

**ELECTRO****MAGNETICA**



**ENERGSys**

**Intelligent Meter Reading and  
Management System for  
Electricity Networks**



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# Introduction

## What is smart grid?

A smart grid is an upgraded electricity network in which the two-way digital communication between supplier and consumer allows intelligent metering and monitoring of the systems that are parts of it.

## What is smart metering?

Smart metering is an inherent part of a smart grid. It consists of an electricity meter that records consumption of electric energy and communicates that information to the grid operator and energy supplier for monitoring and billing purposes. Moreover, the grid operators can better plan the use of infrastructure and system balance, for instance in terms of integration of renewable.

## Smart grids are expected to:

- Enable secure functioning of the internal network;
- Create conditions for efficient use of electricity;
- Give the consumer the ability to adapt his consumption to benefit from the lowest prices offered during the day;
- Enhance energy efficiency. Consumers can follow their actual electricity consumption. This provides them strong incentives for energy saving;
- Optimise electricity grid management;

# Company overview

## Main Activities:

- Production of Electricity Metering and Electricity Distribution Equipment;
- Production of LED Lighting Equipment;
- Production of low voltage switchgear;
- Smart - Metering Systems - Smart Metering for electrical energy, for all types of subscribers;
- Production of plastic injected parts, tools and molds, auto parts, metal and rail traffic safety systems;
- Electricity production from renewable hydropower;
- Electricity provision;
- Rental and utility services supply.



# ELECTROMAGNETICA S.A. Certifications



# ENERGSys - Overview & History

The Intelligent Meter Reading and Management System ENERGSys has been developed since 2004 by Electromagnetica SA and has an entirely Romanian design and manufacturing system. ENERGSys System is an open system that allows interfacing both single-phase meters produced by Electromagnetica and can accommodate many other types of single-phase or three-phase meters from other manufacturers. Starting with 2010 static single phase meters for active energy manufactured by Electromagnetica SA used in Smart Metering System and System ENERGSys System received recertification according to EC/2004/22 MID Directive by KEMA.

ENERGSys is a registered trade mark of Electromagnetica S.A.

ENERGSys system is based on the requirements of the Romanian Commercial Code on Wholesale Electricity Market, and Electricity Measuring Code, concerning meter data management and storage in the database and access of all involved parties to these data.

The system complies with the European and national regulations and includes all the functions specific to Smart Metering systems, according to the Third Regulation Package of the European Commission. the requirements of 2009/72/CE Directive and of M/441 CE Mandate, functions to be used for interfacing the system with different billing applications specific to customers or MDMS applications (Meter Data Management System), similar with other metering systems developed worldwide, in countries like USA, Italy, France. These functions are transposed in national regulations by Romanian Regulatory for Energy (ANRE) as Order no. 91/2013 (modified in Order no.145/2014), which contains all mandatory and optional functions of the smart metering systems.

Today ENERGSys System operates in Electrica SA (one of the major players in the distribution sector, supply of electricity and energy services in Romania) territorial units and also in other private electricity DSO networks, including more than 50,000 residential and industrial consumers.

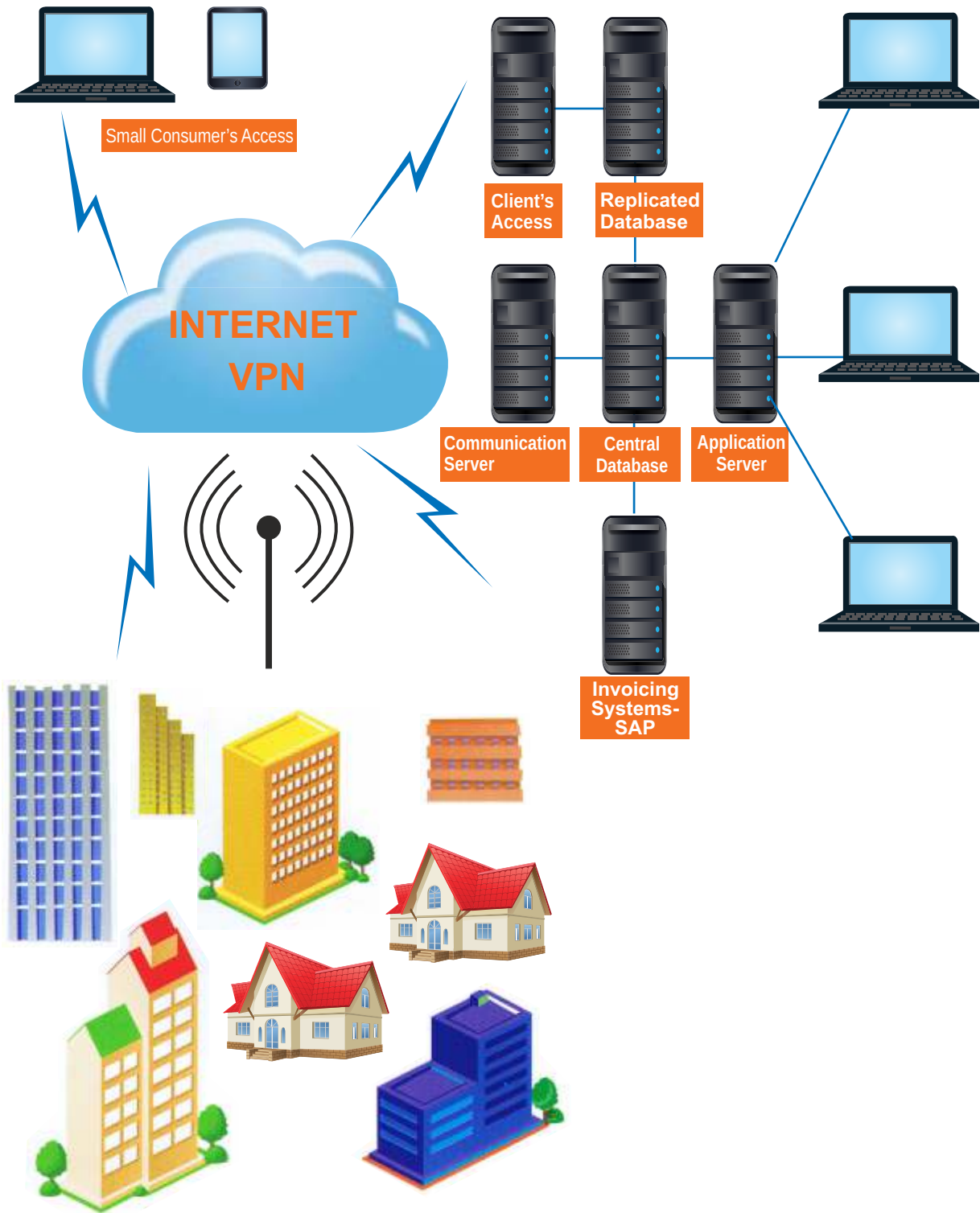
ENERGSys system includes the main components of the AMM concept, as follows:

- meter data management;
- data acquisition and transmission;
- system installation;
- program management.

# ENERGSys - Certifications - A.S.C. ELECTROMAGNETICA S.A. Registered



# ENERGSys - System Architecture





# ENERGSys - Main Benefits

- Web-based application that allows generation of reports based on real data acquired from the system. Secure and fast access to the application is possible using any internet browsing program or using customer's infrastructure (LAN/VPN);
- Consumers have improved control upon their energy consumption as they provide the ability to measure their energy usage in the real-time or based on hourly increment;
- Remotely controlled field equipment - proving better management of the electric network;
- Real-time faults detection allows for quick response times for intervention either by remote or by quick dispatch;
- Performance monitoring of the Conversion Points in order to minimize losses;
- Consumption Peaks minimization (Exemple: by configuring the installed devices within Location/Point of Measure - significant savings in terms of electricity bill payment);
- Elimination of human error often occurred in exchanging information with other data management systems (Exemple: reading, transcribing and transmitting of meter readings);
- Continous monitoring on energy quality paremeters (real-time data about voltage on each phase of the network, compliance with the established tresholds switches, voltage fluctuations on the phase out of bounds default, various events within the network)
- System's architecture follows the <open system> concept, allowing continous developing and/or adding new features by hardware and software upgrade. Currently the system can accommodate any type of one-phase energy meter manufactured by Electromagnetica S.A. as well as any type of energy meter from different suppliers.
- The system is modular and expandable, comprising the following functional blocks:
  - consumer equipment (meters, protection devices)
  - acquisition equipment (Local Module for meters reading - ML, Central Module - MC, Radio Interface Module - MIR)
  - communication equipment (GSM/GPRS Modem)
  - Uninterruptible Power Supply (UPS)
  - Central Office equipment, including Networking Devices, Server, UPS and software for system communication and management.

# System Components (selection)



## SINGLE-PHASE ELECTRONIC METER FOR ACTIVE ENERGY WITH MECHANICAL REGISTER

- Class I
- $U_{ref} = 230 \text{ V}$  ( $U_{max. allowed} = 400\text{V}$ )
- $I_{ref} / I_{max} = 5 \text{ A} / 60 \text{ A}$  or sub ranges
- Meter Constant = 1600 imp/kWh
- Equipped with electric test output, class B, according to IEC 62053-31:1998
- Electric test output constant: 5 Wh/imp
- LED Signaling for good/wrong connection of the meter
- Certified to meet requirement of European Directive 2004 /22/CE (MID) by KEMA



## SINGLE-PHASE ELECTRONIC METER FOR ACTIVE ENERGY WITH LCD DISPLAY

- Class I
- $U_{ref} = 230 \text{ V}$  ( $U_{max. allowed} = 400\text{V}$ )
- $I_{ref} / I_{max} = 5 \text{ A} / 60 \text{ A}$
- Meter Constant = 1000 imp/kWh
- Optionally equipped with electric test output, class B, according to IEC 62053-31 or optical isolated serial communication port.
- Energy direction signaling (direct or reverse energy)
- Distinct register for the exported and imported active energy



## Three phase electronic meters for active / reactive energy from reputable: ISKRA, Elster, Landy&Gyr

- Class I (B) - active energy, class 2 re-active energy
- $U_{ref} = 3 \times 230 - 400 \text{ V}$
- $I_{ref} / I_{max} = 5 \text{ A} / 120 \text{ A}$  or sub range
- Equipped with electric test output, class B according to IEC 62053-31:1998  
optional RS485 bus
- Load Curve (available as an option)



## LOCAL MODULE FOR ELECTRONIC METER READING:

- Interface between the meters equipped with communication port and the central communication module
- Count of impulses from the meters equipped with electric output - providing communication capabilities for them
- Events storage
- Closing / opening the contact « tamper » from the meters equipped with « tamper » contact
- Door contacts from the indoor cabinets equipped with “door opening”
- Connects to the Central Concentrator Module by a serial connection RS485 full duplex
- Use of Protocol « D » as per SR EN 61107
- Powered by bus RS485 from MCC
- Backup power supply (local Li-Ion battery)
- Subscriber disconnection from the electric network upon request from the Operation Center
- Maintaining consumer disconnection as long until reconnect clearance is received from the Operation Center



## CONCENTRATOR MODULE (MC) -

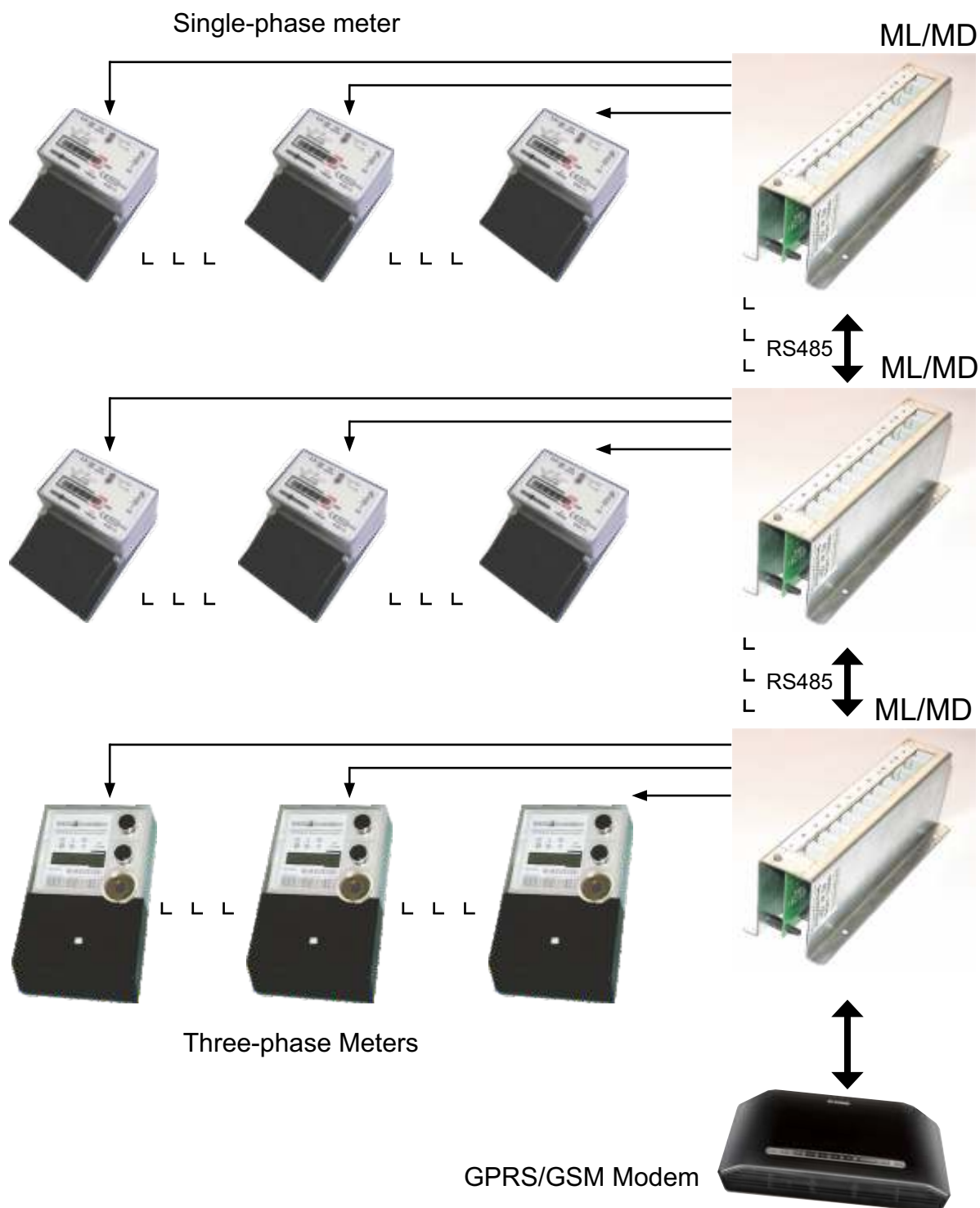
- Meter data reading and transmission;
- Taking over and signaling different events;
- Serial communication with the local modules for meter reading;
- Auto-detection of topology of associated communication system;
- Local communication of serial type asynchronous with associated GSM modem;
- Read data storage pending for download in the database of the central point;
- CM together with GSM interface and power supply unit (PS) form the central communication module (MCC)

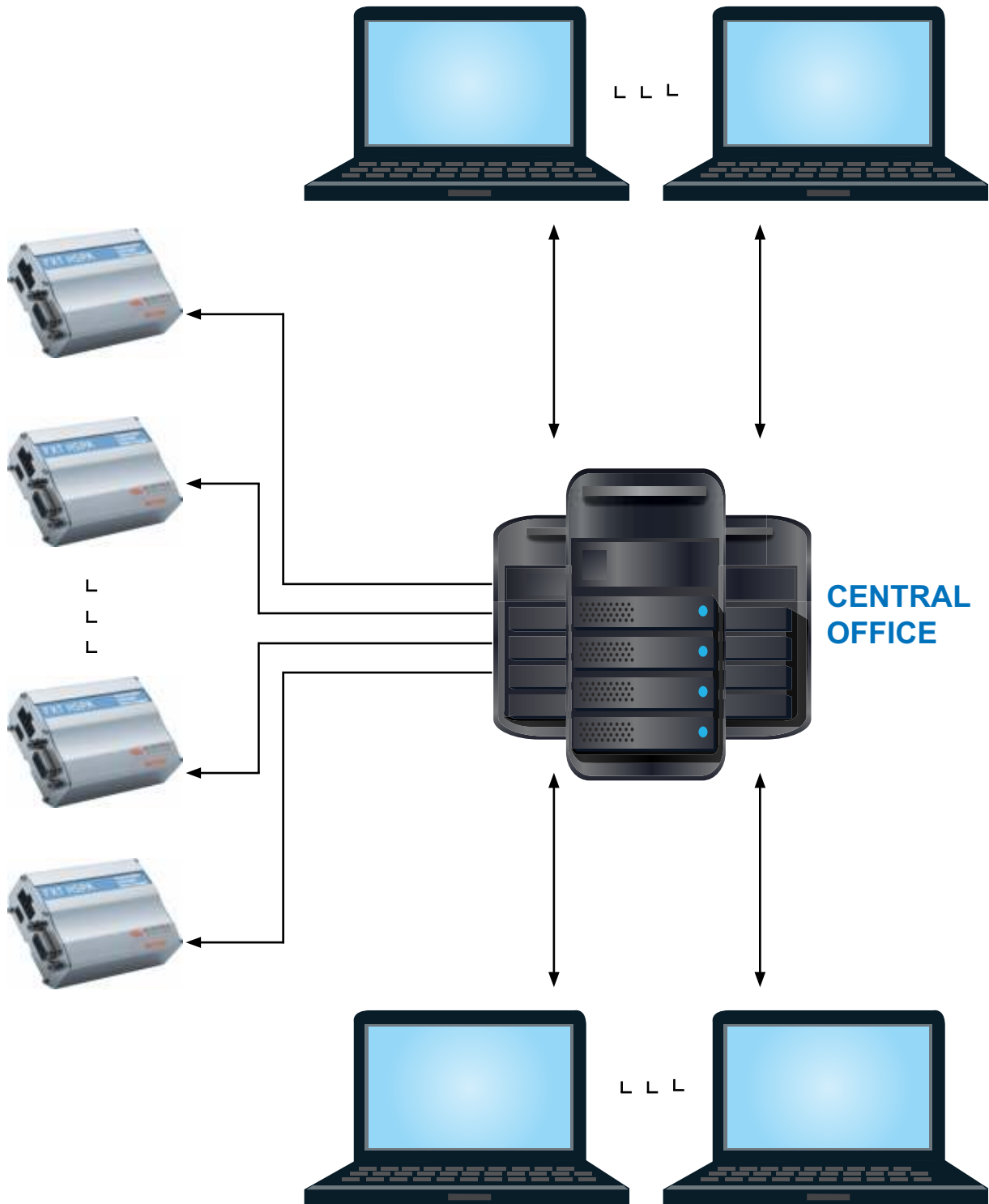


## GPRS / GSM INTERFACE AND POWER SUPPLY MODULE (PS)

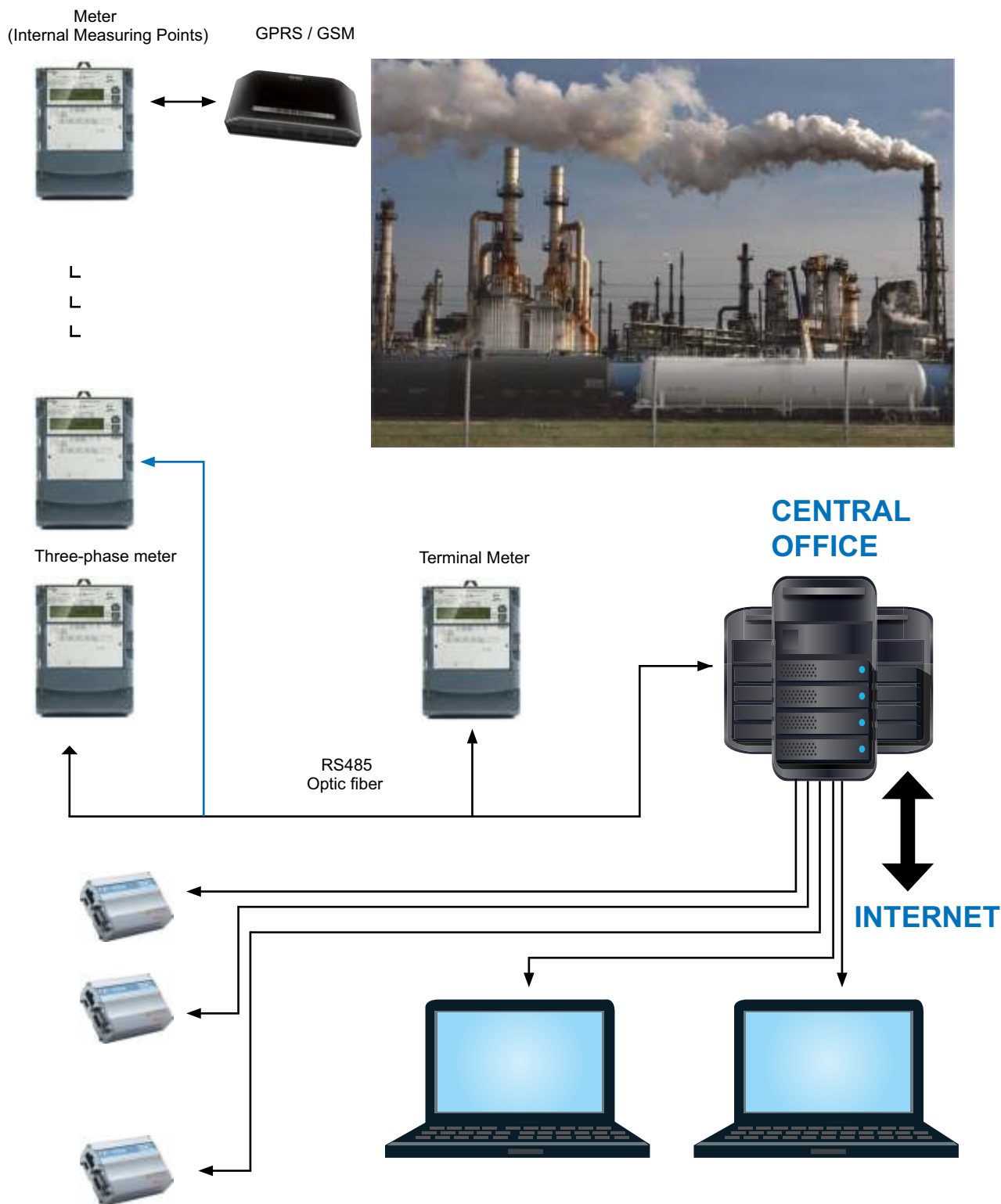
- Power feeding the system from the main electric power source;
- Should any situation of events in the electric network occurs it generates failure signals;
- Connects the backup power supply when the main power source is offline;
- If battery energy lowers to the threshold value, automatically records and stores the event then disconnects the system;
- Includes:
  - power supply of local module and GSM modem
  - power supply of Concentrator Module.

# ENERGSys Implementation – Small and Residential Consumers





# ENERGSys Implementation – Large Consumers



# ENERGSys - Technological Flow Integration ELECTROMAGNETICA S.A.

- Manufacturing ● Metrological Validation
- Assembly ● Final testing





# ENERGSys Software System - Structure and Main Features

- Acquisition and processing of data received from the measuring points , fully automatic or upon authorized request. Rules can be set for defined groups of meters - time frame between automated readings / moment of the day for reading.
- Automated download of collected data in a relational database.
- Comprehensive reporting tools - report generation (including user-defined) with flexible data processing using arithmetic or commonly mathematic functions.
- Automated data validation using various criteria.
- Prevention of unauthorized access by generating program options based on permissions set by the System Administrator.
- Detailed log of all operations accomplished by any user of the program (LOG file) with the possibility of selecting the period of interest.
- Continous monitoring of users, connections and movement of data within the system and outside the system.
- Database updates due to a change groups and/or component features and maintenance history.
- Data exchange interface for using in relationship with other data management software (MDMS) used by certain companies (Exemple: SAP - IS-U)
- Implemented Technologies:
  - .NET FRAMEWORK 4.0
  - IIS 8.0
  - ASP.NET



# ENERGSys - System Database

- The relational model (Relational Model) upon which is built the new ENERGSys Web database allows you to view a database as a set of two-dimensional tables. The model is based on the notion of mathematical relationship, which corresponds to a set of entities of the same type.
- ENERGSys Web Database meets the following requirements:
  - data independence
  - improved facilities for use of the data
  - minimal and controlled redundancy of the information in the database (reduced redundancy is achieved by identifying common information)
  - data privacy and security
  - data sharing features (for enhanced compatibility with partner system)
  - data integrity
- Main Sections:
  - Section containing the tables required for authentication operations, configuration, data validation, log and communication.
  - Section containing the tables required for measuring points and locations management, meter readings and also configuration features for all the elements (grouped in branches) within ENERGSys System.



# ENERGSys - Administration Menu

- Management of users and permissions for the software platform options depending on the individual competence level.
- Management and configuration of the communications between field data reading equipment and main web application.
- Database(s) access parameters configuration.
- Log file for all users (every operation in the platform is tracked and stored - any entry in the log file contains the timestamp, page accessed and changes made).

## Jurnal activitate

Administare Configurare Analiza Andrei Viorog

ENERGSys ADMINSTRARE -> PAGINA LOG ACTIVITATE

Log aplicatie Log comunicatie Log parametrizare

Utilizator: Administrator

Pagina: Log

De la ora: 2015-05-28 09:10:24

La ora: 2015-05-28 09:23:24

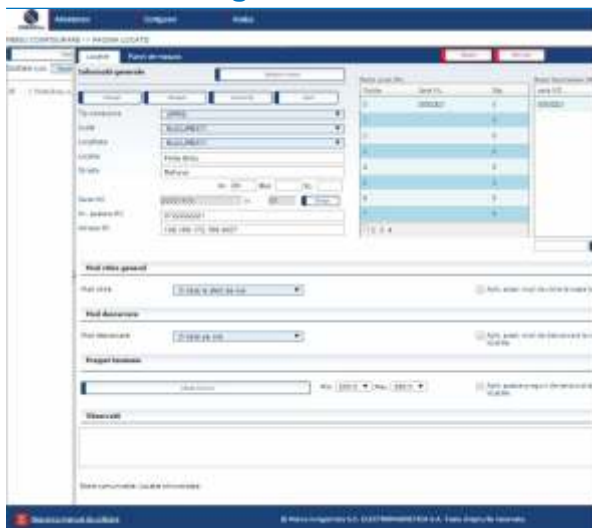
Nume Utilizator	Pagina	Operatiune/Operatiuni	Data si Ora	Cant. inregistrat	Valoare initiala	Valoare finala
Administrator	Log	pagini	2015-07-28 18:18:12			
Administrator	Log	pagini	2015-07-28 18:28:48			
Administrator	Log	pagini	2015-07-28 18:07:48			
Administrator	Log	pagini	2015-06-12 10:52:25			
Administrator	Log	pagini	2015-06-12 10:52:42			

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# ENERGSys - Configuration Menu

- Definition and detailed configuration for the Locations within the network.
- Definition and parameters configuration for the Points of Measure within Locations.
- Point of Measure specific details can be defined and set (address, meter type, phase, communication type, reading time parameters).
- Network organization on consumption groups - the criteria can set according by the network architecture.
- Balance Meter assignment for certain Group(s).

## Location Configuration Section



## Groups Configuration Section

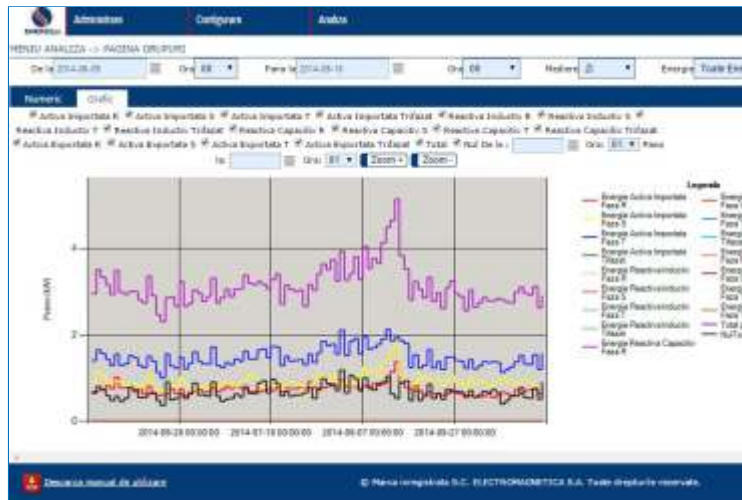
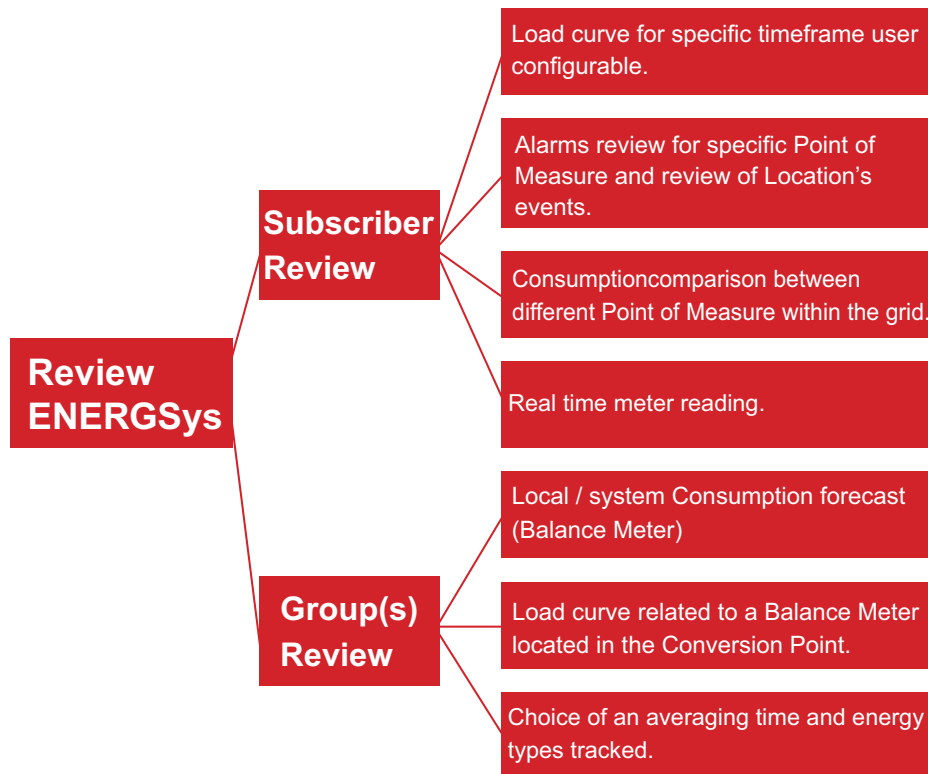


# ENERGSys - Review Menu

## Reports (selection):

- Consumption Analysis;
- Advanced multirate analysis for certain timeframe / energy type;
- Communication History;
- Load Curve (partly / entire system) ;
- System Events.

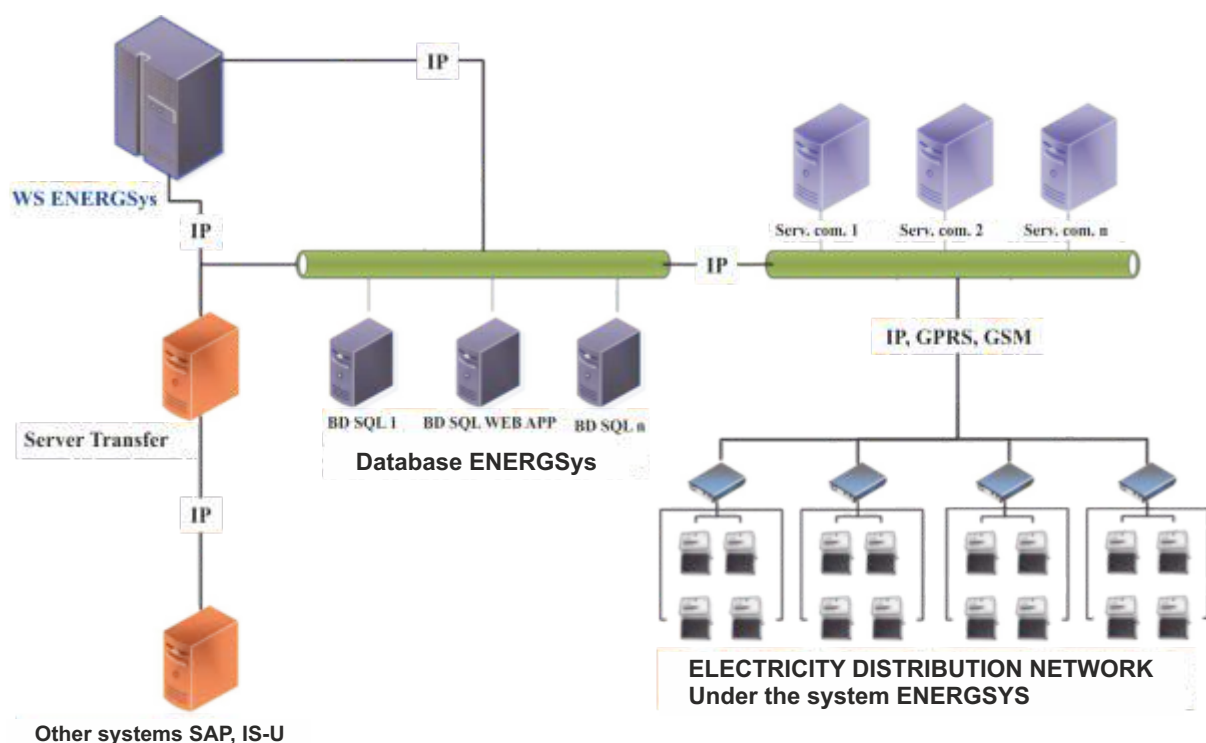
- Extended support for advanced tariff-systems (multitariff - import and export energy)
- Advanced visualisation / review of recorded power and consumption data
- “Subscriber’s Record“;
- Statistical analysis on max, average and total values for all energies contained in Group Analysis

# ENERGSys - Communication Flow

## IP - based COMMUNICATION

- Simultaneous communication with all the location within the grid (GPRS);
- Real time monitoring for certain location within the system (based on GPRS data connection);
- Data backup for Concentrator Module;
- Backward compatibility with existing equipment;
- Support for earlier communication system;
- Two-way communication between Web Application installed in Central Office Server and field equipment.



# ENERGSys - System Security

## Security methods:

- VPN tunnels;
- Automated identity verification;
- Automatic validation of all data in the system;

## User acces configuration

- https access to main application ENERGSys;
- Active Directory authentication (upon request);
- Permissions for users at page level;
- Recording all user actions;
- Storing sensitive information in an encrypted database;

## Clients access

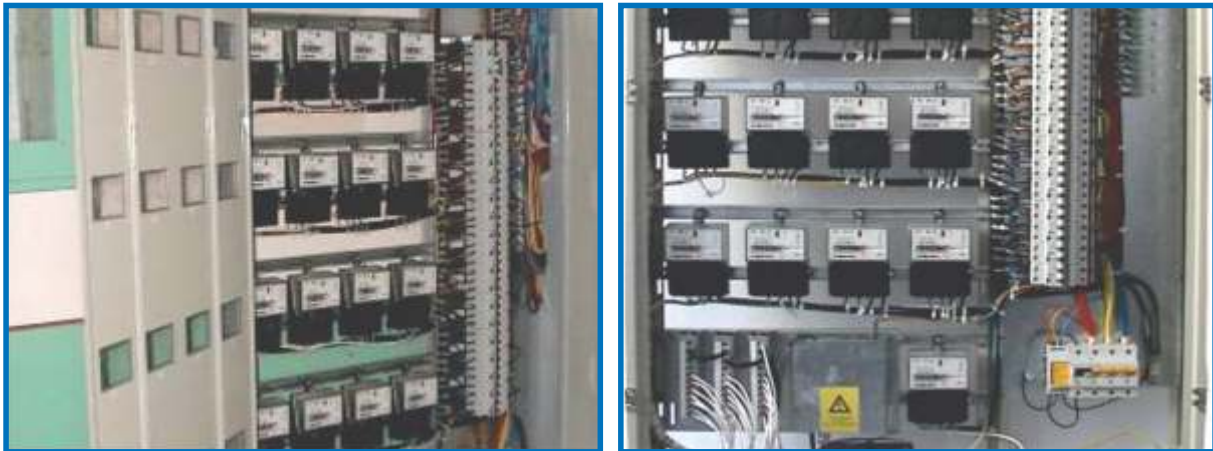
- Access to data through a replicated database;
- Data encryption on user information
- Possibility of communication of financial information to the client.



## Groups containing Points of Measure before ENERGSys Implementation



## Groups containing Points of Measure after ENERGSys Implementation



## Random Operational Location within ENERGSys System

- Secure distribution enclosure (2mm thick steel) for measuring and communication equipment;
- Locking systems;
- Monitoring enclosure access door by signage application access inside the enclosure;
- Power quality monitoring;
- Keeping the transmitted data and the possibility of manual recovery of the data contained in the concentrator modules.



## Groups containing Points of Measure after ENERGSys Implementation



## Conclusions

- Readings frequent enough to manage consumption and energy savings by client and network planning of the distributor;
- Possibility of integration into system for other manufacturers meters;
- Support for advanced charging systems (IBD / Multi Tariff);
- Imported / Exported Energy management;
- Remote disconnection for any points of measure within the system;
- Possibility of continuous development of the network, while keeping compatibility with the current structure;
- Detection and signaling supply disruptions and / or exceeding the threshold voltage;
- Unauthorized access monitoring of the grid;
- Consumption monitoring by using Balance Meters;
- Analysis in relation to the Balance Meters;
- Possibility of communication of financial information to the client;
- Guarantees of software support for the entire lifetime of ENERGSys system;
- Possibility of adding supplementary functions and features upon request of the beneficiary or as a result of specific regulatory changes;
- Backward compatibility with the existing architecture of the system, where currently operational.



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