

WEB ACCESS TO METERING DATA FOR ADVANCED NETWORK ANALYSIS AND FRAUD DETECTION

Lilia CONSIGLIO
ENEL Distribuzioone – Italy
lilia.consiglio@enel.com

Massimo BRICCOLA
ENEL Distribuzioone – Italy
massimo.briccola@enel.com

Paola Lucia PETRONI
ENEL Distribuzioone – Italy
paola.petroni@enel.com

ABSTRACT

ENEL Distribuzione implemented STAmi, an Advanced Metering Interface, fully integrated with MV network Remote Control Systems, to provide innovative applications for LV network monitoring, using smart meters data.

STAmi fully exploits the potentiality of smart meter data for new purposes: it provides network operators with a dedicated web interface, to collect on demand specific data stored in smart meters, without additional load for the AMM system.

INTRODUCTION

With 32 million smart meters in operation and about 300 million remote activities yearly performed, Enel Distribuzione's Automatic Meter Management (AMM) system has already been in operation for some years, optimizing business processes and improving customer relationships.

Logistic support to all Enel crews is performed by the Work Force Management system: all processes are supported through mobile applications, the ENEL cartographic (both MV and LV levels) is available on board, all the crews in the field are connected to the Centre for the optimal management of resources and works assignment.

More than 100 thousands MV/LV substations are remote controlled and automatically perform faulty sections isolation and restoration on MV network.

This broad deployment of smart grid technologies and equipment opens a new scenario for the development of dedicated applications towards LV network management. The LV network, in fact, has been largely unmonitored until now: to address this challenge, STAmi allows the direct access to specific data, stored in the smart meters, for LV network management and monitoring purposes.

ARCHITECTURE

“STweb” is a suite of functionalities and tools, based on web interfaces, integrated in the ENEL Distribuzione remote control system.

STAmi (AMI: Advanced Metering Interface) is just one of the several tools available for the operators, both for network operation or back office purposes.

STAmi architecture is composed by a dedicated infrastructure, able to collect, remotely and on demand, specific high quality and accurate data stored in smart meters, without additional load for the AMM Central System.

STAmi provides to Enel MV network operators in the control room and in the back office, as well as field work operators (thanks to wireless connection via tablet PC) a dedicated suite of functionalities and tools based on web interfaces.

From this interface the operators can request data to smart meters by a dedicated infrastructure (STAmi Gateway).

The gateway is integrated with AMM by Web Services, just in order to collect information about the connection to the in field devices; it is able to connect directly and in real time, via GSM, GPRS, or PSTN, to the concentrator installed in the MV/LV substation, in a completely independent way from the AMM, thanks to the STAmi architecture illustrated below.

Using PLC, the concentrator is able to collect the requested data from each smart meters located throughout the network and send them to STAmi.

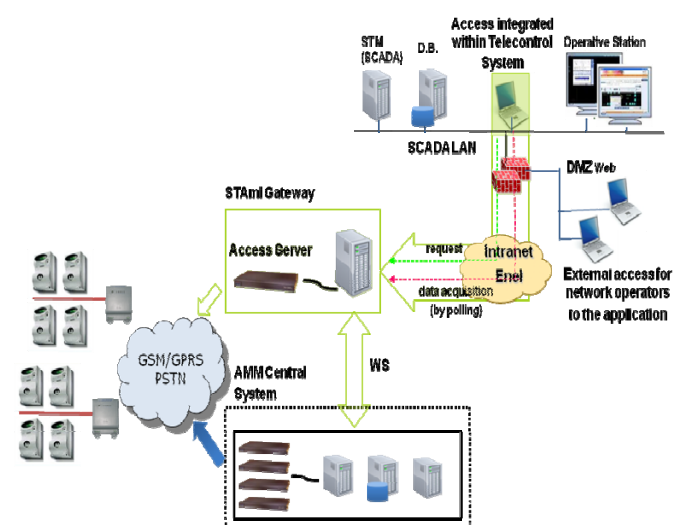


Figure 1: STAmi Architecture

FUNCTIONALITIES

STami is an innovative application for LV network monitoring, just a first step towards LV network management.

It opens new possibilities to prevent and solve problems in the LV distribution network and to obtain further savings in the operational costs, supporting new business objectives and providing several benefits to different stakeholder.

Network analysis

STami operators are able to query smart meters, energy balance meters and concentrators, collecting:

- Voltage quality data (minimum voltage level, maximum voltage level, etc.) in the current week and in the previous one
- Supply interruptions data (time interval, affected phase, onset time, etc.) in the current billing period and in the previous one
- Percentage of contractual power threshold available to customers.

The use of STami improves the customer satisfaction thanks to a quicker feedback in case of LV local network anomalies: the possibility to check voltage presence and voltage quality at the supply terminal is useful to avoid “in the field” verification by a crew when a customer complains about a specific problem, minimizing work force interventions and thus reducing CO2 emissions.

The acquisition of power threshold available to customers provides network operators with significant information to manage bad payers.

Voltage quality and supply interruption data are also useful in LV outage detection: a simple feedback from the smart meter allow the network operator to precisely drive the crew in the field in a faster and more efficient way.

The automatic collection of energy consumption (both active and reactive) at MV/LV transformer level is a strong basis for DMS calculation: balance meters or selected meters load profiles can improve the accuracy in the calculation, reducing the estimation errors.

Some MV/LV transformer can be used as a slack point for network voltage regulation thanks to the availability of measures deep in the network.

Fraud detection

Important results have been obtained during this first year in operation in the frauds detection field, thanks to the friendly access to:

- Daily data energy consumption and energy production (active and reactive energy) in the

current day and in the previous one

- Load curves (in 15 minute samples) of the last 38 days
- Active/reactive, positive and negative energy registers data (related to past and present billing periods) in the current billing period and in the previous one.

ENEL Distribuzione launched last year a wide campaign to recover “non technical” losses all over the southern region of Italy.

A preliminary analysis has been done, in order to select specific areas with great differences with respect to typical technical losses value.

Several critical areas have been identified and special task forces have been working during last six months, focusing on domestic and small industrial customers frauds detection.

Most of the analysis were easily done in back office, preparing the “in field” activities, thanks to the availability of precise LV network information and diagrams.

Special tools allow the comparison of aggregated sets of customers and balancing meters data, using friendly graphical interfaces and numeric tables.

Thanks to this flexibility in data management, STami operators are able to perform detailed analysis on the LV network, providing support to the work force in the identification of frauds or of unauthorized uses of electricity in the selected critical areas.

Starting from the MV/LV substation “aggregated” data, such as energy consumption at bus bar level, the first step is to discover critical deviation from medium consumption, evaluated utilizing typical consumption data.

The analysis continues, drilling down the energy consumption data and finding out the critical LV feeder and, hopefully, the “suspected” meters.

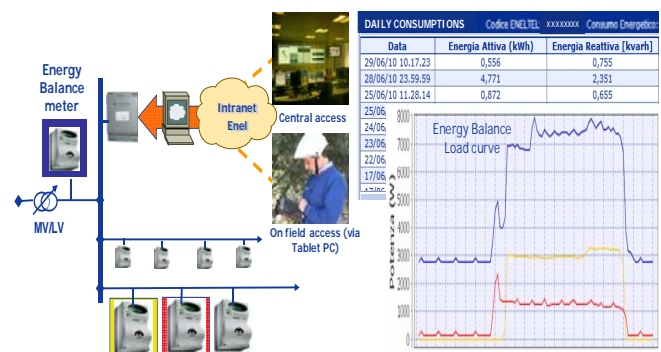


Figure 2: Energy consumptions comparison

The load curves are finally acquired and analyzed only for these suspected meters, avoiding to collect huge amounts of data.

A simple interface allows the operator to manage different load curves and build up aggregated profiles. These aggregated curves can be easily compared with load curves measured at bus bar or feeder level by balance meters or by special portable meters, temporarily installed along the LV network for inspection purposes.

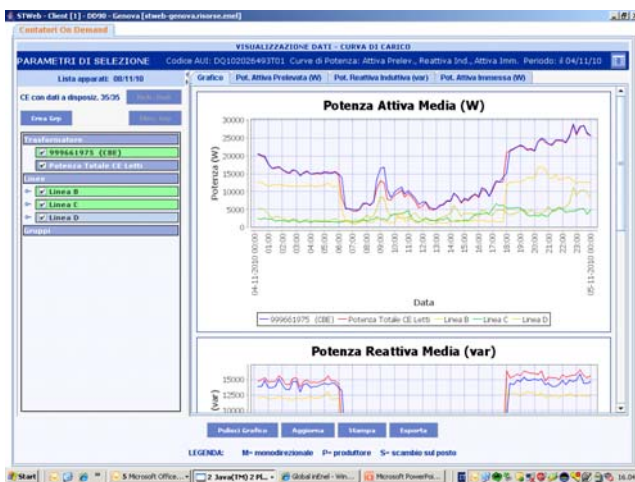


Figure 3: Load curve comparison

CONCLUSION

Last year the capability of the system have been deeply tested in real operation in three regions of Italy, by different kind of users and for different business purposes, obtaining good results.

In the next year STami will be deployed all over the Country on a new HW architecture and with new functionalities, aiming at satisfying the increasing request of performances coming from the operators.

REFERENCES

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