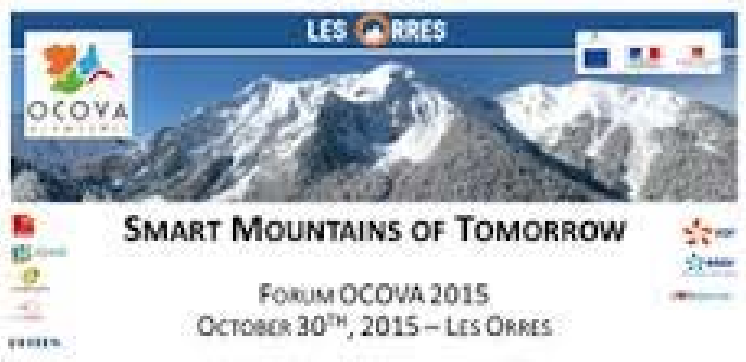
Smartgrid/microgrid experience in Liguria

Daniele D. Caviglia

Department of Electrical, Electronic and Telecommunication Engineering, and Naval Architecture

University of Genoa, Italy



DITEN

UNIVERSITÀ DEGLI STUDI DI GENOVA

DITEN-IEES

Intelligent Electric Energy Systems Lab

stefano.massucco@unige.it

OCOVA
ALPMEDNET

SmartGen:

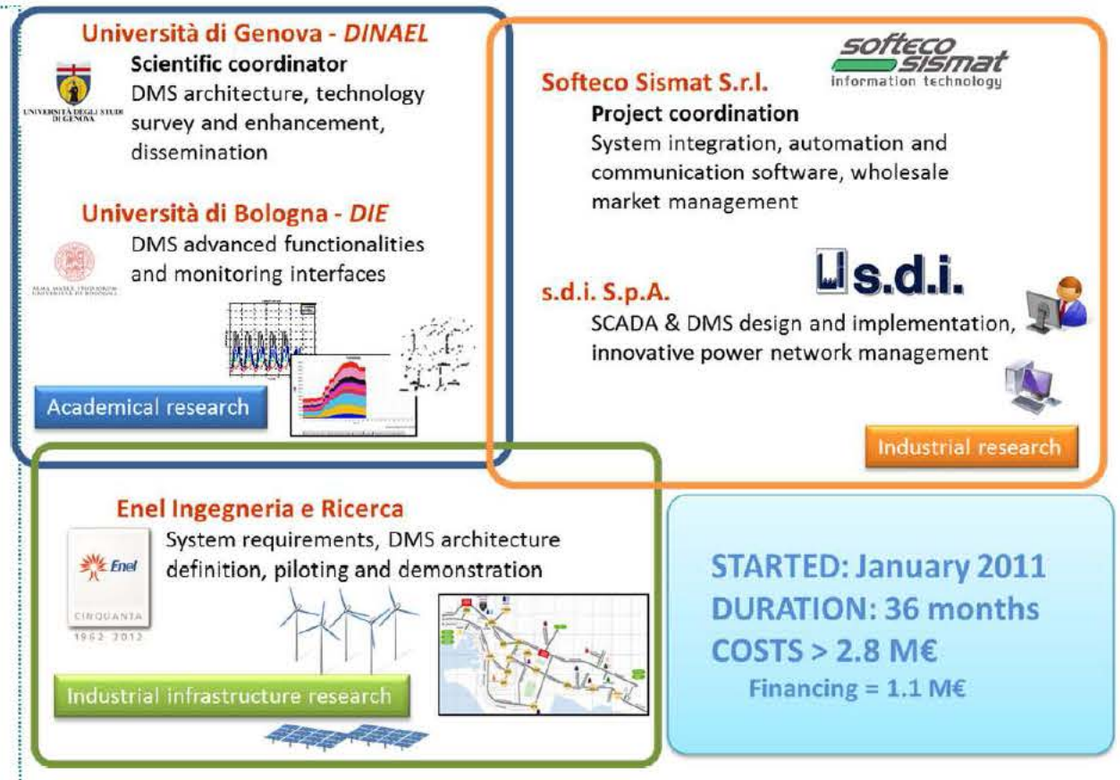
Innovative tools for the management of electrical distribution grids with renewable generation sources

SmartGen develops and provides enabling technologies for active distribution networks Generation/Load Management/Storage

Development of a advanced DMS (aimed at future scenarios of the electricity market), Grid control/Energy balancing

Experiments on real test sites

- AMAIE (Sanremo)
- Economics School (University of Genova)
- ENEL (Livorno experimental area)



A project funded by
MSE – Ministry of Economic Development

UNIVERSITÀ DEGLI STUDI
DI GENOVA

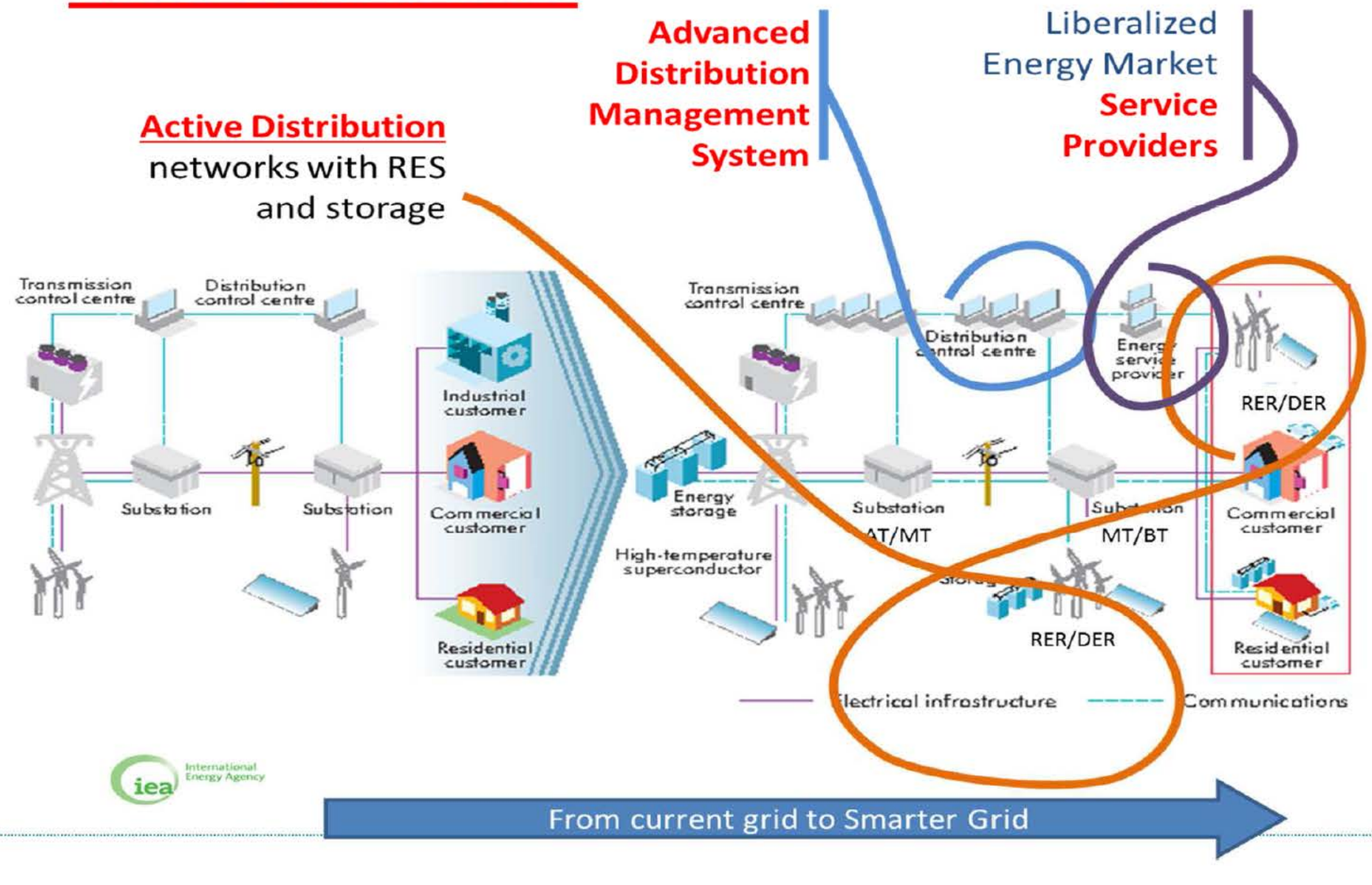
DITEN-IEES

Intelligent Electric Energy Systems Lab

stefano.massucco@unige.it

OCOVA
ALPMEDNET

Action Areas



UNIVERSITÀ DEGLI STUDI
DI GENOVA

DITEN-IEES

Intelligent Electric Energy Systems Lab

stefano.massucco@unige.it

OCOVA
ALPMEDNET

Analyzing scenarios of smart grids and active interaction with the electricity market

- with distributed generation (DG) and storage with the possibility of load control
- to identify main technical and economical constraints
- to define future actors (aggregators, price signals, active demand management)

Defining and implementing the architecture of innovative Distribution Management System

- Interfacing to data acquisition systems and SCADA (Supervisory Control And Data Acquisition)
- State estimation and simulation scenarios
- Management of optimization problems, control of power flow, voltage and supply of ancillary services from DG, and load dispatch
- Study of different distribution management modes: normal (system interconnected to the main distribution network), dysfunctional, and/or emergency mode (islanding)

Demonstrating features and benefits in real user cases

- Definition of complex reference scenarios
- Validation of real network functional efficiency
- Integration of real networks and simulation in pilot sites

UNIVERSITÀ DEGLI STUDI DI GENOVA

DITEN-IEES

Intelligent Electric Energy Systems Lab

stefano.massucco@unige.it

OCOVA ALPMEDNET

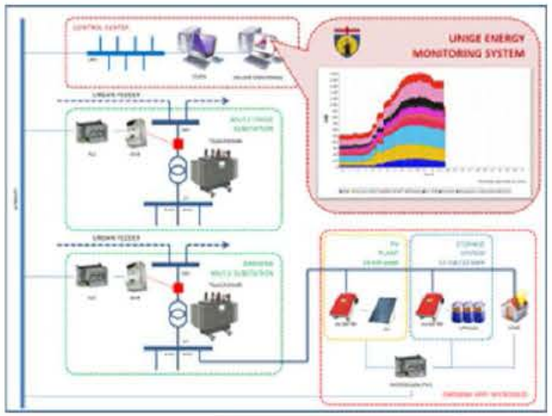
VPP – University of Genoa experimental micro-grid

University experimental micro-grid

- Generation and network components
- 19,74 kW PV plant
- Bidirectional inverter (10kW-12kVA) with batteries control system (storage system lithium-ion battery: 4 modules (2,2 kW-48 V))
- Controllable resistive – inductive load (10 kW – 12 kVAr) for islanding scenarios (storage + PV+ load)

Data Acquisition System

- Monitoring system for generation and weather data acquisition (radiation, ambient temperature, retro-module temperature)
- Acquisition system for electrical variables (voltage, current, power, frequency, SOC) with sampling values per second
- Indipendent acquisition channels (for storage, PV and PCC) and transmission over LAN on University network.
- Development of Mixed-Integer algorithms



Other significant site with PMU and smart meters installation. This site is located in Sanremo (AMAIE)

UNIVERSITÀ DEGLI STUDI
DI GENOVA

DITEN-IEES

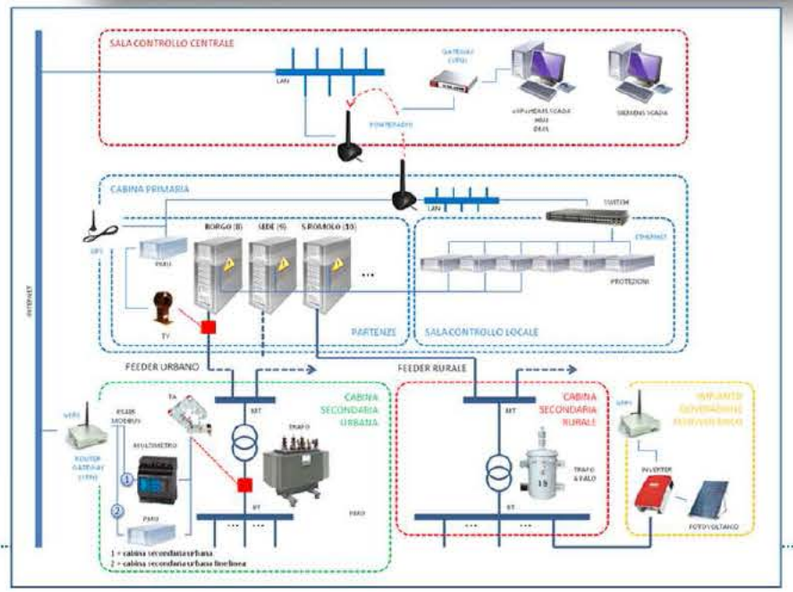
Intelligent Electric Energy Systems Lab

stefano.massucco@unige.it

OCOVA
ALPMEDNET

Real Distribution Network test case

- a primary HV/MV substation supplying urban and rural users
- 2 x 40 MVA Transformers
- **10 MV feeder MT** radially operated
- **~115Km MV lines** (cables and overheads lines)
- **~ 200 Secondary MV/LV substations** 15/0,4 kV
- **~30.000 users** (27.000 domestic, 15 industrial, 3.000 others)
- **~50 PV** plants:
  - 1 x 470 kW at MV, 10 x (10-100 kW) at LV



UNIVERSITÀ DEGLI STUDI
DI GENOVA

DITEN-IEES

Intelligent Electric Energy Systems Lab

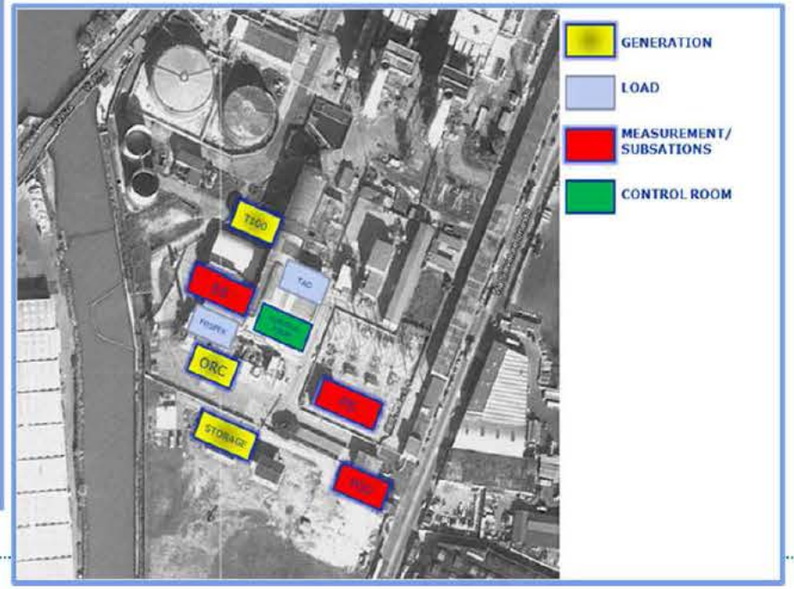
stefano.massucco@unige.it

OCOVA
ALPMEDNET

Experimental distribution network
Livorno Experimental Area

- **Main DMS SCADA functionalities**
  - Load/generation forecasting
  - Optimization of DER working point
  - Virtual islanding operations
- **Possibility of field tests with no impact on the DSO**
- **MV and LV internal network available**
- **Assets involved in SmartGen demo**

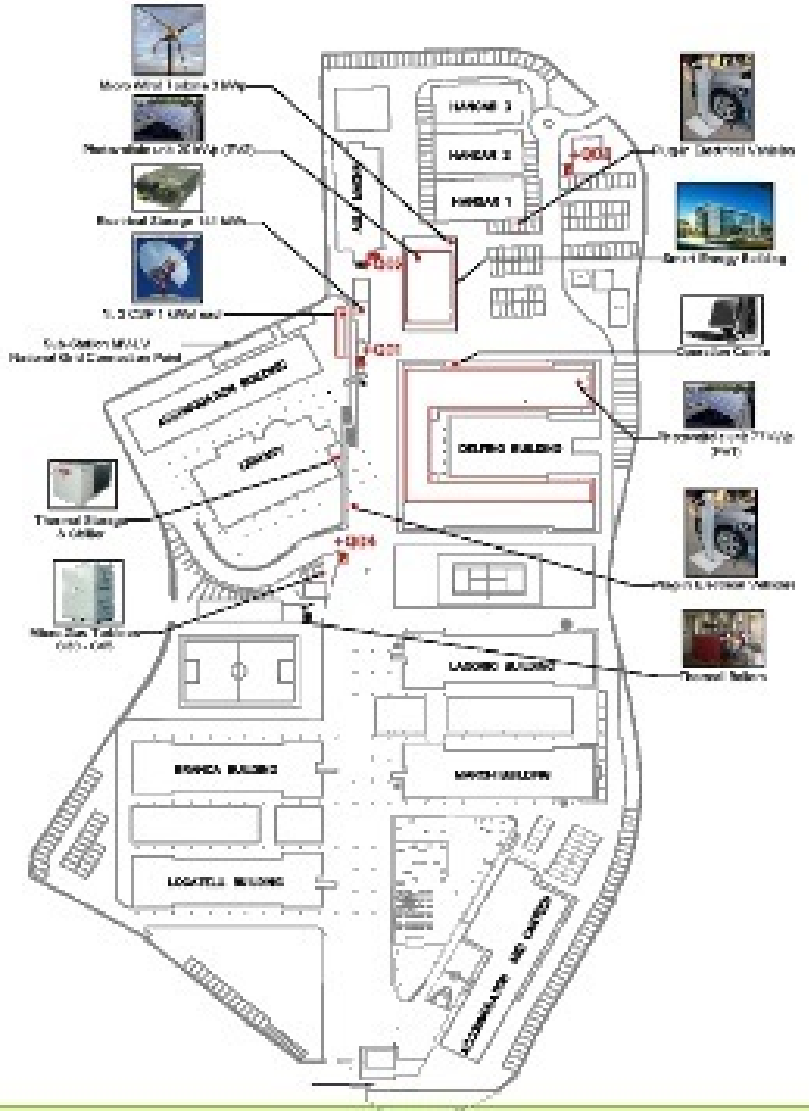
Area overview and main SmartGen Elements



Generation	Loads and Storage
• PV 20 kW	• Storage systems 90 kW
• ORC 500 kW	• water pumps 2x50 kW
• T100 100 kW	• fans 2x70, 50 kW
	• motors 120, 80 kW

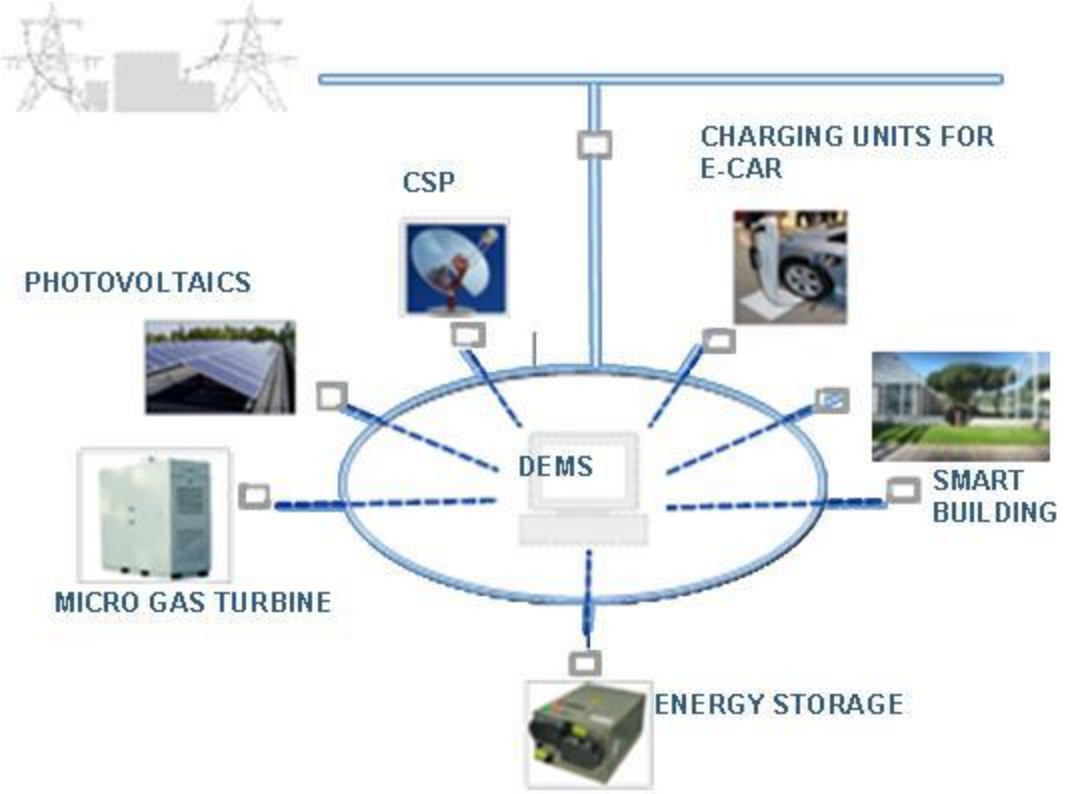
UNIVERSITÀ DEGLI STUDI
DI GENOVA

N.I.C.E.S. - LAB
Network Infrastructures &
Complex Electrical Energy Systems



Smart Polygeneration Microgrid

in the Savona Campus of the University of Genoa


CHARGING UNITS FOR E-CAR
CSP
PHOTOVOLTAICS
DEMS
SMART BUILDING
MICRO GAS TURBINE
ENERGY STORAGE


ENERGIA 2020
UNIVERSITÀ DEGLI STUDI DI GENOVA
In cooperation with
SIEMENS
Innovative Technology Project
Smart Polygeneration Microgrid
SIEMENS
ENERGIA 2020
SIEMENS

Thank you!

OCOVA
ALPMEDNET