QUALITY OF ELECTRICITY SUPPLY MONITORING AND REGULATION: THE ITALIAN EXPERIENCE

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THE ELECTRICITY DISTRIBUTION AND SUPPLY IN ITALY

- MARKET — total consumption **330 TWh** (2006 incl.losses)
  free customers **150 TWh** (2006)
- USERS — LV: around **35 millions**, about **130 TWh**
  MV: around **100.000**, about **105 Twh**
  HV: around **1.000**, about **60 TWh** (+self-consumpt.)
- NETWORKS — HV: 20.000 km
  MV: 367.000 km
  LV: 798.000 km
- DISTRIBUTION SHARES: **ENEL** **85 %**
  OTHERS **15 %**
- OTHER UTILITIES — > 100.000 users: **11** local utilities
  5.000-100.000 users: **31** local utilities
- MICRO NETWORKS — about **140** (↘) small utilities (<5.000 users)

Content

- The evolution of the legal framework: from Citizen's Charter to service quality regulation
- The development of continuity of supply monitoring in distribution networks
- Incentive/penalty regulation for continuity of supply for reducing interruptions
- Automatic compensations to the customers (guaranteed commercial quality standards)
- A comprehensive view of service quality regulation

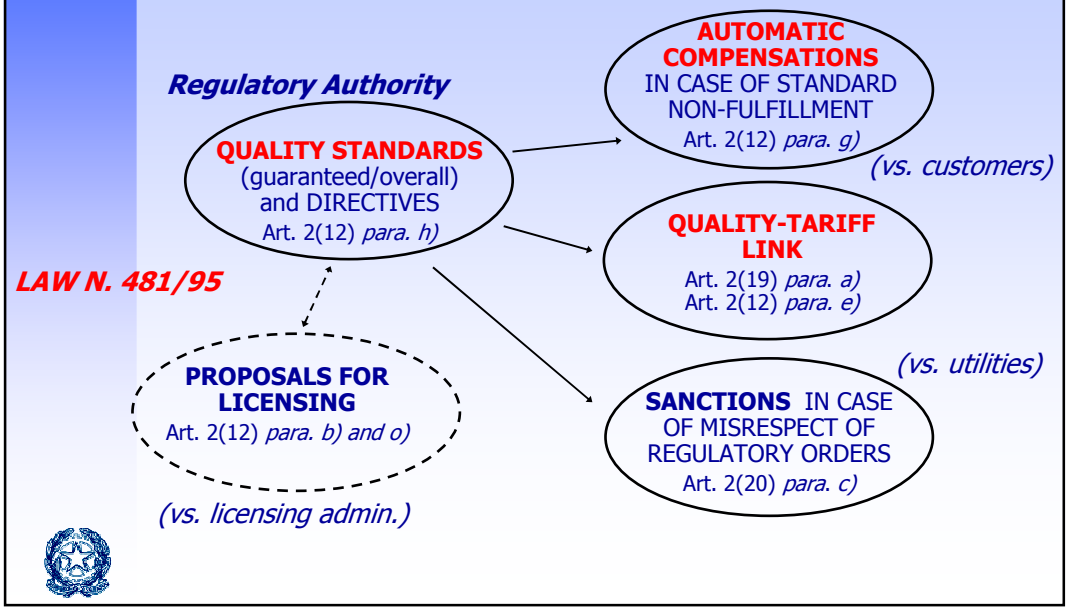
LEGAL FRAMEWORK EVOLUTION
1/ Brief history

- From 1997 the regulatory Authority is fully in charge of (new) service quality regulation
- Before 1997, (old) service quality regulation was under the **"Citizen's charter" scheme**, that was a "self-regulation" scheme issued before the Authority was constituted
- Under the "Citizen's charter" scheme:
  1. each utility could set its own quality standards
  2. each utility had to identify at least 4 indivual standards subject to refund if they were not met
  3. almost all utilities adopted compensation schemes on request to customers
  4. only very few companies (only one large in gas sector) adopted automatic compensation mechanism
- Since 2000 the Citizen's charter scheme has been overpassed by the new quality regulation of the Authority

LEGAL FRAMEWORK EVOLUTION
2/ The former compensation scheme upon-request was not effective

COMPANIES	Standard mismatch (#)	Penalties actually paid (#)	Standard mismatch (#)	Penalties actually paid (#)	Procedure for penalties
Enel	5.289	2	_	_	On request
Italgas	_	_	1.002	1.002	Automatic
Acea Roma	ND	1	_	_	On request
Aem Milano	4	0	136	2	On request
Camuzzi	_	_	691	0	On request
Other major loc.ut.	513	0	8.878	76	On request
Medium-size loc.ut.	293	18	3.172	26	On request (automatic 1 loc.ut.)
Small-size loc.ut.	ND	14	386	131	On request (automatic 6 loc.ut.)
Total	6.099	35	14.265	1.237	*Year 1998*

LEGAL AND REGULATORY FRAMEWORK
3/ Regulatory Authority's legal powers



LEGAL AND REGULATORY FRAMEWORK 4/ Guaranteed and overall standards

- The law foresees **two types of quality standards**
  - **Guaranteed standards (GS):** have the function of ensuring that all consumers receive a minimum quality level and therefore are **oriented to the protection of (worst-served) customers through compensations**;
  - **Overall standards (OS):** have the function to monitor the company performance at system level and therefore are **oriented to promoting improvement through incentive/penalties schemes**
- It's up to the Authority to **choose which type of standard** apply to different quality issues

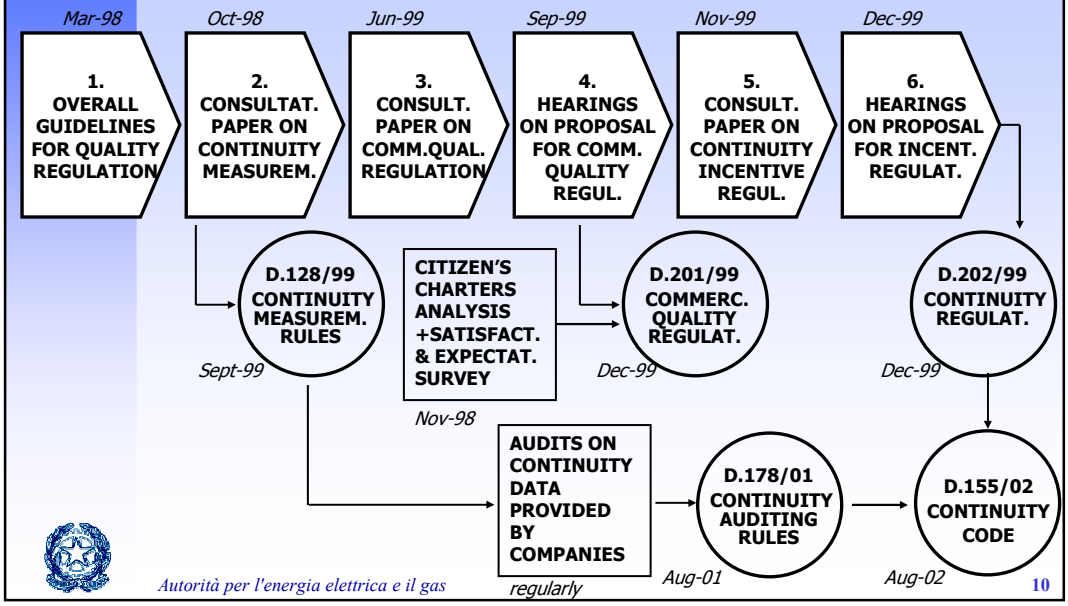
LEGAL AND REGULATORY FRAMEWORK 5/ Guaranteed and overall standards

- **Guaranteed Standards**
  - referred to each single transaction between customer and utility
  - detailed knowledge of the company performance, down to individual customer level (detailed measurements are needed)
  - Guaranteed standard = minimum quality
    - CQ: maximum time to connect the customer with simple work
    - CS: maximum number of interruptions per year that affect the single customer
- **Overall Standards**
  - referred to the average performance of the utility in a given area
  - monitoring function through periodic publication of results (might affect the reputation of the company, if not its financial results)
  - Overall standard = average quality (or quality at a given percentile)
    - CQ: at least 90% of customer's claims answered within the maximum time for substantial reply
    - CS: maximum number of interruptions per year per customer (average in a given area)

LEGAL AND REGULATORY FRAMEWORK
6/ Consultation and Decision Process

- The Authority issues **consultations papers** containing guidelines and proposals
- Consultation papers are **public** (on the web site) and are send to all **stakeholders involved**:
  - companies
  - consumers' associations
  - trade unions
  - environmental associations
  - technical associations and bodies
- Formal hearings and informal meetings are organized with main actors
- Everybody can formulate questions, **comments and suggestions in written**
- No decision is taken without at least one consultation round (two/three for most complex issues – R.I.A.s)

FIRST REGULATORY PERIOD
CONSULTATION PROCESS



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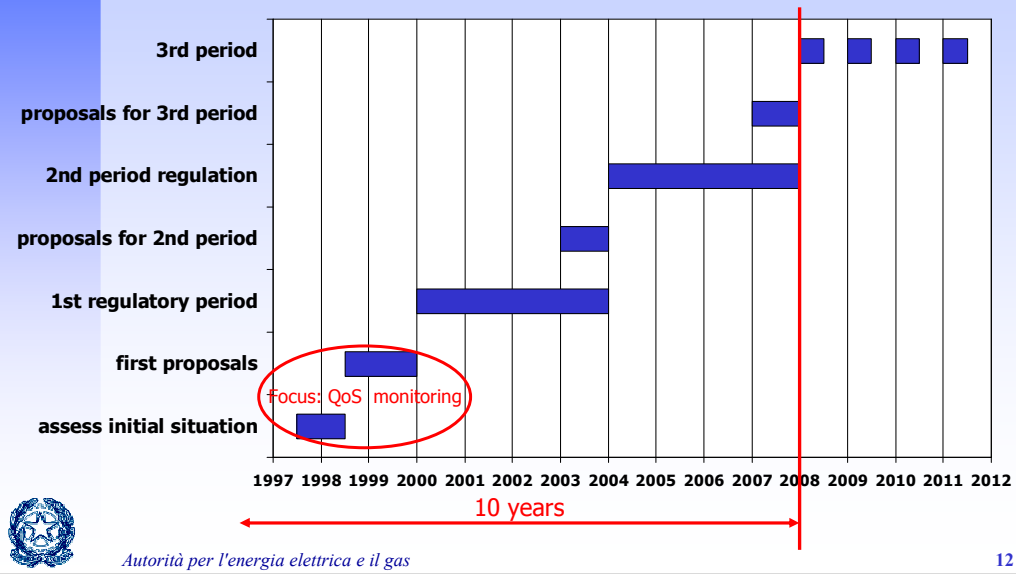
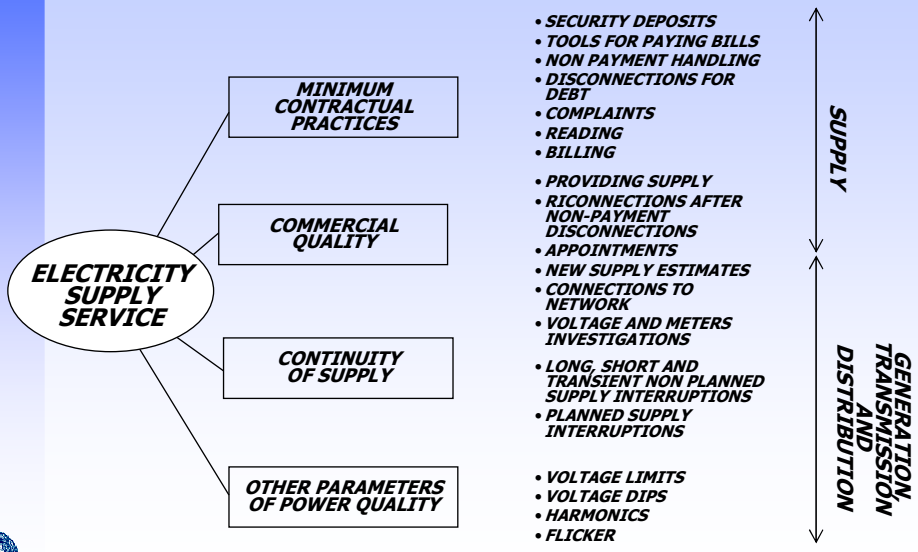
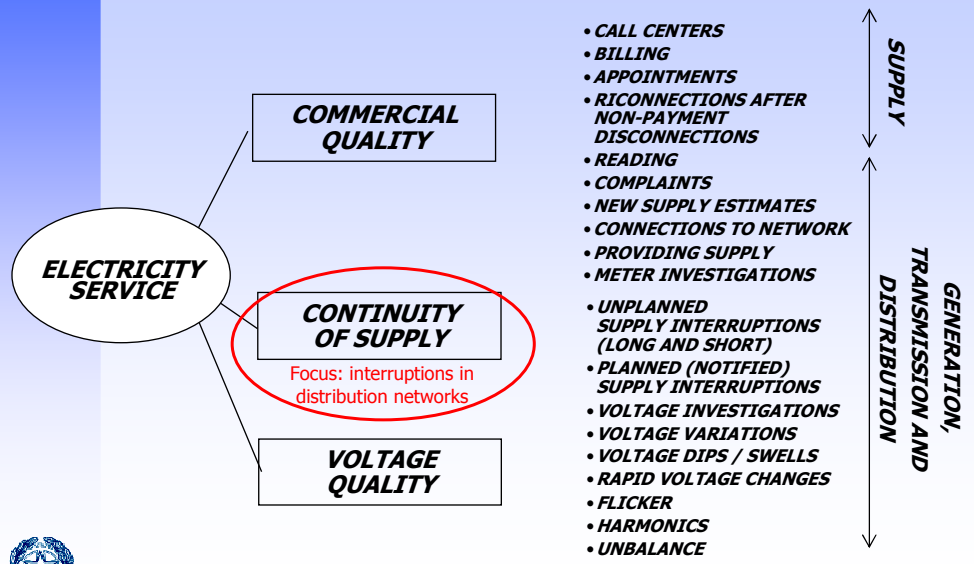
MONITORING IS A PRELIMINARY STEP TOWARDS INCENTIVE REGULATION



ELECTRICITY SUPPLY SERVICE
Main quality factors

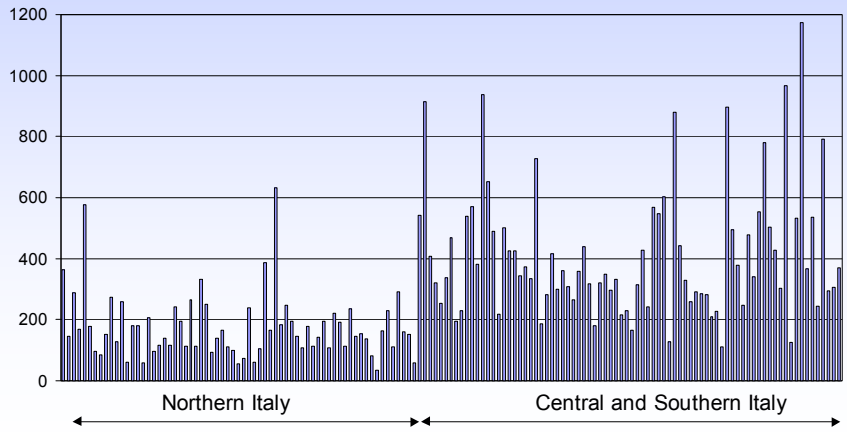


Output regulation



ASSESS THE INITIAL SITUATION
Continuity of supply: actual levels, 1996

YEAR-CUMULATIVE DURATION OF INTERRUPTION
(MINUTES LOST PER LV USER; Enel, 1996)



WHO MEASURES CONTINUITY

- Distribution company
  - Remote control system (SCADA): allows automatic registration of each interruptions starting time
    - Italy: compulsory on each HV circuit and each MV circuit
  - Interruption register: contain all data requested for each interruption (manually updated)
    - Italy: compulsory for each long and short interruption; users can have access to the register
- Regulatory Authority
  - Is provided each year with continuity indicators and an electronic copy of the register and makes audits
    - Italy: SAIDI, SAIFI, MAIFI, per each territorial district (~300)
- Customers: individual information for major ones
    - Italy: customer can ask for individual measurement

HOW CONTINUITY IS MEASURED

- Interruptions are described through
  - Time between events or number of interruptions (for each type) in a period of time (in general, 1 year) and in a given distribution territory (homogenous!) of N customers
    - SAIFI: average number of long interruptions per customer per year (MAIFI for short interr.)

$$SAIFI = \frac{\sum_{i=1}^{K} N_i}{N_{tot}}$$

    - SAIDI: average duration of interruption per customer per year

$$SAIDI = \frac{\sum_{i=1}^{K} N_i D_i}{N_{tot}}$$

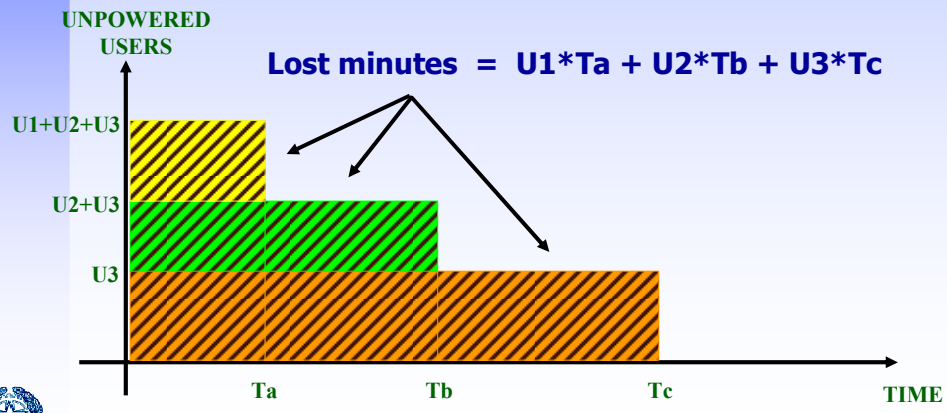
  - Per each interruption of the same type, main characteristics to be recorded are
    - Customers affected (involved) N_i ➔ SAIFI, SAIDI
    - Duration (time of start & finish) D_i ➔ SAIDI

TERRITORIAL CLASSIFICATION OF CUSTOMER AFFECTED

- A territorial classification is needed in order to set separate and acceptable standards
- Italian classification
  - Urban ("high density") areas: territory of municipalities with more than 50,000 inhabitants
  - Sub-urban ("medium density") areas: territory of municipalities with more than 5,000 and less than 50,000 inhabitants
  - Rural ("low density") areas: territory of municipalities with less than 5,000 inhabitants
- In other EU countries different criteria are adopted; in some cases ex-post methods are adopted (f.i. Great Britain and Sweden)

CALCULATION OF SAIDI

Contribute to SAIDI of the current interrupt. = $\frac{U1*Ta + U2*Tb + U3*Tc}{\text{Total users supplied}}$



EXAMPLE OF CONTINUITY YEARLY DATA PROVIDED TO THE AUTHORITY

DISCO: COMPANY A
Territorial area: urban
Year: 2002
Type of interruption: long unplanned

Voltage levels

Respon-sibility

Lost minutes per user

	T	HV	MV	LV	Total
Force Majeure					
External Causes					
Disco's Resp.					
Total					

Number of interruption per user

	T	HV	MV	LV	Total
Force Majeure					
External Causes					
Disco's Resp.					
Total					

THE ITALIAN SCHEME FOR MONITORING (enforced from 1999)

UTILITY: **ENEL Distribuzione Spa**
INTERRUPTIONS: **UNPLANNED, LONG** YEAR: **2004**
TERRITORY: **ALL AGGREGATE** UP TO MONTH: **12**

		VOLTAGE LEVELS				
	CAUSE	TRASM.	HV	MV	LV	TOTAL
DURATION (CML, SAIDI)	Acts of God	0,0	0,0	14,9	1,1	16,0
	Users' or third parties' respons.	2,3	0,1	11,2	1,5	15,0
	Utility's responsibility	0,0	3,0	45,6	14,4	63,1
	Total all causes	2,3	3,1	71,7	17,0	**94,1**

	CAUSE	TRASM.	HV	MV	LV	TOTAL
NUMBER (CIs, SAIFI)	Acts of God	0,00	0,00	0,08	0,00	0,09
	Users' or third parties' respons.	0,14	0,01	0,28	0,01	0,44
	Utility's responsibility	0,00	0,10	1,87	0,14	2,11
	Total all causes	0,14	0,11	2,23	0,15	**2,64**

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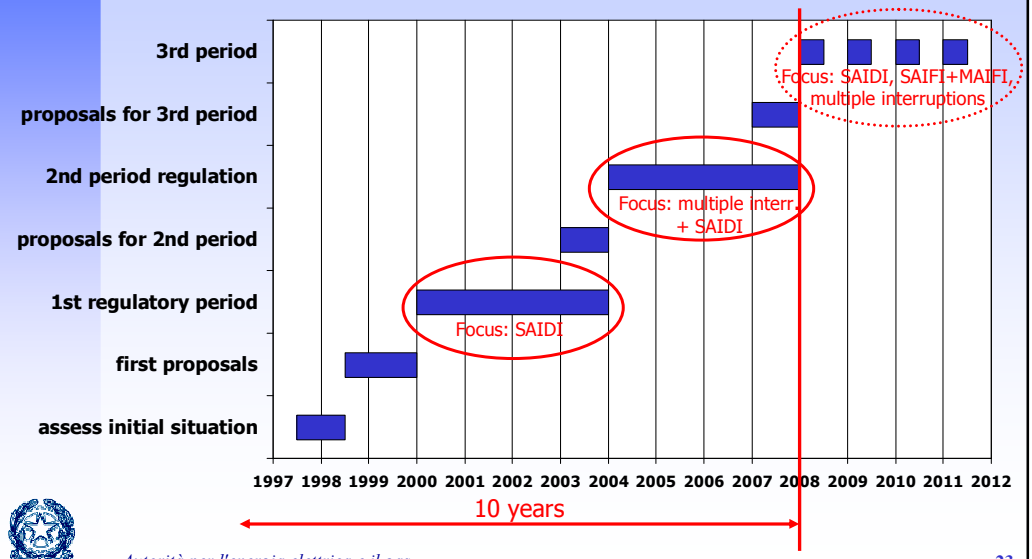
THE ITALIAN INCENTIVE SCHEME: EVOLUTION



CONTINUITY OF SUPPLY REGULATION The Italian incentive scheme/1

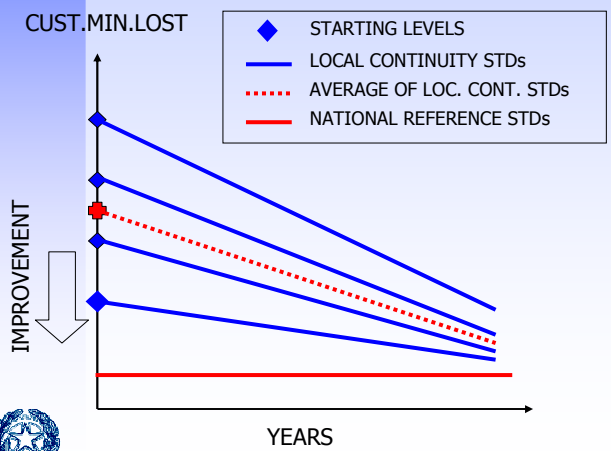
- **Enhance the overall level of continuity in Italy**
  - improve the country average level towards European benchmarks
- **Reduce the gaps between Northern and Southern regions**
  - reduce variation of regional and district levels around the country average level
- **Maintain levels of continuity where they are already good**
  - avoid to deteriorate quality in best-served areas

CONTINUITY OF SUPPLY REGULATION
The Italian incentive scheme/2

- **Continuity indicator oriented to point out the responsibility of distribution suppliers**
  - minutes lost per lv users, net of interruptions caused by act of god and by users or third parties and net of interruptions originated in the EHV/HV network
- **Continuity indicators measured at district level**
  - 300 districts (about 100 for urban areas, 100 for suburban, 100 for rural) covering almost all the country
- **Mechanisms to make the indicator more sound in respect of weather effects**
  - 2-years rolling average
  - deadbands (+/- 5%)

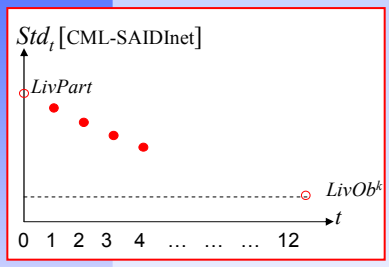
CONTINUITY OF SUPPLY REGULATION
The Italian incentive scheme/3

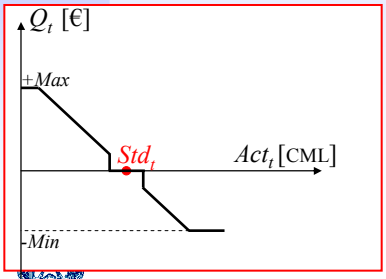
- **THE MAIN IDEA: A CONVERGENCY SYSTEM**



- **IF UTILITIES IMPROVE CONTINUITY MORE THAN REQUIRED GAIN AN EXTRA INCENTIVE**
- **IF UTILITIES IMPROVE CONTINUITY LESS THAN REQUIRED MUST PAY A PENALTY**
- **IF UTILITIES IMPROVE CONTINUITY AS REQUIRED (DEAD-BAND +/-5%), NEITHER INCENTIVES NOR PENALTIES APPLY**

CONTINUITY OF SUPPLY REGULATION
The Italian incentive scheme/4





Ex-ante for 4 years

$$Std_{j,t} = Std_{j,t-1} \times (1 - \alpha_j)$$

$$\alpha_j = \max\left[1 - \left(\frac{LivOb^k}{LivPart_j}\right)^{\frac{1}{12}}; 2\%\right]$$

k: territ. density

$$price\_cap = RPI - X \pm Q_t$$

Ex-post each year *t*

$$Q_t = \sum_{j \in Districts} (Std_{j,t} - Act_{j,t}) \times \left[\frac{c_{ndom} En_{j,t,ndom} + c_{dom} En_{j,t,dom}}{8760}\right]$$

$$|Std_{j,t} - Act_{j,t}| < 5\% \Rightarrow Q_{j,t} = 0 \qquad Min \le Q_{j,t} \le Max$$

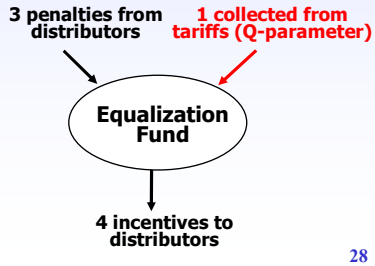
CONTINUITY OF SUPPLY REGULATION
The Italian incentive scheme/5
How is it funded?

- **THE INCENTIVE SYSTEM IS FUNDED THROUGH:**
  - **THE PENALTIES PAID BY UTILITIES** FOR DISTRICTS IN WHICH THE BASIC IMPROVEMENT RATES ARE NOT MET
  - **A Q-PARAMETER IN THE PRICE-CAP FORMULA:** **ΔP = RPI -X +Q** TO COLLECT THE DIFFERENCE BETWEEN INCENTIVES AND PENALTIES
- BECAUSE TARIFF IS UNIQUE, **AN EQUALISATION FUND IS NEEDED** TO DISTRIBUTE INCENTIVES/PENALTIES TO UTILITIES ACCORDING TO RESULTS: example

	urban	semi-urban	rural
distributor 1	+	-	=
distributor 2	-	=	+
distributor 3	+	+	-

Ipothesis: same incentive or penalty in each district

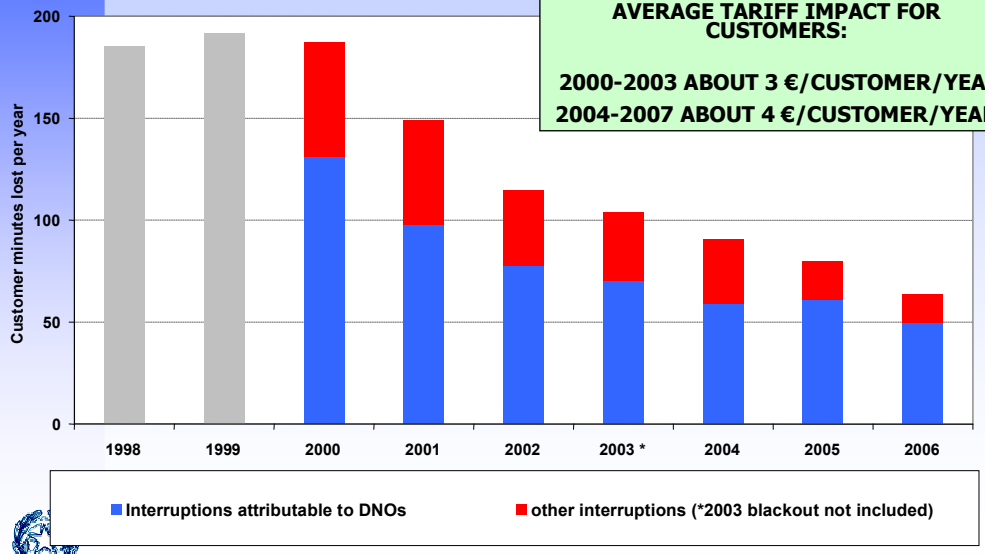
incentives	4 x (+1) = 4
deadbands	2 x 0 = 0
penalties	3 x (-1)= -3
net (to be collected)	1



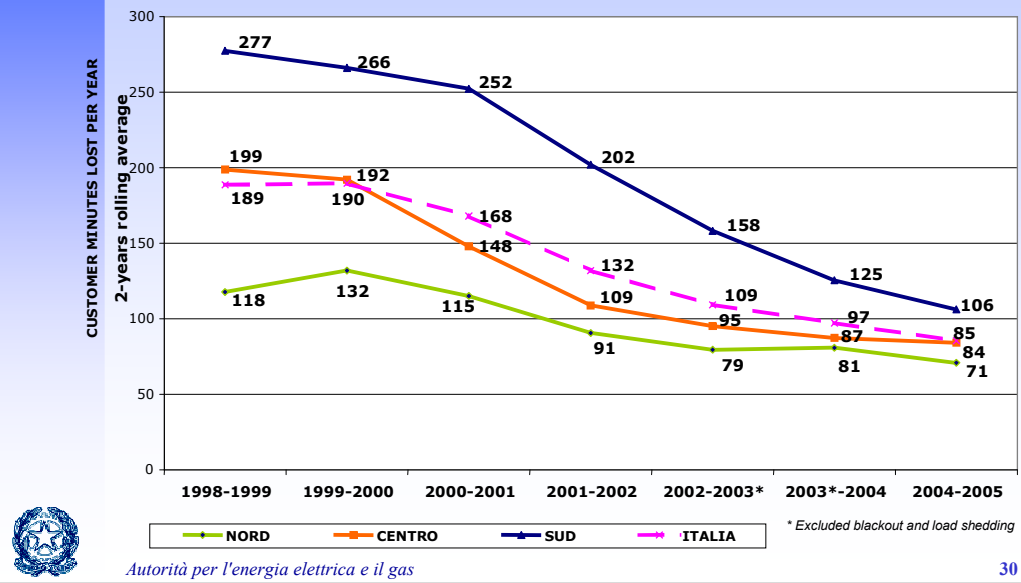
CONTINUITY OF SUPPLY REGULATION
The Italian incentive scheme - effects

AVERAGE TARIFF IMPACT FOR CUSTOMERS:

2000-2003 ABOUT 3 €/CUSTOMER/YEAR
2004-2007 ABOUT 4 €/CUSTOMER/YEAR



CONTINUITY OF SUPPLY REGULATION
The Italian incentive scheme - effects

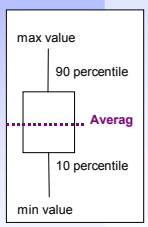


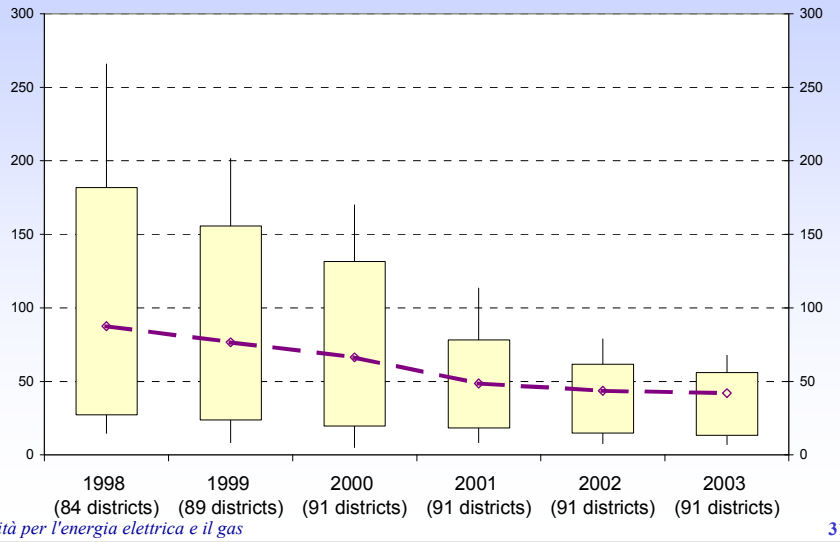
CONTINUITY OF SUPPLY REGULATION
The Italian incentive scheme - effects

Urban districts

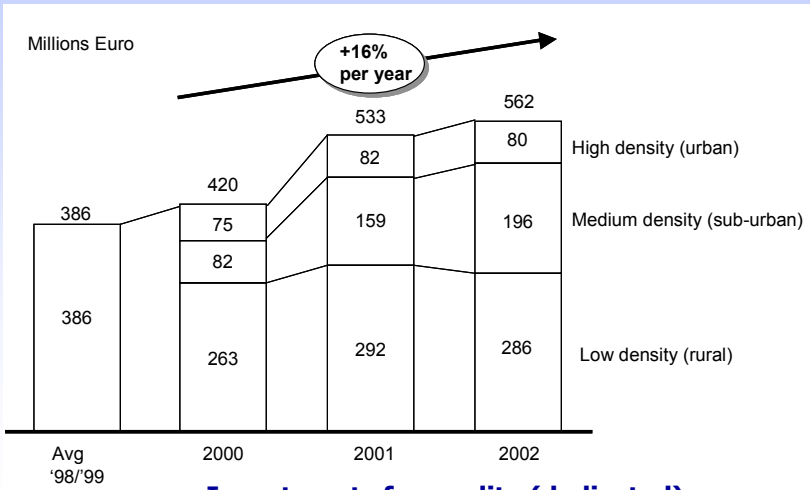
CML due to interruptions ascribed to DNOs responsibilities

Legenda



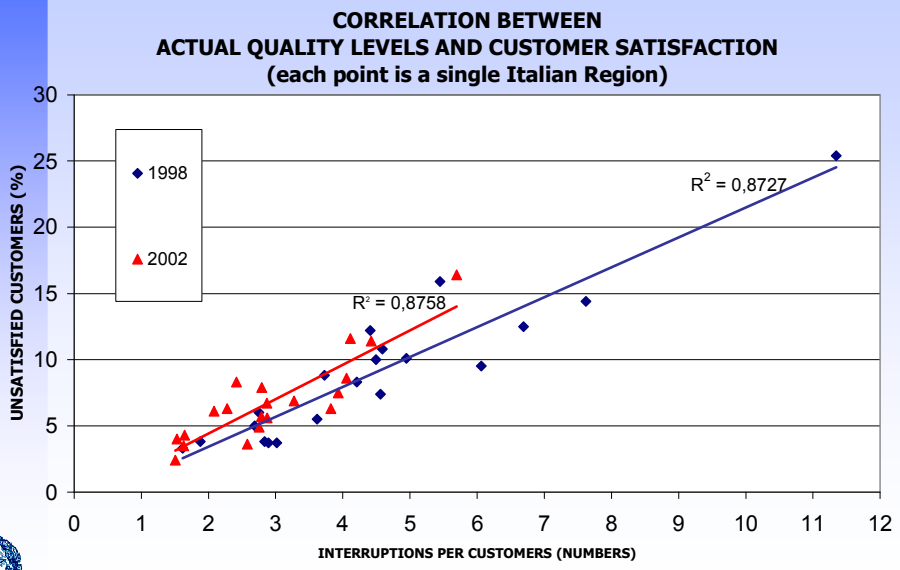


The Italian incentive scheme - effects
INVESTMENTS FOR CONTINUITY OF SUPPLY: ENEL



Investments for quality (dedicated); source: response to consultation paper

The Italian incentive scheme - effects
IMPACT ON CUSTOMER SATISFACTION

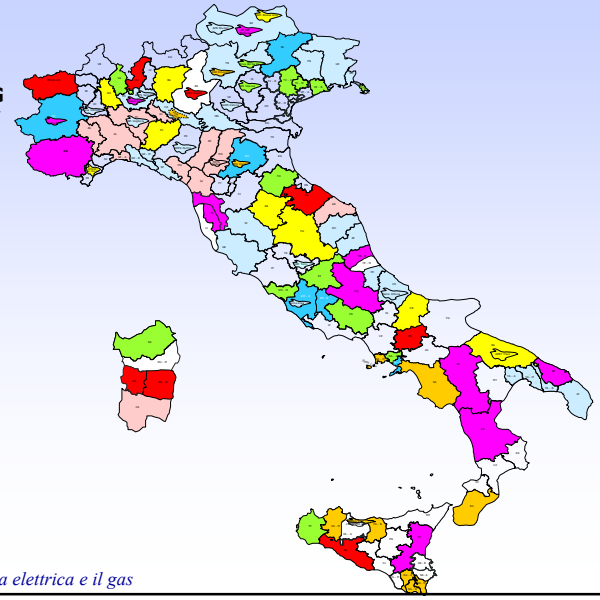


IMPLEMENTATION PROBLEMS

- Distribution utilities have generally accepted the new regulation
- Measurement system is recognised to be fair and seriously implemented
- Problems have been encountered in defining *Force Majeure* and have led to a statistical system (started in 2004 on optional basis)
- Correctness index has been contested in the beginning but after a review of audit procedures has been accepted as well
- Some problems have been found on starting-levels data (years 1998-99) in three regions (out of 20) and have led to special regulation for these regions
  - In this case a sanction was imposed as well; so far it's a unique case

AUDITS ON CONTINUITY DATA 1999-2006

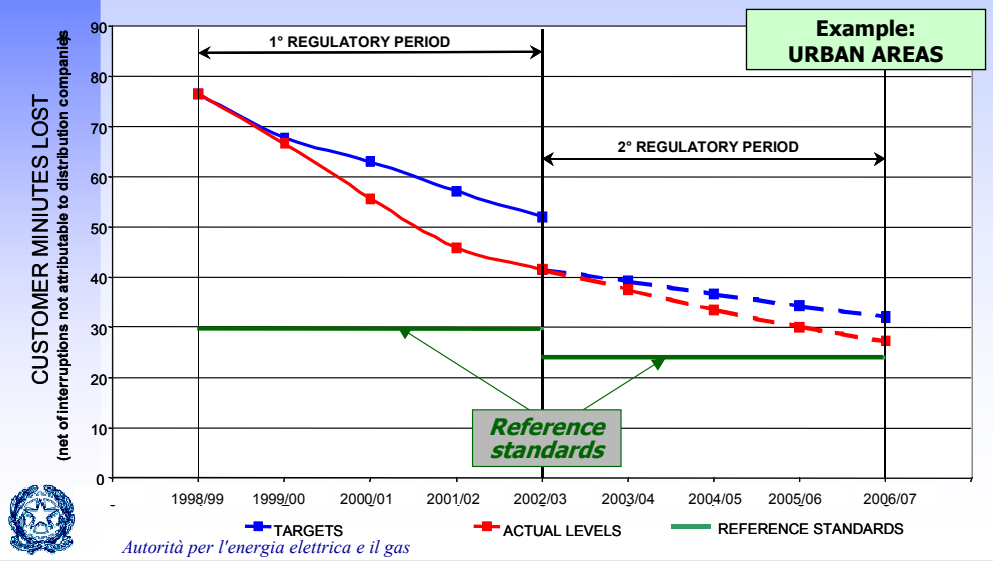
AUDITS BY AEEG ON CONTINUITY DATA



CONSULTATION AND DECISION PROCESS 2nd REGULATORY PERIOD: 2004-2007

Jun-03	*Jul-03*	*Nov-03*	*Jan-04*	*Jan-04*	*Jan-04*
1. 1st CONSULTAT. PAPER	**2. PUBLIC HEARINGS**	**3. 2nd CONSULTAT. PAPER**	**4. 3rd CONSULTAT. PAPER**	**5. PUBLIC HEARINGS**	**D. 4/04 QUALITY CODE 2004-07**
• Quantitative assessment of effects of 1st regulatory period • Objectives for 2nd regulatory period • Alternatives • Views invited on issues	• Draft deliberation • Further alternatives taking into account comments • Range of values for main parameters	• Stressed objective of convergence • Further alternatives taking into account comments • Range of values for main parameters	• Includes both continuity and service quality • Technical report with impact analysis		

SAIDI REGULATION ADJUSTMENT FROM 1ST TO 2ND REGULATORY PERIOD



EVOLUTION OF THE OBJECTIVES FROM 1st TO 2nd REGULATORY PERIOD

2000-2003

- Improve the Country average level towards European benchmarks.
- Reduce the gap between North and South; reduce variations between the regional and district levels and the Country average level.
- Maintain levels of continuity if already good, preventing the deterioration of the best served areas.

2004-2007

- SAIDI Regulation: Improve continuity of supply and converge on target levels, differentiated by area type (urban, suburban, rural).
- Multiple Interr. Regulation: Reduce the number of annual interruptions suffered by HV and MV customers.
- Power Quality: Promote individual measurements, quality contracts, monitoring campaigns on distribution networks

CONTINUITY REGULATION

Comparison between first (2000-2003) and second (2004-2007) regulatory period

ISSUE	2000-2003	2004-2007
Scope of continuity regulation	Only duration (long interruptions)	Duration (incentive/penalty)+ single-cust. standard for max interr. number (long interr.)
Perception of final customers	Small impact on tariffs; Individual yearly account of interruptions (only major customers)	Small impact as before (but *c* parameter based on WTP)+ automatic compensation for worst-served major customers
Interruptions excluded	Acts of God: Written evidence required Third parties' damages: excluded from regulation	Acts of God: statistical method (avoid written evidence) Damages: included in regulation (on demand)
Short interruptions	Only approximate recording	Exact individual recording (starting 2006)
Market mechanisms	None	Power quality contracts (major customers; not enforced)
Audit process	Only sampling continuity records	Sampling continuity records + data collection system audit

FIVE SUGGESTIONS FOR "BEGINNERS"

Quality regulation is an opportunity both for regulator (not only cost-cutting!) and for companies (improvement can have an economic pay back), but…

1. First of all, you need a sound measurement system before setting standards
2. Start only with verifiable measures (coming from the part of the network equipped with remote control)
3. Audits are essential to gain the attention of network middle management and information systems engineers
4. When setting standards, graduality pays: start with a few indicators and with not-too-aggressive standards, and enlarge the quality aspects, raising the standards over time
5. Implementation is the hard work: you must found viable solutions, because the aim is improving, not sanctioning

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GUARANTEED STANDARDS (2004-2007)		**Final LV customers**	**Final MV customers**
Distrib.	Maximum time for estimating charges for execution of work on LV network	20 work.days	n.a.
	Maximum time for execution of simple work	15 work.days	30 work.days
	Maximum time for activation of supply	5 work.days	5 work.days
	Maximum time for closing supply at customer's request	5 work.days	7 work.days
	Maximum time for restarting supply following suspension for lack of payment	1 day incl. Saturday	
	Maximum time band for customised appointments	3 hours	
	Maximum time for restoration of supply following a failure of the metering device	3 hours (day-time) 4 hours (night-time)	
Supply	Maximum time for correction of bills (for errors in already paid bills)	90 calend.days	60 calend.days

SERVICE QUALITY REGULATION comparison between before and after Authority's regulation

	Self-regulation			Regulation issued by the Authority					
	1997	1998	1999	2000 II° sem.	2001	2002	2003	2004	2005	2006
Number of requests with not fulfilled guaranteed standards	6.099	4.167	8.418	7.902	25.650	61.881	67.344	57.424	64.696	73.867
Actually paid Compensation payments	21	54	22	4.771	12.437	52.229	79.072	48.305	63.822	73.714
Total amount Actually paid For compensations Euro Millions	0,001	0,002	0,001	0,22	0,82	3,11	4,21	3,41	4,43	4,07

SERVICE QUALITY REGULATION Effects of guaranteed standards (2006)

SERVICES SUBJECT TO GUARANTEED STANDARDS	Standard	2006 RESULTS			
		Number of requests per year	% Stds not fulfilled	Average Time (net) w.d.	Number of automatic compensat.
ESTIMATE CHARGES (for work on the LV network)	20 working days	**328.637**	**2,8%**	**13,08**	**8.434**
COMPLETE SIMPLE WORKS (net of authorization)	15 working days	**419.042**	**2,4%**	**8,77**	**9.688**
START THE SUPPLY	5 working days	**1.702.260**	**1,0%**	**1,97**	**16.653**
TERMINTE THE SUPPLY (on customer's request)	5 working days	**826.458**	**0,5%**	**1,58**	**3.144**
RESTART AFTER NON-PAYMENT DISCONNECTION	1 days	**863.530**	**3,6%**	**0,51**	**32.361**
CORRECT BILLING PROBLEMS (already paid sums)	90 days	**11.453**	**7,1%**	**46,65**	**515**
SOLVING METERING FAULTS (with service interruptions)	3 hours (daytime) 4 hours (night)	**130.461**	**1,7%**	**1,71**	**2.501**
KEEPING APPOINTMENTS (punctuality band hours)	3 hours	**52.674**	**0,7%**		**259**

w.d.: working days

GUARANTEED STANDARDS FOR COMMERCIAL QUALITY Implementation issues

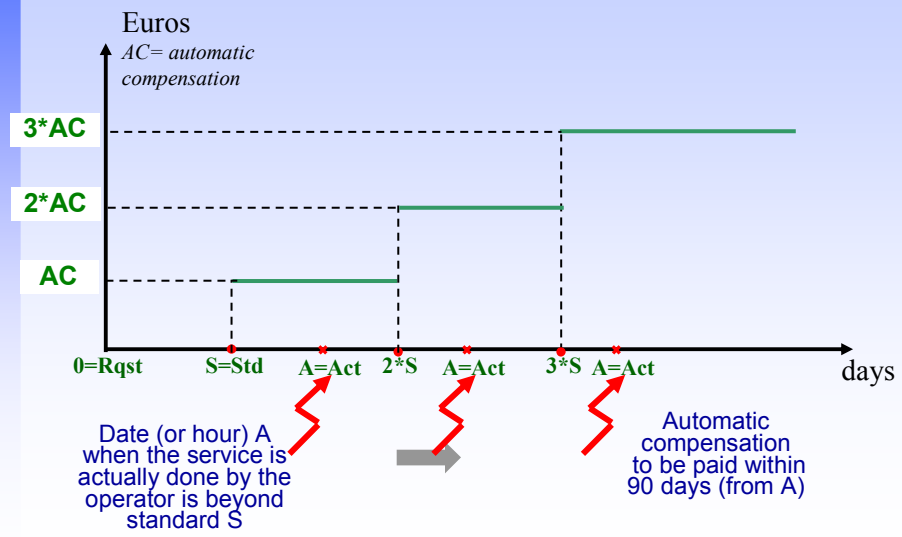
- **Defining content of services subject to standards: e.g. "simple works"**
  - ITALY: "simple work" if it is limited to the final network lenght
- **How to consider delays due to customer or public authorisation**
  - ITALY : suspension of clock for these cases
- **Documentation of customer no-show (no right to compensation)**
  - ITALY : company must leave a message and keep internal record
- **Commercial quality data publication:**
  - ITALY: not only % of requests with standard not fulfilled, but also average times, number and amount of compensations

AUTOMATIC COMPENSATIONS Amounts and exemptions

• **Amounts**	Domestic LV customers	Non domestic LV customers	MV customers
Automatic compensation (**AC**) paid in the next bill	30 euro	60 euro	120 euro

- **Exemptions**
  - Force majeure and third party action (to be adequately proven)
  - In cases where the customer is not up to date with payments owed to the operator.
  - Concerning "maximum time for restoration of supply following a failure of the metering device " the operator shall not be required to pay the compensation if the interruption of supply is caused:
    - by release of lock cable terminals;
    - by intervention of the load limiter due to overconsumption;
    - by damages caused to the metering device when installed in rooms where only the customer can have admittance.

AUTOMATIC COMPENSATION
Escalation in case of delayed execution



GUARANTEED STANDARDS FOR CONTINUITY OF SUPPLY

- **Focus on average improvement rather than on the protection of worst-served customers**
  - Overall standards referred to a given area (in Italy: 300 districts)
  - Improvement targets and incentive/penalty schemes
- **In some countries guaranteed standards for continuity of supply do exist**
  - Very long interruptions
  - Multiple interruptions
- **Automatic compensations for interruptions require the exact knowledge of affected customers**
  - "Connectivity model" are needed
  - Real network configuration at the moment of interruptions
  - Interaction between commercial and technical information systems

CONNECTIVITY MODEL: ASSESSING NUMBER OF CUSTOMER INTERRUPTED

- **MV network: evolution over time through SCADA**
  - 1999: obligation to have remote control on each MV feeder; avg ratio of customer / MV-LV transformer (differentiated per each of 8.000 municipalities) and standard MV network configuration
  - 2002: ratio of customer / MV-LV transformer (differentiated per each of 8.000 municipalities) and real MV network configuration in case of long (>3') interruptions
  - 2006: exact number ratio of LV customer per each of 400.000 MV-LV transformers and real MV network configuration in case of both long and short interruptions; full connectivity for MV customers
- **LV network: recent rule (n.122/06)**
  - Up to 2007: avg ratio of customer / LV feeder (differentiated per each of 8.000 municipalities) and standard LV network configuration
  - From 2008: at least exact number of LV customer per each of 1.000.000 LV feeders and quasi-real LV network configuration
  - Incentive for using AMR for having full connectivity for LV custom.

GUARANTEED CONTINUITY STANDARDS Comparing Regulations in EU

MULTIPLE LONG INTERRUPTIONS
- Great Britain
- Italy *(approved in 2004, enforced from 2006)*
- Spain
- France

MULTIPLE SHORT INTERRUPTIONS
- France *(customised contracts)*

VERY LONG INTERRUPTIONS
- Great Britain
- France
- *Italy (approved in 2007)*

All these standards have been compared in the 3rd CEER Benchmarking Report on Quality of Supply *(available on the CEER website!)*

THE ITALIAN SCHEME FOR MULTIPLE INTERRUPTIONS G.S. /I

As from 2006 the regulation of the maximum yearly number of long unplanned interruptions ("multiple interruptions" GS) apply to all major customers (connected to MV networks).

This is a rather complex regulation made of 6 elements

1. Standard for multiple interruptions
2. Exemptions
3. Penalties for distribution companies
4. Automatic compensations for customers (conditioned to technical specifications)
5. Technical specifications for selectivity of protection relais
6. Extra tariff component for customers not compliant with technical specifications (after a due time for complying)

This regulation required a long graduality path and a big effort for implementation and communication

THE ITALIAN SCHEME FOR MULTIPLE INTERRUPTIONS G.S. /II

1. **Guaranteed standards for MV customers** (1-35 kV):
   - 3 long unplanned interruptions/year (urban areas)
   - 4 long unplanned interruptions/year (suburban areas)
   - 5 long unplanned interruptions/year (rural areas)

2.Exemptions

- interruptions due to external causes and acts of God
- interruptions originated in HV-EHV networks (transmission and distrib.)
- interruptions repeated within 1 hour (only 1 counts)
- transmission blackouts and rolling blackouts (generation inadequacy)
- planned interruptions

Percentiles of MV customer per yearly number of long interrupt.
(contract. power >=100 kW, 2002)

	Urban areas	Suburb. areas	Rural areas
<=2	88	77	73
<=3	94	86	83
<=4	97	91	88
<=5	98	93	92
<=6	99	95	95

Excluded interruptions due to force majeure, third party action, transmission and HV network

THE ITALIAN SCHEME FOR MULTIPLE INTERRUPTIONS G.S. /III

3. **Penalties** paid by DNOs when guaranteed standards are not met:

$$P = \sum_{j=1}^{m} \sum_{i=s+1}^{\min(2s;n)} (Vp \times PMI_{ij})$$

Vp { = 2,5 €/kW-interrupted (MV up to 500kW)
= 2 €/kW interrupted (MV beyond 500kW)

PMI = Average Interrupted Power (70% of the contractual power)

m means worst served "*major customer*" according to a graduality path:
- from 2006: MV customers with contractual power higher than 500 kW;
- from 2007: all MV customers with contractual power higher than 100 kW.

There is a cap for maximum amount of penalties (2% of tariff from MV customers)

4. **Automatic compensations** received by each *w* worst served MV customer **of any contractual power** when guaranteed standards are not met by DNOs **and** whose installations fulfil technical specifications determined by the Authority:

$$I_w = \sum_{i=s+1}^{\min(n;2s)} (Vp * PMI_{iw})$$

THE ITALIAN SCHEME FOR MULTIPLE INTERRUPTIONS G.S. /IV

5. **Technical specifications determined by the Autorithy**

- **Basic specifications**: circuit breaker, controlled by protection relays able to detect short circuit and earth fault currents;
- **Simplified specifications** (for MV customers with only one MV/LV transformer smaller than 400 kVA, equipped with switcher and fuse, and connected to the network though a MV cable shorter than 20 m):
  - ➢maintenance contract to the substation with a qualified firm (every 6 months for cleaning, every 1 years for the switcher)
  - ➢register of the maintenance inspections

A large part of long interruptions originated on MV network (around 1/3) are not localised. Some of them are originated within customers' installations. The objective of this regulation is the selective coordination of DNO's and customers' protection relays. This is of fundamental importance to avoid that interruptions originated within customers' installation may interrupt all the customers connected to the same MV line

THE ITALIAN SCHEME FOR MULTIPLE INTERRUPTIONS G.S. /V

6. Extra tariff component

- As from 2007 customers with contractual power larger than 500 kW not fulfilling technical specifications must pay an extra tariff component related to the probability that they provoke an interruption:

$$\text{CTS} = 1€/\text{day} + 0.15€ * \frac{\text{annual energy consumption}}{\text{contractual power}}$$

- Customers with contractual power smaller than 500 kW must pay the extra tariff component from 2008
- DNOs can keep a part of the amount of extra-tariff component

Cost/benefit analysis

- Single customers suffering each year 1 interruption more than the standard have a pay back time for the investment needed to fulfil specifications:
  - 1 year (contractual power = 1000 kW)
  - 5-7 years (contractual power = 250 kW)
- Customers adopting simplified specifications have a yearly cost
- System cost/benefit analysis: 3.4 – 4.5 years (including benefits for LV cust.)

THE ITALIAN SCHEME FOR MULTIPLE INTERRUPTIONS G.S. /VI

Implementation issues

- Strong effort for communication in order to divulgate knowledge and enact customers to understand the benefits of this regulation and plan their investments for fulfill technical specifications
  - More than 8.000 customers and installers contacted in events
  - DNOs obliged to direct communication to each MV customers
  - Industrial customer association involved
- Maintenance of the regulation in order to solve some detail problems
- Agreement with technical standardisation body (CEI) for developing and issuing a technical norm on electric maintenance in MV customer installations

New consultation process (ongoing)

- Proposed review of standards (from 3-4-5 long interr. to 2-3-4)
- Proposed new standards for long+short interruptions (rejected)

MULTIPLE INTERRUPTIONS GUARANTEED STANDARDS

Territorial classifications	STANDARDS (applicable to long interruptions, d>3')					COMPENSATION PAYMENTS
	Metro-politan	Urban (cities)	Semi-urban (towns)	Rural (villages)	Rural disperse	
FRANCE	**2** *(MV)* **n.a** *(LV)*	**3** *(MV)* **n.a** *(LV)*	**3** *(MV)* **n.a** *(LV)*	**6** *(MV)* **n.a** *(LV)*		*Amount of claimed damages*
GREAT BRITAIN	**3** *(MV) (each longer than 3 hours)* **3** *(LV) (each longer than 3 hours)*					*Compensation of £50 on customer's request*
ITALY	**3** *(MV)* **n.a** *(LV)*		**4** *(MV)* **n.a** *(LV)*	**5** *(MV)* **n.a** *(LV)*		*Automatic conditioned yearly discount proportional to contr. power and exceeding interr.*
PORTUGAL	**8** *(MV)* **12** *(LV)*		**18** *(MV)* **23** *(LV)*	**30** *(MV)* **36** *(LV)*		*Automatic yearly discount proportional to contractual power and exceeding interr.*
SPAIN	**8** *(MV)* **12** *(LV)*		**12** *(MV)* **15** *(LV)*	**15** *(MV)* **18** *(LV)*	**20** *(MV)* **24** *(LV)*	*Automatic yearly discount proportional to contractual power and exceeding interr.*

Source: 3rd CEER Benchmarking Report. 2005

Territorial classifications are different, this table makes an attempt of a relative comparison

VERY LONG INTERRUP. SCHEMES Main experiences in EU

GREAT BRITAIN

- Normal situation (non-severe weather): 18 hours
- Severe weather: 3 types of events, 24 to 96 hours
- Compensation: £25 at the trigger + £25 every 12 hours
- Allowance pre-set in the tariff (initially a partial cost recovery was admitted)
- Transmission faults excluded
- Compensations: active role of companies in detecting affected customers ("semiautomatic")

FRANCE

- 6 hours, but excluded very rare events (probability < 1 out of 20 yrs *and* > 100.000 customers affected)
- Compensation: 2% of fixed part of tariff every 6 hours
- Transmission faults included
- Automatic compensations

THE ITALIAN SCHEME FOR VERY LONG INTERRUPTIONS /I

- **2003:** Blackout for transmission/dispatching problems (lost interconnections with abroad during night min-peak)
  - 33M customers affected (only Sardinia at safe), up to 24 hours (Sicily)
- **2004:** Large interruptions in some regions due to exceptional severe weather.
  - More than 2 M customers involved in 4 large events (7 regions);
  - Around 400.00 customers interrupted for more than 12 hours
  - Around 50.000 cust. for more than 2 days (up to 5 days, 2.000 cust.)
- **2005:** First round of consultation
- **2006:** Second round of consultation
- **2007:** Third round of consultation and final decision (July)
- **2008:** Implementation time
- **2009:** new standards for all customers in case of very long interruptions with automatic compensations (even LV cust.)

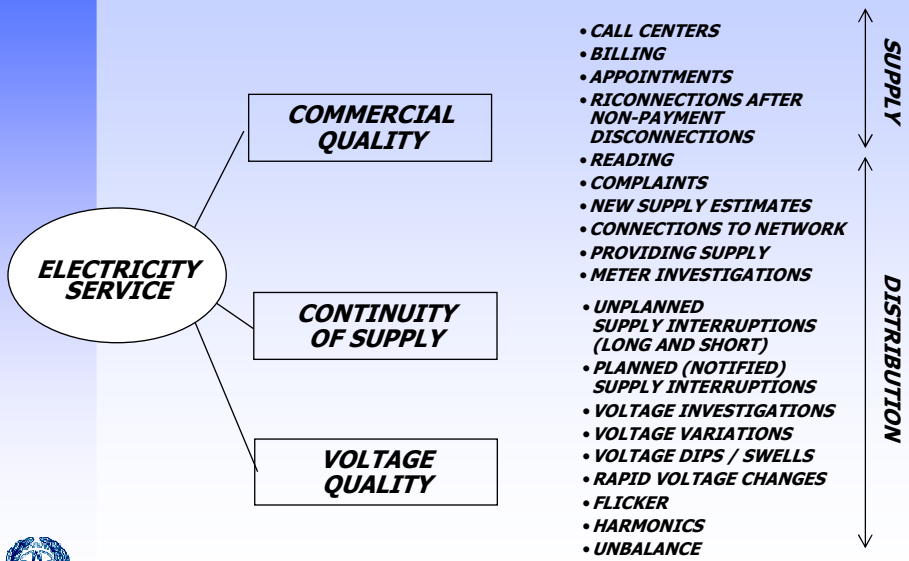
THE ITALIAN SCHEME FOR VERY LONG INTERRUPTIONS /II

- **MAIN ELEMENTS**
  - GUARANTEED STANDARDS ARE APPLICABLE TO BOTH NORMAL AND EXCEPTIONAL EVENTS
    - Urban areas: 8 hours; Suburban areas: 12 hours; Rural areas: 16 hours
  - STATISTICAL METHOD FOR IDENTIFYNG "MAJOR EVENTS"
  - DOCUMENTAL METHOD FOR IDENTIFYNG "EXCEPTIONAL EVENTS"
  - SUSPENSION OF CLOCK OM
  - COMPANY MUST PAY GUARANTEED STANDARDS
  - IN CASE OF MAJOR OR EXCEPTIONAL EVENTS, COMPANIES ARE COMPENSATED THROUGH A DEDICATED FUND
  - ALL CUSTOMERS PUT A LITTLE MONEY IN THE FUND
  - COMPANIES ARE INCENTIVESED IN ORDER TO IMPROVE THEIR PERFORMANCE IN "NORMAL CONDITIONS"
    - Companies must put money in the Fund according to their actual quality net of major and exceptional events
    - Companies receive a sum that is proportional to the expected quality (decreasing over time)

Content

- The evolution of the legal framework: from Citizen's Charter to service quality regulation
- The development of continuity of supply monitoring in distribution networks
- Incentive/penalty regulation for continuity of supply for reducing interruptions
- Automatic compensations to the customers for not fulfilling individual quality standards
- A comprehensive view of service quality regulation

Output regulation

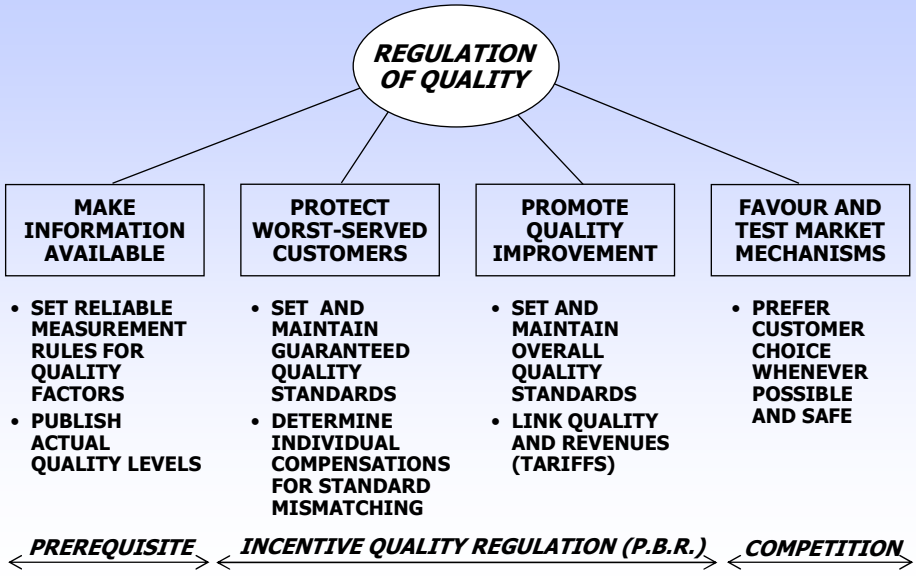


Multidimensionality is an issue

Regulators generally find it easier to regulate price than quality.
Price has the greatest advantage of being (in certain markets at least) both one-dimensional and objectively measurable.
Quality, on the other hand, is hard to pin down. It has many dimensions, some of which typically rest upon subjective evaluations by the consumer.

R. Baldwin and M. Cave,
Understanding Regulation, 1999

Service quality regulation objectives



A map for understanding service quality regulation

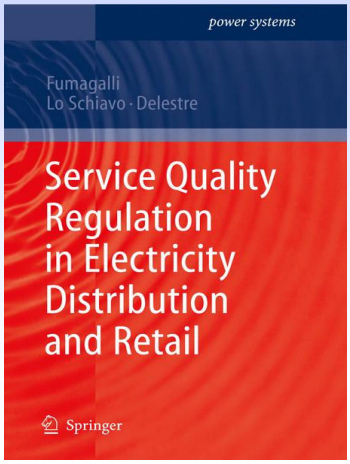
	MAKE INFORMATION AVAILABLE	PROTECT WORST-SERVED CUSTOMERS	PROMOTE QUALITY IMPROVEMENT	FAVOUR AND TEST MARKET MECHANISMS
COMMERCIAL QUALITY				
CONTINUITY OF SUPPLY				
VOLTAGE QUALITY				

A map for understanding service quality regulation

	MAKE INFORMATION AVAILABLE	PROTECT WORST-SERVED CUSTOMERS	PROMOTE QUALITY IMPROVEMENT	FAVOUR AND TEST MARKET MECHANISMS
COMMERCIAL QUALITY	Quality data publication	Guaranteed standards	Telephone response incentives	
CONTINUITY OF SUPPLY	Regulatory measurement guidance	Multiple interruption standards	Incentive/ penalty scheme	Power quality contracts
VOLTAGE QUALITY	Volt.Qual. Monitoring systems	Volt.Qual. minimum standards		

Handbook of service quality regulation

- Product of joint cooperation between CEER and Florence School of Regulation (FSR)
- A tool for regulators, utilities and scholars
- Both beginners and advanced topics
- Contents:
  1 Introduction.- 2 The basics of service quality regulation.- 3 Commercial quality.- 4 Continuity of supply.- 5 Voltage quality.- 6. References on specific issues.
- Published in Sept-07 by Springer



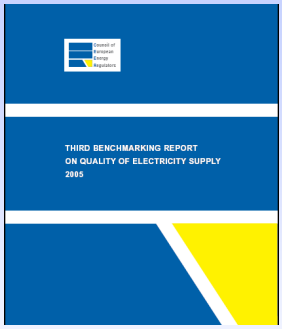
ISBN: 978-3-540-73442-0

Objectives of the Handbook

- To describe the regulatory instruments that can be employed in service quality regulation
  - Focus on design and implementation of quality regulation in practice
- To help develop a shared framework for service quality regulation across the EU
  - To facilitate the sharing of ideas and innovations
  - To encourage the exchange of data and information (further research and analysis)
- Structured according to the map
  - Each chapter is referred to a cell in the map

Reasons behind

- **CEER 3rd Benchmarking Report**
  - During the preparation work the need for an Handbook raised from many EQS TF members
  - Good results obtained in different countries



- **EU-funded Twinning projects**
  - Service quality regulation of paramount importance in new accession countries (privatisation + price-cap)
- **FSR interest in launching a book series**
  - Publication of both training and academic interest
  - No robust textbook in this field

General messages

- Preliminary requirement: quality data measurement
  - Regulatory instruments must be fair and simple to implement
- Adjust regulatory schemes to account for specific industrial and institutional factors of the country
- Quality regulation greatly benefits from a gradual approach to the implementation process
- Quality regulation is never a permanent solution: periodic evaluation and revision
- An open dialogue across all interested parties is a fundamental part of an efficient regulation

THE NEED FOR HIGH LEVEL COMMITTMENT

Liberalisation is often opposed on the grounds that it could damage public service and weaken national industry.

We have taken quality of service as one of the main targets of regulatory action, the aim being to demonstrate that liberalisation plus regulation will produce better quality than did the previous regime.

Pippo Ranci, former AEEG President

[P. Ranci, *Regulating Energy in Italy*, in: C. Henry *et al.* (editors), Regulation of network Utilities. The European Experience, Oxford University Press, 2001, p. 195-204]

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...thank your for your attention!

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