The Smart Grids in Italy – an example of successful implementation

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IBM Italy

The Polish Parliament
Warsaw - October 27th, 2009
Role of Italian institutions

- Active promotion of competition and efficiency
- Tariffs setting
- Quality standards and service conditions

Joint stock company, established after the merger between GRTN (former ISO) and Terna (formerly Enel’s subsidiary and owner of transmission assets). Italian State has a stake; limit to voting rights for electricity operators holding Terna’s shares
- Owns and operates the transmission network, including Grid Planning and investment
- In charge of dispatching electricity

State owned, it is in charge of managing the spot and forward markets
- Also runs trading platforms for “environment” markets (green certificates, white certificates, CO2)

Acquirente Unico is a State owned company which is responsible for buying energy on the wholesale market for “universal service” customers (formerly for all captive customers), at the most favorable conditions
- Formerly GRTN, has maintained responsibility for GRTN activities not related to transmission management and dispatching
- Management of feed-in tariffs (so-called CIP6 and solar PV) for renewables
- Qualification of green electricity production and issuance of green certificates
Italian market structure

*Or sale companies, connected to distributors, providing the universal service and satisfying the unbundling requirements

**Companies providing the last resort supply service are included
Italian Electric Balance, 2008

- **Water**: 13% (46.7 TWh)
- **Coal Oil Gas**: 72% (250.1 TWh)
- **Geothermal fluid**: 1.5% (5.2 TWh)
- **Wind and sun**: 1.5% (5.1 TWh)
- **Import/Export**: 12% (40.1 TWh)
- **Industry**: 48% (151.4 TWh)
- **Domestic**: 22% (68.4 TWh)
- **Agriculture**: 2% (5.7 TWh)
- **Services**: 28% (89.1 TWh)

Total Consumption: 327* TWh

Grid Losses: 20.4 TWh
Italian generation, 2008

**Generation mix**

Italy's generation mix based on most expensive sources

- **Oil/others**: 3.0%
- **Gas**: 23.0%
- **Nuclear**: 28.0%
- **Coal**: 18.0%
- **Renewables**: 20.0%

**EU 27**

- **Gas**: 28.0%
- **Nuclear**: 14.0%
- **Coal**: 54.0%

**Italy**

- **Gas**: 28.0%
- **Nuclear**: 20.0%

Source: Italian Energy Authority 2008

*With Pumpings*
Italian Smart Grid experience well represents a global trend: the infusion of intelligence into the way the world works

Our world is becoming **INSTRUMENTED**

- Today, there are 1 billion transistors for each person on the planet.¹
- By 2010, 30 billion RFID tags will be embedded into our world and across entire ecosystems.¹

Our world is becoming **INTERCONNECTED**

- The internet of people is 1 billion strong. Almost one third of the world’s population will be on the web by 2011.¹
- There will be nearly 4 billion mobile phone subscribers worldwide by the end of 2008.¹

Virtually all things are becoming **INTELLIGENT**

- Every day, 15 petabytes of new information are being generated. This is 8x more than the information in all U.S. libraries.¹
- An average company with 1,000 employees spends $5.3 million a year to find information stored on its servers.¹

... Our planet is becoming smarter
What does it mean to become Smarter for an electricity grid?

Measuring, Monitoring, Modeling and Managing

- Data collection
- Data Integration
- Comparison of historical data, with newly collected data
- Data modeling and analytics to create insights from data to feed decision support and actions

Source: IBM Corporate Strategy
Smart Metering is at the center of the evolving Energy Value Chain and the starting point of Italian roadmap towards Smart Grids.
Smart metering in Italy means ENEL Telegestore

**Summary**

- **Telegestore** is fully operational on > **31 Mln Customers**
  Leading **Technology**
  **Excellence** in operation

- **Benefits** are targeting Enel and the Italian Electricity System

- Italian Authority AEEG has published the resolution 292/06: all **Italian** electricity customers will be equipped with **AMMS** (Automatic Meter Management System) by 2011
Technical Infrastructure
Equipment family

- Single phase
  Mod. GEM/GISM

- Poly-phase direct (without CT)
  Mod. GET1/GET3A/GIST

- Poly-phase indirect (with CT)
  Mod. GET4S/GISS

- LV Data Concentrator

- GSM/GPRS module
Benefits

FOR CUSTOMERS and other electrical system operators

- INVOICES ON REAL CONSUMPTION
- REMOTE CONTRACT MANAGEMENT
- TAILORED TARIFFS
- SAVINGS IN BILLING
- PRE PAYMENT
- EASIER FREE MARKET DEVELOPMENT AND MANAGEMENT

FOR THE ELECTRIC POWER SYSTEM

- PEAK SHAVING
- ENERGY EFFICIENCY AND CO2 REDUCTION
- REDUCTION OF COMMERCIAL AND TECHNICAL LOSSES

FOR ENEL

- LEADERSHIP IN INNOVATION
- CUSTOMER SATISFACTION
- EXCELLENCE IN COMMERCIAL AND TECHNICAL QUALITY
- OPERATING COST SAVINGS
Telegestore Solution at a glance

- 127 Enel Distribuzione Zones
- 500 Enel.si agencies
- > 3,500 third-party installers
- 31,800,000 Meters
- 358,000 LV concentrators
- 8,500 Palmtops
- 120 ICT Project technicians

One High Availability System
Investment and savings areas

TOTAL INVESTMENTS → 2,100 M€

- R&D COSTS
- PRODUCTION AND INSTALLATION OF ELECTRONIC METERS
- PRODUCTION AND INSTALLATION OF CONCENTRATORS
- IT SYSTEM DEVELOPMENT

Saving Areas
500 M€/Y

Revenue Protection

- Thefts and Failures
- Checks on Meters

Customer Service

- Customer Service
- Collection
- Bad Payers
- Invoicing

Purchasing and Logistics

- Purchasing
- Revision
- Warehouses
- Internal Transportation

Field Operations

- Installation and Recovery
- Interventions on Failures
- Replacement
- Activation Deactivation
- Failed Accesses
- Readings

Enel
L’ENERGIA CHE TI ASCOLTA
Deployment plan

1999→2001
- Kick-off (1999)
- Laboratory Prototype (2000-2001)
- Industrial pre-series (2000-2001)
- Strategic Agreements Stipulation with Echelon
- Trial start with AMPY Meters
- Start Installation plan of single phase digital meters and Low Voltage concentrator

2002
- Start Installation Plan of Multiphase Digital Meters
- LV concentrators Commissioning
- Massive installation (700,000/month)

2003
- Remote Management of Commercial Work Order
- Remote Management of Technical Work Order
- PDA application for commercial and technical Work Order
- Remote Meter Reading

2004
- Periodic (bi-monthly) Meter Reading and advanced Billing Tariff schemas
- Remote Management of fraudulent Customers

2005
- Evolution to Meter Data Management System, monthly Remote Reading Consumption Profiles
- Start deployment of New Generation Meters and LVC with KAIFA PLC chipset.

2006...
- Advanced Management of Distribution Network
- Demand and Energy Procurement
- Multi metering
- Bidirectional Meter for Micro Generation Management
- Integration with WFM System for Real-time Work Orders Assignment and Optimization
- Meter & LVC Problem Manager Sub-System
- Mass installation completed

...2008
- Commercial and Technical Agreements with Meters Manufacturers (Actaris, Iskraemeco, ABB Elster and Siemens Landis), to support AMR System development
- Trial start with Actaris Meters
- First release of Measures Management Module: acquisition, validation, storage, ...
- Completed Measures Management
- Remote Management of Commercial and Technical Work Order
- Measures Pre-billing Sub-System implementation

30 Millions meters replaced and put in operation in 5 years without any related benchmark project worldwide...
Lessons learnt
Installation in Italy*

- Meter remotely managed: 31,810,000
- Concentrators installed in MV/LV substations: 360,000

* up to May 2009
## Lessons learnt

Remote management readings and operations

<table>
<thead>
<tr>
<th></th>
<th>Final '08</th>
<th>Forecast '09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly-bimonthly</td>
<td>205,000,000</td>
<td>215,000,000</td>
</tr>
<tr>
<td>Spot readings</td>
<td>5,000,000</td>
<td>5,500,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>210,000,000</strong></td>
<td><strong>220,500,000</strong></td>
</tr>
</tbody>
</table>

**READINGS**

- 700,000 per day

<table>
<thead>
<tr>
<th></th>
<th>Final '08</th>
<th>Forecast '09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activations</td>
<td>845,000</td>
<td>929,000</td>
</tr>
<tr>
<td>Contract management</td>
<td>8,075,000</td>
<td>14,000,000</td>
</tr>
<tr>
<td>Contract termination</td>
<td>759,000</td>
<td>700,000</td>
</tr>
<tr>
<td>Bad payers management</td>
<td>3,027,000</td>
<td>3,030,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12,706,000</strong></td>
<td><strong>18,659,000</strong></td>
</tr>
</tbody>
</table>

**OPERATIONS**

- > 300,000 per day
Lessons learnt
Tailored tariffs, some examples

- **sera**
  - 19.00 - 01.00
  - 3 kW power supply main flat
    - Lun: 19:00 - 1:00
    - 16% reduction

- **week end+**
  - 0:00 - 24:00
  - 3 kW power supply main flat
    - Lun: 24:00 - 7:00
    - 22% reduction

- **Otto sette & WEEKEND**
  - 0:00 - 24:00
  - 3 kW power supply main flat
    - Lun: 20:00 - 24:00
    - 6% reduction
Lessons learnt

Energy balance

- Value grid-losses
- Localize energy fraud & theft
- Plan energy distribution grid

All relevant transformers are equipped with Energy Balance meters
Lessons learnt
Energy Balance and Revenues Enhancement

With the energy balance data from the AMM system the success rate of the meters verification activity has increased from 5% to 60%.

<table>
<thead>
<tr>
<th>Year</th>
<th>N° of meter’s verifications</th>
<th>Success Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>140,000</td>
<td>50%</td>
</tr>
<tr>
<td>2008</td>
<td>100,000</td>
<td>60%</td>
</tr>
<tr>
<td>Before AMM</td>
<td>140,000</td>
<td>5%</td>
</tr>
</tbody>
</table>
Technology
Enel technology is the only “proven” in the field with “industrial” volumes

Know how
- Unique experience in deploying AMM system, process redesign and change management
- Successful implementation and Customer satisfaction
- Enel AMM technology has been already deployed over 10 Utilities with different dimension (from 30K to 1M Customers)
- Field trial unique in the world with unmatched testing capabilities to test new development and monitor the product quality

Partnership
- Enel is an electricity utility, not only a system vendor
- Enel AMM technology will be available in the market for all the system lifetime
From Telegestore to Smart Grids: investing in automation and innovation

...in the last 7 years...

Automatic Meter Management
- 31 millions of smart meters installed in 2001-2006
- 210 millions of remote readings in 2008
- 12 millions of remote managed activities in 2008

Network automation
- HV and MV network remotely operated
- More than 100,000 MV substations remote controlled
- Automatic fault clearing procedures

Work Force Management
- Logistic support to Enel crews
- ENEL cartographic available on board
- All processes through mobile applications
- Connection from Field to the Centre to all Enel crews

More than 2500 Ml of euros invested in Enel
Overcoming technical barriers: investing in Research and Development

Support the national / international projects focused on Smart Grid, providing skills and competences from DNO experience on managing electrical distribution networks

Strong cooperation with Universities and Research Centers

Internal research using advanced network modeling, real time simulation techniques, field tests on the real grid, where DG is already present

Special actions to manage, monitor and analyze connection of distributed generation
From Smart Grids to SmartCity: building a demonstration program

EV/PHEV recharging infrastructure

Agreement with Dailmer for an extensive and innovative pilot involving 400 charging points.

- **Customer identification** for a secure and safe recharge
- Enabling **different tariff structures** for recharging the vehicles
- Enabling **power management** to optimize the impact on the grid
- Recharging station placed in **Private and Public environment**

**European research Project**

*Impact analysis on electricity grid for mass introduction of EV (Grid for Vehicle – G4V)*

Enel, RWE, EDF, Endesa, EDP.

Enel Distribuzione Work Package Leader for technical impact assessment.
In 2006 AEEG defined the roadmap for electronic meter installation requiring 95% of meters (<=55 kW) installation within the end of 2011

**Authority Objectives**

- Gradually expand the multi-hourly tariffs to all the domestic customers, to boost the consumption when the energy is cheaper
- Allow the Customers to acquire information about their consumptions profile, in order to make them aware about the risk/opportunity to adopt multi hourly tariffs
- Foresee safeguard mechanism to defend the domestic customers from risk of penalization in case of low capability to move the consumption load in different time periods
- Define mechanisms for correct allocation of the minor cost of the electric energy supplying due to the shift of the consumption to the periods when the purchase and dispatching costs are cheaper

**Distributor Duties**

- The consumption must be shown in the invoice divided by time band; day time, night time and sunday
- Information must allow the customer to verify the goals of the selected tariff profile, if not reached, and verified the gained discount amount, if reached
IBM has spread across Italian distributors the Enel technology and approach.

<table>
<thead>
<tr>
<th>Utility</th>
<th>N. Meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEM Milano</td>
<td>950.000</td>
</tr>
<tr>
<td>AEM Torino</td>
<td>580.250</td>
</tr>
<tr>
<td>Trentino-BZ</td>
<td>575.000</td>
</tr>
<tr>
<td>ASM Brescia</td>
<td>294.250</td>
</tr>
<tr>
<td>Hera Modena</td>
<td>250.000</td>
</tr>
<tr>
<td>AGSM Verona</td>
<td>173.177</td>
</tr>
<tr>
<td>Acegas Trieste</td>
<td>140.510</td>
</tr>
<tr>
<td>Enia Parma</td>
<td>124.830</td>
</tr>
<tr>
<td>Deval</td>
<td>120.000</td>
</tr>
<tr>
<td>AIM Vicenza</td>
<td>75.020</td>
</tr>
<tr>
<td>AEM Cremona</td>
<td>47.015</td>
</tr>
<tr>
<td>Other</td>
<td>218.053</td>
</tr>
<tr>
<td><strong>TOTALE</strong></td>
<td><strong>3.548.105</strong></td>
</tr>
</tbody>
</table>

~ 3.500.000 Digital Meters

**Standard de facto in Italy**

Contracts signed by Enel
But ENEL AMM experience is recognized also around the world.

- 645,000 meters (e-on España)
- 188,000 meters (Oxxio Slim met energie)
- 1,500 meters (Pilot 1.500 meters)
- 2,100 meters (Pilot 2.100 meters)
- 1,200 meters (Pilot 1.200 meters)
- 100 meters (Pilot 100 meters)
- 250,000 meters (MoU Arabia Saudita)
- 645,000 meters
Thank you

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- Energy & Utilities Industry
- IBM Italy

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