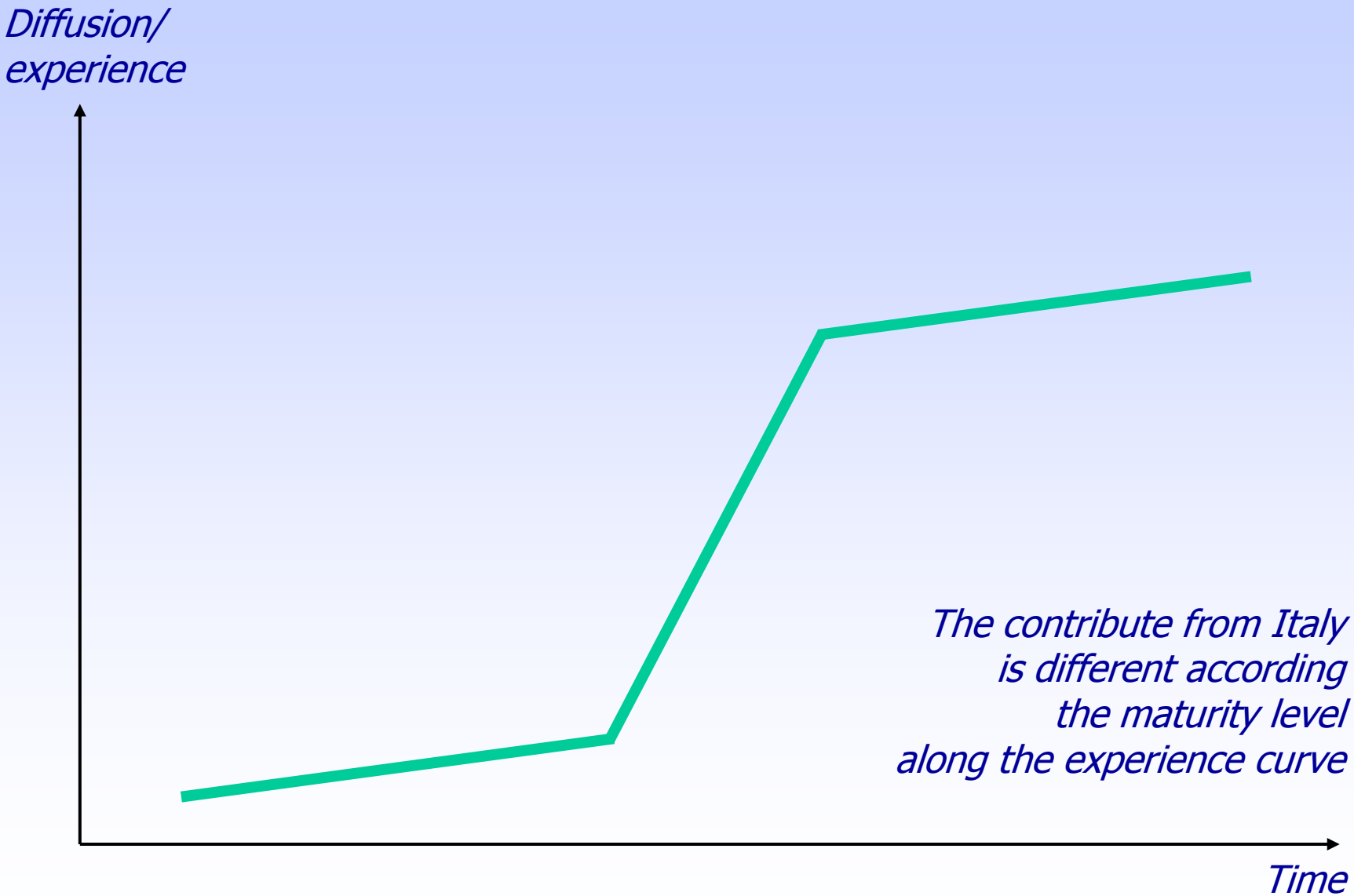
Source: AEEG Annual report (2009)

	Electricity	*Gas*
Regime	regulated	regulated
Operator responsible	DSO	DSO (retailer until 2008 for meter reading only)
Accounting separation	From 2001	From 2001
Tariff separation (from distrib.)	From 2004	From 2009
Minimum functional requirem.s	From 2006* (95% by 2011)	From 2008** (80% by 2016)

* Electricity: Regulatory Orders 292/06 and 235/07 (*in English:* http://www.autorita.energia.it/docs/06/292-06allengnew.pdf)

** Gas: Regulatory Order ARG/gas 155/08: (*in English:* http://www.autorita.energia.it/docs/08/155-08alleng.pdf)

EXPERIENCE CURVE



The contribute from Italy is different according the maturity level along the experience curve

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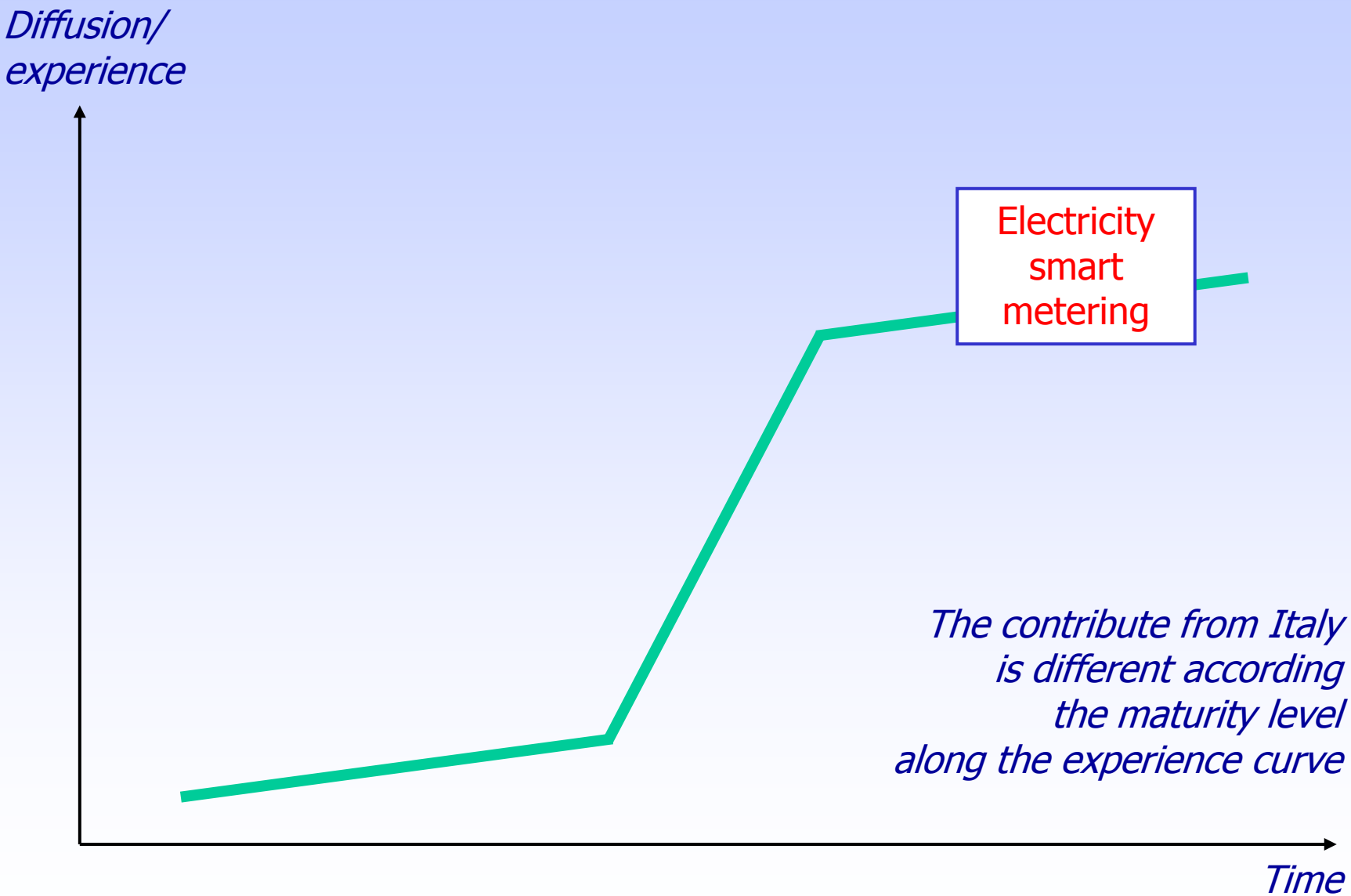

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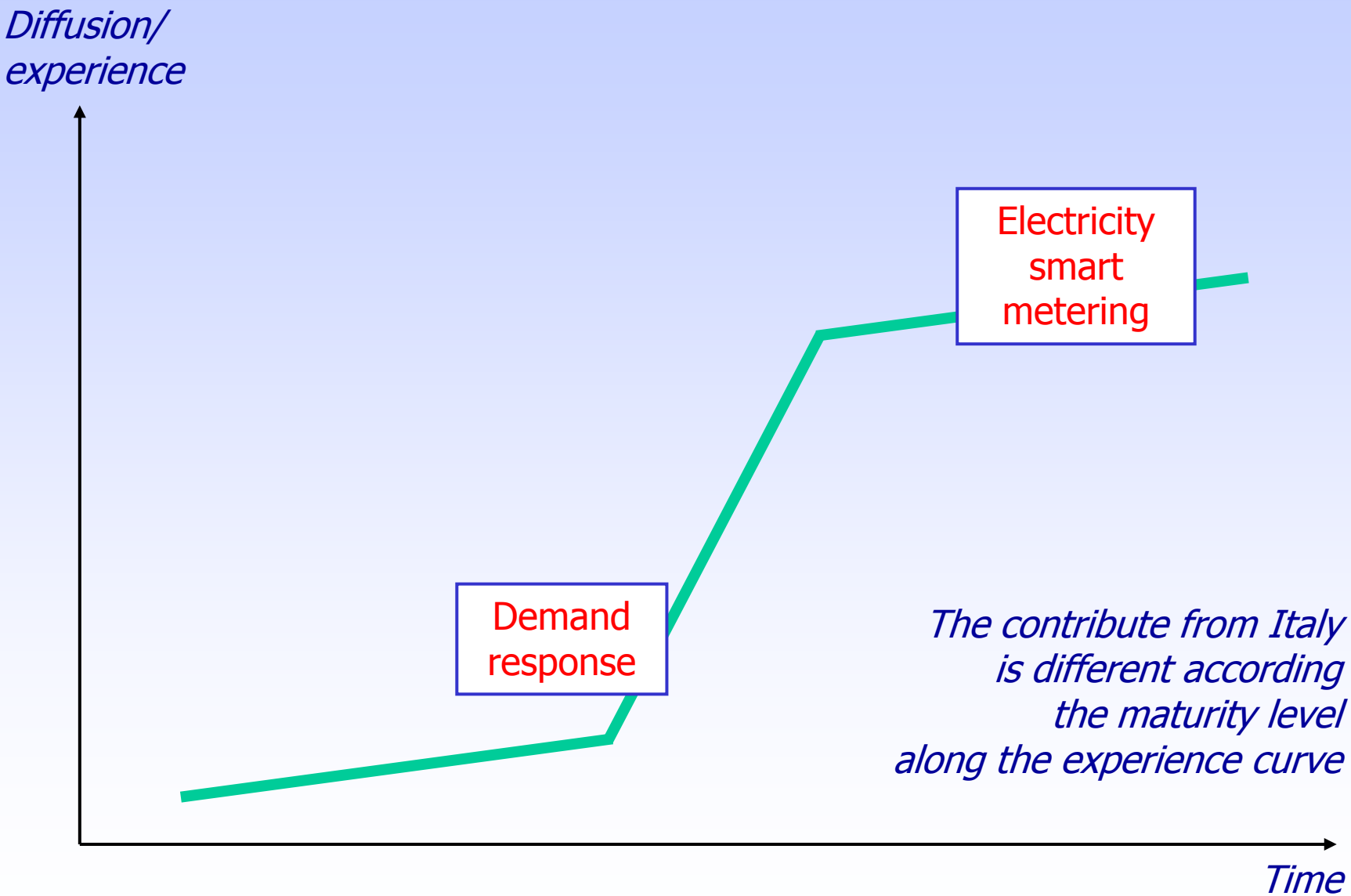

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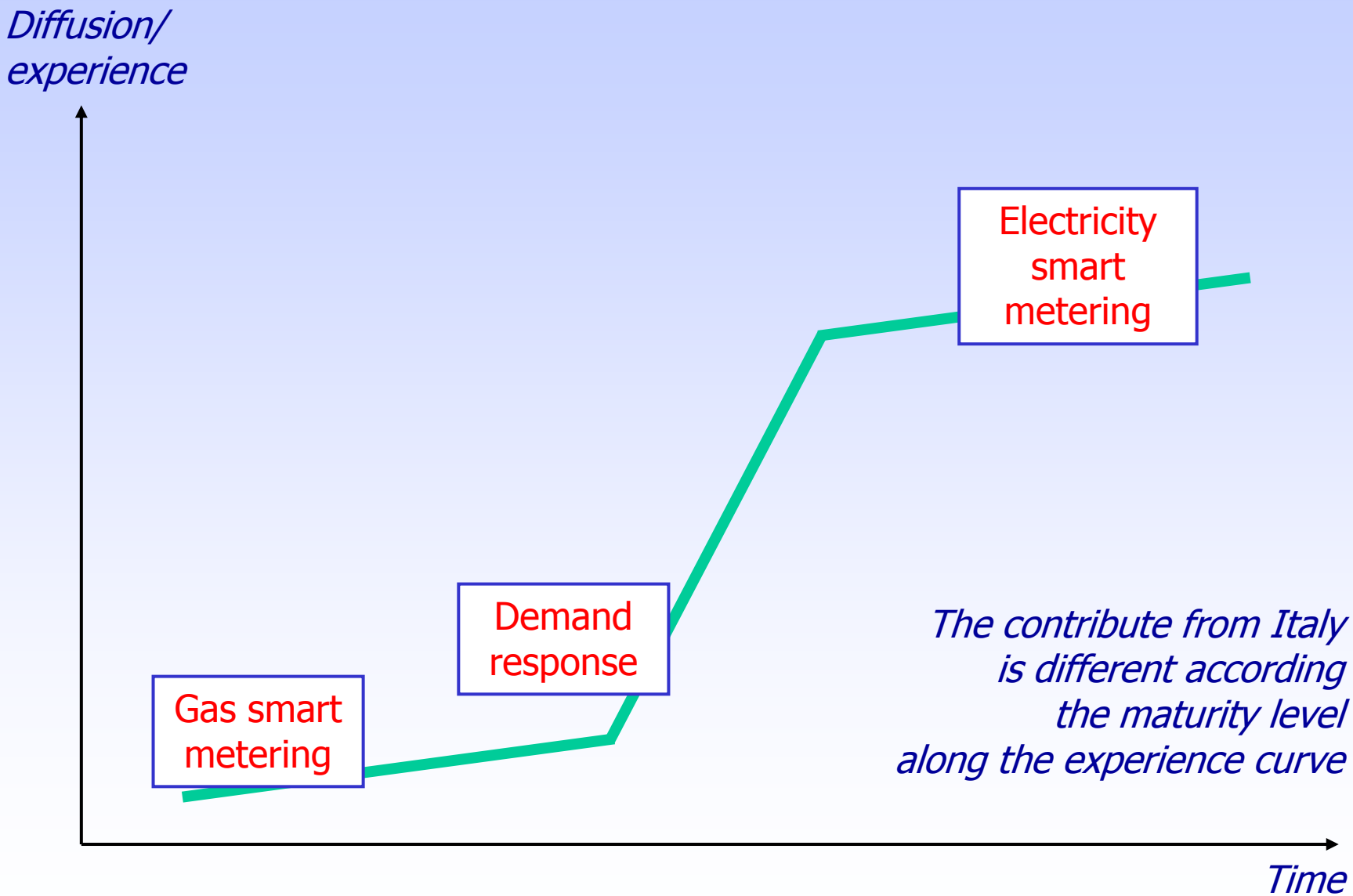


The contribute from Italy is different according the maturity level along the experience curve

SMART METERS FOR LV CUSTOMERS
Mandatory timetable (1/2)

		Installation	Commissioning	Penalty (*)
Household customers and non household customers with P<=55kw	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>55kw	100%	31-Dec-08	30-Jun-09	

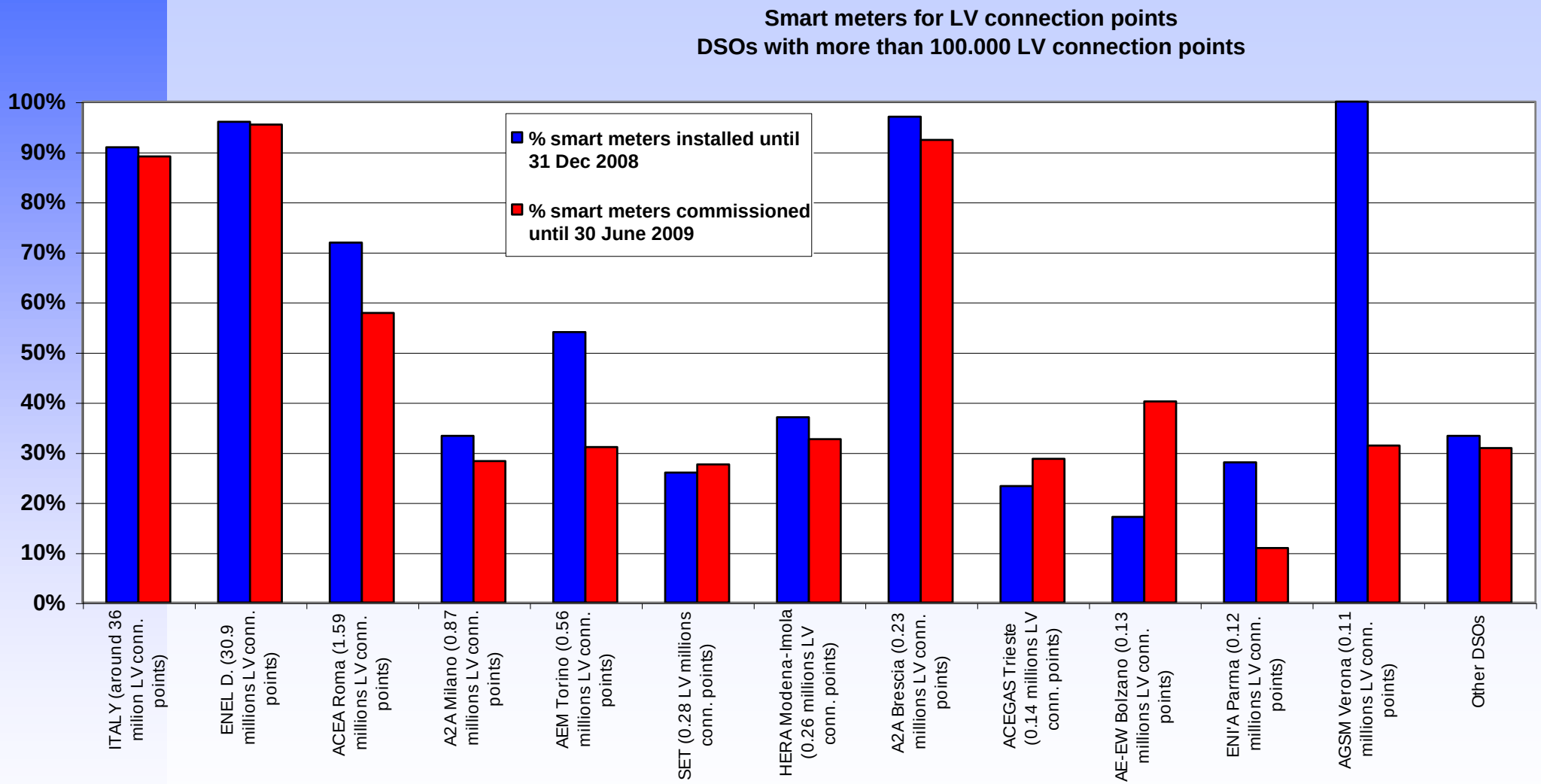
(*) not recognized CAPEX for electromechanical meters not replaced

SMART METERS FOR LV CUSTOMERS
Mandatory timetable (2/2)

- Starting from 1 January 2008, for each low-voltage withdrawal point through which the injection of active electricity into the network is activated, DSOs shall install one single smart meter, single-phase for single-phase applications and three-phase for three phase applications.

First step towards smart grids

STATUS OF INSTALLATIONS AND COMMISSIONING



Source: data submitted to the Autorità by DSOs

REGULATORY DRIVERS IN 2006

- Completion of the liberalization of the electricity sector as from 1 July 2007
- High differentiation among DSOs (AMM systems vs. electromechanical) in the absence of any obligation to set up AMM systems
- Prevent DSOs from "free riding", in light of a single national tariff
- Major role that AMM systems can play in the electricity market of today and tomorrow
- The comments received to a previous consultation document (7 March 2005) on the same matter suggested the Authority to characterize AMM systems from the functional and performance points of view
- European Directive 2006/32/EC (article 13)

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 to low-voltage withdrawal points also
- To improve the quality of the electricity metering, supply and distribution services for LV consumers and ensure the same functional and performance levels both for customers in the free market and those in the universal service
- (Not included in the R.O.): to look further some specific requirements, in particular consumption awareness (remote display) and demand response issues (home and building automation)

WHY MINIMUM REQUIREMENTS

- In order to guarantee:
  - the pursuance of the objectives
  - the same options to all customers (household/non household; free/in the protection scheme)
  - interoperability and standardization
- They should fulfil the following criteria:
  - system oriented
  - such as to avoid raising of barriers or limits to technical/technological innovation
  - such as to prevent the rejection of new solutions/architectures
  - be independent from telecommunications systems

MAIN MINIMUM FUNCTIONAL REQUIREMENTS-AMM

Specified for:

- Single phase mono-directional meters
- Single phase bi-directional meters
- Three-phase phase mono-directional meters
- Three-phase bi-directional meters

- TOU price scheme (weekly profile): up to four bands, up to five intervals per day (1 totalizer + 4 band registers)
- Interval metering (min. 1 hour, depth = 36 days)
- Remote transactions [consumption reading (registers and intervals), supply activation/deactivation, change of the subscribed power, change of the TOU tariff, power reduction]
- Security of data (inside meters, during the transmission to the control centre, status word with prompt transmission to the control centre in case of meter failure)
- Freezing of withdrawal data (billing, contractual changes, switching)
- Breaker on board of meters + demand control algorithm (alternative: registration of the peak power per TOU band)
- Meter display (current totalizer and activated TOU band registers, last freezing)
- Slow voltage variations (according to EN50160)
- Upgrade of the program software

PERFOMANCE REQUIREMENTS

- After the introduction of minimum functional requirements, some performance indicators of AMM systems have been introduced (R.O. 235/07):
  - Annual percentage of successful remote transactions (activation/deactivation, change of the subscribed power, change of the price scheme, power reduction) within 24 hours and within 48 hours
  - Annul number of meters that at least once registered a failure reported to the control centre (through the status word)
  -

Reading frequency	Threshold S	No. of meters with no. of successful readings below threshold S	No. of meters with no. of successful readings below 0
Monthly	6		
Bimonthly	3		
Three-monthly or four-monthly	2		
Six monthly	1		
Annual	0		

ENEL DISTRIBUZIONE PERFORMANCE 2008

	Annual percentage of successful remote transactions (activation/deactivation, change of the subscribed power, change of the price scheme, power reduction) within 24 hours and within 48 hours	
	Within 24 hours	**Within 48 hours**
ENEL DISTRIBUZIONE	79%	83%

Source: data submitted to the Autorità by Enel Distribuzione

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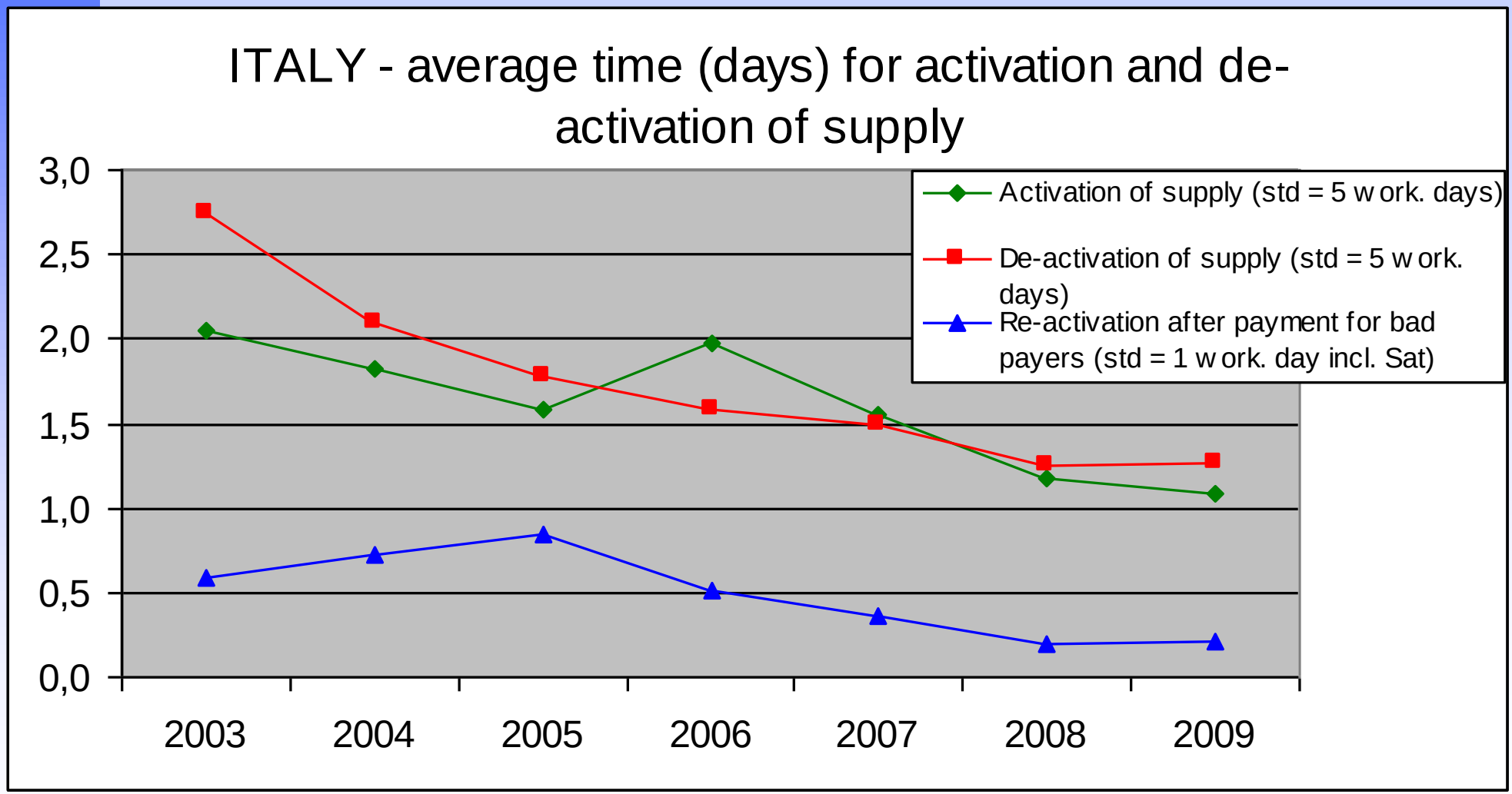
Meter reading frequency	Threshold S	% of meters with successful no. of annual readings below threshold S	% of meters with successful no. of annual readings = 0
Monthly	6	1,68%	0,59%
Bimonthly	3	1,73%	0,60%

Source: data submitted to the Autorità by Enel Distribuzione

COMMERCIAL QUALITY
GUARANTEED STDs. vs ACTUAL PERFORMANCE
activation and de-activation of supply



Source: data submitted to the Autorità by DSOs

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

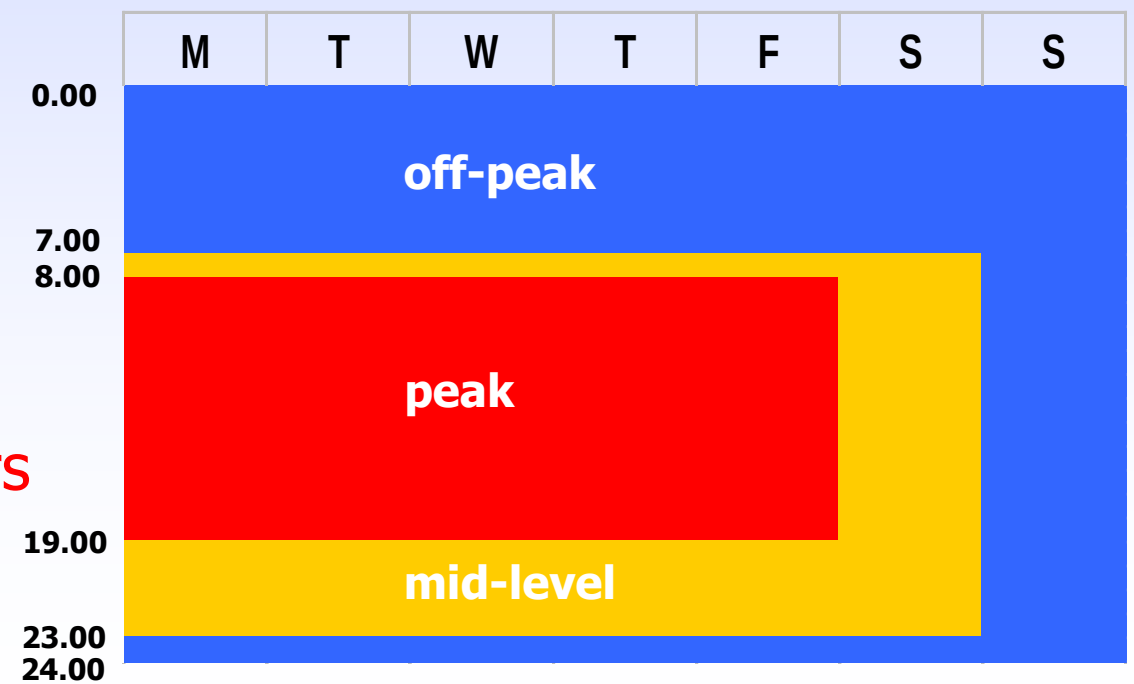
DEMAND-RESPONSE
Energy or Power capacity?

- Retail markets (LV customers)
  - Power: household capacity limit: 3 kW (normally)
    - Power absorption limited with breaker on the meter
    - Strong tool for energy efficiency ⇒ no thermal electricity usage
  - Energy: graduality in exploiting Smart Metering benefits:
    - From 2005: required interval metering (1 hour) for all MV cust.
    - From 2007: extended interval metering (1 hour) to all LV customers with power capacity > 55 kW
    - From 2009: required 3-band metering for all LV customers (to be completed by end-2011)

DEMAND RESPONSE (ELECTRICITY): OPPORTUNITY FROM SMART METERING

Household customers:

- Individual information about separated consumption per band (6 months per each customer, through the bill)
- Universal service 2-bands tariff (peak / midlevel+offpeak) progressively compulsory from mid-2010 (graduality regime)
- Cost-reflectivity for each LV customer
- Move contractual power capacity from 3 to 4.5 kW only during off-peak hours (automatically on board)



SNAPSHOT OF THE LV MARKET
31 December 2009

	Free market	Regulated market
No. of household consumers	2.5 millions Not known the number of them with TOU tariffs	26.0 millions 0.2 millions with TOU tariff (willingly chosen)
No. of LV non household consumers	1.4 millions	5.0 millions

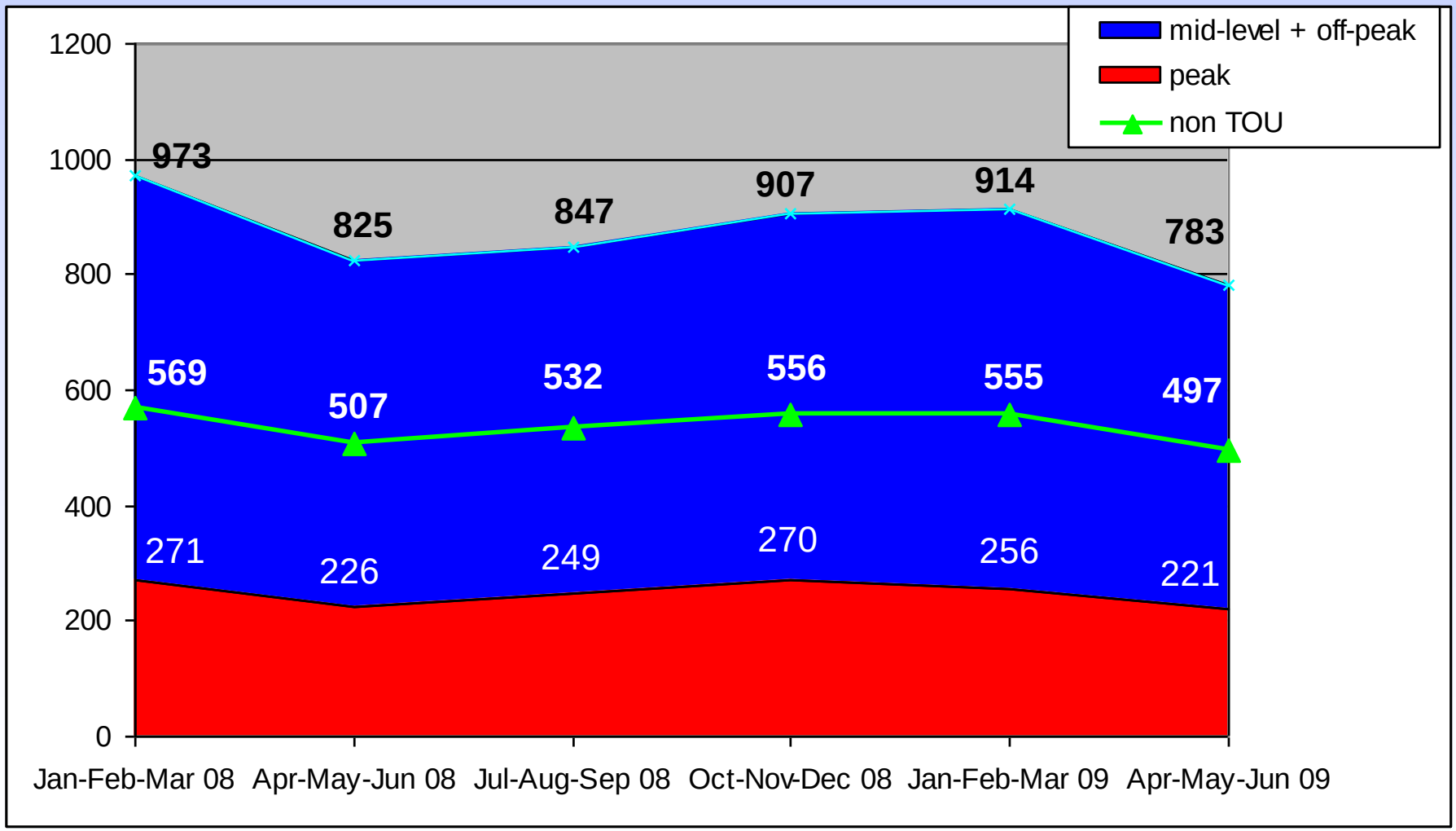
TOU TARIFF FOR THE DOMESTIC REGULATED MARKET: RECENT PROPOSALS (1/2)

- Recently, with two consultation documents of end November 2009, the Autorità proposed the mandatory TOU tariff for all household consumers in the regulated market as from July 2010 (the application of the TOU tariff for LV non household consumers in the regulated market started in 2008)
- Prices differentiated per bands (peak vs. mid-level + off-peak) and as from 2012 also per season (high vs. low)
- The application of the TOU tariff will be conditioned by the following aspects:
  - the consumer must have a commissioned smart meter, re-parametrised according to the peak, mid-level and off-peak bands
  - the consumer has received specific information and at least three bills (one bill every two months) reporting the distribution of his consumptions with respects the peak, mid-level and off-peak bands

TOU TARIFF FOR THE DOMESTIC REGULATED MARKET: RECENT PROPOSALS (2/2)

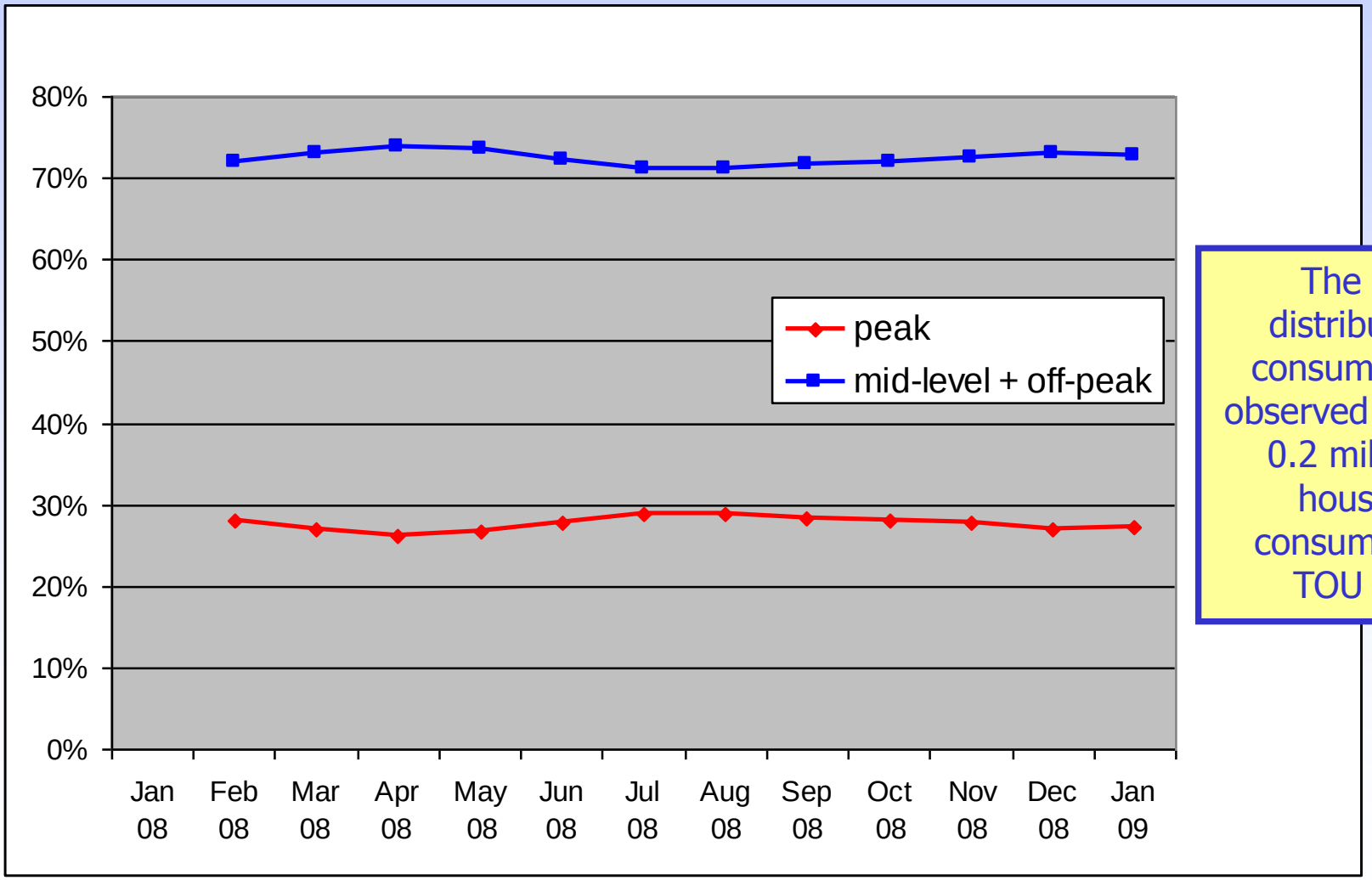
- The behaviour of consumers in shifting potentially their consumptions and the potential consequences on the LV network have been assessed by the Autorità
- Economical consequences for consumers - the equilibrium in the cost of the bill with respect to the non TOU regime is:
  - 1/3 of consumptions in the peak band
  - 2/3 of consumptions in the mid-level + off-peak bands
- If the consumer will be able to concentrate less than 1/3 of his consumptions in the peak band, he will pay less with respect to the non TOU regime, for the same consumption

Regulated market – average consumption per capita (kWh) for household consumers with TOU tariff vs. average consumption per capita (kWh) for household consumers with non TOU tariff



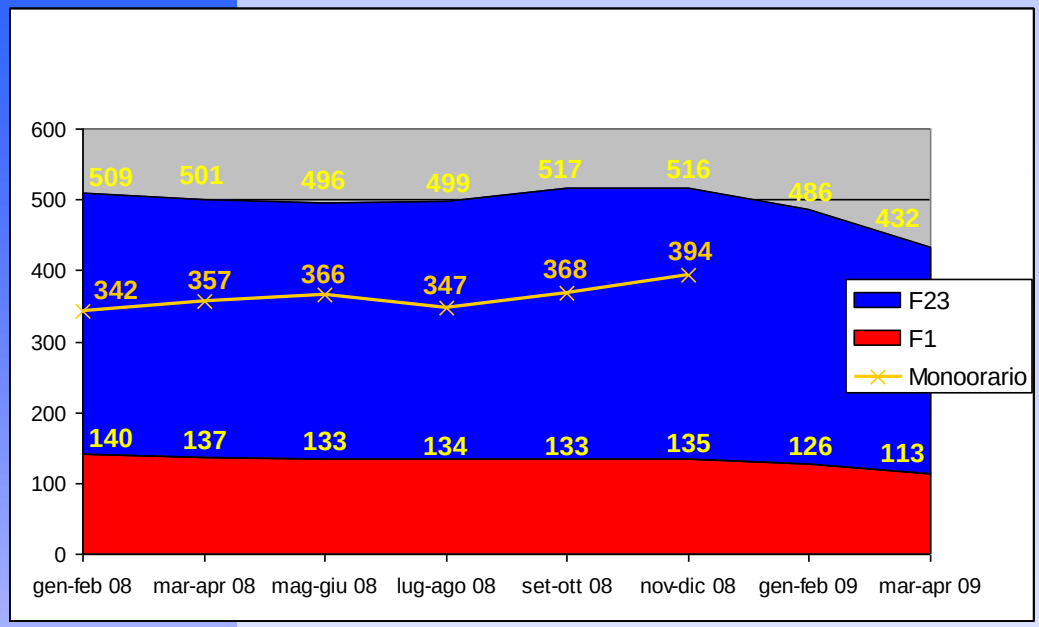
Source: Enel Servizio Elettrico

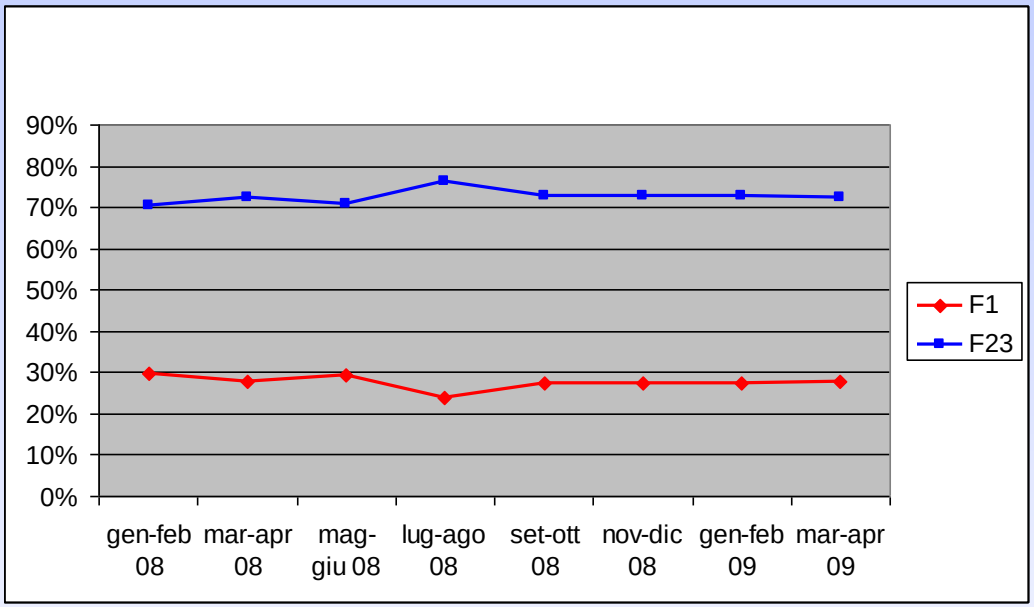
Regulated market – distribution of consumptions for a sample of 2,800 household consumers with voluntary TOU tariff as from January 2008 (until December 2007 they were consumers with non TOU tariff)



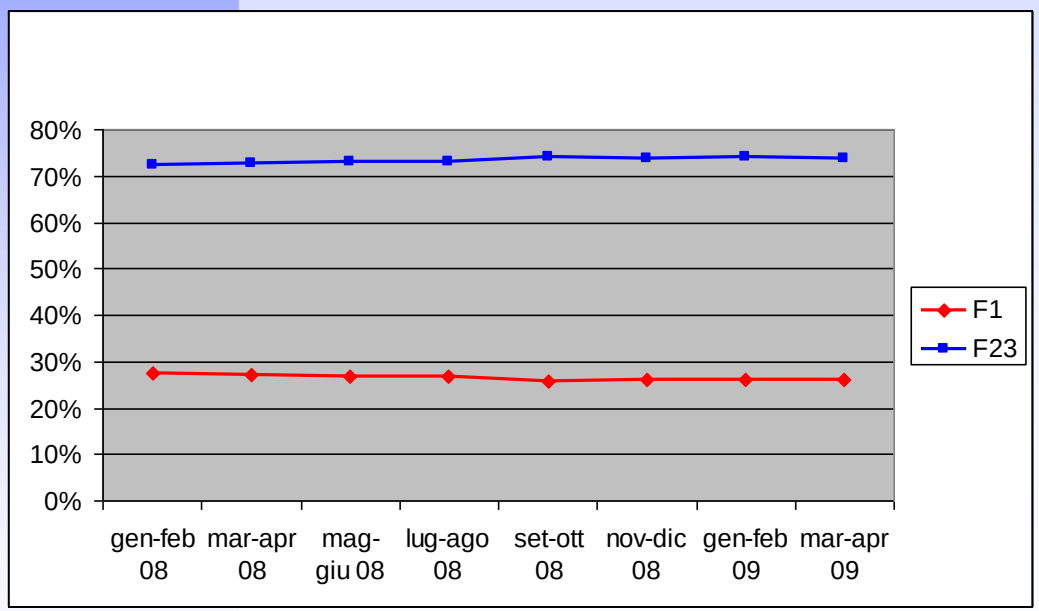
The same distribution of consumptions is observed for all the 0.2 millions of household consumers with TOU tariffs

Source: Enel Servizio Elettrico





Source: local supplier in North Italy, 50 TOU consumers



Source: local supplier in North Italy, 1,000 TOU consumers

Source: Enel Servizio Elettrico

GAS SMART METERING IN ITALY

GAS: 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 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 for natural gas and the new balancing service
- To improve the quality of natural gas metering, sales and distribution services, while ensuring the same functional and service levels irrespective of the operator responsible for the metering service and at the same time fostering greater awareness of consumption levels

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: FINDINGS OF THE COST-BENEFIT ANALYSIS

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

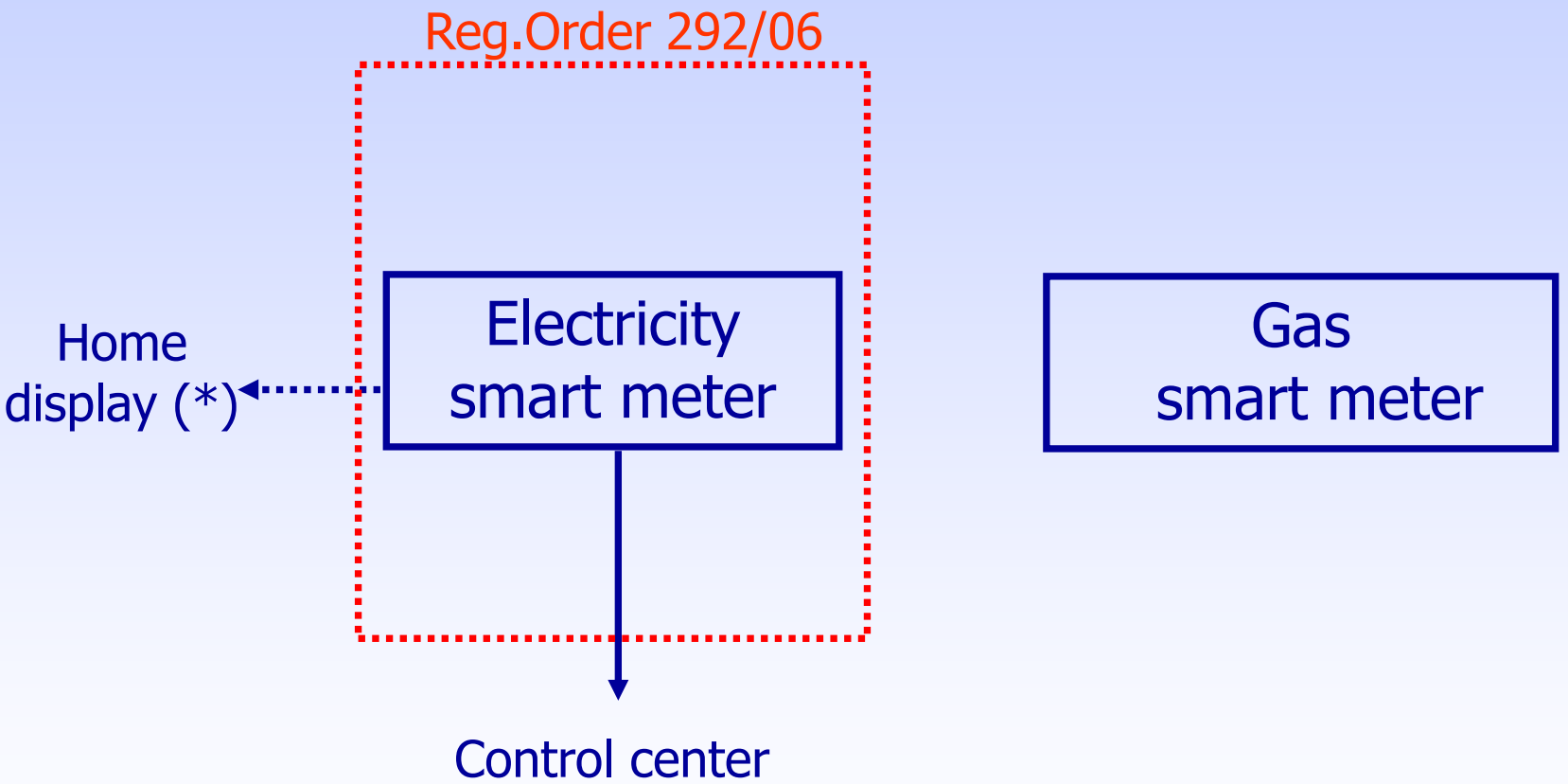
NPV at year 15 for different annual consumption bands [€/meter]

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

GAS: 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)

INTEGRATED DEMAND-RESPONSE
Envisaged evolution of architecture/interoperability



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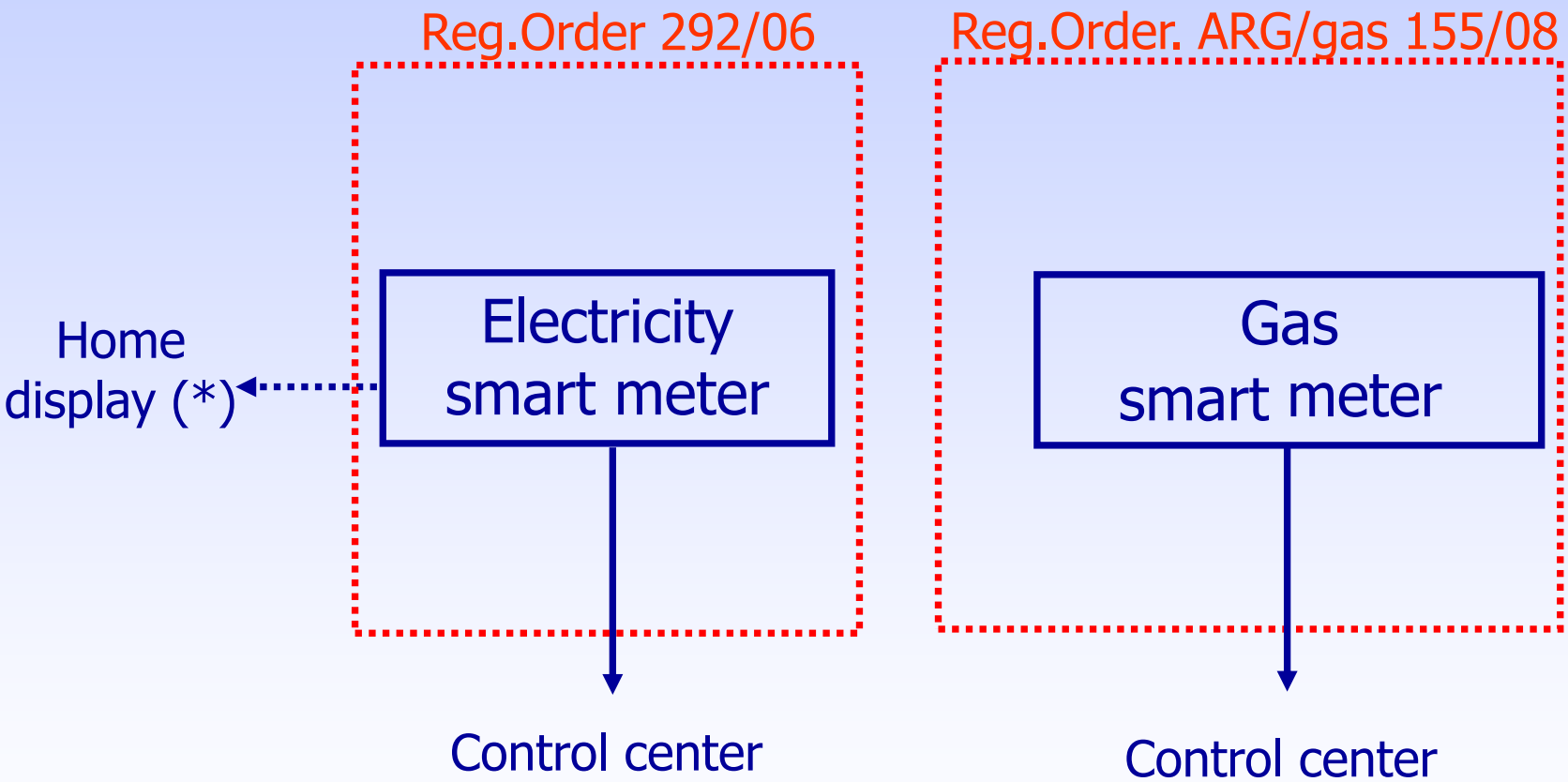

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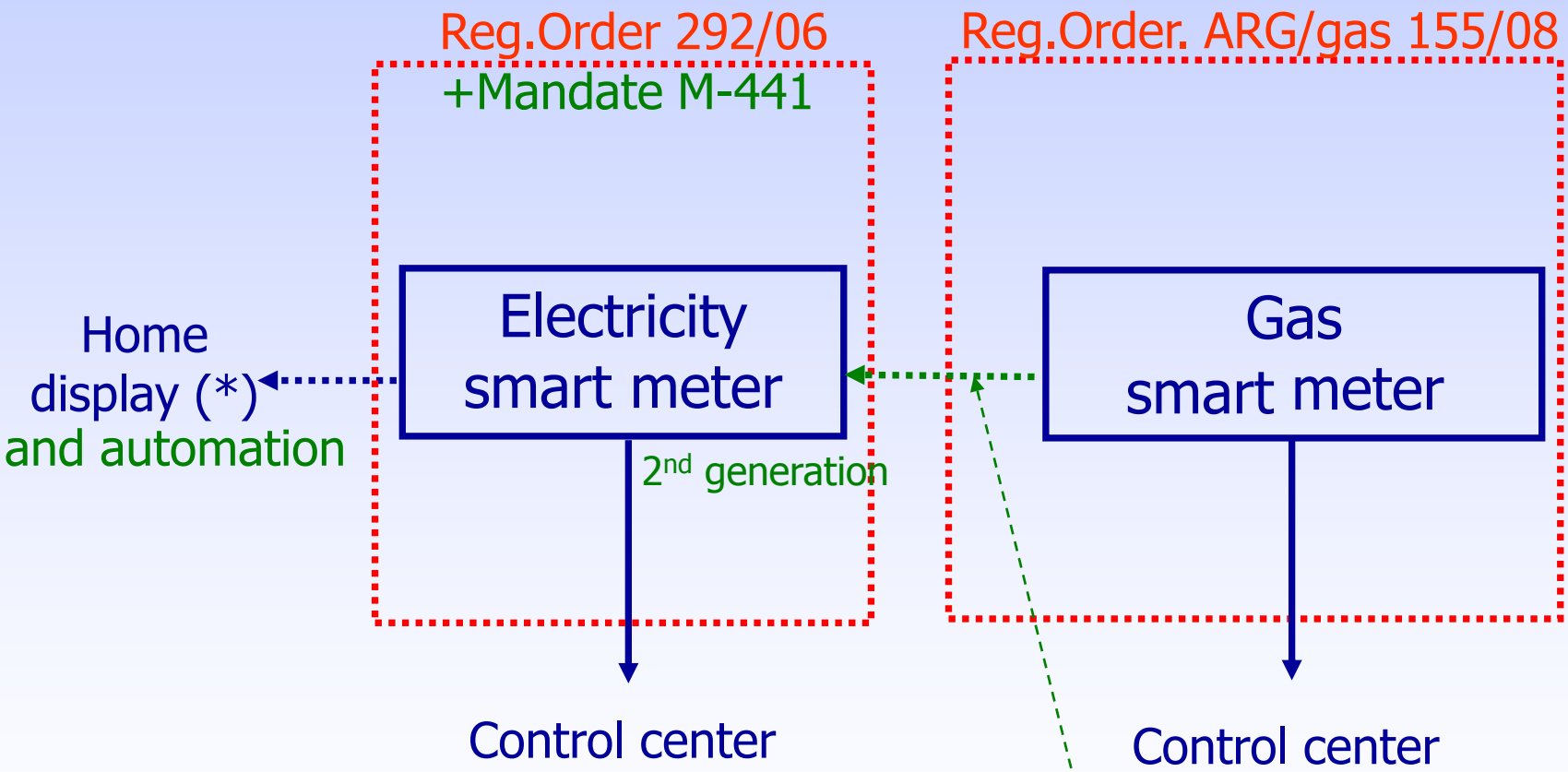

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CONCLUSIONS (ANSWERS TO SOME QUESTIONS ADDRESSED BY IEA)

CONCLUSIONS
QUESTIONS ADDRESSED BY IEA (1/5)

- What type of policies, programmes or measures were undertaken or implemented?
  - Roll-out with mandatory deadlines for replacement
  - Minimum functional requirements
  - Financial penalties for missed replacements
  - Equalization mechanism in order to recognize higher costs to smaller DSOs
  - No interferences with DSOs on technology issues and in the choice of system architecture and telecommunication systems

CONCLUSIONS
QUESTIONS ADDRESSED BY IEA (2/5)

- What were the barriers or challenges (financial, regulatory, implementation, compliance)?
  - Need to harmonize among customer needs/rights, system needs and technical limitations of smart metering systems
  - More than 30 million consumers equipped with smart meters: it is not like a pilot project!
  - Consumers' reactions

CONCLUSIONS
QUESTIONS ADDRESSED BY IEA (3/5)

- How were difficulties overcome?
  - Some difficulties still remain:
    - The current solution is not fully suitable for the in-house display, especially for DR purposes
    - Communication protocols are proprietary
    - Still it takes too time to parametrize all meters or to download a new SW version into all meters (Enel is working to reduce it)
    - PLC solution: suitable for smart grids only if part of the smartness/intelligence of the central system will be de-centralized to data concentrators installed in MV/LV substations
  - Dialogue with all stakeholders involved: consultations and hearings with companies, consumers' associations, trade unions, environmental associations
  - Avoid to forget problems and try to find always a solution

CONCLUSIONS
QUESTIONS ADDRESSED BY IEA (4/5)

- What were the results or conclusions?
  - The Italian experience shows that:
    - smart metering is feasible
    - the extra-charges for consumers are limited
  - Smart metering seems to accelerate the competition in energy supply
  - Quality of metering, distribution and supply services can really be improved by smart metering …

ITALY: 30 MILLION SMART METERS INSTALLED AT LV (1/2)

- Monthly/bimonthly readings ⇒ almost no estimated billings
- Interval metering ⇒ higher cost-reflectivity
- Remote activation/de-activation of supply and change of the contractual power ⇒ improved customer service
- Remote temporary reduction of the allowed power for bad payers ⇒ minimum "vital" service
- Remote reconnections after payment ⇒ better service
- Easy switch (spot reading) ⇒ easier competition
- Theft detection ⇒ revenue protection, energy balance
- Recording voltage variations and (optionally) supply interruptions ⇒ higher level of customer protection

ITALY: 30 MILLION SMART METERS INSTALLED AT LV (2/2)

- **Achievements** at end-2009
  - 13 Million LV customers' consumptions recorded according to three bands (peak/off-peak/mid-level)
  - 3.9 Million customers in the free market with TOU prices
  - 0.2 Million household customers (universal supply) with ToU voluntary option TOU tariff
  - All customers to be billed according to time-of-use prices (starting from mid-2010) ⇒ reduced distance between end-user pricing and volatile wholesale market prices
- **TOTEX net increase** – around 2 €/customer/year (extra)
- **OPEX reduction** – 2008-2011 price cap X-factor:
  - metering activities: 5%
  - (distribution: 1.9%)

CONCLUSIONS
QUESTIONS ADDRESSED BY IEA (5/5)

- What type of evaluation was carried out (if any)?

CONCLUSIONS
QUESTIONS ADDRESSED BY IEA (5/5)

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Smart metering is really part of the Italian electrical systems and is in the life of the Italian citizens!

Thank you for your attention!

For further information:
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