

## CERVANTES PROJECT AND “METERS AND MORE”: THE STATE OF THE ART OF SMART METERING IMPLEMENTATION IN EUROPE

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### ABSTRACT

Endesa and Enel leveraged the synergies of the corporate group formed by applying Enel's knowledge and experience in the field which, in addition to the broad technology experience of Endesa, guarantees success in the joint development and implementation of a new-generation smart metering system. Endesa has already started the installation of such **new AMM solution that will be fully deployed on its 13 million customers in Spain within end 2015.**

The new smart metering solution capitalizes on Enel Telegestore technology, the first and unique AMM system worldwide fully in operation on more than 32 million customers and considered the benchmark in terms of reliability, functionalities, performances and cost. For the optimizations introduced by Enel and Endesa into the smart metering solution, the project received the prestigious European Utility Awards 2009 in the category of Business Performance.

Another relevant innovation of the new solution is that the Enel PLC communications protocol applied in the system – **Meters and More PLC protocol** - has been opened thus converting it into a standard which can be applied by other utilities. For this purpose, a no-profit association (AISBL) named *Meters and More* has been created in March 2010. Enel and Endesa are thereby promoting the creation of a reliable and cost-efficient standard, which will be applied within 2015 in millions of meters in Italy and Spain.

### INTRODUCTION

ENEL is the first utility in the world that has developed and operates an automated system to remotely manage more than 32 million electricity meters. The ENEL Automated Meter Management (AMM) Solution, named Telegestore, was fully deployed from 2001 to 2006 and is strongly supporting Enel achieving an operational excellence in terms of operational cost and quality of service (*Figure 1*).

Thanks to this solution, metering data can be remotely collected and sent to energy retailers; moreover, the Telegestore is able to remotely perform most of the typical contractual operations, such as: activation of new furniture, deactivation, modification in contractual power, etc. In 2010 the Telegestore performed more than 300 million remote reading and around 20 million operations.

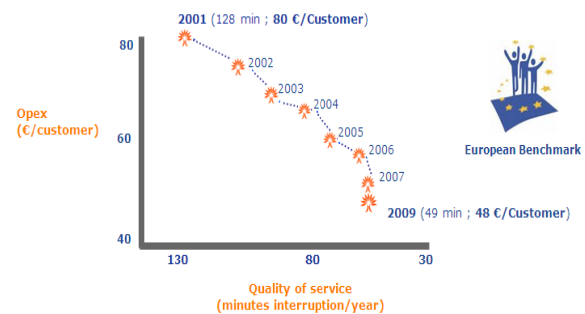


Figure 1 – Enel operational excellence

Based on Telegestore success, Italian Authority for energy and gas (AEEG) published a national decree obliging Italian DSOs to install smart meters to their own customers within 2011.

Spanish Energy Authority (CEM) issued a Royal Decree in line with the European target of 3<sup>rd</sup> Energy Package. Such decree establishes that Spanish DSOs have to replace the electromechanical meters with new smart meters within 2018. With this aim Endesa, the largest Utility in Spain, started to develop a smart metering solution in 2006. Once Endesa entered into Enel Group a joint working team evaluated the possibility to apply the Enel Telegestore solution on Endesa's LV network and defined the changes to make the Telegestore solution compliant with Spanish regulation requirements as well as the Endesa's business ones. The Cervantes project - so called internally by Enel and Endesa - thanks to the mentioned synergies among Enel group companies will allow Endesa to complete the deployment 3 years before the deadline defined by Spanish Authority.

At the same time, Enel and Endesa are jointly participating to all the initiatives (*Figure 2*) towards smart metering standardization in Europe, making their experience and technology available to become one of the European standards in this field.



Figure 2 – European Working Group for smart metering standardization

## THE CERVANTES PROJECT

After the benefits and the relevant results achieved by the Enel Telegestore in Italy, a new generation of the Enel Automated Meter Management (AMM) solution has been developed. It has grown out of the capitalization of the synergies among the Enel Group, in particular with the Enel's affiliated company in Spain, Endesa.

The new solution is based on the field proven robustness and reliability of the Italian solution and includes some innovative features in terms of both components and functionalities. The Cervantes solution has been designed to target a high level of technology innovation in accordance with functional, economic and time-schedule requirements of the project.

The positive results achieved by Enel in Italy using Power Line Carrier have supported the choice to confirm such technology in the Cervantes solution (Figure 3), including in the new field components (meters and data concentrators) the **last generation of PLC modem**. It means in particular: (i) a data transmission real bandwidth up to 4.8 kbps (a double value respect to Telegestore one), (ii) introduction of new effective functionalities (i.e. network impedance and signal/noise rate measurements) that increase communication between meter and concentrator; (iii) different modulation mechanisms to improve meter reachability rate. This reachability rate and the effectiveness of communication are fundamental for meter management more than the bandwidth: the innovation included in the Cervantes solution has been chosen in accordance this target.

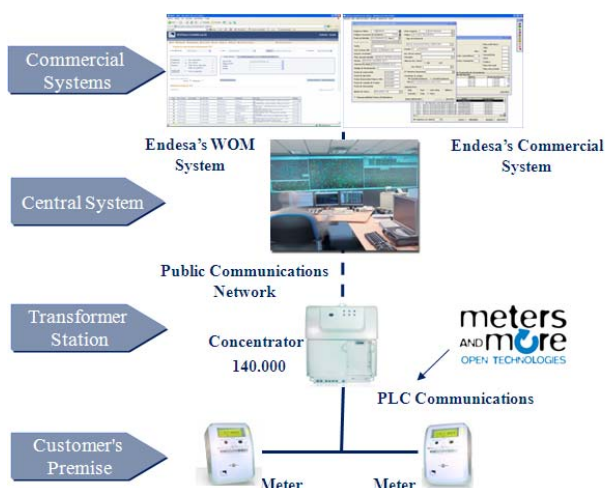


Figure 3 – Cervantes solution architecture

In addition to the abovementioned PLC communication innovations, other important improvement have been inserted in the field components as well as in the central SW system:

- new CPU that allows to optimize the development and management of new meter software.
- meter design: the new meter thanks to the mentioned

improvements has small dimension and does not need socket to be installed, in accordance with DIN standard (Figure 4).

- **Automatic rearm by remote:** Enel and Endesa jointly developed an innovative functionality that allow the customer to rearm the meter directly by its own premises after a power cut-off. The Cervantes meter has an internal cut-off element that works like a power/energy control switch, which means, it opens when a customer requires a higher power than the contracted one, in the same way as a traditional power control switch. The innovation is that the rearm can be carried out by switching any of the protection devices that are already in the customer home (main switch, power control switch or differential breaker), thereby avoiding the installation of an additional device for the reinstatement of supply within the customer's house. Therefore, this new feature supposes important savings in costs, deployment time and less trouble for the customer.
- **Meter autodiscovery and automatic system configuration:** meters are detected in an automatic way by the concentrator, without any need of prior configuration of what meters it has to look for. This feature allows a **plug-and-play installation** and operation, thus avoiding the need of having a detailed and continuously updated geographical information system for the low voltage grid. Automatic adaptation of the system configuration to topological changes in the grid. The system detects which meters have changed connection with concentrator due to topological changes in the low voltage grid (typically due to operations for grid maintenance and development). Manually informing and updating these changes is not necessary because the system adapts in an automatic way. This feature It allows to save time by simplifying the processes of grid work
- Innovative data concentrator: the update of data concentrators allowed to **include new functionalities towards a Smart Grids deployment**, in particular enabling acquisition and management of data, alarms and info from different devices installed on the DSO network. It's possible also thanks to the inclusion of standard interface into concentrator design (i.e. USB).
- AMM SW modules fully integrated with Endesa Legacy and in operation from day-one: it's allowing Endesa to exploit smart metering benefits from the beginning. Other innovative features have been included by Enel in such SW modules such as (i) high and distributed scalability to manage different quantities of field components and from different management point; (ii) easy integration and configuration with existing DSO Legacy systems; (iii) completed automation thanks to meter autodiscovery and to the improved automation of all operational procedure; (iv) system independence from TLC communication technology (GSM, GPRS, PSTN, etc).



Figure 4 – Cervantes meter

Leveraging on the inclusion of the last innovative technologies in the meter's components, the new Cervantes solution will be able to increase more over the performances reached in the Italian smart metering system.

Moreover the field components developed within Cervantes project are fully compliant with MID and Spanish normative requirements, having been certified by an authorized certification body (Figure 5).



Figure 5 – Single-phase meter label

Endesa has started the roll-out of the new Enel AMM solution installing in 2010 the first 150.000 meters of its 13 million customers (Figure 6). The replacement process will cover the next five years and will fully comply with the Spanish regulation in terms of time schedule and system functionalities. The Cervantes project is currently the main European smart metering project in phase of deployment.



Figure 6 – First meter installations by Endesa

**Such further installation of an Enel AMM solution means that within 2015 more than 50 million customers in Europe will be equipped with Enel smart meters.**

## METERS AND MORE TECHNOLOGY

Another relevant innovation of the new solution is that the Enel PLC communications protocol applied in the system – Meters and More PLC protocol - has been

opened thus converting it into a standard which can be applied by other utilities. The aim is to make available to all the stakeholders an innovative protocol, based on the Italian one that is still the unique field proven PLC protocol available worldwide. It will proactively contribute to create a complete catalogue of certified devices, applications and services from different providers to be applied in European energy market.

For this purpose, Enel and Endesa have set up a no-profit association based in Brussels (Figure 7), created to promote the open Meters and More specification. The association will efficiently manage the entire process of communication protocol evolution: from innovative ideas to valuable certified products.

From March 2010, Meters and More can now count on the support of major companies like IBM, Siemens, ST Microelectronics, Sagemcom, CESI, operating in the industry with different roles, including electricity distributors, solution and service providers, technology providers and meters vendors, which together will enrich the association with expertise in the smart metering, smart grids and meter data management.



Figure 7 – Meters and More Association

The association has already made the **Meters and More specification available to the European and international standardization process for smart metering**, via the OPEN meter project and the technical committees of various standardization organizations. Thanks to the establishment of Meters and More Association, Enel and Endesa is making their field-proven technology available to projects, such as the mentioned OPEN Meter, that are currently implementing the European Commission mandate to standardize remote meter management solutions across the continent.

Meters and More application protocol has already been successfully operated on several modulation schemes, including FSK and BPSK. The effectiveness, robustness and security (includes data encryption and authentication) of its communication features are inherited directly by Enel Telegestore protocol, applied on more than 32 million customers in Italy, and also improved as described in the previous paragraph.

Technical working groups are being created in order to discuss and manage the evolution of the protocol in terms of performances, functionalities, new application. All the evolution and/or new application of Meters and More protocol shall be verified and certified by a certification body appointed by the Association with the aim to create a complete set of certify product to be installed in Europe as well as in other countries worldwide.

The possible new applications of Meters and More protocol are not restricted to metering sector but could refer to other business such as Smart Grids functionalities and value added services to customers (*Figure 8*). In fact, Meters and More protocol has been designed from the beginning to support and enable services that bring benefits not only to DSOs but also to other interested companies and to all energy sector.

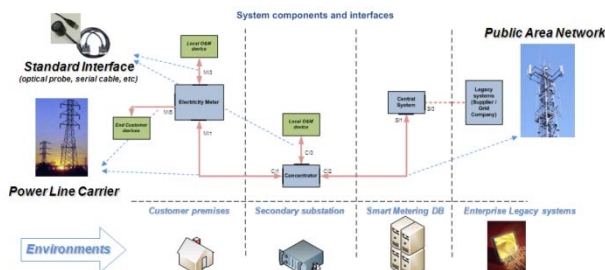


Figure 8 – Supported components and interfaces

## CONCLUSIONS

Enel Group became a worldwide reference with the deployment of Telegestore system in Italy and now is reinforcing its benchmark solution thanks to the Cervantes project carried out jointly with Endesa in Spain. It confirms not only the experience and know how reached by Enel in smart metering and smart grids during the last 10 years but also the positive results achieved working in synergy with its affiliated company facing different challenges in a different country.

The smart metering standardization process currently in progress in Europe is obviously considering the Enel technology through Meters and More protocol as it's still the unique smart metering solution in operation on the entire customers in Italy and in few years in Spain.

## REFERENCES

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