

SmartGen:

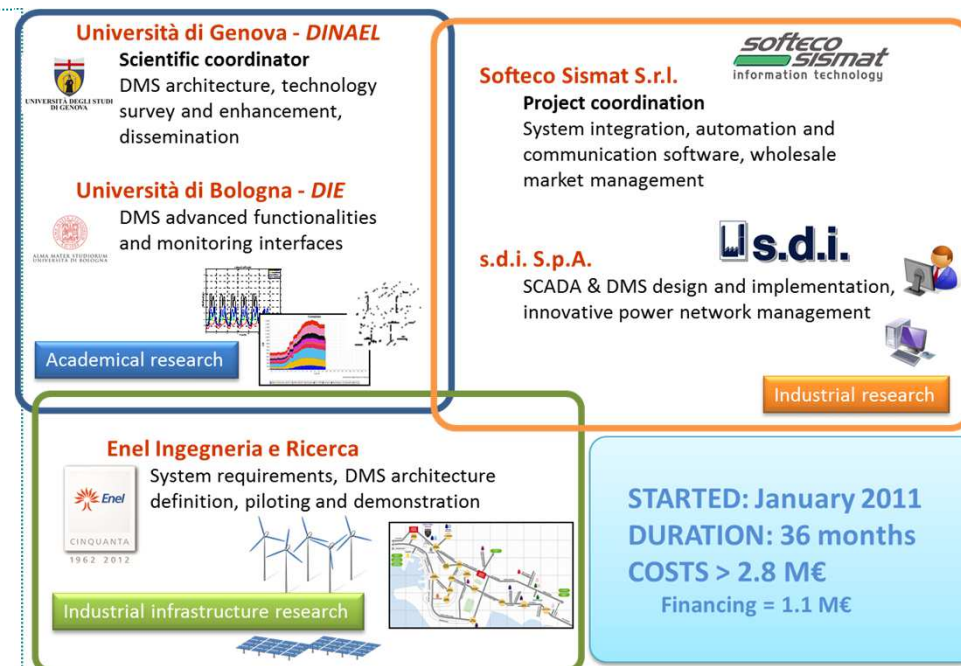
Innovative tools for the management of electrical distribution grids with renewable generation sources

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

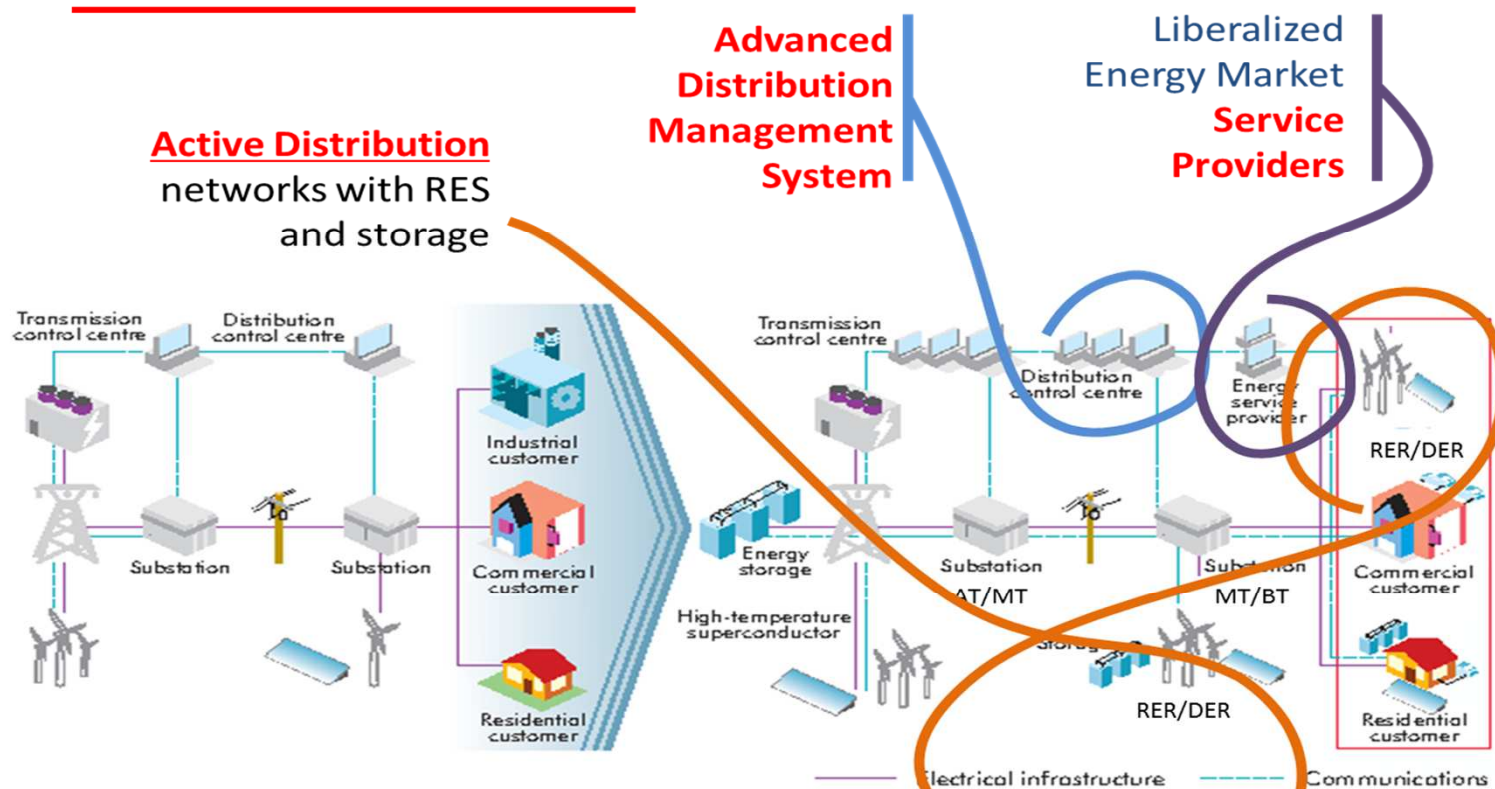
Experiments on real test sites

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



A project funded by
MSE – Ministry of Economic Development

Action Areas



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

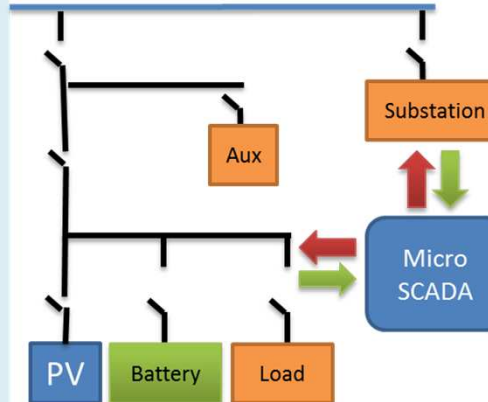
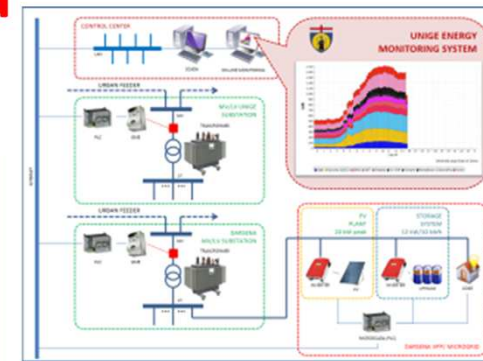
VPP – University of Genoa experimental micro-grid

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

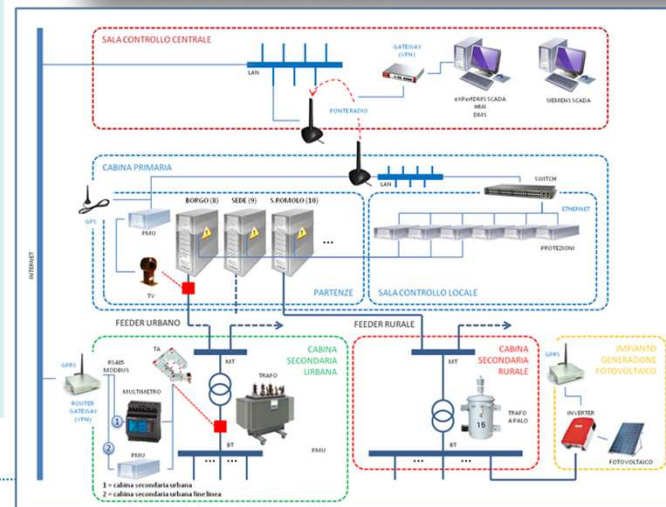
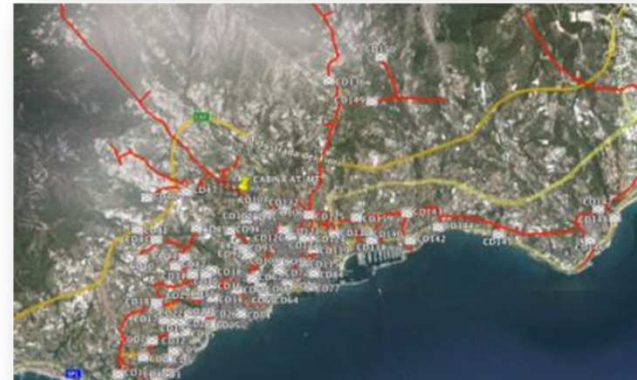
- **Monitoring system** for generation and weather data acquisition (radiation, ambient temperature, retro-module temperature)
- Acquisition system for electrical variables (voltage, current, power, frequency, SOC) with sampling values per second
- Independent acquisition channels (for storage, PV and 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)

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



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**

Generation

- PV 20 kW
- ORC 500 kW
- T100 100 kW

Loads and Storage

- Storage systems 90 kW
- water pumps 2x50 kW
- fans 2x70, 50 kW
- motors 120, 80 kW



Area overview and main SmartGen Elements

