Smart solutions.
Strong relationships.

SMART GRID Solutions by

DISTRIBUTION AUTOMATION SOLUTIONS (DAS):

AMI

LV SUPERVISION

MV SUPERVISION AND AUTOMATION

COMPACT SECONDARY SUBSTATION

OVERHEAD MV LINE AUTOMATION

MICROGRID

Beyond Smart Metering
Multi-standard solutions to make the smart grid real

CG is a global organization with a broad portfolio of products and services, ranging from high-end Power and Industrial Solutions to lifestyle consumer products.

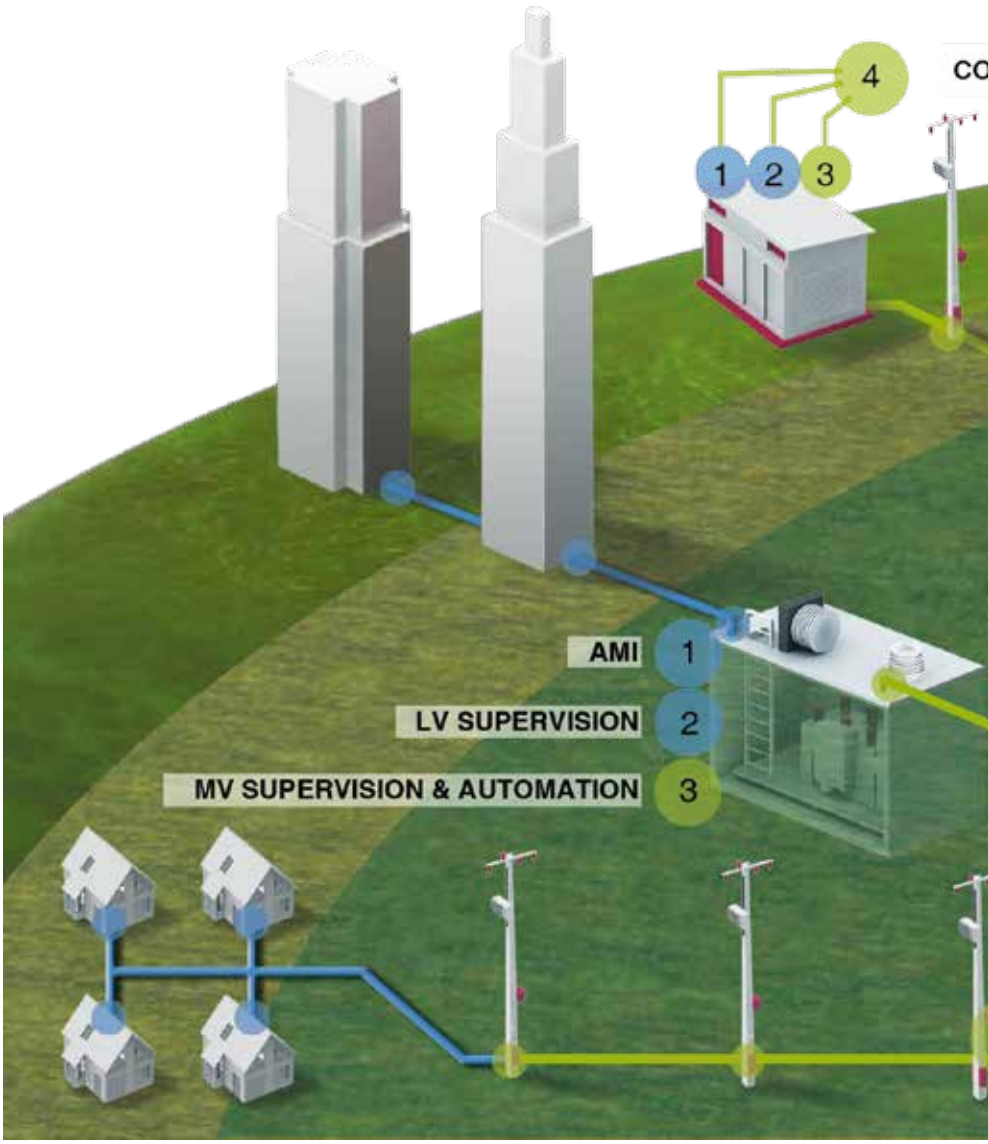
CG is present in 85 countries with more than 16,000 employees across the world.

CG Automation BU is dedicated to the design, manufacture and marketing of digital protection, control, metering and communications equipment and systems for generation, transmission and distribution electric utilities, industries and EPC contractors worldwide; as well as automation systems for transit and water utilities.

CG Automation headquarters is located in Bilbao, Spain and hosts the center of excellence for the development of CG's smart grid solutions marketed under ZIV® brand name.

CG Automation business unit offers a complete **Distribution Automation Solution** portfolio (ZIV DAS).

A portfolio based on proprietary technologies and a unique mix of knowledge and experience in protection & control, communications and metering technologies.



Distribution Automation Solutions

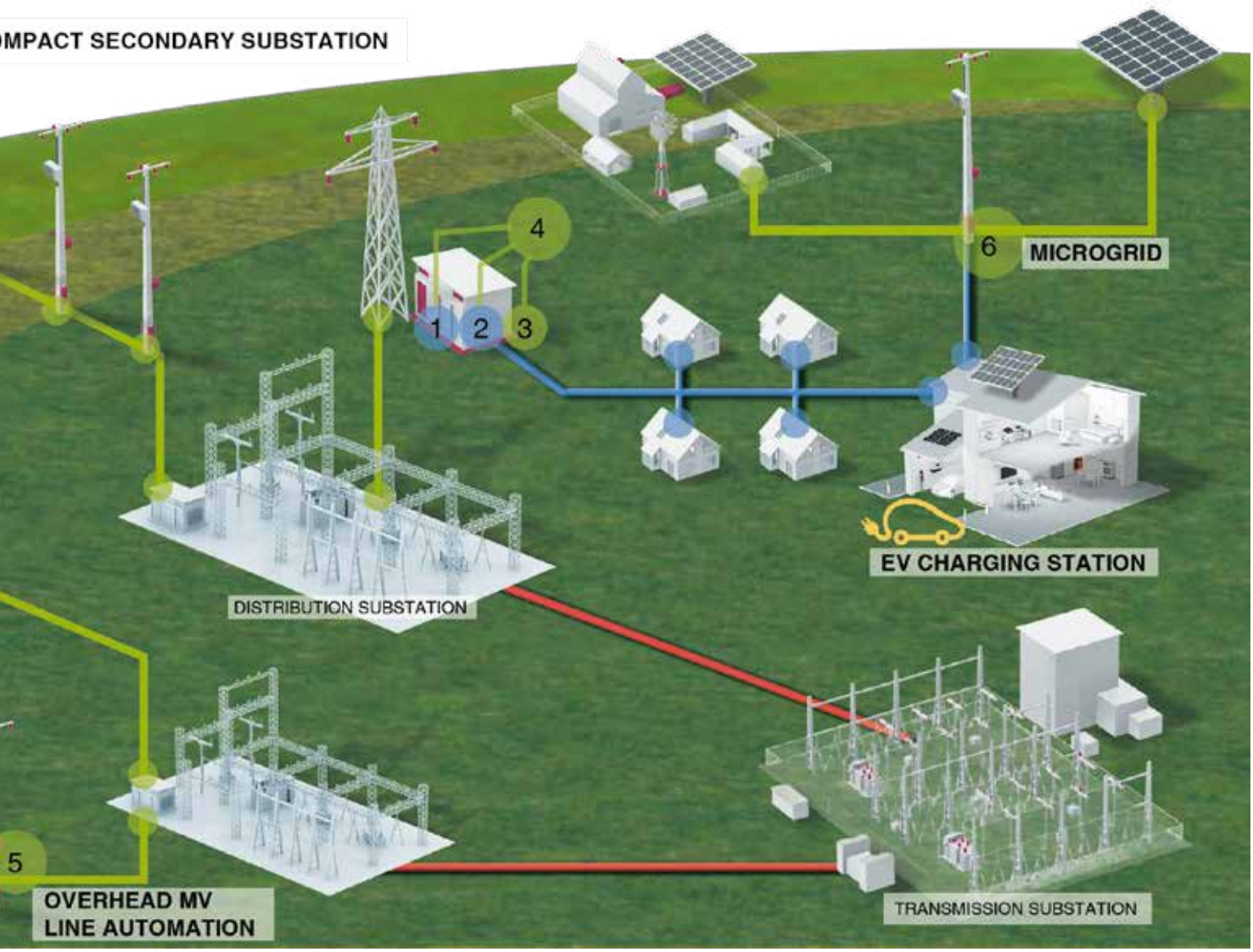
1 **AMI**

2 **LV SUPERVISION**

LV advanced supervision systems enable the implementation of advanced low voltage monitoring functionalities such as blowout fuses, fraud detection, feeders load unbalances and quality of supply assessment

3 **MV SU AUTOM**

Intellige Solution monitor solution Ring Ma Air RMU



PERVISION & MATION

nt Control Cabinet ns to implement ing and automation s for gas insulated ain Units as well as Us

4

COMPACT SECONDARY SUBSTATION

LV supervision + MV automation systems when integrated in a compact secondary substation are able to collect and transmit information via PLC, cellular or xDSL communications. They are designed for trouble free and fast commissioning air RMUs installations

5

OVERHEAD MV LINE AUTOMATION

Automation solutions for switches and circuit breakers. They can split MV lines into several sections providing the capability to isolate faults either automatically or via remote control

6

MICROGRID

A full set of intelligent solutions to transform these facilities to real Smart Microgrids, with remote controlled devices, AMI solutions and with a small SCADA

EV CHARGING STATION

A complete and powerful solution for building up EV charging infrastructures in parking lots.

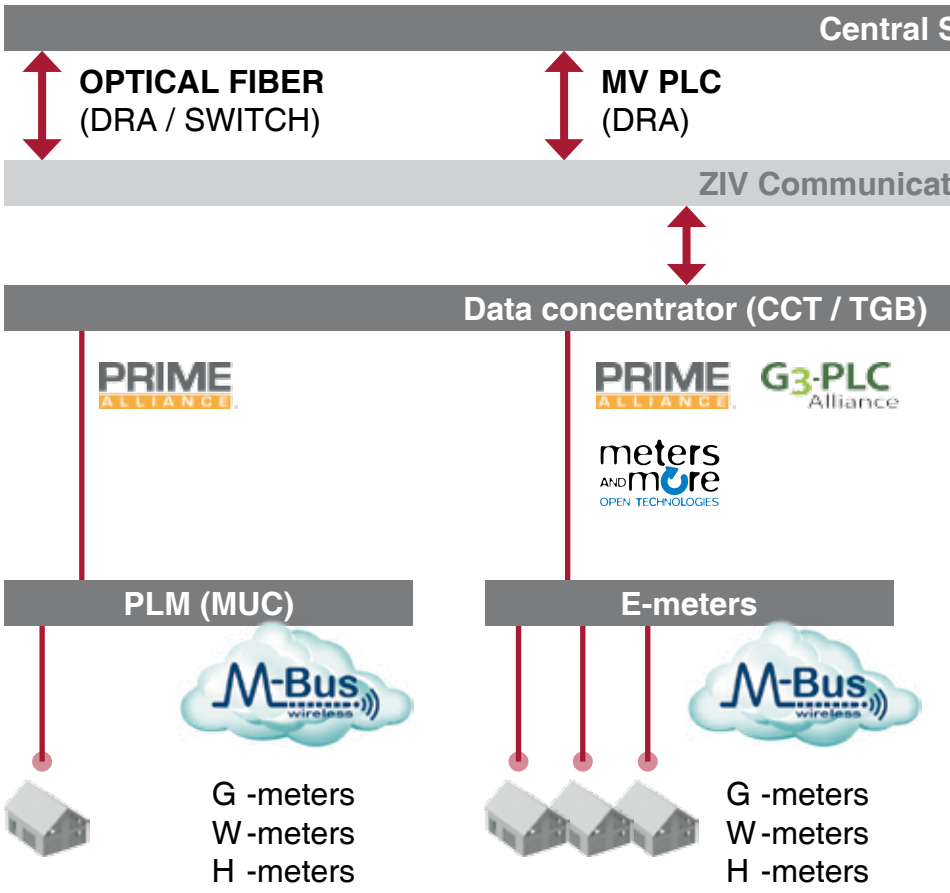
PRV - WALL BOX

PRV - OUTDOOR to suit outdoors and street parking charging applications

1

ADVANCED METERING INFRASTRUCTURE

Over 3 million smart meters deployed worldwide



Most Distribution Network Operators worldwide are modernizing their distribution grids for improving network management, energy efficiency and demand response.

In many countries, there are legislative and regulatory incentives to promote Smart Metering as well as a public and technical driving forces. Not only grid operators can improve their operational processes. Suppliers, energy service companies and customers will also benefit from the availability of data and the possibility to manage aggregated load profiles.

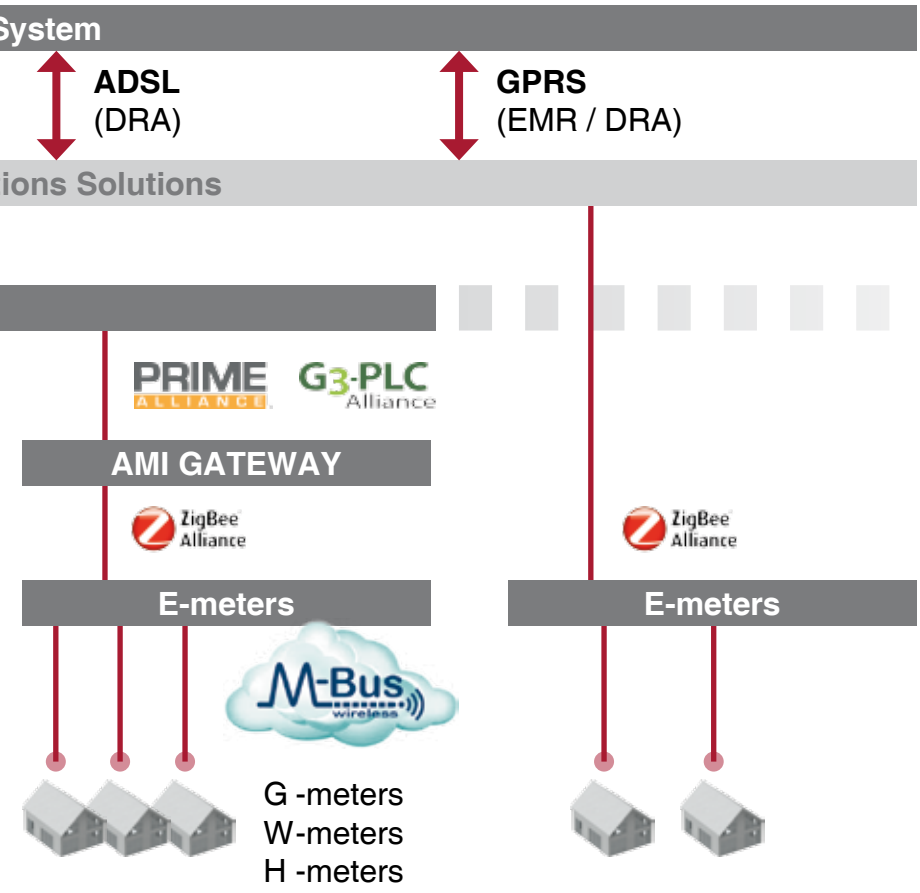
Smart Metering systems offer many options and capabilities that were not possible with traditional meters. These range from remote load shedding and meter reading to time of use tariffs and power quality measurement.

Depending on the technical functionality or grid characteristics, different communication architectures may be required. To ensure interoperability between different players and applications, the use of existing open standards is recommended.

CG covers a broad range of smart metering equipment from single phase meters for residential use up to sophisticated and accurate high precision meters for large consumers, in addition to all the necessary communication devices to enable Automatic Meter Management.

Making the Smart Grid real

DRA **EMR**



TGB

4CCT

Smart Meters family
Multi-utility communications

ZIV AMI Key Features / benefits

- Smart meters integrate energy measurements, load profile and Time of Use (TOU) features, as well as local and remote communications capabilities.
- Smart meters are automatically activated in the network and central MDM system (plug & play).
- Breaking and reconnection elements for remote switching operation, power control and demand-side management. Utilities in charge of electricity, water and/or gas distribution can optimize their investments in an advanced metering infrastructure.
- Data concentrators may include a built-in three-phase meter to monitor the LV section of the distribution transformer.
- Standard protocols and interoperability.
- Tampering detection functions.
- Flexibility, designed to fit your needs.
- CG owns the technology embedded in the AMI products.
- Advanced diagnostic tools.
- Efficient data transfer optimized for communications over noisy lines.
- Flexible family of meters with a broad range of functions.
- Compact, easy-to-install and ruggedized devices.
- Smart Grid laboratory (with 500+ meters and simulating 5 secondary substations) for near-real life testing and validation of products.
- CG PLC communication devices are able to tackle all kind of LV grid situations and topologies, increasing the communications range and minimizing the deployment costs.

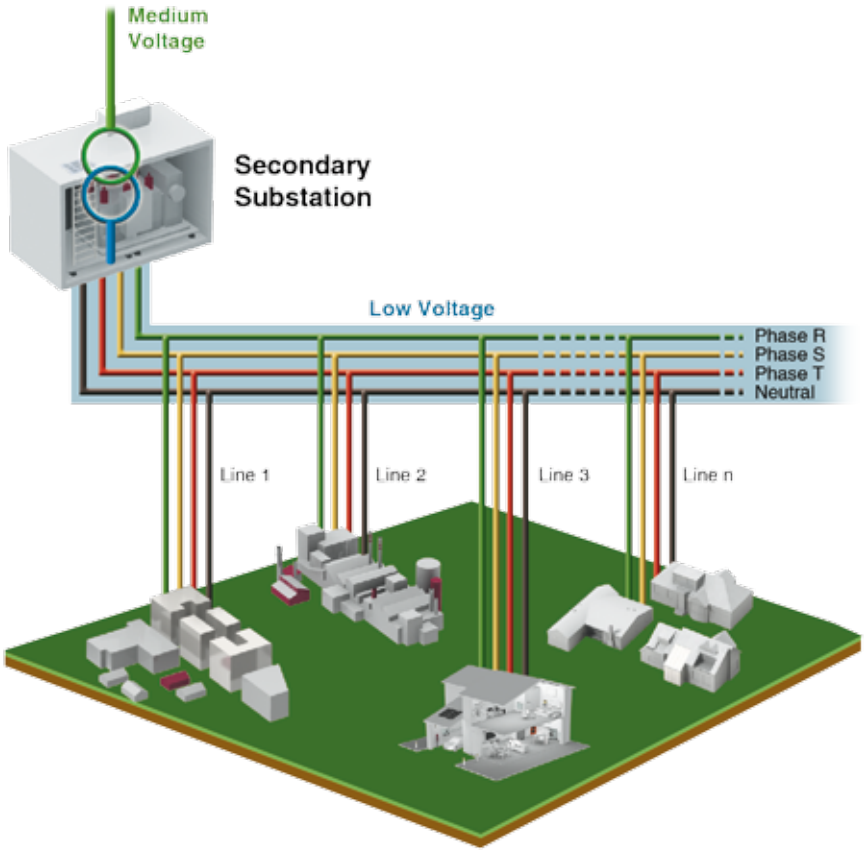
Global AMI: Remote communication over PRIME PLC, G3 PLC or ZigBee

2

LOW VOLTAGE SUPERVISION

LV grid evolution is enabled through the progressive development of the communications subsystems. They make this important infrastructure able not only for remote meter reading purposes but for efficient distribution network supervision.

Utilities can also use this information for tampering detection and quality of supply monitoring. In the future, it will open the door to the implementation of LV grid automation for critical sections of the network.



LV GRID CHALLENGES

Low Voltage (LV) Distribution Electricity Grids are the most unknown and manually controlled elements of the electricity grid.

Additionally, new challenges to be faced are being identified:

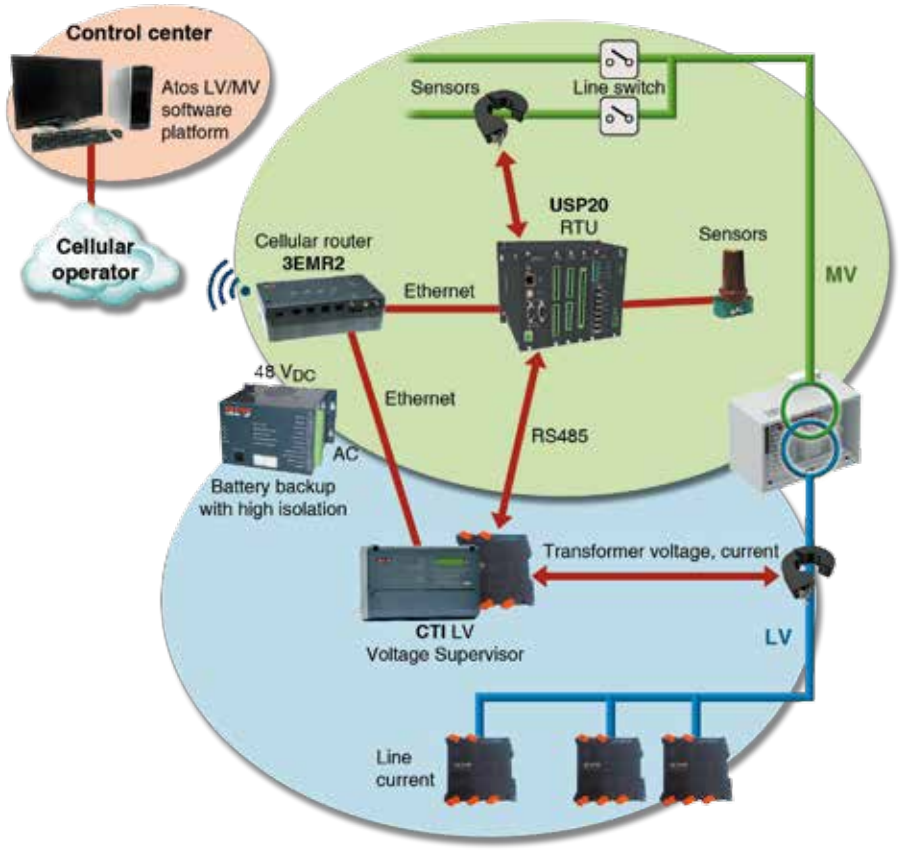
- Renewable source generator integration and the management of its intermittency.
- Integration of new energy consumers such as Electrical vehicles.
- Peak shaving and congestion control.

Utilities can gain substantial advantage from the knowledge of the LV parameters and the grid topology.

LV GRID EVOLUTION

LV supervision information can be used to feed real data into the enhancement and refurbishment plans for LV grid infrastructure, and for operational improvement of maintenance operation in LV lines (feeders). Examples are: secondary substation feeder load optimization, transformer phase balance and LV feeder fault management.

ADVANCED LV SUPERVISION SYSTEMS



Key features

5CTI feeder supervisors allow to monitor every feeder leaving from the low voltage switchboard in the secondary of the Distribution Transformer (DT).

5CTI is linked with a LV controller (4CCTI or USP-20) via a RS485 bus or LV PLC communications. Its functionality is based on DLMS/COSEM protocol.

The data is sent periodically to a Head End or SCADA System.

The low voltage Distribution Transformer (DT) supervision function is performed by the LV supervisor connected between the secondary of the transformer and the LV switchboard. It is able to monitor and register overall performance of the DT, including voltage waveform, presence of harmonic signals, voltage dips and other distortions.

Benefits

This solution enables the implementation of advanced low voltage monitoring functionalities such as blowout fuses, fraud detection, load feeder unbalances, quality of supply assessment...

Its compact design allows several DIN-rail mounted units in a compact space, able to monitor all the LV feeders.

In addition to DCU and LV supervision, 4CCTI implements a Line Detection algorithm which makes the utility capable of updating the LV circuit topology, mapping each end customer meter to the LV feeder and the phase in which it has been connected.

Power quality indices often provide ways to evaluate the performance of electrical distribution service.

DCU (4CCTI)

Advanced LV supervision Data Concentrator Unit (DCU). This metering data concentrator unit works as a control node for the feeder supervision units (5CTI).

LV three phase line supervisor & feeder detector (5CTI).

Modular RTU (USP 20)

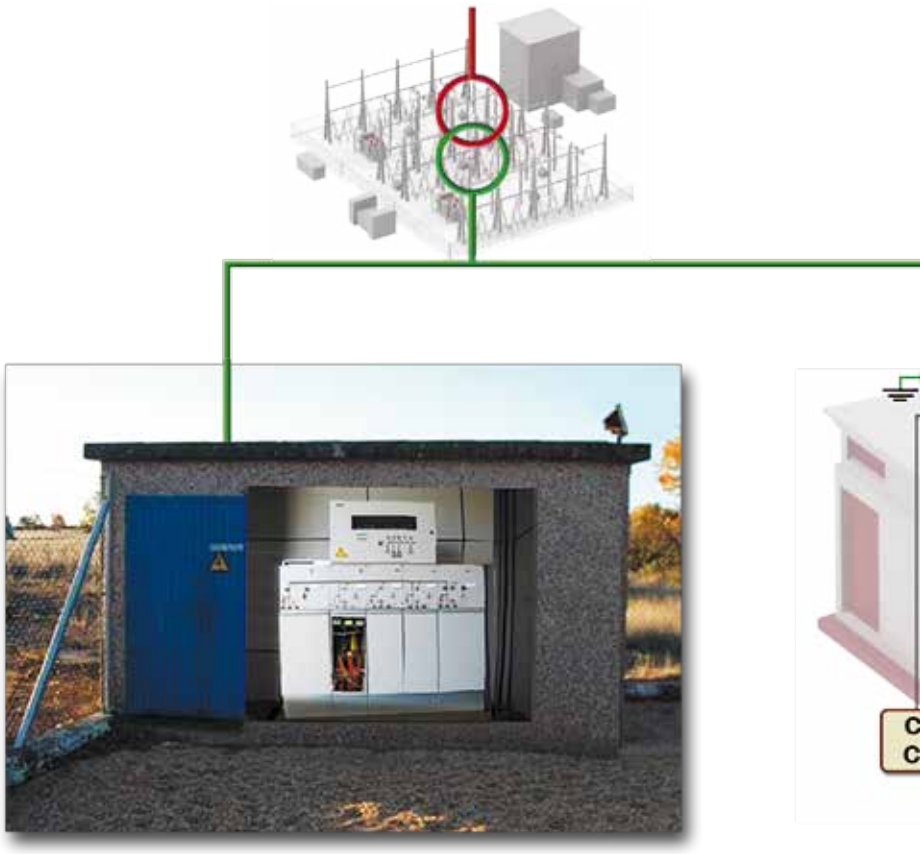
Modular device which includes general purpose I/O, analog inputs and directional Fault Pass Detection functionality. It is possible to integrate external equipment by means of RS485 or ethernet buses, converting the Modbus RTU protocol RTUs into IEC104, Modbus TCP or DNP3.

3

MEDIUM VOLTAGE AUTOMATION AND SUPER

Over ten thousand MV Automation and supervision solutions have been already implemented by ZIV. They allow to manage electricity supply in an efficient and sustainable way, guaranteeing service quality.

Intelligent Control Cabinet solution including monitoring and automation solutions for gas insulated Ring main units as well as Air insulated RMUs.



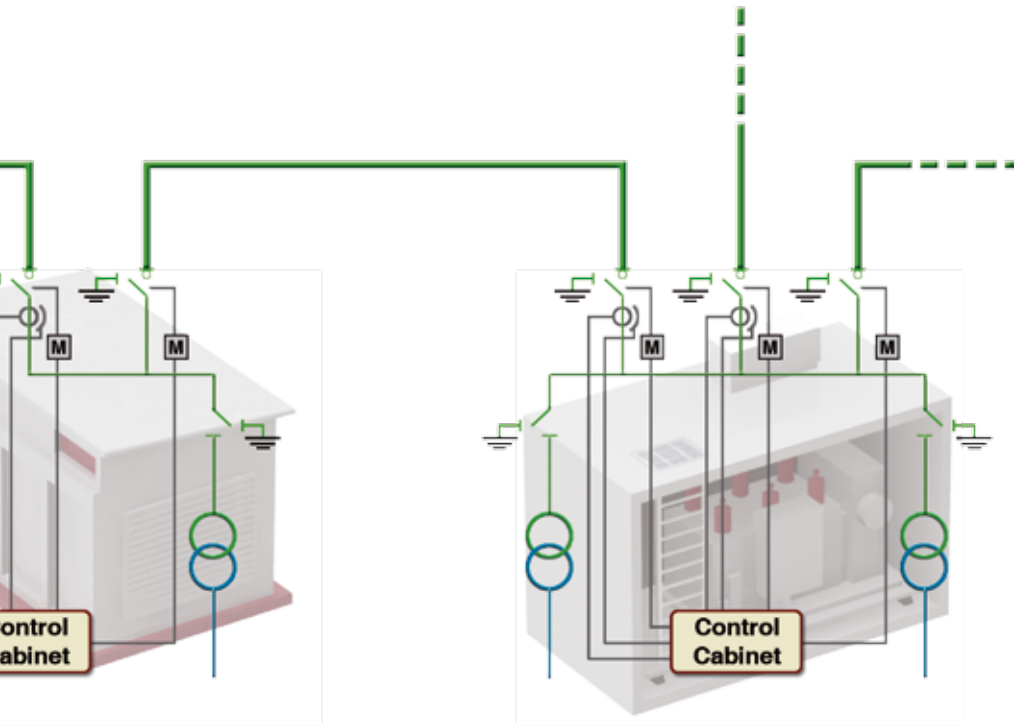
The introduction of Smart Grid into the medium voltage distribution grid for automation and supervision purposes has made necessary to develop new solutions to address the evolving requirements of the grid.

CG Automation has, among its solutions, a reliable **Intelligent Control Cabinet** for Ring Main Units. It provides new services and value added functions which will enable a better grid operation, and more efficient business management.

The applications targeted by the Intelligent Control Cabinet, can be split into 2 groups:

- **Supervision** and monitoring solution with directional fault detection and indication for MV networks.
- Complete solution to **automation** MV grids.

RVISION



Key features

- Local and remote control.
- Directional fault detection and indication.
- Reduction of response time to faults, thus improving customer services.
- Power supply/battery management, monitoring.
- Power quality measurements and supervision.
- Secondary substation alarm monitoring.
- Communication protocols: IEC 104 S, DNP3.0 (M/S), DNP 3.0 - IP(M/S), Modbus (M/S), others.
- Secure communication.
- Web, WS and Workbench configuration .

Benefits

- Improve the management of distribution facilities.
- Improve the reliability and availability of the network.
- Increase the capacity and energy efficiency of the grid.
- Fast and accurate fault location in medium voltage grids.
- A total view of the grid.
- Improve the IEEE reliability index: SAIFI and SAIDI.
- Quick and trouble free installation.
- Modular solutions adapted to the different Ring Main Unit schemes and manufacturers.
- Fully tested, configured and assembled in factory.

Services

CG provide project management and in situ supervision that allows the maximum resource efficiency, fast problem resolution, performance optimization as well as effective support for the utility's operating team.

CG works with a team of expert engineers that offer solutions to all the requirements during commissioning, as well as technical assistance during the warranty period. Our qualified technicians know the specific requirements for each product and application. They will share technical knowledge with the staff through training courses.

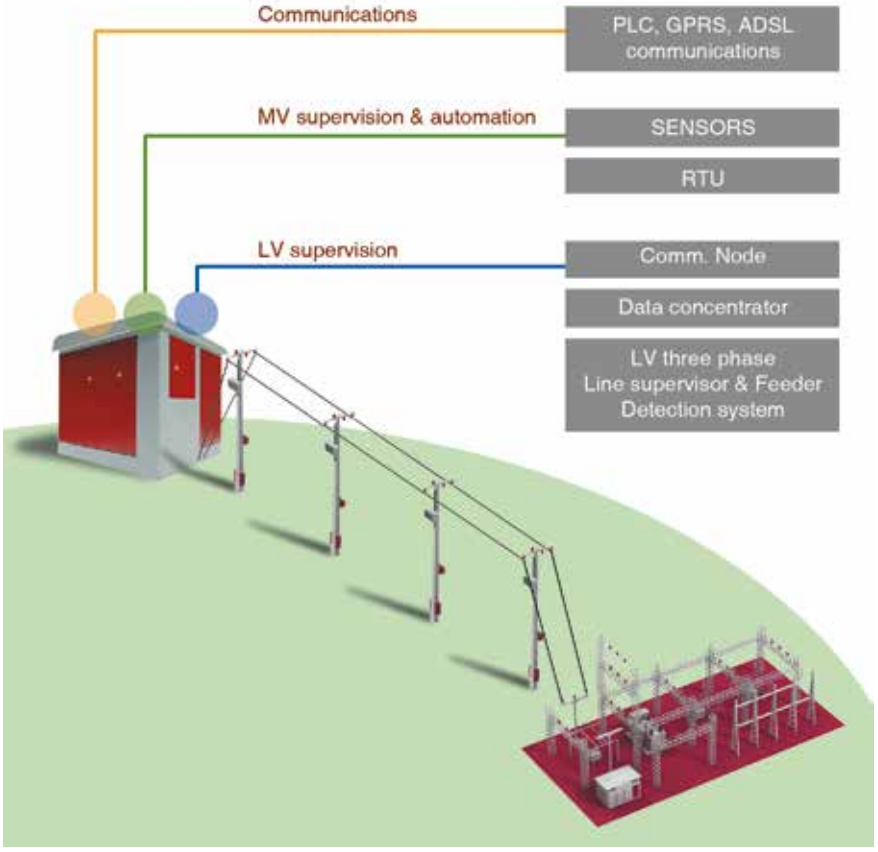
Value-added services

CG service team also performs value-added operations, using tools and applications specially designed for this type of work.

- *In field asset verification and parameterization.*
- *Optimization of PLC or radio based AMI systems.*

4

COMPACT SECONDARY SUBSTATION



Ready for trouble free installation and fast commissioning:

Due to the small size of the secondary substation and the fact that is fully assembled in factory, the time required for commissioning will be minimal.

It has 2 doors to access independently the MV/LV cabinet and the control panel.

CSS is designed to reduce EMC and ensure a low heat profile due to its high cooling surface by natural convection in all circumstances.

Scalability

Every smart feature of the CSS, such as LV/MV grid monitoring, OLTC, communications… can be ordered from the factory, or retrofitted later once the unit is installed for ease of rollout and to improve CAPEX management for the utility.

The Smart Grid a reality is transforming the distribution network into an intelligent system, in order to improve operation efficiency and power quality.

To achieve this goal, the key element is the automation of secondary substations.

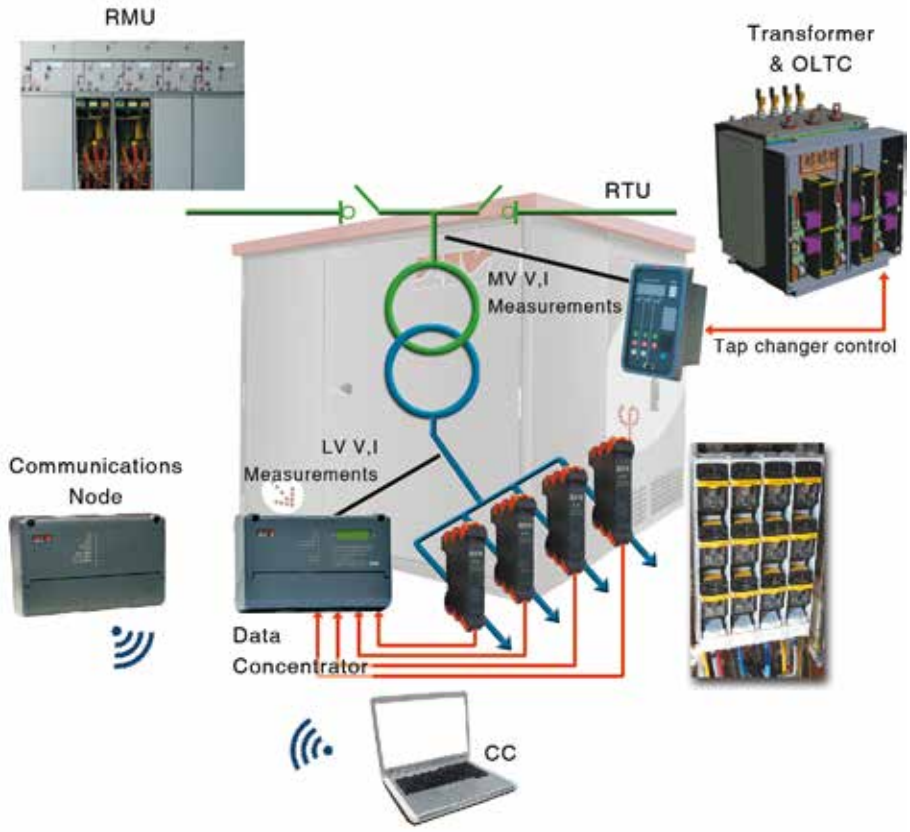
Until now, the secondary substation was a passive element. To automate the network it is necessary to transform secondary substations in active units which are able to collect information, transmit it to the dispatch and react, so that the times for analysis and restoration of the system are minimal.

Bio-SMART TRANSFORMER

Due to the use of **K3 class liquids** and homogeneous insulation as per IEC 60076-14 based on the DuPont high temperature NOMEX® insulation systems, these transformers are very compact and offer low noise and low losses in combination with high fire safety, **bio-friendliness** and increased reliability.

The transformer has an optional **On-Load Tap Charger** accessible from the control compartment and dings of pressure, temperature and fluid level.

The **compactness** also represents a reduced use of materials and ECO-footprint. These types of transformer are popular in market segments where space is limited and safety is a priority.



COMPLETE AUTOMATION SOLUTION

The CSS is an active unit which is able to collect information transmit it, via **PLC, Cellular** o **xDSL** communications, to the dispatch centre and react, reducing the time for analysis and restoration of the system. The implemented functions are:

MV supervision & automation
Using V and C sensors and an embedded RTU, it is possible to inform the dispatch about the status of the grid and each switch at any particular time in order to do local or remote operations. It has a directional fault detection which can isolate the line in fault and achieve a quick restoration of areas that are not affected.

LV supervision
Installing smart metering equipment in the secondary of the transformer and in each LV feeder the maintenance of the network is improved, due to reporting of specific alarms such as feeder unbalance and blown fuses. Another critical functionality is commercial loss (fraud) detection by doing energy balance at the secondary substation level.

Using the most modern technologies, thoroughly tested to facilitate 24x7 on-demand data acquisition related to key parameters in MV and LV within the secondary substation, an accurate picture is obtained for LV distribution network. In addition, full visibility of the secondary substation is achieved via the utility DMS or SCADA system.

EV CHARGING STATIONS

CG Automation has devised a complete and powerful solution for installing EV charging infrastructure in parking lots. The system comprises a main central unit called master (PRV-M) and slave units (PRV-S).

It provides Ethernet, 3G communications and OCCP (Open Charge Point) protocol.

Case Study: IBIL

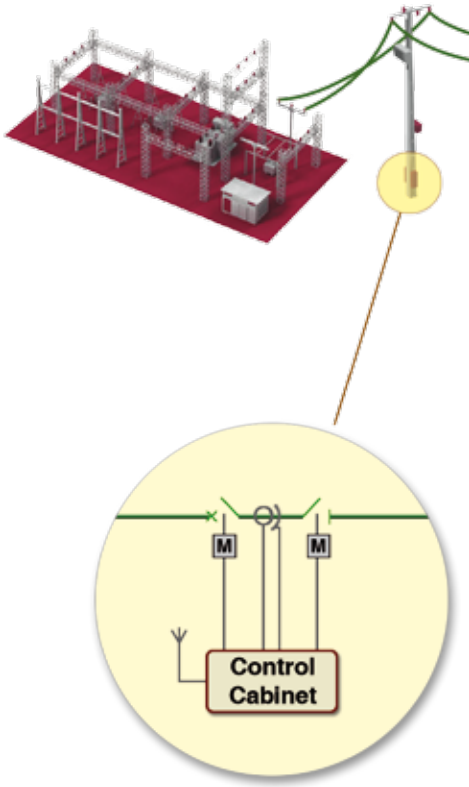
CG Automation has provided different kind of EV charging stations to IBIL. A company which offers electrical mobility services by providing and managing a recharging infrastructure for electrical vehicles.

- *PRV - WALL BOX.*
- *PRV - OUTDOOR to suit outdoor and street parking applications.*

5

GRID AUTOMATION FOR OVERHEAD MV LINES

Outdoor smart control cabinets enable both local actuation over OCR elements and remote control from the system control center via wireless connectivity and control protocols. Battery management and operation support is also available.



In order to improve the operational efficiency and reliability of the overhead MV distribution grids, utility companies need to consider automation solutions for the switch disconnectors as well as circuit breakers. These type of solutions allow to divide MV lines into several sections, and provide the capability to insulate the faults automatically or via remote control.

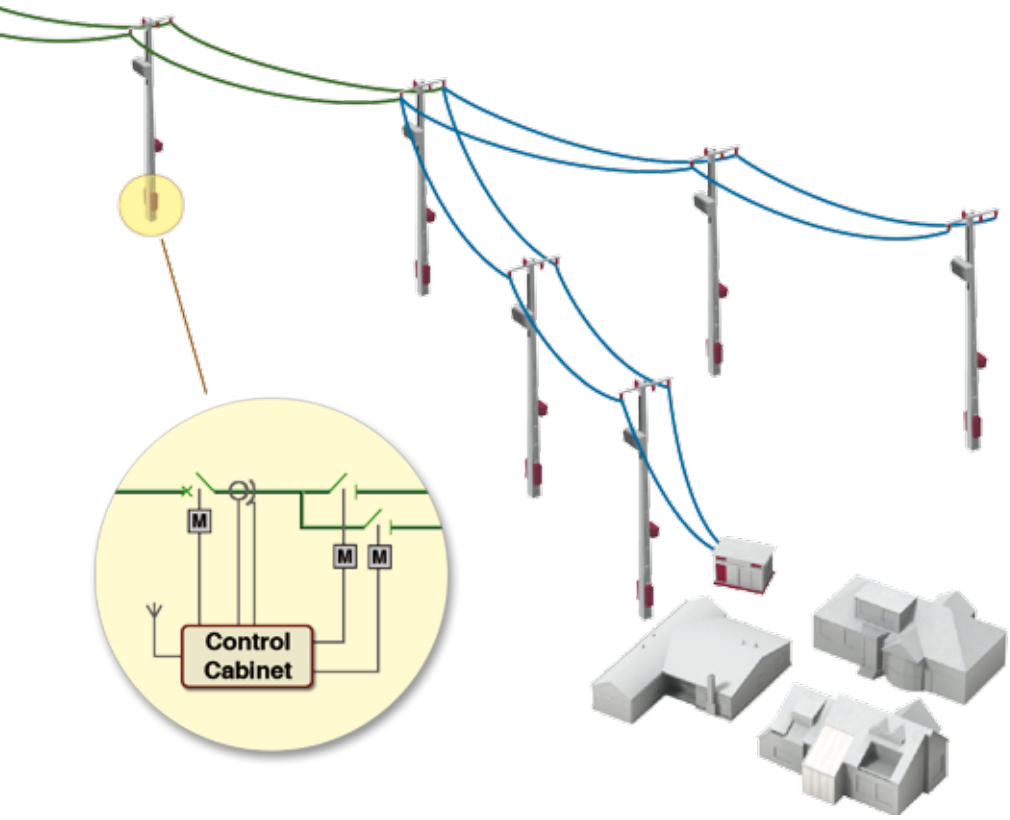
CG has, among its system solutions, two alternatives:

- **Full advanced OCR** with integrated control functions for new distribution lines.
- A reliable **Intelligent Control Cabinet** in order to implement retrofit projects with new advanced functions.

Intelligent Control Cabinets enable monitoring and automation solutions for overhead MV grids.

This solution can be integrated with hand operated or motor operated switch disconnectors as well as circuit breakers (OCR). They are full factory tested.

APPLICATION



Benefits

- Full integration of overhead distribution MV lines management.
- Fast location of faults based on directional algorithms and remote control in order to implement MV grid reconfiguration.
- Improve the IEEE reliability indexes (SAIFI and SAIDI).
- Quick and easy installation (plug & play). Full factory tested and configured systems.
- Flexible solutions with configurable functionalities.

Key features

- Local and remote control.
- Protection and auto-reclosing.
- Reduction of response time to faults, thus improving the provision of customer services.
- Accurate fault location in medium voltage grids.
- Fault oscillographic recorders.
- Battery and power supply management.
- Monitoring of power quality measurements.
- Control protocols available: IEC 104, DNP 3.0 (IP), Modbus, others.
- Secure communication with private VPN and firewall.
- High level management based on web server, web services and/or Workbench application.

OCR Protection Relay plus RTU

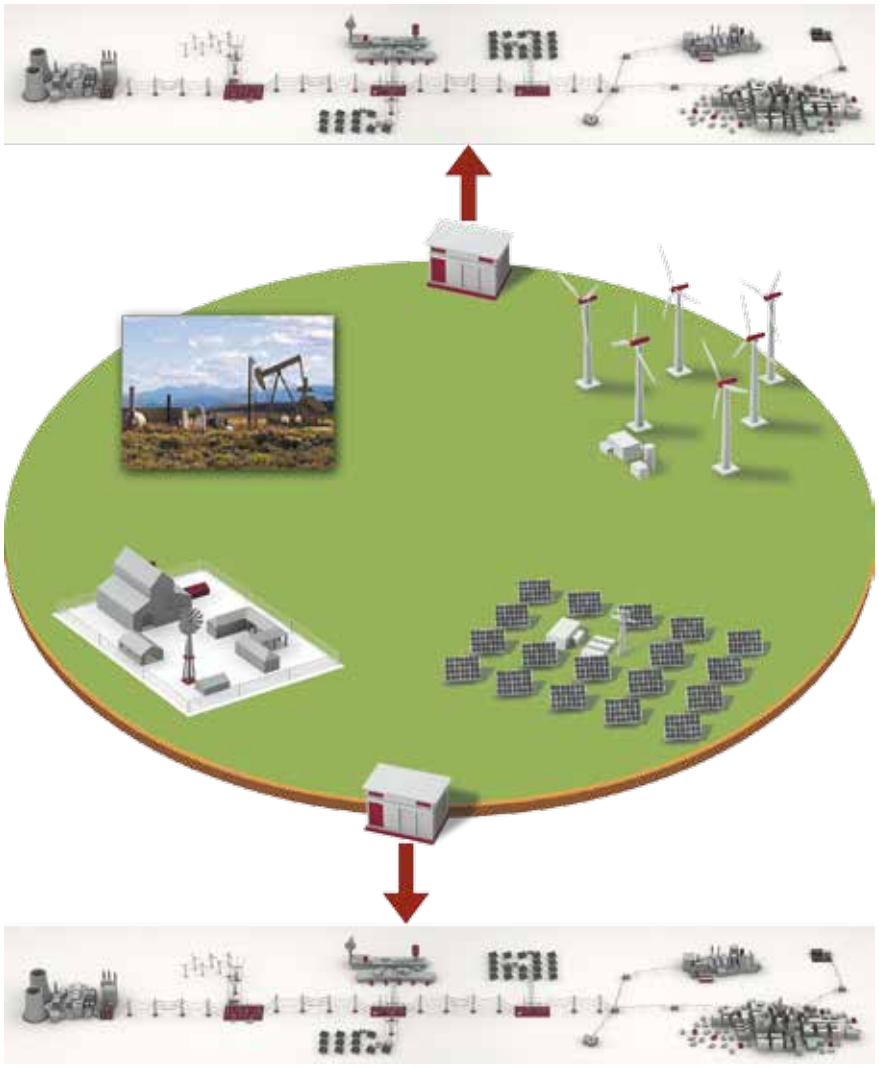
Protection relay for OCR elements with RTU functionality and local HMI. Directional protection units and autoreclosing function included .

Industrial Gateway

Industrial gateway with Cellular (GPRS / 3G) interface. It is possible to implement a private VPN via IPsec tunnels integrating the MV circuit breakers into the customer network.

6

MICROGRIDS



In the last decades, the classic one-direction scheme for energy generation-transport-consumption has been deeply modified by the emergence of Distributed Energy Resources (DER).

Microgrids are the technological core of this new scenario.

Within the Microgrids, there are both distributed generation resources (wind, solar or gas pumps) and consumption of own facilities. Furthermore, this type of installations can be connected with the conventional distribution grid of an utility company. Internally, the Microgrid includes elements of a real distribution grid, such as switchgears, remote control systems, compact secondary substations or a control center.

CG has a full set of intelligent solutions in order to transform these facilities into real Smart Microgrids, with remote controlled devices, AMI solutions and an small office. SCADA

These systems are usually solar or wind generation facilities as well as private grids such as mining or oil facilities.

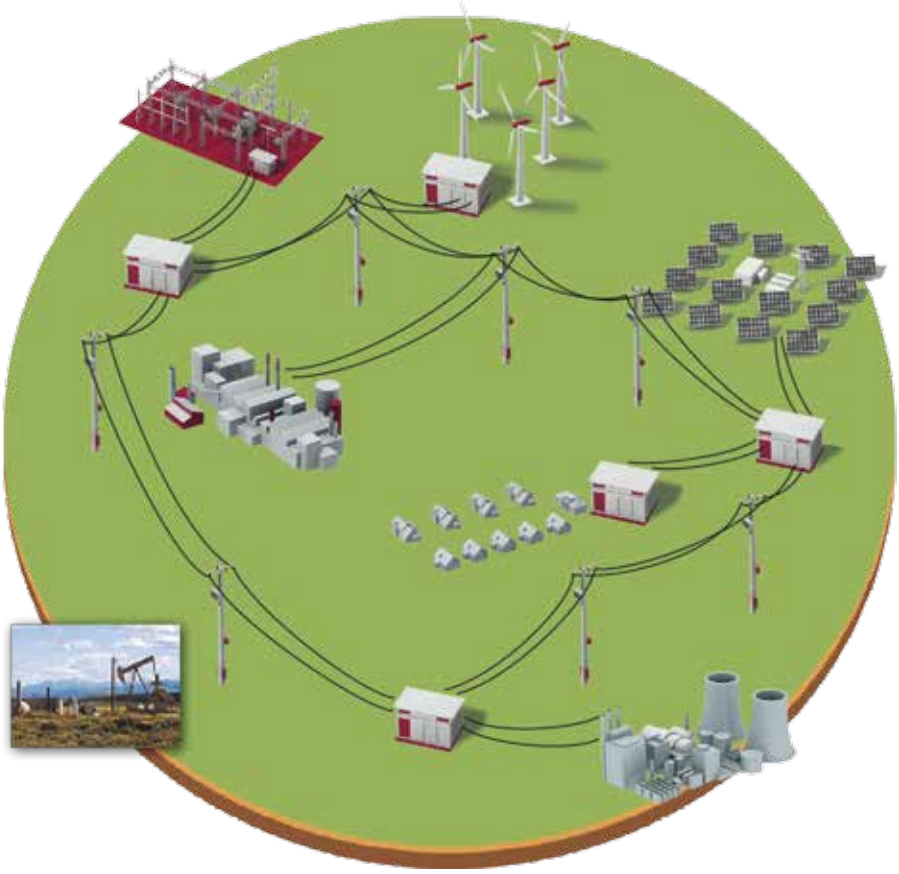
In order to implement and manage a Smart Microgrid in these scenarios, it is necessary to have available accurate control methods over the generated power and the distributed loads in the installation. It is possible to re-configure the grid through remote control, taking into account different variables, such as production costs, fault events or external grid conditions (i.e. islanding).

All the distributed information will be processed by the control centre, that will be able to perform autonomous decisions based on the customer defined policies.

There are different options for the communication between the different nodes of the microgrid and the control centre such as cellular or PLC-based technologies.

Depending on overall Power Quality policies and the global costs, load shedding and OLTC mechanisms can be automated with these solutions.

FLEXIBLE SOLUTIONS TO FIT YOUR NEEDS



Key features

- Smart and flexible automation and monitoring of the MV distribution lines within the Microgrid.
- Optional Small CG Scada System optimized for microgrids.
- Management of Power Quality of the overall system via the individual OLTC control or Static VAR compensation systems.
- Automated management of load disconnections.
- Reduction of fault response times, thus improving customer service.
- Secure remote communications with private VPN and firewall.

Benefits

- Energy efficiency managing local generation, storage, loads and grid connectivity.
- Flexible and reliable management of islanding conditions in microgrids with DER available.
- Distributed Energy Resource (DER) and energy storage integration. When one DER goes down, the microgrid can reduce load in other locations and utilize other DERs to adjust for the electricity generation capacity loss and thus stabilize the microgrid.
- Power quality. Microgrid controllers monitor the power quality and can provide command and control authority to dispatch generation assets as appropriate to maintain the quality of power within a set range.

Automatized Ring Main Units and Reclosers

AMI Solutions and RTU

Smart Secondary Substations

CG Small Office SCADA

Smart solutions,
Strong relationships.

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