Fabrizio Ferrari
Getra – Italy
fabrizio.ferrari@getra.it

Ludovica Zigon
Getra - Italy
ludovica.zigon@getra.it

Francesca Pelizzola
Getra – Italy
francesca.pelizzola@getra.it

# A DREAM ABOUT LOW CARBON MANUFACTURING PLANT BECOME REAL

## G.R.E.A.T. PROJECT (GETRA RESEARCH FOR ENERGY AND TECNOLOGY)

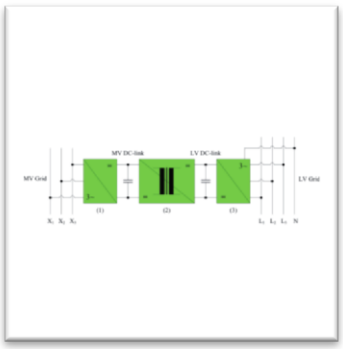
Getra Distribution is a dedicated factory of **Getra Group S.p.A.** (Italian manufacturer of Large, Medium, Distribution Transformers and Reactors), in charge about design, manufacturing and testing on Medium/Low Voltage Distribution transformers, for the Italian and foreign markets.
Getra Distribution is located in Pignataro Maggiore (CE) Italy, with annual production capability of around 10000 unit / year.
Within the activities of the Research and Development finalized to a low carbon economy through smart grid distribution, the employment of electrical components and innovative systems optimally managed, was decided that the Getra Distribution shall become a "research laboratory" in real scale.
This research project is carried out in co-operation with the **University of Naples Federico II**.
In the report are described the different phases of the project, the goals to be achieved and the criteria by which it will be analysed and evaluated the results actually achieved compared to those provided by the simulations.

1) Production of energy from renewable sources

2) Storage systems

3) Aggregators of "plug in" vehicles

4) Electronic transformers

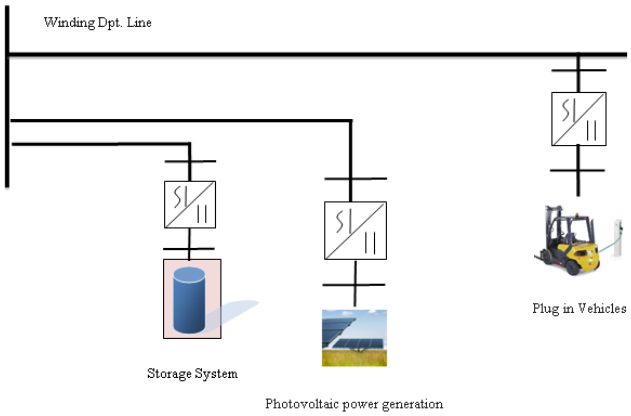


## INNOVATIVE TECHNOLOGIES FOR SMART GRID (FACTORY GETRA DISTRIBUTION - PIGNATARO MAGGIORE - CE)

The plant Getra Distribution of Pignataro Maggiore becomes a "research laboratory" where is experienced functional integration of different technologies at the forefront of Smart Grid.
In this project is foreseen to power the factory by a photovoltaic plant and a wind farm, equipped also with storage systems with distribution network inside (in continuous and alternate current) for feeding the different departments.
The different departments such as winding, mechanical, assembly department, etc., in which the processes are highly robotized, form an "islands" with different characteristics and different load diagrams between them.
Precisely for this reason the plant is a miniature world where different users implement and experiment the total management of an electrical system from the generation to the distribution and taking into account an optimal scheduling of loads.
On each of the four lines (Winding Dpt., Mechanical Works, Assembly, Testing Room) is experimented a different technology:

### Winding Dpt.: Integrated system "Photovoltaic - Electric Storage" for load levelling

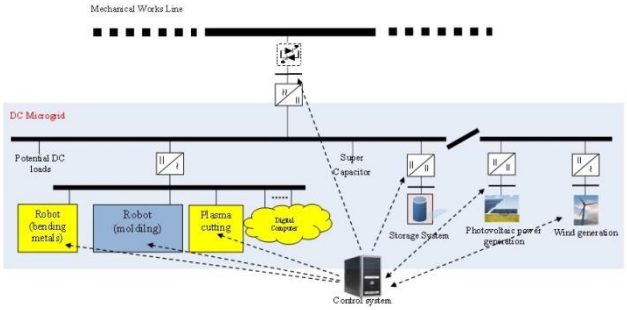
It levels the load diagram around an optimum value with resulting reduction of the peak values obtained from the network.
The management is based on a two-step procedure: 1 - phase of "scheduling" (prior day), 2 - phase of "operation" (real time).
In both phases are applied: a) techniques for "forecasting" the short and very short term (advanced neural networks and / or Bayesian methods), b) methods for nonlinear constrained optimization.




Winding Dpt. Line

### Mechanical Works: microgrid continuous current for powering to sensitive loads with high quality and continuity

The DC network allows you to efficiently integrate energy sources that produce electricity in DC current and AC current.
The direct supply of DC loads and AC loads through DC / AC converters provides continuity and a better quality of the waveform of the voltage.
The operation of the microgrid is optimized both in "grid connected" than in "stand alone".
The management (optimal) of the loads and of the storage is performed on the basis of the forecast of the power generation.

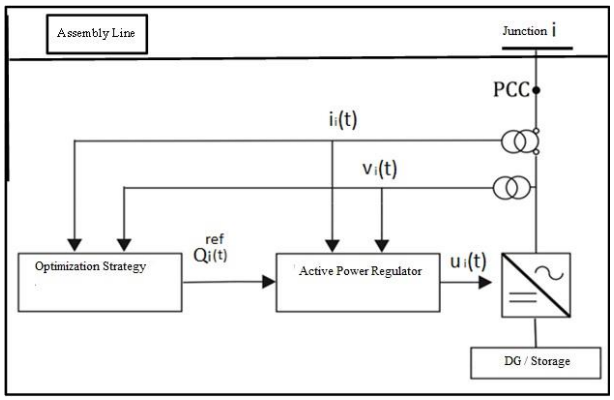



Mechanical Work Line

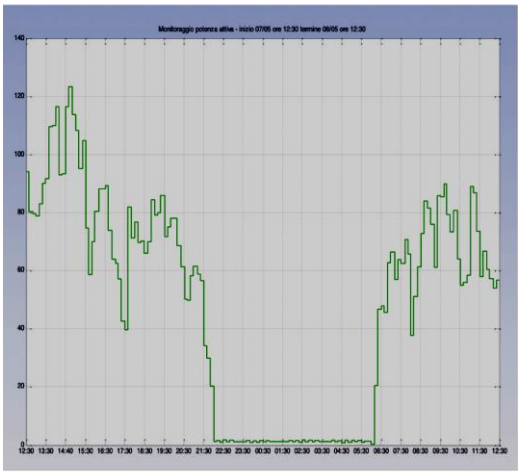
### Assembly: decentralized control of a photovoltaic system or a system of electric storage

Use only the measurements of local voltage and current (at the connection point of the GD or the storage system to the feeder).
It is based on a fully decentralized approach which does not require communication with other control systems in the distribution network.
Allow to identify the switching from conditions of parallel to operation conditions in island.
Strategy is applied to optimization of three steps:

1) it is estimated the Thevenin equivalent seen from the point of connection of the device (GD or accumulation)
2) are evaluated the load conditions and the voltages profile of the feeder
3) Minimizes the feeder losses, with respect to constraints on the voltages in the junction




Assembly Line



Field measurement and first analysis

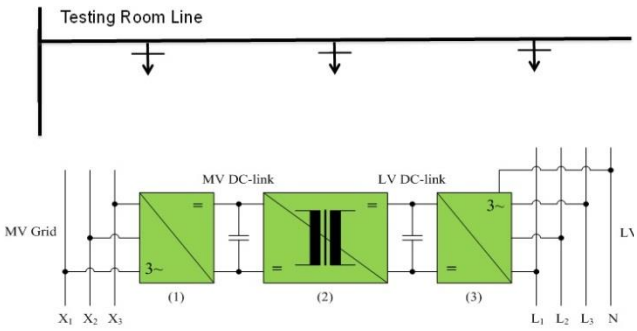
## Testing Room: electronic power transformer

The electric variables input and output to the structure are adjustable, with the possibility, therefore, input, to perform services of "support" to the MV network (eg, the supply of reactive power) and, in output, to ensure high levels of quality and continuity to the loads supplied.

It has a significant flexibility in the feeding of loads, due to the presence of a 'section' in DC, which you can easily connect advanced systems of storage.

It has the decoupling between the input and output voltages, so being able to avoid the propagation of faults and noise between the interconnected networks.

It's marked by a high power density and small size.



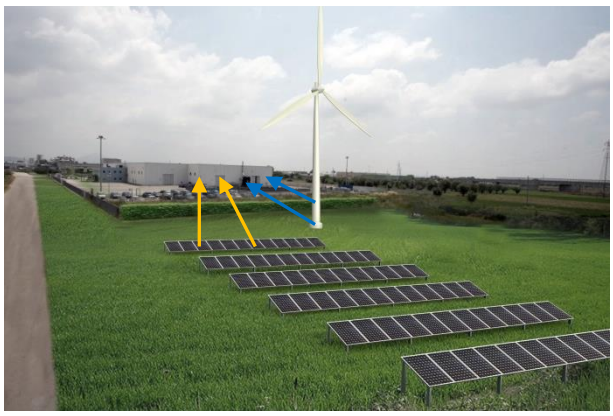

Testing Room Line

**Attached:** pictures of Getra Distribution Plant, subject of the activity of research, shown in Pic. 1 ÷ 4 its renewable energy sources in view of a low carbon economy.

Pic. 1

Pic. 3

Pic. 2



Pic. 4