



UNIVERSITÀ DEGLI STUDI
DI GENOVA



OCOVA AlpMedNet FORUM
GENOVA / GÊNES
VILLA CAMBIASO
5-6 GIUGNO/JUIN 2014

THE SAVONA CAMPUS (University of Genova) SMART POLIGENERATION MICROGRID

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Test-bed facilities, research activities and projects.

The Savona Campus test-bed facilities (Smart Polygeneration Microgrid, Sustainable Energy Building) on sustainable power systems are here presented, with specific reference to the interdisciplinary research team, related projects/activities, and collaborations with Sustainable Energy Innovation Pole, University of Genova, Savona Municipality, IPS, and other actors/industries.



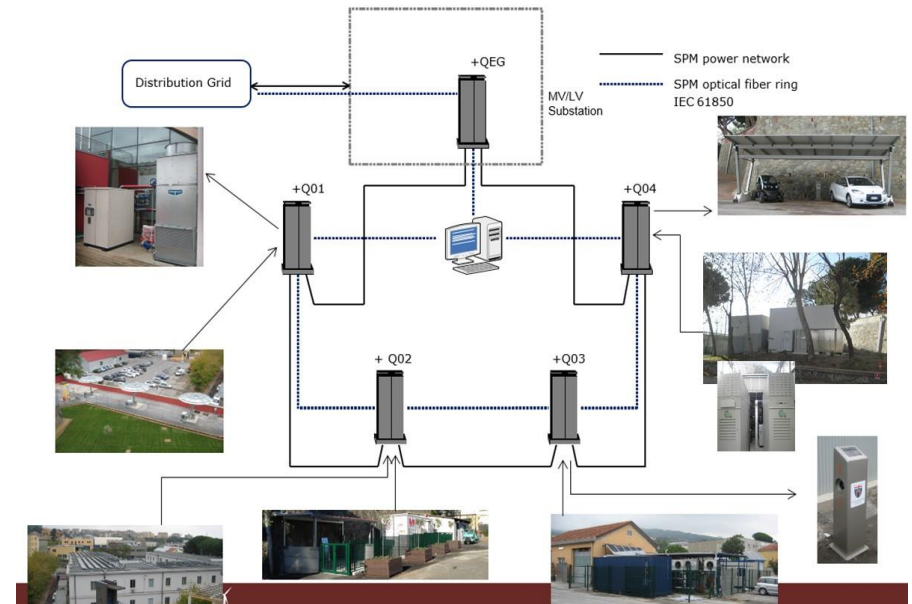
The Savona Campus: a R&T facility of the University of Genoa

- 50,000 square meters
- courses from the Faculties of Engineering, Medicine, and Media Sciences
- laboratories, research centers and private companies (several operating in the environment & energy field)
- library, residences, canteen, café, etc...



The Smart Polygeneration Microgrid (SPM) Project

- Special project in the energy sector funded by the Italian Ministry of Education, University and Research (amount 2.4 M€)
- Owner: University of Genova
- SPM is a 3-phase low voltage (400 V line-to-line) “intelligent” distribution system running inside Savona Campus and connecting:
 - CHP Gas Turbines fed by natural gas;
 - 1 PV field (80 kWp);
 - 3 CSP equipped with Stirling engines (3 kWe; 9 kWth);
 - 1 absorption chiller with a storage tank;
 - 1 electrical storage: batteries (100 kWh)
 - 2 charging stations.
- Optical fiber ring IEC 61850



The Smart Polygeneration Microgrid (SPM)
Project



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Main goals:

- to build a R&D facility test-bed for both renewable and fossil energy sources
- to promote joint scientific programs among University, industrial companies and distribution network operators
 - ✓ **Day-ahead production scheduling of dispatchable sources and storage exploiting renewables forecast and optimization techniques**
 - ✓ **Real time optimal control of production and storage systems**
- to optimize thermal & electrical energy consumptions, **minimizing the CO₂ emissions, annual operating costs and primary energy use of the whole University Campus**
- **To export the approach to wider areas and to interact with DSO and external loads**

Other projects:
Smart Energy Building (SEB) Project,
Smart Meter Project (to be developed with
Enel (DSO) and Siemens)



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- SEB: Special project in the energy efficiency sector funded by the Italian Ministry for Environment (amount 3.0 M€) (Geothermal heat pump, PV plant on the roof, Micro wind turbine)
- Smart meter project for Milan Expo 2015: Building Management System, Load Monitoring, Generation Monitoring



SPM & SEB inside the Savona Campus of the University of Genoa

- **SEB is an “active load” of the SPM**
- **SEB is an energy “PROSUMER”**

Research Activities, Innovation and Goals



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The research activity has the objective to develop methods and models for the sustainable planning and management of microgrids and smart grids (also including renewables and storage systems).

The following main interests can be listed:

- **Definition of policies and market strategies to integrate private microgrids in a District managed by a DSO (Distribution System Operator).**
- **Demonstration and application of demand response programs.**
- **Decision Support Systems.**
- **Optimization and control for planning and management purposes (applied to: polygenerative microgrids with renewables and storage systems, intelligent buildings, smart grids, interconnected microgrids, active demand management).**
- **Economic and environmental assessment (costs, energy and CO2 savings).**
- **Power systems modeling and stability.**

EU Projects



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Ongoing

“OPTIMising the energy USE in cities with smart decision support systems (OPTIMUS)” (FP7-SMARTCITIES-2013; Objective ICT-2013.6.4 Optimising Energy Systems in Smart Cities)

«coupling REnewable, Storage and ICTs, for Low carbon Intelligent Energy maNagementT at discript level «(RESILIENT); Call identifier: FP7-2012-NMP-ENV-ENERGY-ICT-EeB

Under evaluation

ISTORE “Intelligent Energy Storage for Business Models Development”-LCE8-Local/small energy storage

ROSE “Realtime Operational Smartgrid for Europe”-LCE7-Distribution Grid and retail Market

Recent Publications



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- S. Bracco, F. Delfino, F. Pampararo, M. Robba, M. Rossi. *The Smart Polygeneration Microgrid test-bed facility of Savona University Campus: the overall system, the technologies and the research challenges*, Renewable and Sustainable Energy Reviews (Elsevier), Volume 18, Pages 442–459, February 2013.
- F. Delfino, R. Minciardi, F. Pampararo, M. Robba. *A Multilevel Approach for the Optimal Control of Distributed Energy Resources and Storage*, IEEE Transactions on Smart Grid, to appear
- S. Bracco, F. Delfino, F. Pampararo, M. Robba, M. Rossi. A mathematical model for the optimal operation of the University of Genoa Smart Polygeneration Microgrid: Evaluation of technical, economic and environmental performance indicators, Energy, 2013, in press, available online, <http://dx.doi.org/10.1016/j.energy.2013.10.039>.
- Bonfiglio, F. Delfino, R. Procopio, R. Minciardi, M. Robba. A dynamic decision model for smart grid real time optimal control, Proceedings of IEEE ENERGYCON 2012.
- S. Bracco, F. Delfino, F. Pampararo, M. Robba, M. Rossi. *Planning and Management of Sustainable Microgrids: the test-bed facilities at the University of Genoa*, Proceedings of IEEE AFRICON 2013

Additional Information



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Thank you

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