# PROMOTING INNOVATION AND INVESTMENTS IN SMART GRID

## The Italian Regulatory Experience


Luca Lo Schiavo

*Italian Regulatory Authority for electricity and gas*

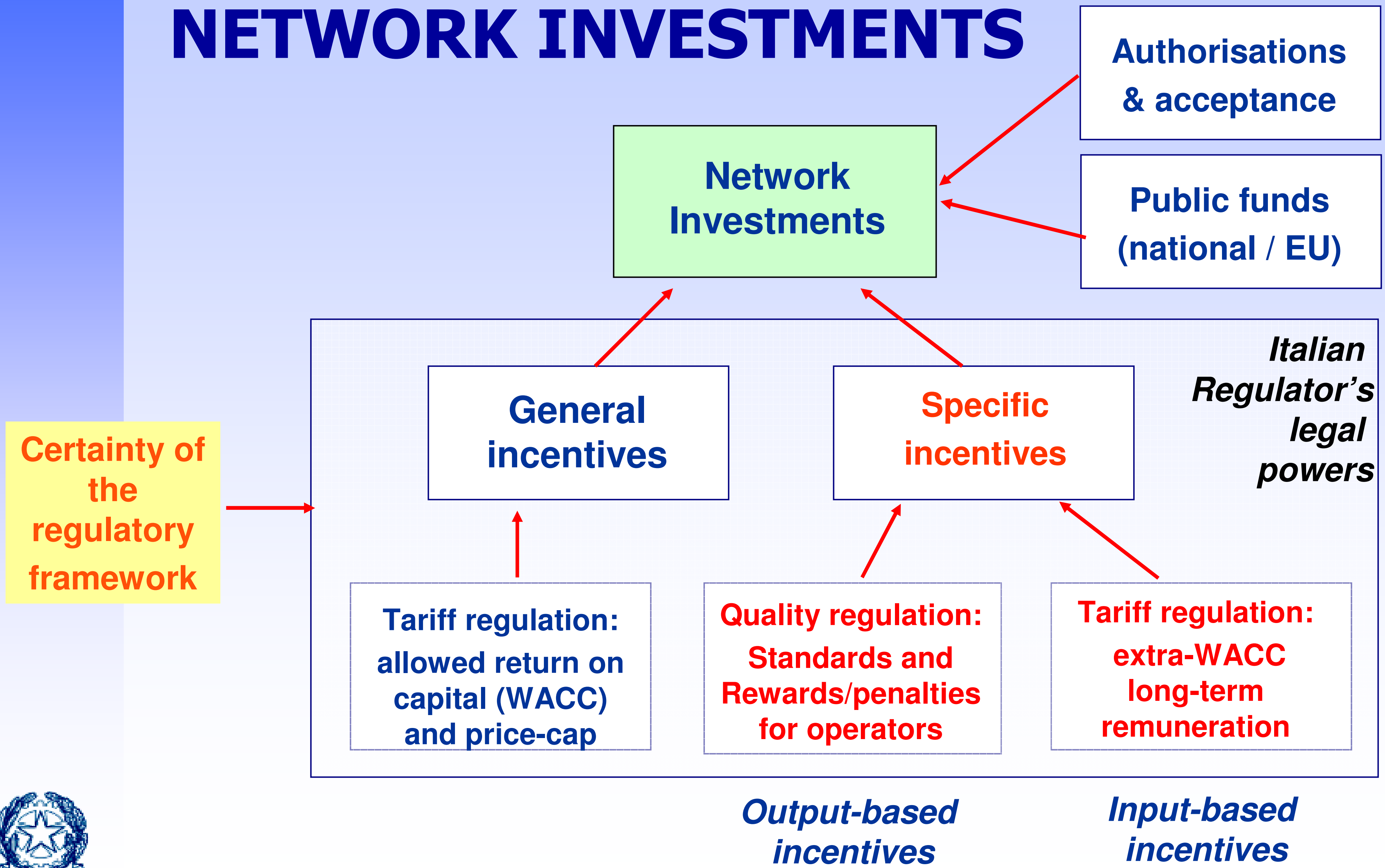
lloschiavo@autorita.energia.it


JRC Workshop – Electricity Session
Dubrovnik 7 October 2011

# Content

- **Network investiment regulation**
  Incentive Framework: Input-based *vs* Output-based
- **Smart Power System: a wide paradigma**
  Cost and benefit approach
- **Smart Grid Demostration and Deployment**
  The Italian incentive regulation
- **EV recharging infrastructure**
  The Italian incentive regulation for demonstration
- **Smart meters**
  Snapshot of benefits and regulation

# VARIABLES INFLUENCING NETWORK INVESTMENTS



# EVOLUTION OF ITALIAN INCENTIVE REGULATION FOR ELECTRICITY GRIDS

| | | *output-based* | *input-based* |
|---|---|---|---|
| *First regulatory period* 2000-2003 | Priority in the Regulatory Agenda: Focus on investments for recovery of quality of supply gaps | ✓ *(distrib.)* | |
| *Second regulatory period* 2004-2007 | Priority in the Regulatory Agenda: Promotion of investments for security of supply (transmis.only) and quality of supply (distr.only) | ✓ *(distrib.)* | ✓ *(transm.)* |
| *Third regulatory period* 2008-2011 | Priority in the Regulatory Agenda: Promotion of strategic investments and quality of supply Transmission/distribution/metering | ✓ *(distrib. +transm.)* | ✓ *(distrib. +transm.)* |

# OUTPUT-BASED INCENTIVES

## Quality incentive regulation: mechanism

*Incentives for quality (year t)*

$$\pm Q_t = f(T_t, A_t, V_{ENS}, P_{avg})$$

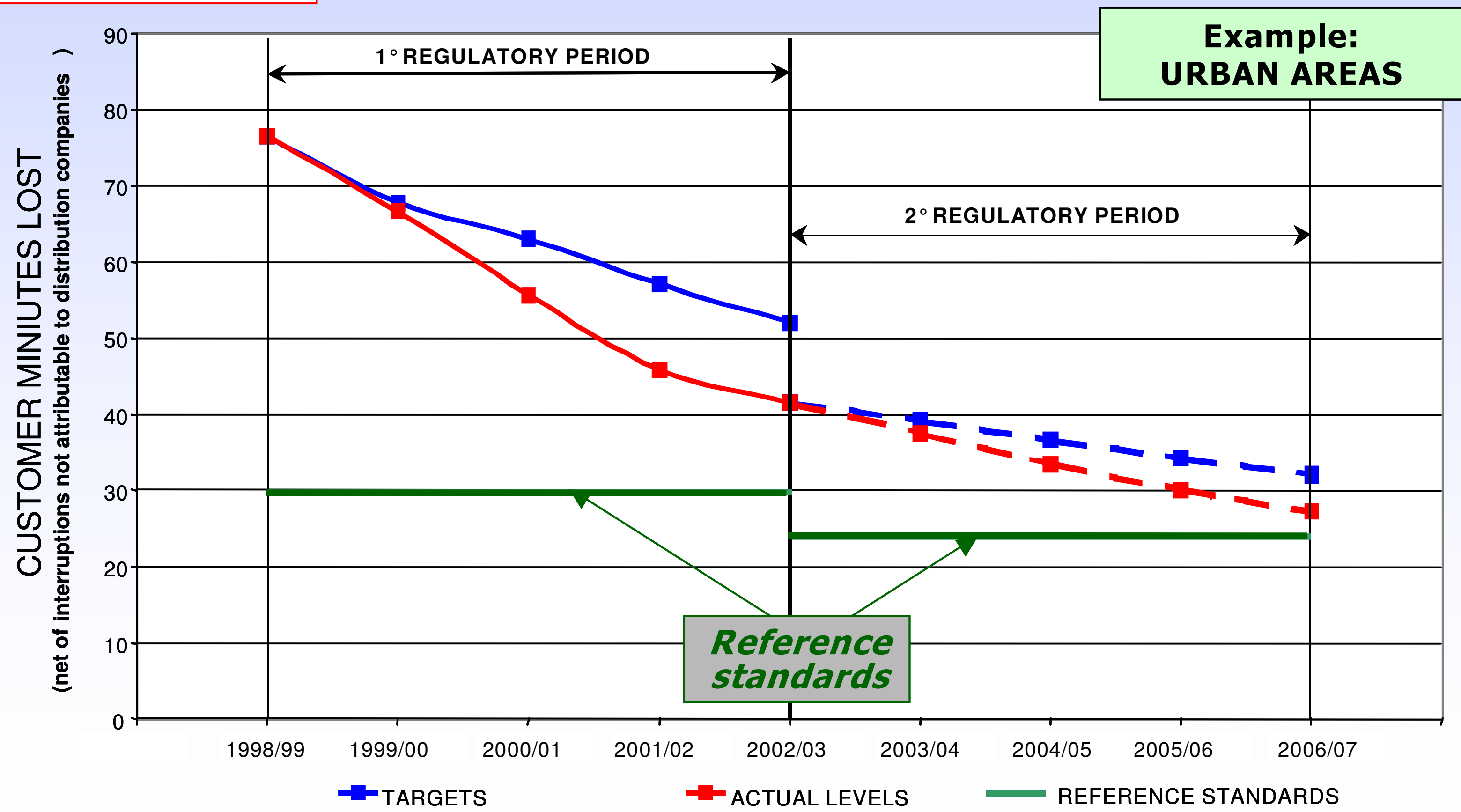
***$T_t$**: targets (ex-ante for each district)*

***$A_t$**: actual levels*

***$V_{ENS}$**: value of 1 hour interrupt. avoided for 1 kW (avg)*

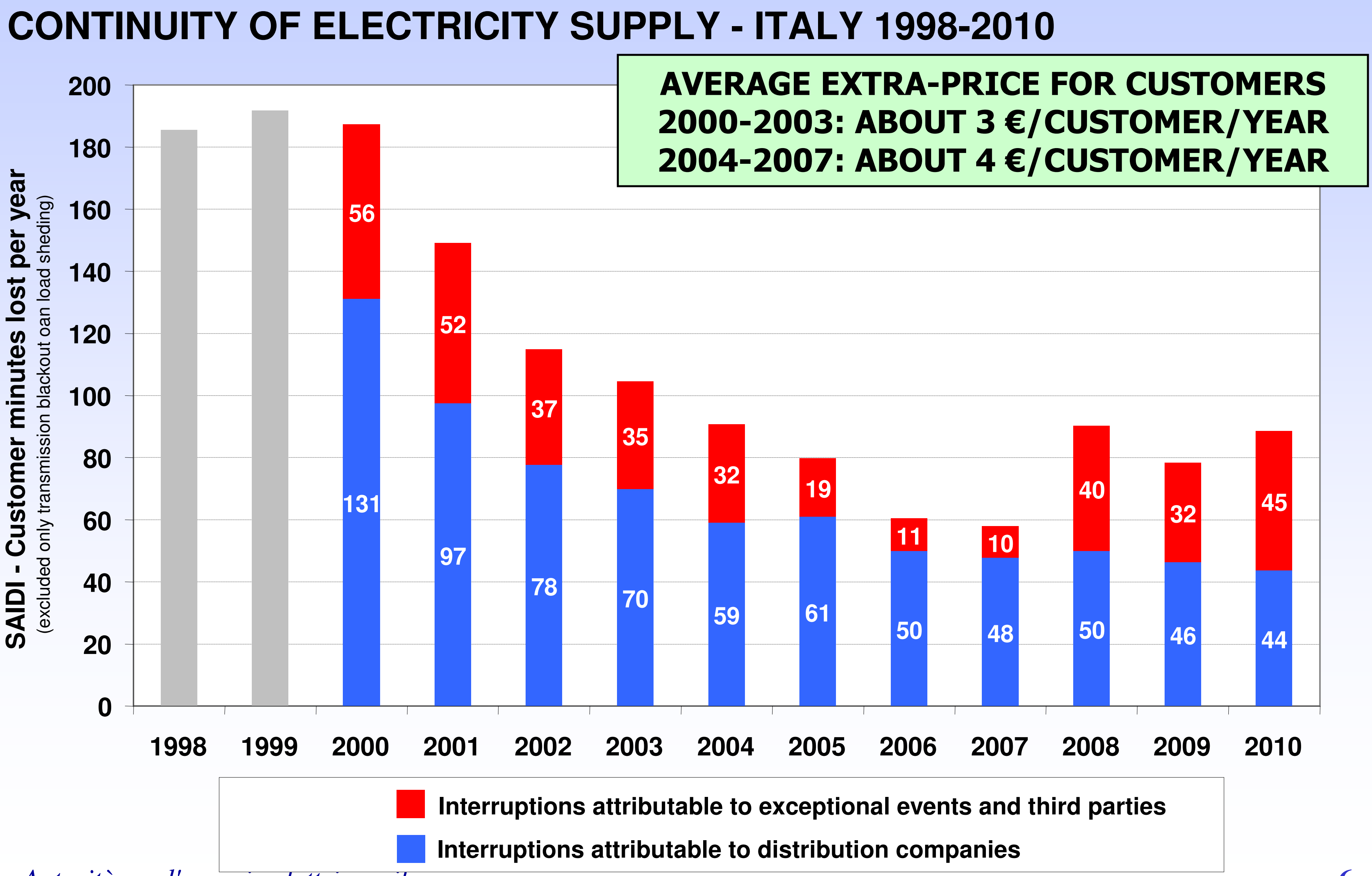
***$P_{avg}$**: average power of each district*

**INCENTIVE REGULATION ADJUSTMENT FROM 1ST TO 2ND REGULATORY PERIOD**



# OUTPUT-BASED INCENTIVES

## Quality incentive regulation: effects over 2 reg.periods



# INPUT-BASED INCENTIVES

## remuneration of new strategic investments

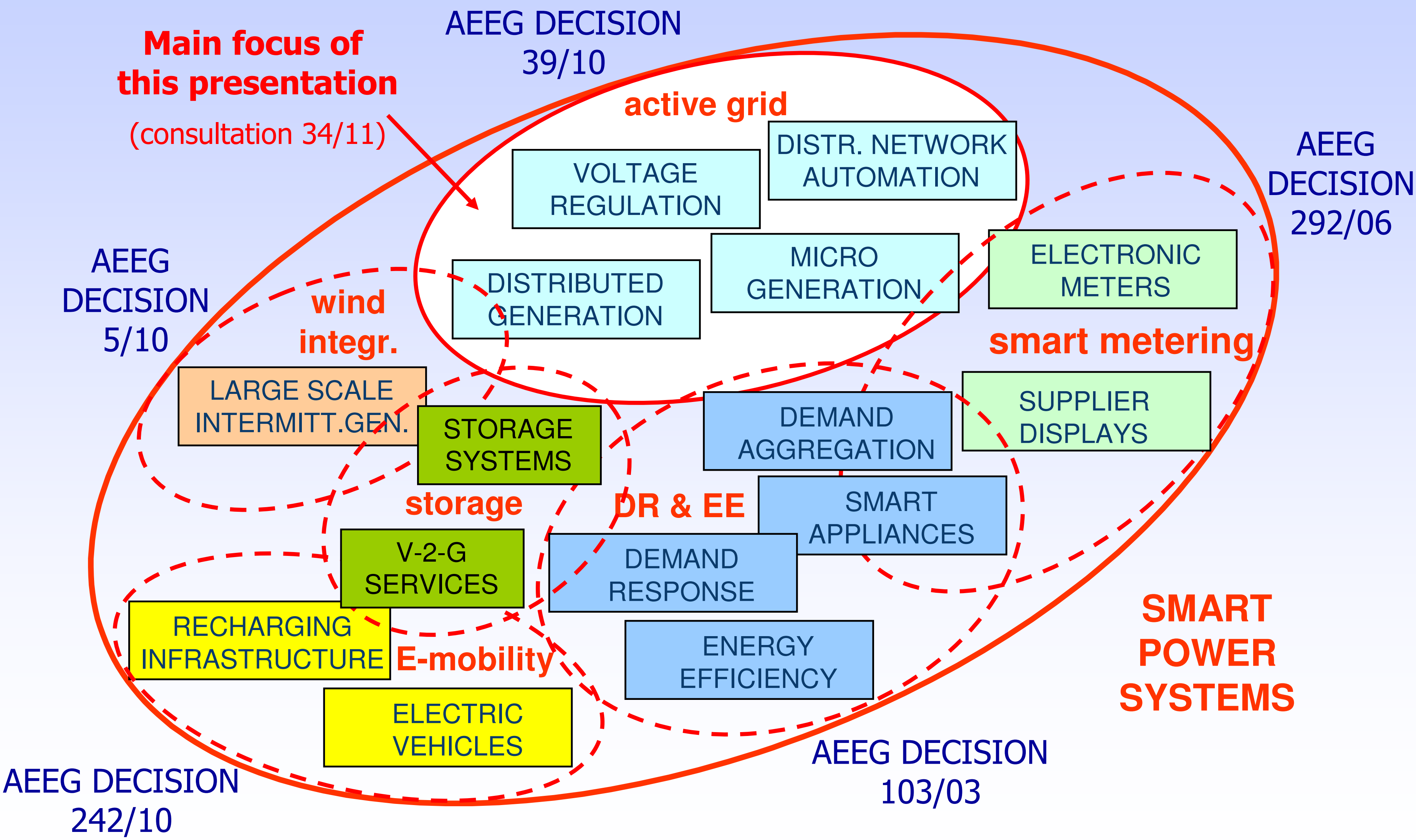
- Electricity networks:
  - extra remuneration guaranteed up to 8-12 years for new strategic investments aimed at:
    - reducing congestion in transmission networks
    - facilitating network modernization (not quality)
    - Promoting innovation (smart grid demo projects)
  - Remuneration for new selected investment is currently between 9% -10% in real terms before taxes

| Electricity | WACC | Max Incentive |
|---|---|---|
| Distribution | 7 % | +2% |
| Transmission | 6,9 % | +3% |
| Metering | 7,2 % | |

# Content

- **Network investiment regulation**
  Incentive Framework: Input-based *vs* Output-based
- **Smart Power System: a wide paradigma**
  Cost and benefit approach
- **Smart Grid Demostration and Deployment**
  The Italian incentive regulation
- **EV recharging infrastructure**
  The Italian incentive regulation for demonstration
- **Smart meters**
  Snapshot of benefits and regulation

# *SMART GRID* or *SMART POWER SYSTEM*
# a very wide paradigma



# EVALUATING SMART GRID COSTS AND BENEFITS

*"Many technical and economic features of the Smart Grid, Distributed Generation and Demand Response provide diffuse benefits to the customers that are hard to put a value on.*

*Regulators must engage in lenghty proceedings to set methods of measuring the value and then utilities must administer them under the critical eye of regulators…"*

P. Fox-Penner, *Smart Power*, 2010

# SMART GRID FUNCTIONS (examples)

**Automated Voltage and VAR Control**

Automated voltage and VAR control requires coordinated operation of reactive power resources, including distributed generation (DG) with sensors, controls, and communications systems. These devices could operate autonomously in response to local events or in response to signals from a central control system.

**Adaptive protections**

Adaptive protection uses adjustable protective relay settings (e.g., current, voltage, feeders, and equipment) in real time based on signals from local sensors or a central control system. This is particularly useful for feeder transfers and two-way power flow issues associated with high DER penetration

**Real-time Load Measurement and Management**

This function provides real-time measurement of customer consumption and management of load through Advanced Metering Infrastructure (AMI) systems (smart meters, two-way communications) and embedded appliance controllers that help customers make informed energy use decisions via real-time price signals, time-of-use (TOU) rates, and service options

EPRI*, Methodological Approach for Estimating the Benefits and Costs of Smart Grid Demonstration Projects*, January 2010.

# Content

- **Network investiment regulation**
  Incentive Framework: Input-based *vs* Output-based
- **Smart Power System: a wide paradigma**
  Cost and benefit approach
- **Smart Grid Demostration and Deployment**
  The Italian incentive regulation
- **EV recharging infrastructure**
  The Italian incentive regulation for demonstration
- **Smart meters**
  Snapshot of benefits and regulation

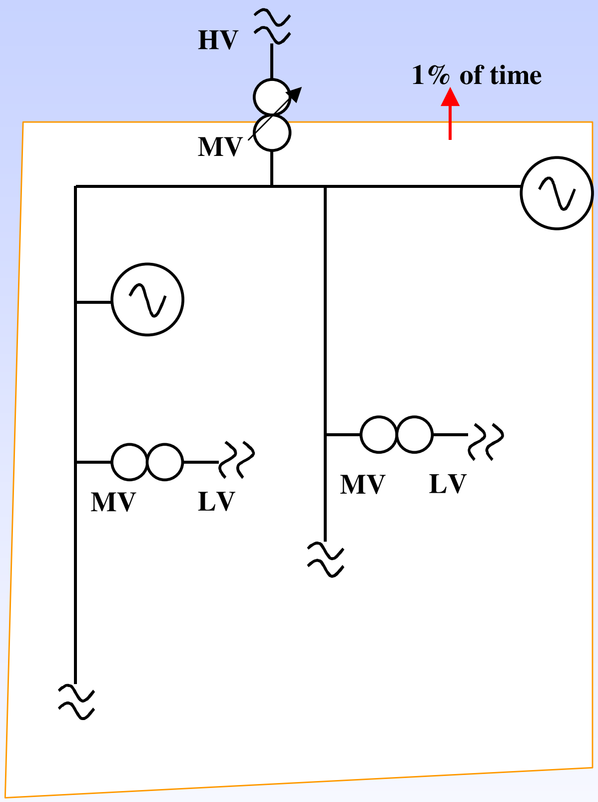
# THE AEEG PATH TO REGULATION OF SMART GRID DEMONSTRATION PROJECTS

- 2010 March: Regulatory order ARG/elt 39/10
  **call for smart grid demonstration pilot projects**
- 2010 July: DTRF resolution n. 4/10
  **selection of experts for evaluation**
- 2010 September: DTRF resolution n. 7/10
  **criteria for smart grid demonstration projects selection**
- 2010 November:
  **deadine for application by distribution companies**
- 2010 December: Regulatory order ARG/elt 191/10, DTRF resol. n. 9/10
  **appointment for independent evaluators for each application**
- 2011 January:
  **collect of evaluators' reports**
- 2011 February: Regulatory order ARG/elt 12/11
  **decision on selection of smart grid demonstration projects to be awarded with tariff incentive "Δ-WACC"**

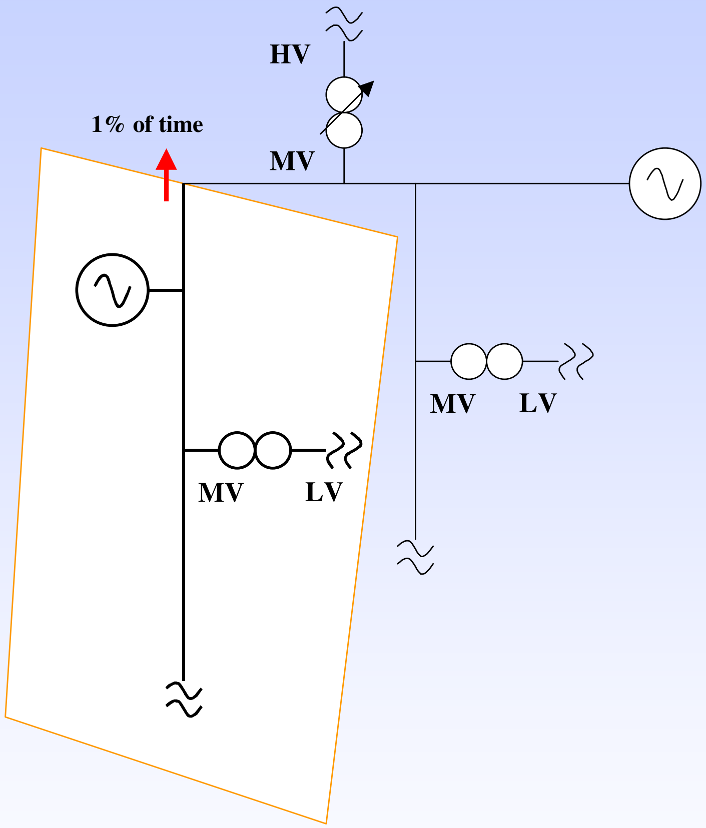
# KEY FEATURES OF SMART GRIDS DEMONSTRATION PROJECTS

- Real grid: A real case in existing distribution networks: real grid, real customers and real generators
  - Focus on DG integration in MV networks [1-35 kV]: 75% of DG power
- Active grid: the selected MV network has to be characterized by a reverse power flow
  - At least 1% of yearly time with reverse power-flow from MV level to HV
- Automated grid: the selected MV network has to be controlled (voltage limits / anti-islanding)
  - Real time control system at MV level
- Open grid: non-proprietary communication protocols only
  - minimize customer costs at the network interface

# ACTIVE GRID MINIMUM REQUIREMENT

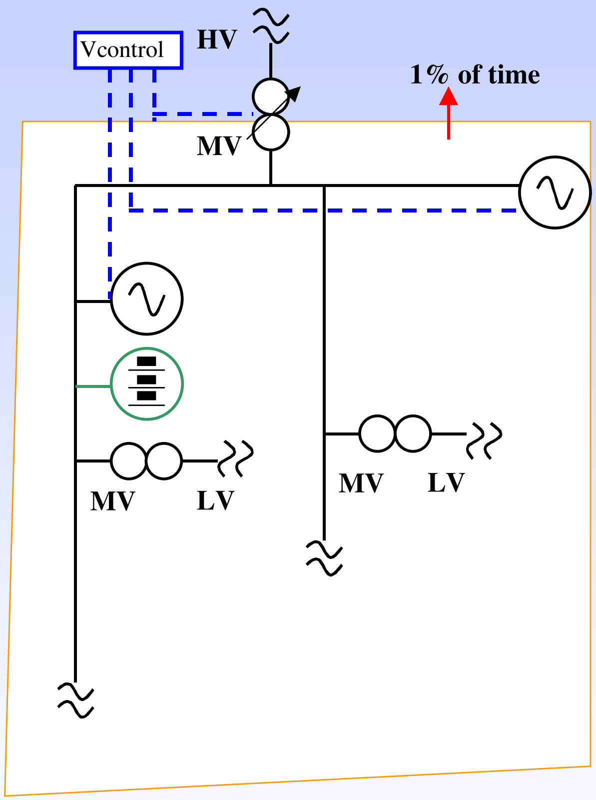


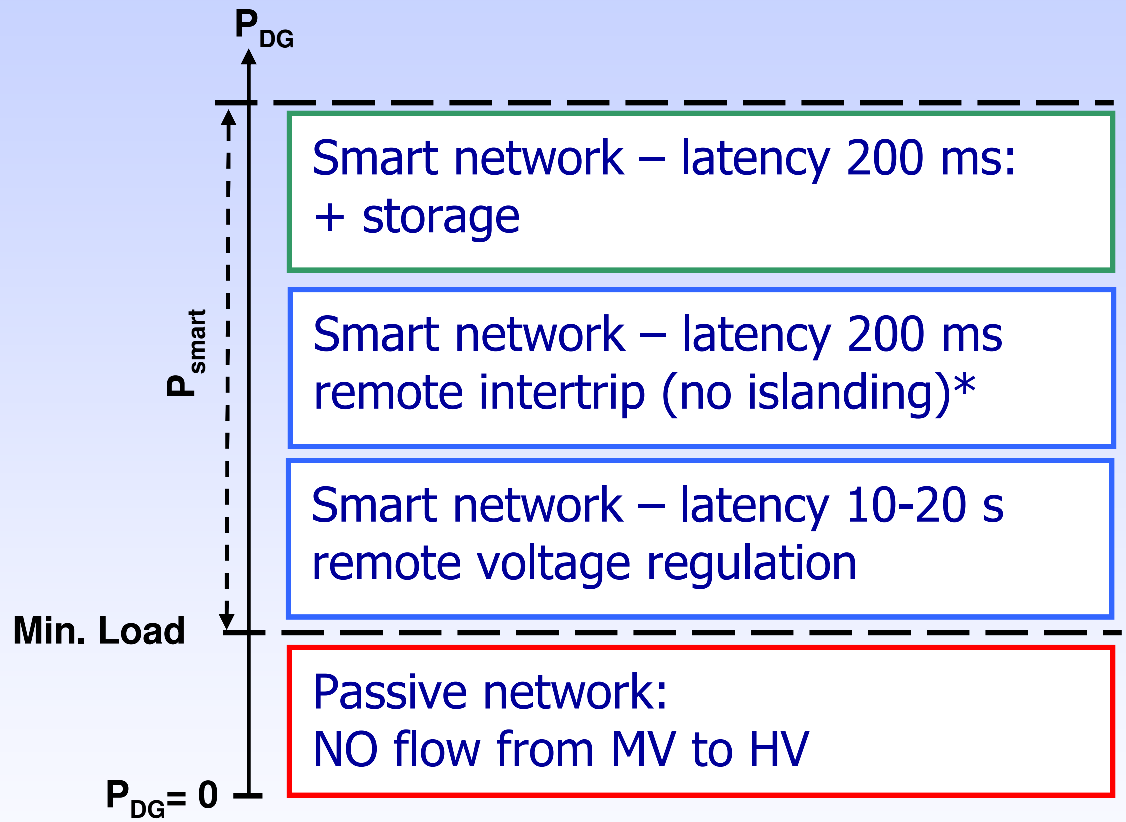

At least 1% of yearly time with power flow from MV level to HV level




At least 1% of yearly time with power flow from MV line to MV busbar

# THE P-smart CONCEPT: HOSTING CAPACITY AT NETWORK LEVEL




$P_{smart}$ is the increase in DG-production ($P_{DG}$) that can be connected to the grid in safe conditions thanks to smart investments on the grid

* *Very critical in Italy due to fast reclosure (400ms)*

# KPI-APPROACH

Synthetic indicator used to assess the expected performance of the selected projects

*Quantitative cost and main benefit indicator*

*Further benefits qualitative scoring*

$$IP = \frac{P_{smart} \cdot \sum_{j=i}^{m} Aj}{C}$$

$$P_{smart} = \frac{EI_{post} - EI_{pre}}{8760}$$

*IP: priority index*

*$A_j$: project benefits [point score]*

*C: project costs [€]*

*P-smart: increase in DG-produced electricity / hour [MW]*

*EI-post: DG-produced electricity that can be injected in the network after the project in safe conditions [GWh]*

*EI-pre: DG-produced electricity that can be injected in the network before the project without reverse flow [GWh]*

# BENEFIT SCORE ($A_j$)

| | | | | |
|---|---|---|---|---|
| A1 | SIZE | b1 | N. generation plants/storage | 6 |
| | | b2 | Increase of electricity production injected into the grid | 12 |
| | | b3 | Increase of ratio "electricity production / electricity consumption" | 8 |
| | | b4 | N. primary substations involved in the project | 4 |
| | | | **Max A1** | **30** |
| A2 | INNOVATION | b5 | Participation of disperse generation to voltage regulation | 6 |
| | | b6 | Presence of control system (SCADA) | 6 |
| | | b7 | Bidirectional comunication and demand response | 6 |
| | | b8 | Presence of storage systems and active power modulation | 12 |
| | | b9 | Partecipation of DSO to ancillary service market | 10 |
| | | | **Max A2** | **40** |
| A3 | FEASIBILITY | b10 | Project schedule | 4 |
| | | b11 | Quality improvements | 6 |
| | | | **Max A3** | **10** |
| A4 | REPLICABILITY | b12 | % of costs on not regulated subjects (DG and storage) | 2 |
| | | b13 | Standard protocols | 8 |
| | | b14 | Consistency between investment costs and objectives / expected benefits of the project | 10 |
| | | | **Max A1** | **20** |
| | | | **Max Project** | **100** |

# EXPECTED BENEFITS

- Increase of electricity production that can be accepted by the distribution grid
  - in particular from renewable sources or cogeneration
  - voltage and current limits respected
  - DG contribute to system security (wider frequency limits)
- Innovation in distribution network management
  - Participation of dispersed generation to voltage regulation (today, no reactive power from DG)
  - New resources: storage, EV recharging infrastructure
  - Customer awareness and Demand Response
  - DSO participation at the balancing market
- Replicability of the pilot projects on a large scale
  - Disclosure of projects and results
  - Ex-post regulatory evaluation in order to identify *outputs*

# SMART GRIDS DEMONSTR. PROJECTS (PROVISIONAL) CONCLUSIONS

- Demonstration projects: no only lab, real service
- Focus on critical situation: MV, high DG penetration (flow MV to HV for >1% of time)
- Requirement: open communication protocols
- Selection process, KPI approach, evaluators
- Benefits – concept of Psmart
- Process still ongoing; expected
  - Replicability on large scale
  - Regulatory learning (next regulat.period 2012-15)

# OUTPUT vs INPUT INCENTIVE REGULATION

- Performance-based (OUTPUT) incentive regulation
  - Incentive/penalties related to performances
  - Applicable when clear metrics of outputs are available
  - Firms are responsible to choose the most cost-effective investment that improves the performance
- Tariff (INPUT) incentive regulation
  - Useful for pursuing specific types of investments
  - Useful when a grounded metric is not available yet (that is: highly innovative projects)
  - Applicable to all part of the value chain (both elec./gas)
- Learning process over time (and over space)
  - The learning process started with a research on Hosting Capacity at nodal level on MV distribution network

# HOSTING CAPACITY OF THE ITALIAN MV DISTRIBUTION NETWORKS

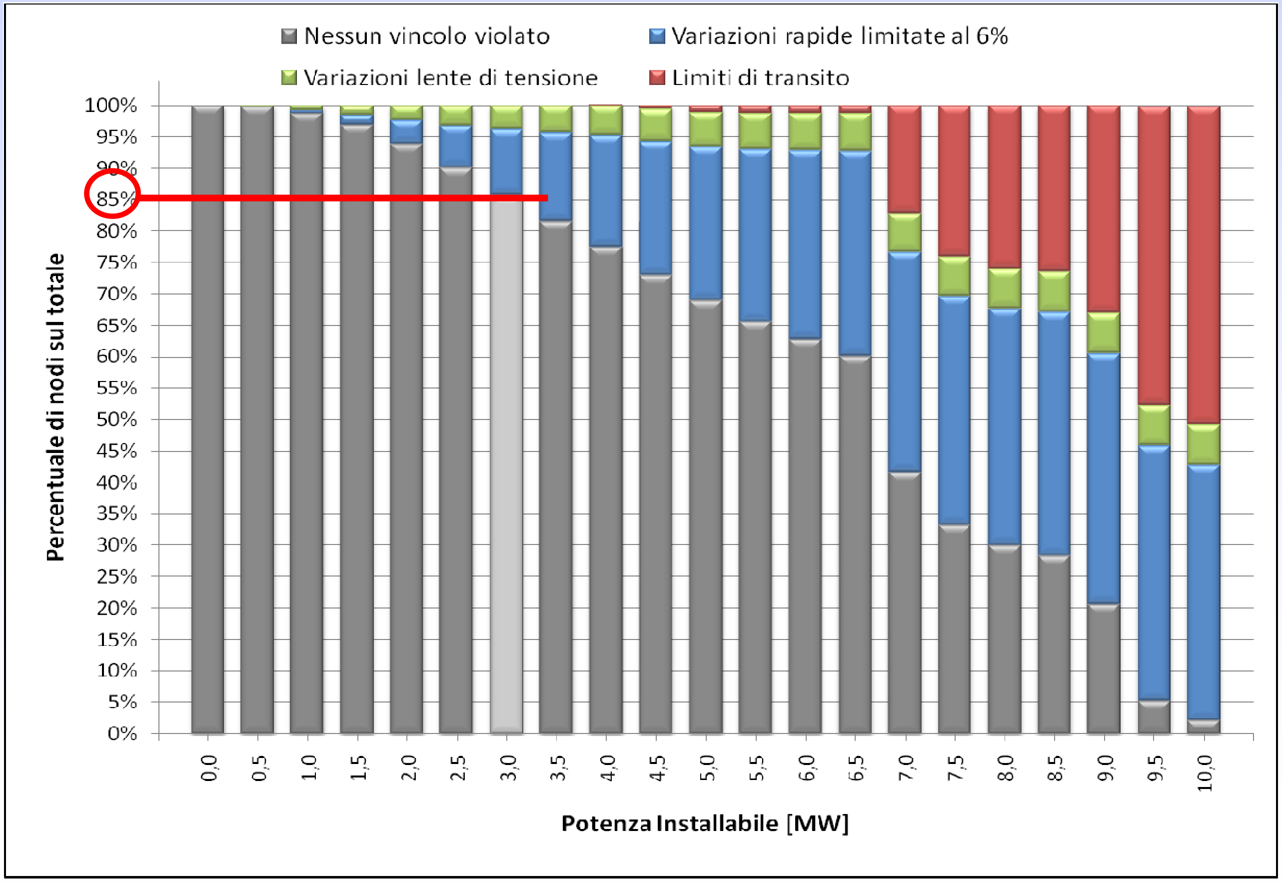
- Research committed in 2008 by AEEG to *Politecnico di Milano*
- Extensive sample (9%) of the Italian MV system
- *Hosting capacity* approach *at nodal level* (Bollen *et al.*, EU-Deep) applied to estimate the ability of MV DN of accepting increasing amounts of DG with no modification in structures and no deterioration in service quality
- Study considering all the relevant technical operating constraints:
  - supply voltage variations (EN 50160, with limits due to LV);
  - rapid voltage changes (EN 50160, $\Delta U_{max}$ =6%);
  - loading limits of branches (according to DNO practices);
  - short circuit currents;
  - unwanted line protection tripping.
- Results published in AEEG resolution ARG/elt 25/09

# HOSTING CAPACITY (AT NODAL LEVEL) OF THE ITALIAN MV DISTRIBUTION NETWORKS

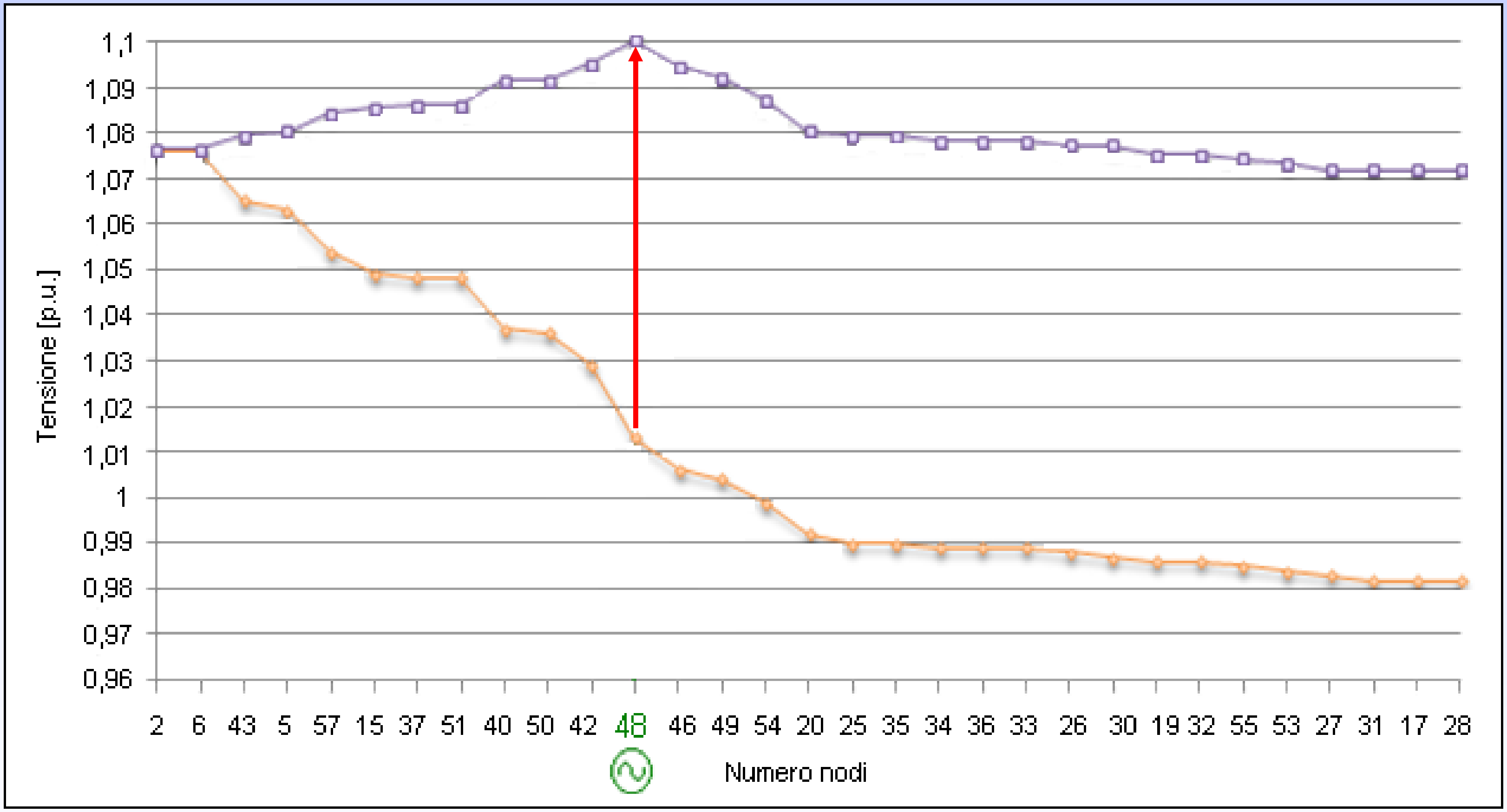
According to a research committed in 2008 by AEEG to Politecnico di Milano, *DG hosting capacity* is adequate in most points of Italian MV distribution networks.

85% of the busses of the sample analyzed can host at least 3 MW (nodal limit of HC)

***Source*** **www.autorita.energia.it/docs/09/025-09arg.htm** ***(in Italian)***



# REVERSE FLOW TIME
## % of year-time with reverse power-flow




This indicator has been used to identify critical situation (risk of undesired inslanding in case of trip); it can be applied to both network and circuit level.

# MEASURING FOR REGULATING

| Indicator | Type of network | Usability for project assessment | Usability for output-based regulation |
|---|---|---|---|
| *Reverse Power-Flow Time* | Distribution (at either network or circuit level) | Identifying critical situations due to high RES-penetration | Filter (together with DG capacity) |
| *P-smart* | Distribution (at either network or circuit level) | Measure of main smart grid benefit | Possibly an output indicator (for incentive) |
| *Nodal Hosting Capacity* | Distribution (at nodal level) | Useful for having a first picture but does not consider the reverse power-flow risk | No for MV<br>Under consideration for LV |
| *Energy not withdrawn from renewable sources due to congestion* | Distribution or Transmission | No (ex-post indicator) | Possibly a disbenefit indicator (for penalty) |

First regulatory thoughts for SG deployment in IT: DCO 34/11

Further indicators are discussed in the just published *CEER Smart Grid Status Review paper*

# Content

- **Network investiment regulation**
  Incentive Framework: Input-based *vs* Output-based
- **Smart Power System: a wide paradigma**
  Cost and benefit approach
- **Smart Grid Demostration and Deployment**
  The Italian incentive regulation
- **EV recharging infrastructure**
  The Italian incentive regulation for demonstration
- **Smart meters**
  Snapshot of benefits and regulation

# THE AEEG PATH TO REGULATION OF ELECTRIC VEHICLES RECHARGE

- 2010 March
  **internal recognition document and workshop with research centers**
- 2010 April — Regulatory order ARG/elt 56/10
  **rules for EV recharging at home and in private places**
- 2010 September — Regulatory order ARG/elt 136/10
  **start of proceeding for recharging services in public places**
- 2010 November — Consultation Document DCO 37/10
  **identified 3 business models for recharge infrastructure**
- 2010 December — Regulatory order ARG/elt 242/10
  **new special tariff for low voltage recharging services in public places and call for demonstration pilot projects**
- 2011 January
  **AEEG filed a position paper in the survey on e-mobility led by a Committee of the Italian Parliament**
- 2011 May
  **selected 6 demonstration projects for EV public recharging**

# EV RECHARGING IN PUBLIC PLACES

**Basic concepts of Regulatory order ARG/elt 242/10**:

for EV “public” recharging infrastructure:

- the use-of-system tariff for EV recharge points (distribution and transmission network services, metering and overall system charges) has no fixed components
- call for demonstration projects (not only distribution companies but also independent service providers);
- criteria for the projects selection and small incentive funded through tariff for information sharing
- 3 different business models

...and according to liberalization of electricity retail markets:

- energy price: market conditions - Multivendor approach

# BUSINESS MODELS

| ***Business Models*** | ***Construction and management*** | ***Type of recharging points*** |
|---|---|---|
| **Distribution company (DSO)** | Electricity distribution system operator only in its concession area | Widely spread in the territory covered by electricty distribution concession. |
| **Area-licensed service provider** | Industial company with local concession | Widely spread in the territory covered by tender |
| **Service providers in competition** | Industry players, without a license | Possibly concentrated in spot places (service-station-*like*) |

- **Multivendor** approach mandatory for distribution (DNO) business model
- Both **Multivendor or Monovendor** approach allowed for service provider business models

# EVs: ENERGY PRICE AND NETWORK TARIFF

| Recharging services without incentive | | Pilot projects | |
|---|---|---|---|
| Energy | based on the market | Energy | based on the market |
| **Specific monomial tariff**<br>T.D.M. + OGS, perequation | **10,283**<br>c€/kWh | Fee<br>**TS*max***<br>*= T.D.M. + OGS + recharging serv.* | **14,3294**<br>c€/kWh |
| Price of recharging service | set by the *service provider* | | |
| Excise duty | % | Excise duty | % |
| VAT | 20% | VAT | 20% |

# EV RECHARGE: CONCLUSIONS

✓ **Private charging points – *Already settled***
- Delivery points and counters dedicated
- Transport tariff: LV other uses
- Efficiency of recharging

✓ **Public recharging points – *Start pilots***
- Pilot projects with several business models
- Demonstration projects can be a part either led by *DNOs* or *service providers*
- Flexibility and ease of use of EVs
- Not yet regulated: *fast charging*

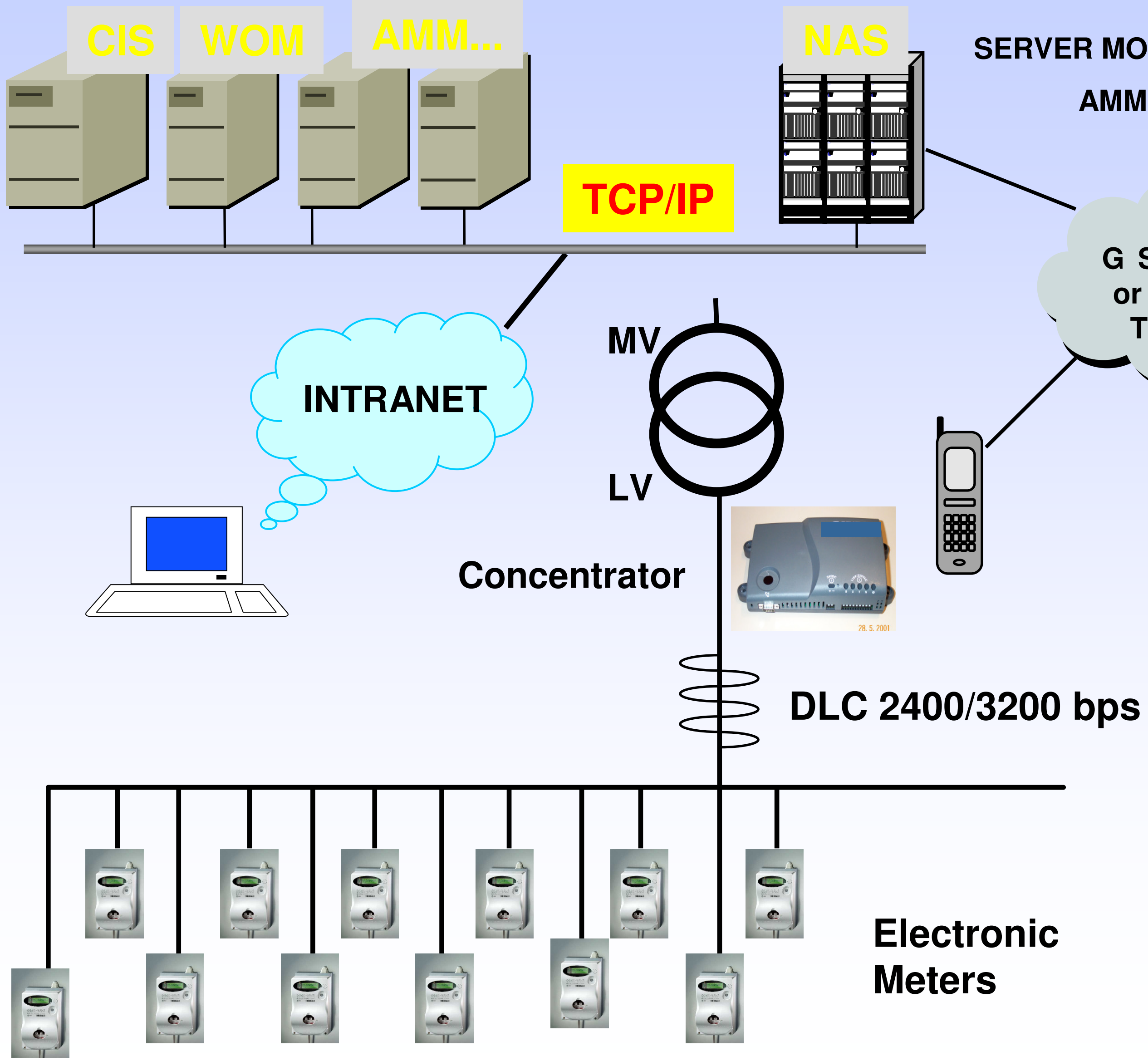
**In both cases – *Integrate EVs in retail competition***
- Energy price: market

# Content

- **Network investiment regulation**
  Incentive Framework: Input-based *vs* Output-based
- **Smart Power System: a wide paradigma**
  Cost and benefit approach
- **Smart Grid Demostration and Deployment**
  The Italian incentive regulation
- **EV recharging infrastructure**
  The Italian incentive regulation for demonstration
- **Smart meters and time-of-use energy price**
  Snapshot of benefits and regulation

# SMART METERING ENEL D. PROJECT

## System Architecture




# METERING REGULATION IN ITALY

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

  ° each between 1 M and 100k cust.

  °° each less than 100k cust.
- Size of LV electr. market
  - 35 Millions LV meters::
    - 28 M household customers
    - 7 M small business customers
  - 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** | DNO | DNO (retailer until 2008 for meter reading only) |
| **Accounting separation** | From 2001 | From 2001 |
| **Metering tariff separated** | From 2004 | From 2009 |
| **Min. funct. requirem's for smart metering** | From 2006* (95% by 2011) | From 2008** (95% 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)

# REGULATORY DRIVERS IN 2006

- Full liberalization of the retail electricity market from 1 July 2007
  ⇒ role of SM for switching and competition
- Enel D. project on company's decision
  ⇒ risk of high differentiation among DSOs in the absence of any obligation to set up AMM systems
- Single national tariff for distribution and metering
  ⇒ prevent other DSOs from "free riding"
- First attempts for Time-of-use (ToU) tariffs
  ⇒ Comments received on a previous consultation suggested AEEG to set minimum requirements for SM system functions and performance
- European Union legislation on energy use
  ⇒ European Directive 2006/32/EC (article 13)

# THE REGULATOR'S OBJECTIVES

- To make the switching process easier and therefore 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 LV customers as well (already available for HV and MV)
- To improve the quality of the electricity services (metering, supply and distribution) for LV consumers
- To avoid discrimination ensuring the same functional and performance levels both for customers in the free market and those in the universal service system
- To look further some specific requirements, in particular consumer awareness (remote display) and demand response issues (home and building automation)

# 30+ MILLION SMART METERS INSTALLED AT LV: THE “DAILY USE” IN ITALY

- Monthly/bimonthly readings
  $\Rightarrow$ almost no estimated billings
- Interval metering
  $\Rightarrow$ higher cost-reflectivity
- Remote temporary reduction of the allowed power for bad payers, remote reconnection after payment
  $\Rightarrow$ minimum “vital” service + better service
- Easy switch (spot reading) $\Rightarrow$ higher competition
- Theft detection
  $\Rightarrow$ revenue protection, energy balance
- Recording voltage variations and (optionally) supply interruptions $\Rightarrow$ higher level of customer protection


*Autorità per l'energia elettrica e il gas*

# MANAGEMENT OF BAD PAYERS

- First step: remote reduction of the 85% of the available power (that’s only 15% maximum of the available power is consumable by the customer)

  $\Rightarrow$ typical domestic customer:

  3,3 kW to be remotely limited at 0,5 kW

- Second step: if the customers keeps on in non-paying, remote meter disconnection after 10 days from the reduction
- Third step: remote meter re-connection with 100% of the available power within 1 day after payment (quality standard, subject to compensation penalty if not fulfilled)

# WHY MINIMUM REQUIREMENTS

- In order to guarantee:
  - the pursuance of the Regulator's objectives
  - the same options to all customers (household/non household; free/in the protection scheme)
  - interoperability and standardization
- Regulatory minimum requirements should fulfil the following criteria:
  - to be system oriented
  - to avoid raising of barriers or limits to technological innovation
  - to be independent from telecommunications solutions and architectures

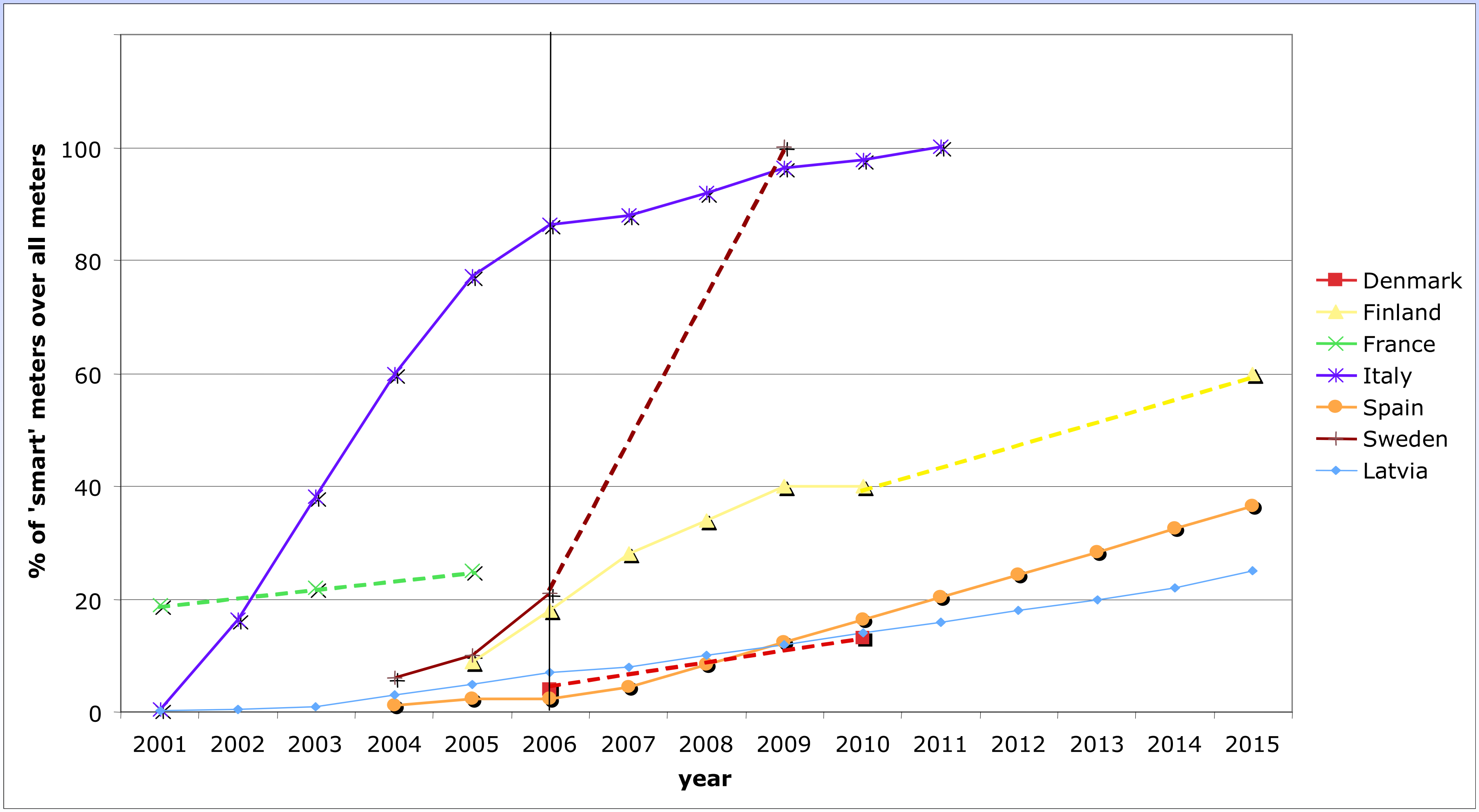
# MAIN MINIMUM FUNCTIONAL REQUIREMENTS-AMM

- 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, max allowed power level 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 for controlling max power limit
- Registration of the peak power per ToU band
- Meter display (current totalizer and activated ToU band registers, last freezing)
- Recording slow voltage variations (according to EN 50160)
- Upgrade of the program software: system performance requirements

Specified for:

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

# ELECTRICITY SMART METERING
## 2006 snapshot
## (ITALY: only Enel D. project at that moment)




*1st ERGEG Status review report on smart metering (2006)*
*available at* www.energy-regulators.eu

# SMART METER IMPLEMENTATION CURRENT SITUATION

| 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 | |

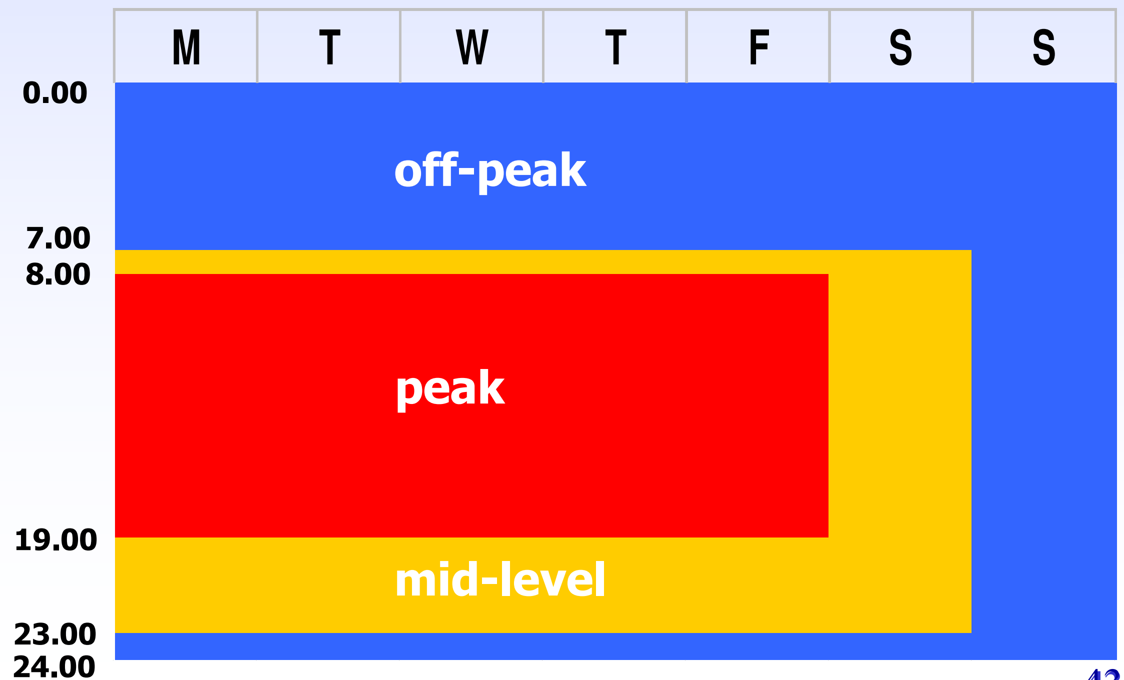
30+ million smart meters installed and working at mid-2009

*2nd ERGEG Status review report on smart metering (2009) available at* www.energy-regulators.eu

# DEMAND RESPONSE (ELECTRICITY): OPPORTUNITY FROM SMART METERING

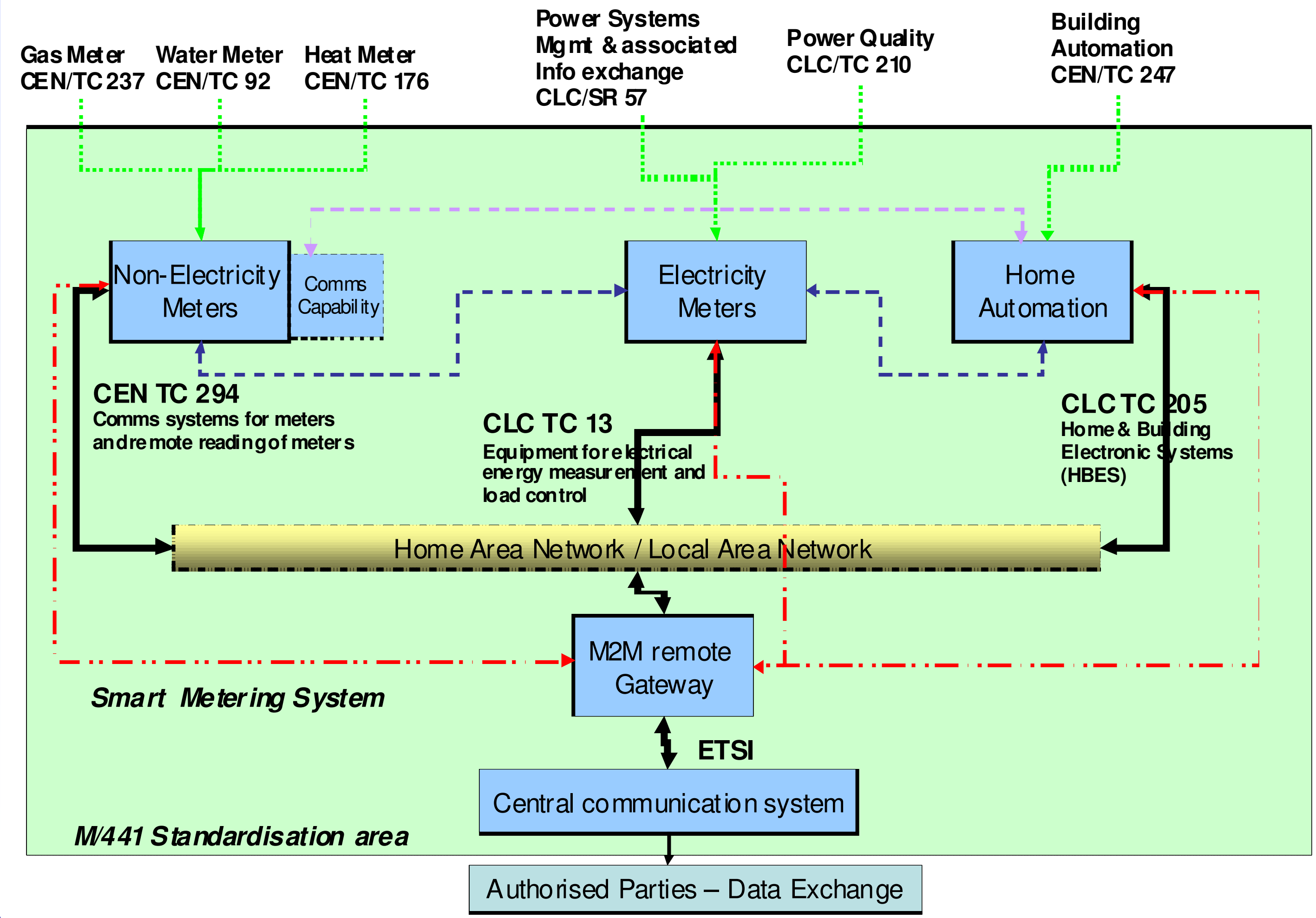
## Household customers:

- Individual information about separated consumption per band (6 months per each customer, through the bill)
- Mandatory ToU 2-bands tariff (peak / midlevel+offpeak) progressively enforced from mid-2010 to all household customers in the universal suppy market (ab. 24 million)
- Cost-reflectivity for each LV customer
- AEEG proposal: Move contractual power capacity from 3 to 4.5 kW only during off-peak hours (automatically on SM board)

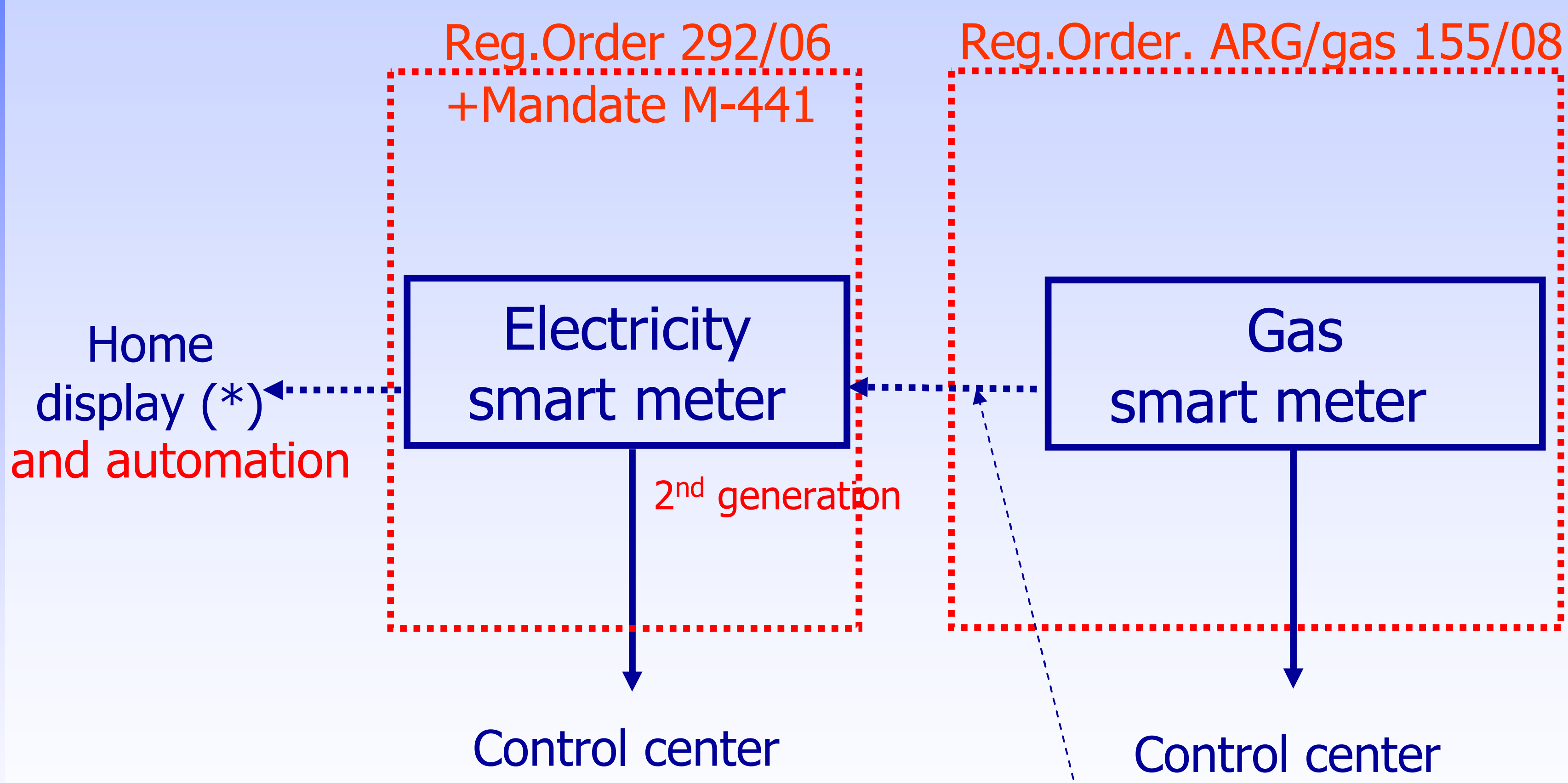


# EUR. COMMISSION MANDATE M/441 TO EUR. STANDARDISATION BODIES

## The interoperable architecture (concept)



# INTEGRATED DEMAND-RESPONSE
# Envisaged evolution of architecture/interoperability




(*) Function not required by the minimum requirements set by AEEG but already available via PLC

Additional physical or logical communication gate (regulatory framework to be developed, but already envisaged by Reg.Order n. ARG/gas 155/08)

# CONCLUSIONS

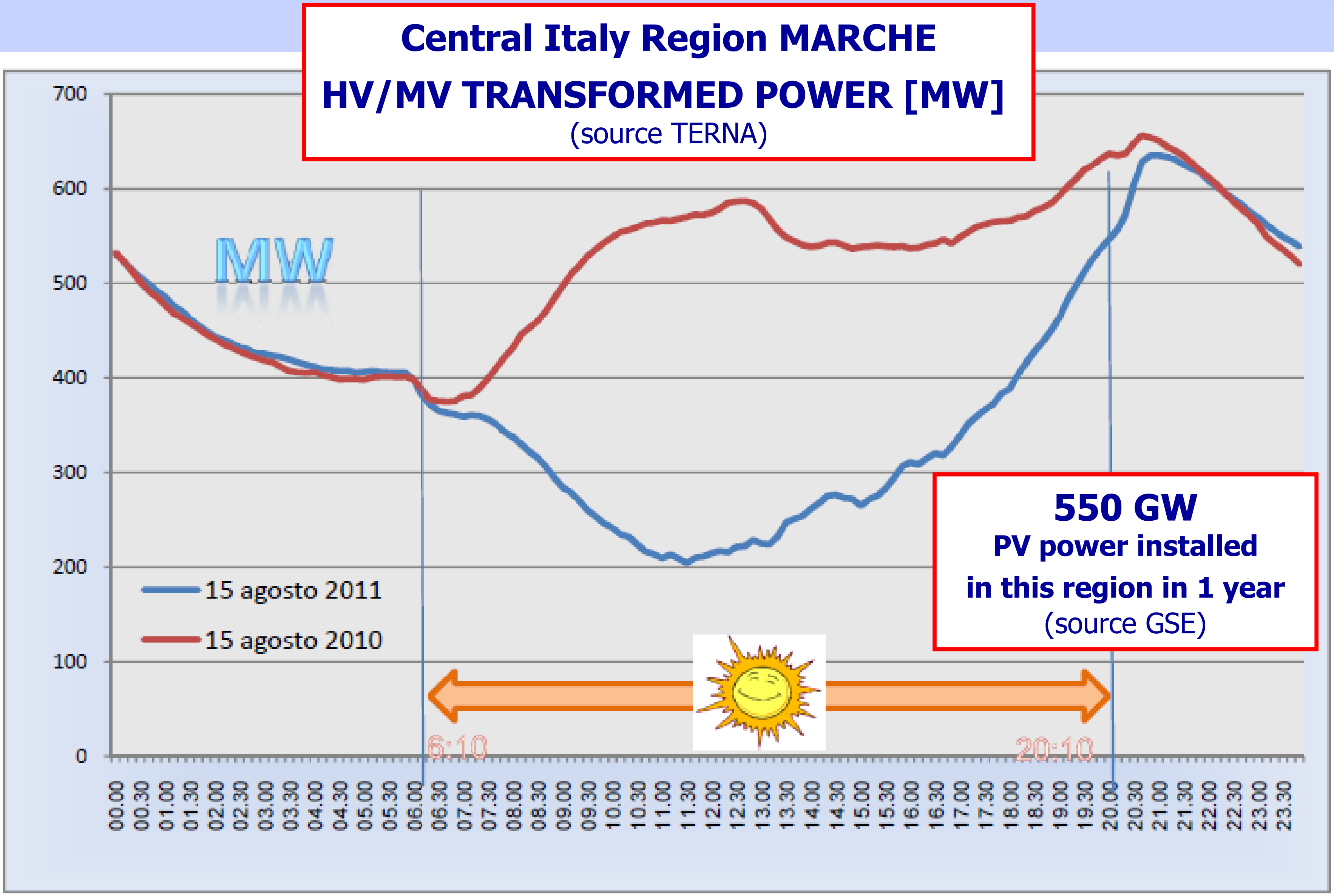
## *CHANGING REGULATION*
## *FOR REGULATING THE CHANGE*

***BUT …***

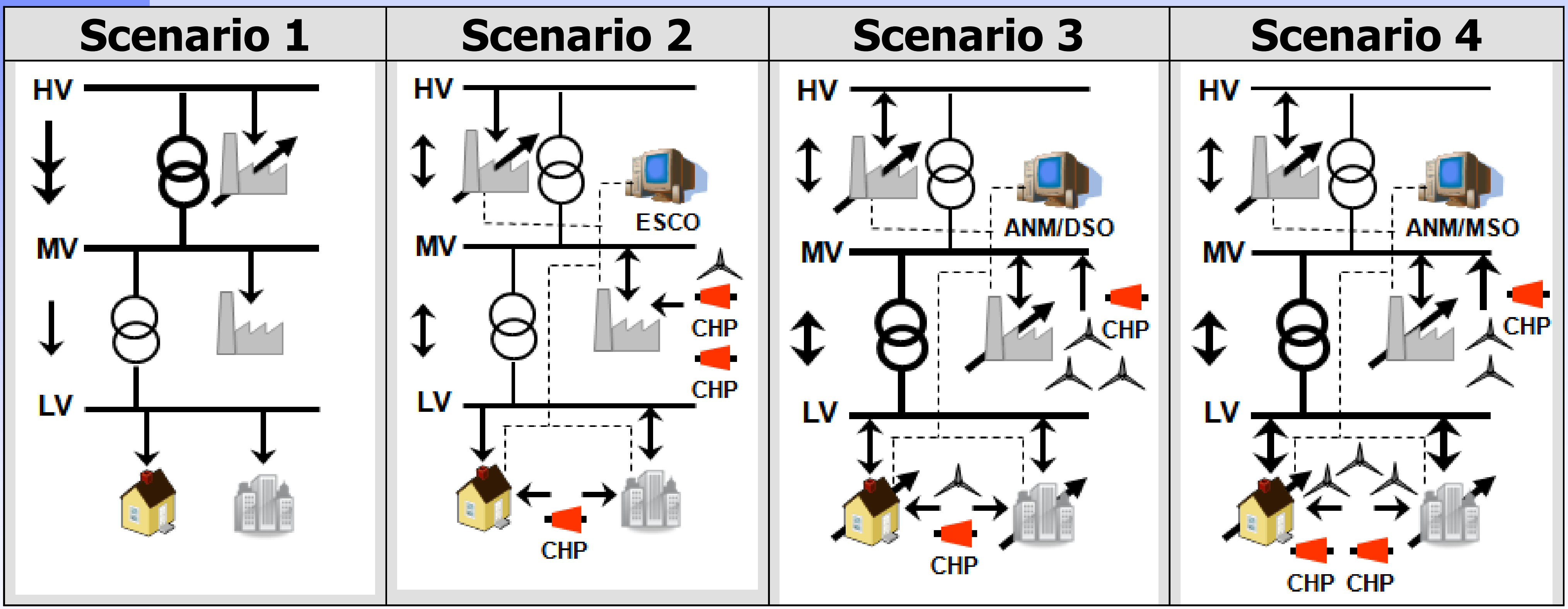
***…how fast is the change ?***

| GW installed | 2008 | 2009 | 2010 | 2011 (provisional data I sem.) | 2020 *(target)* |
|---|---|---|---|---|---|
| Photovoltaic (mainly in Southern Regions, almost all connected at MV-LV level) | 0.4 | 1.1 | 3.5 | >10 | *20* |
| Wind (mainly in Southern Regions, mostly connected at HV level) | 3.5 | 4.9 | 5.8 | >6 | *11* |
| Hydro pumping storage (mainly in Northern Region) | 7.6 | 7.6 | 7.6 | 7.6 | *?* |

# … AND HOW *UNPREDICTABLE* IS THE CHANGE ?



# *LENS* PROJECT – Ofgem
## Long term electricity network scenarios




www.ofgem.gov.uk/Networks/Trans/ElecTransPolicy/lens/Pages/lens.aspx

# THE ROLE OF REGULATION

"*The level of uncertainty about the future role and direction of networks is unprecedented, at least since privatisation.*

*… we think it is important to keep options open wherever possible, to encourage networks to innovate and to ensure the policy and the regulatory frameworks are sufficiently flexible to adapt to changes over time"*

*Ofgem,* LENS Report, 2008

**www.autorita.energia.it**

**www.energy-regulators.eu**

*Thank you for attention*

*Your comments are welcome*

lloschiavo@autorita.energia.it