Operational management of smart grids: the ROSE project and its application to Savona Campus

MAPS
SHARING KNOWLEDGE

campus savona

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DI GENOVA

Energy 20-20-20 (2010)

Energy Roadmap 2050

Kyoto Protocol

Incentives

Increment on the use of renewable resources and distributed generation

New Energy Management Systems (EMSs) for new grid configurations and actors are needed

ROSE

REALTIME
OPERATIONAL
SMART GRID FOR
EUROPE

PROJECT IDEA and POSSIBLE APPLICATION TO SAVONA CAMPUS

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ROSE **OBJECTIVES**

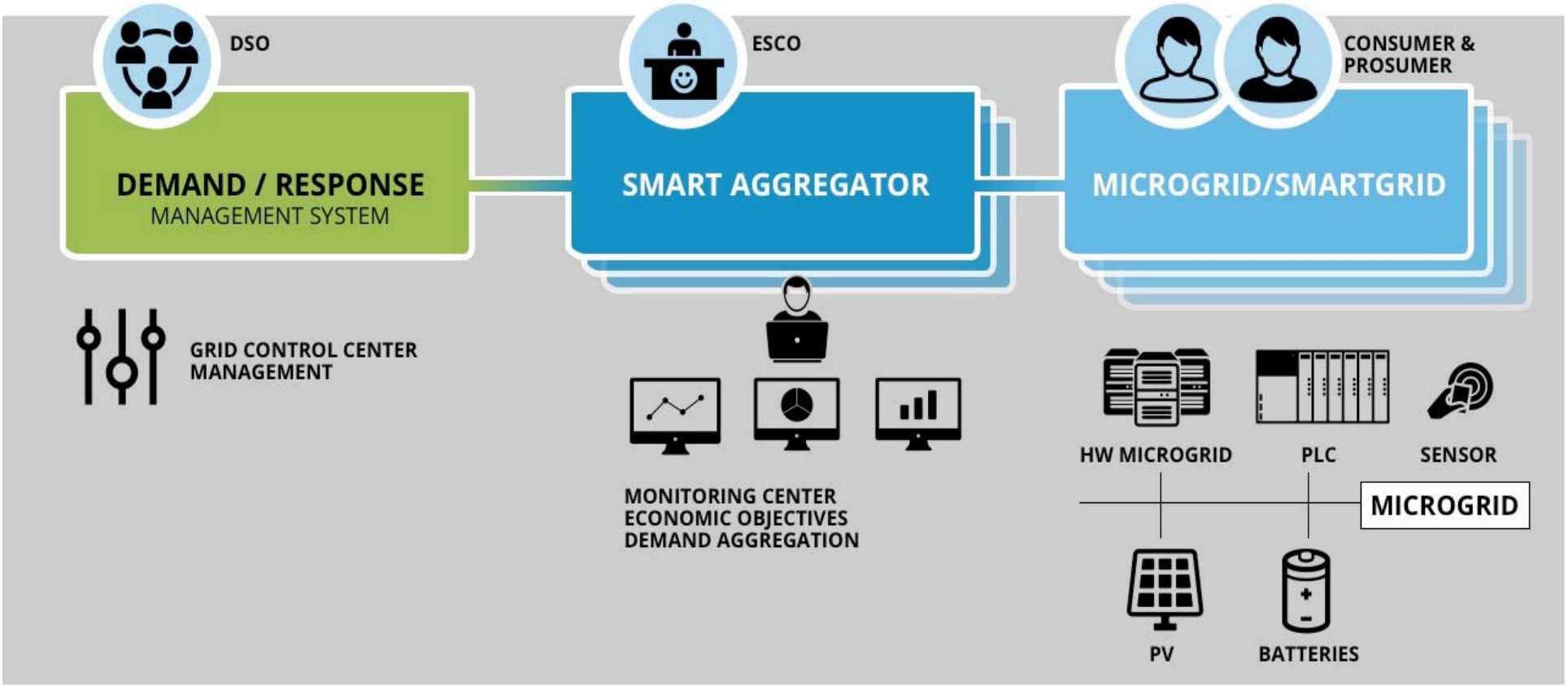
ROSE project is the technical and economic viability of intelligent Smart & Micro Grid nodes, interconnected with Smart Aggregator for global optimization as an effective way to implement an open, active demand/response system integrated with the Grid.

The system is based on 3 elements:

- **Micro-Grid/Smart-Grid**
- **Smart Aggregator**
- **DSO (Distribution System Operators) Integration**

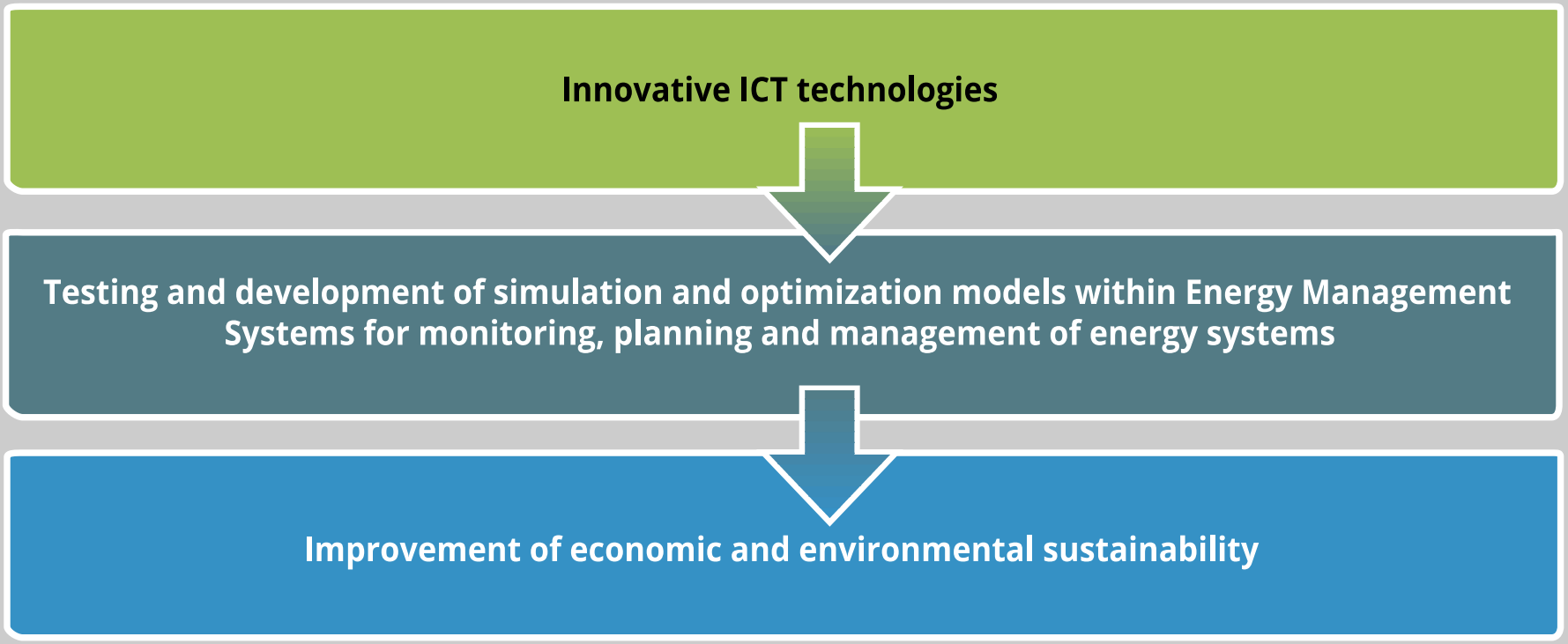
ROSE **ARCHITECTURE**

The overall architecture of the proposed system can be sketched as follows:



ROSE **CONCEPT & APPROACH**

ROSE project is based on the integration and development of advanced ICT tools that can provide the coordinated work of customers, aggregator and DSOs.



ROSE **CONCEPT & APPROACH (2)**

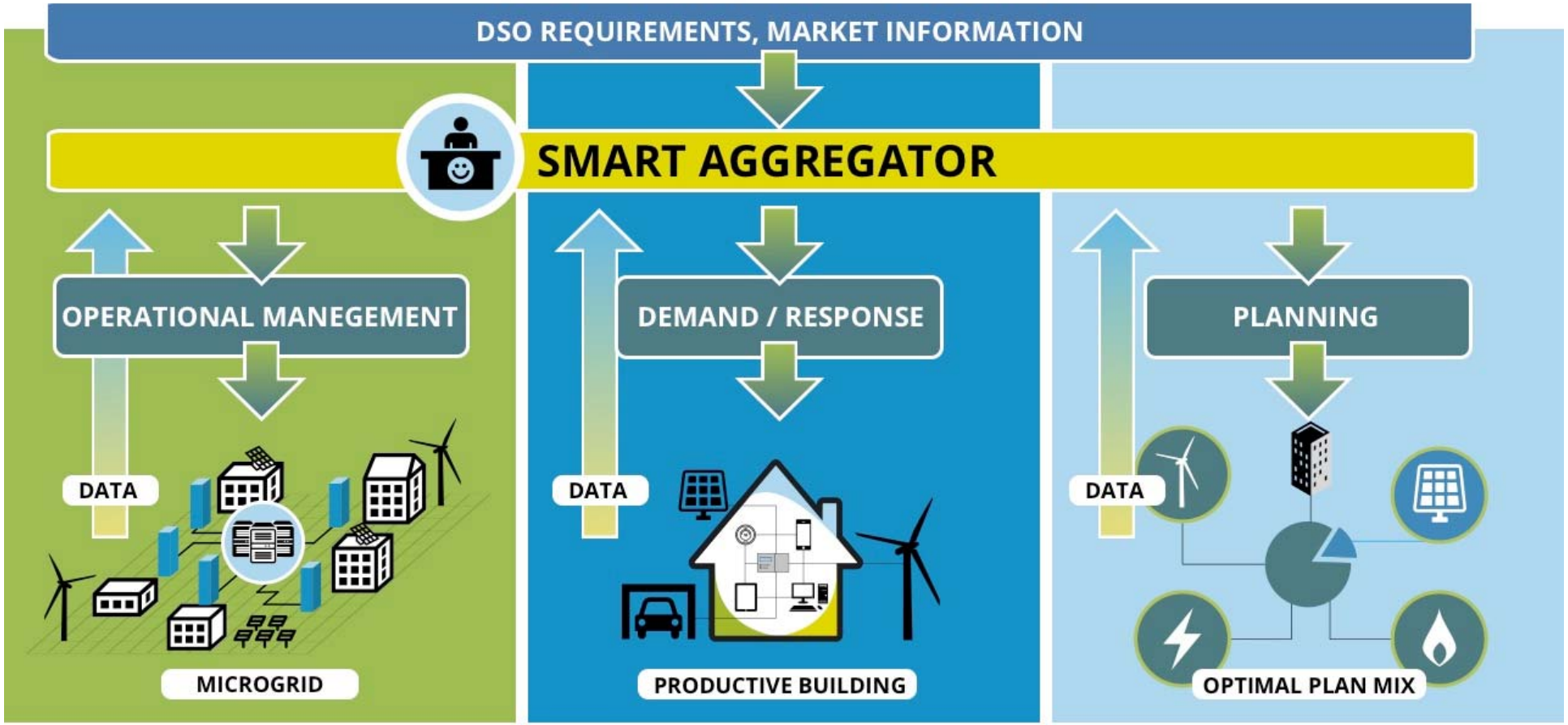
ROSE project optimize smart grids within three different levels:

1. **Micro-Grid/Smart-Grid**
   - **Data from Microgrid Operational Management**
   - **Data from Demand/Response Productive building**
   - **Data from Planning and Forecast**

2. **Smart Aggregator**

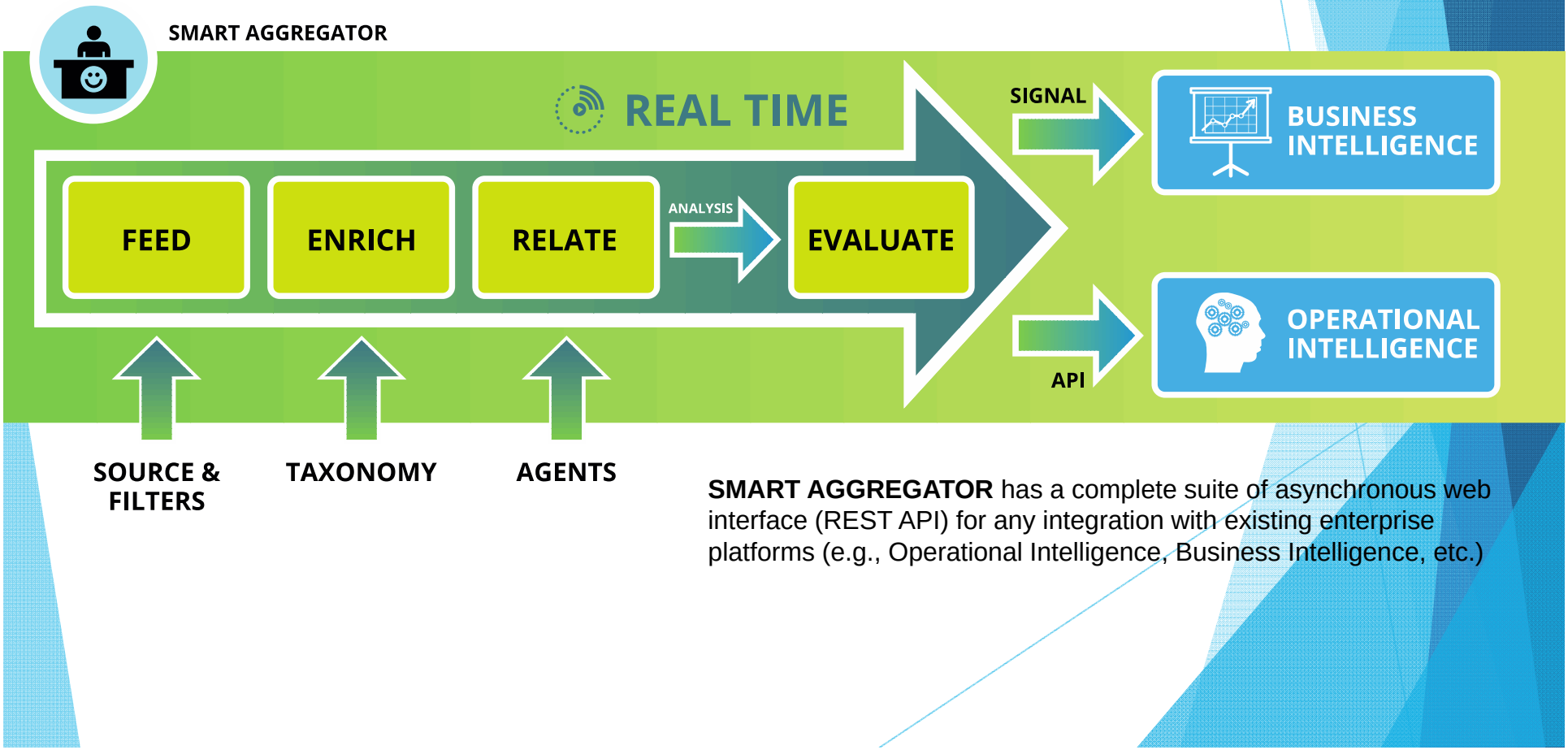
3. **DSO (Distribution System Operators)**
   - **Decision requirements**
   - **Market information**

ROSE **FUNCTIONAL VIEW**



ROSE **SMART AGGREGATOR** by MAPS SHARING KNOWLEDGE

SMART AGGREGATOR is a data platform with a fully-configurable ***Semantic Engine*** to analyze, measure and evaluate **Big Data** in **Real Time.**



SMART AGGREGATOR has a complete suite of asynchronous web interface (REST API) for any integration with existing enterprise platforms (e.g., Operational Intelligence, Business Intelligence, etc.)

ROSE **MAIN GOALS**

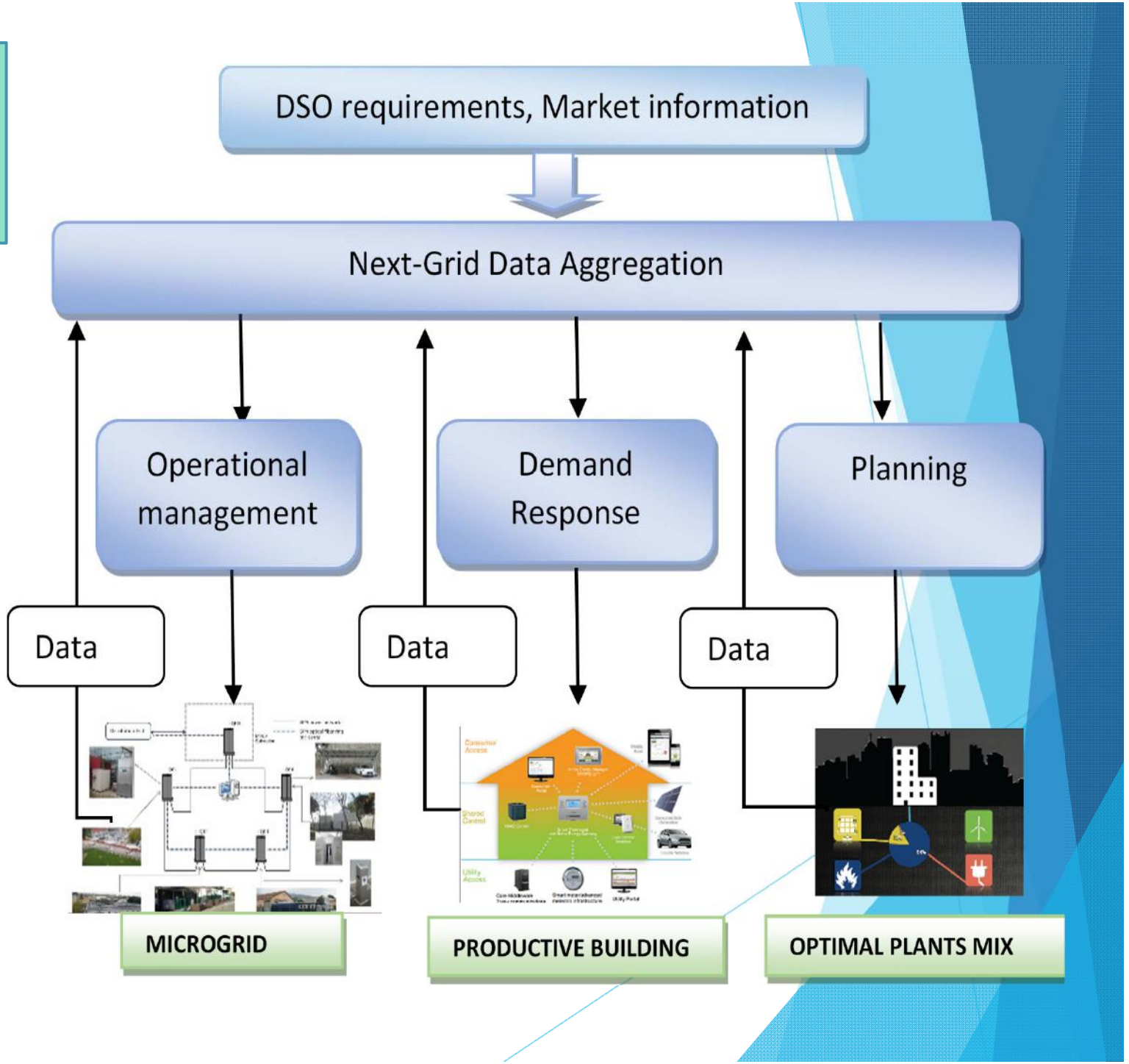
- **Day-ahead production scheduling of dispatchable sources and storage exploiting renewables forecast and optimization techniques**
- **Real time optimal control of production and storage systems**
- **Optimal thermal & electrical energy consumptions, minimizing the CO2 emissions, annual operating costs and primary energy use**

Possible case studies within a Campus

Microgrid at the Campus scale

Buildings

Inter-connected buildings

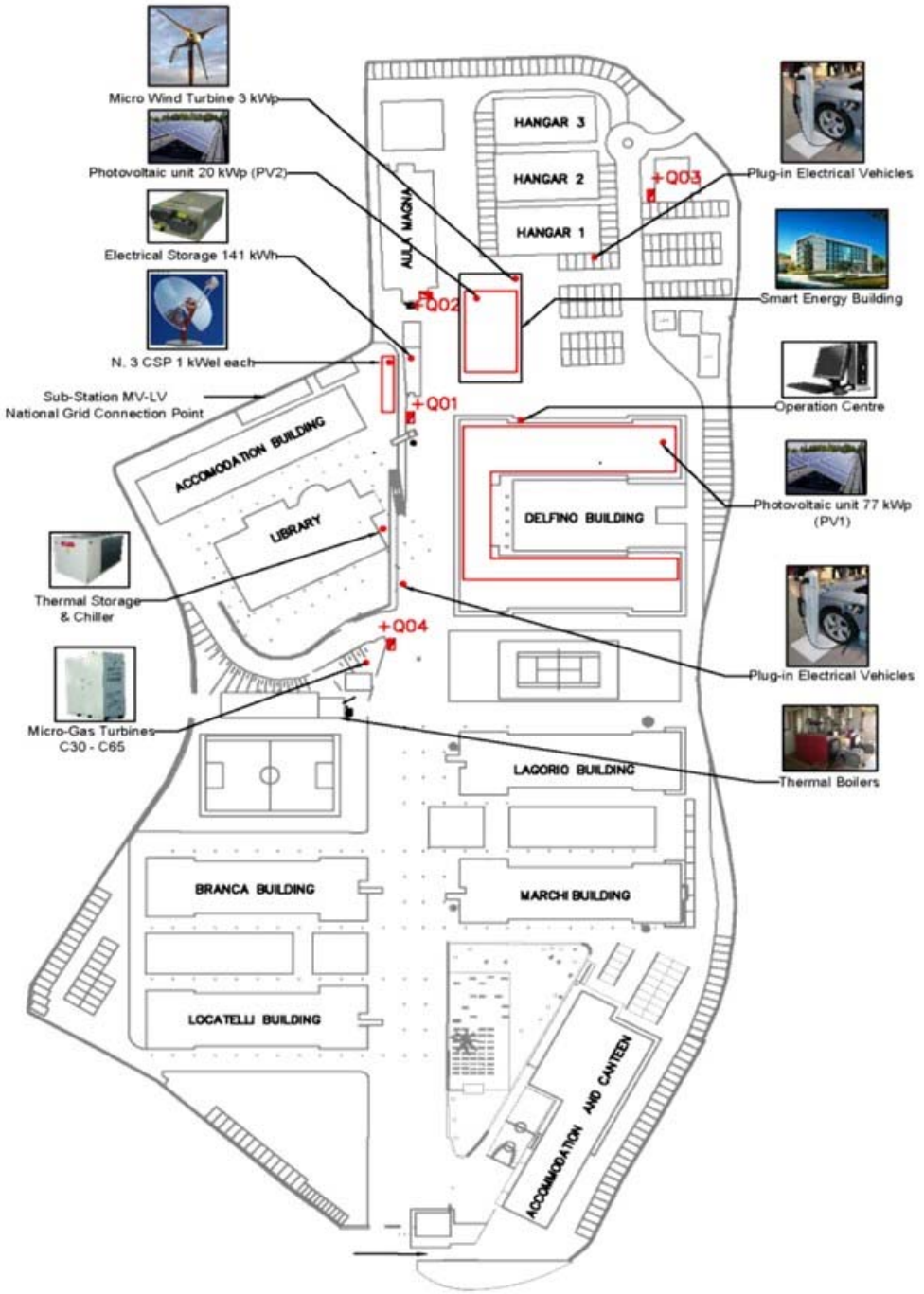


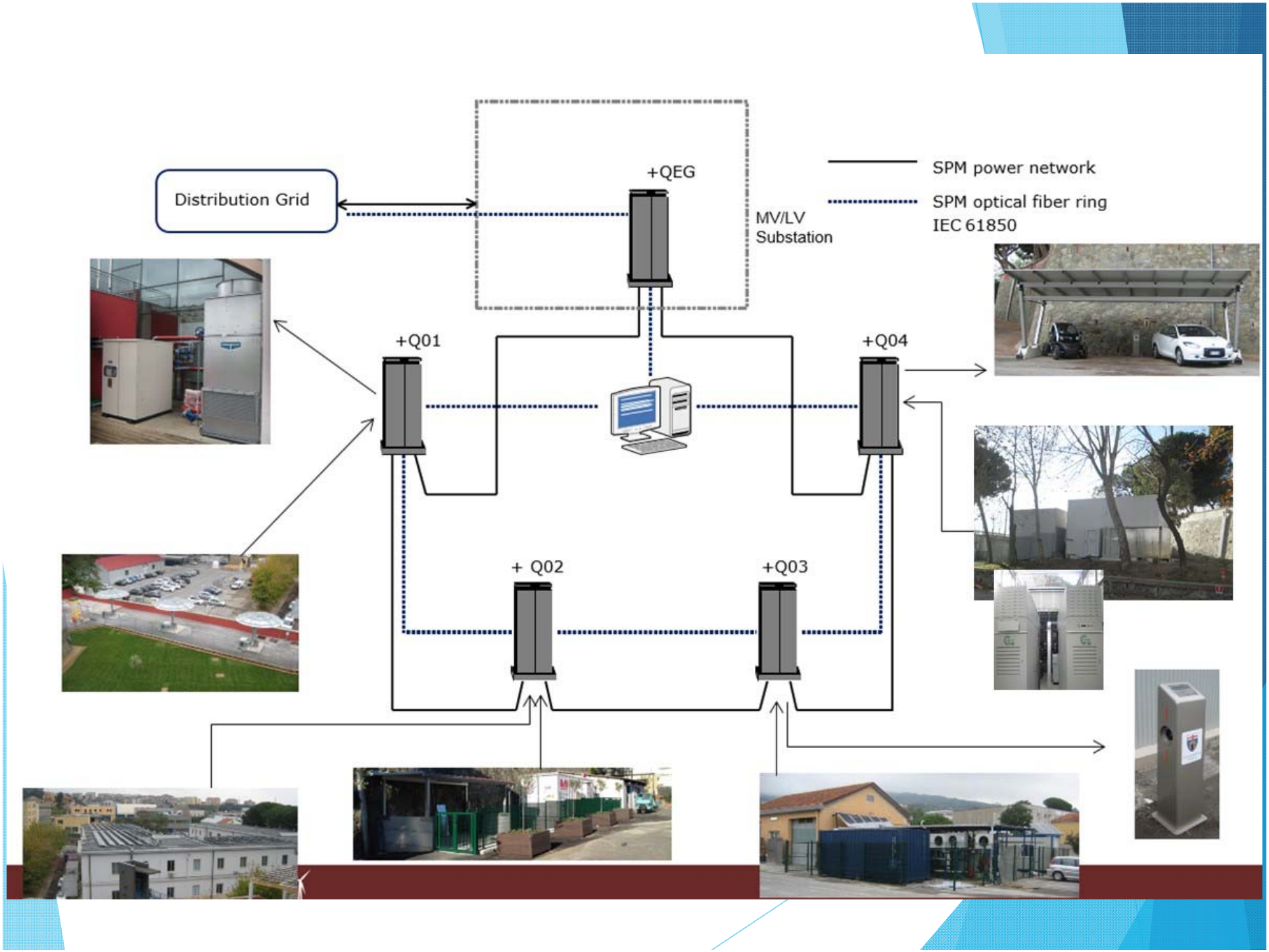
Savona Campus pilot site (testing for polygeneration microgrids and smart city demonstrators)

- **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

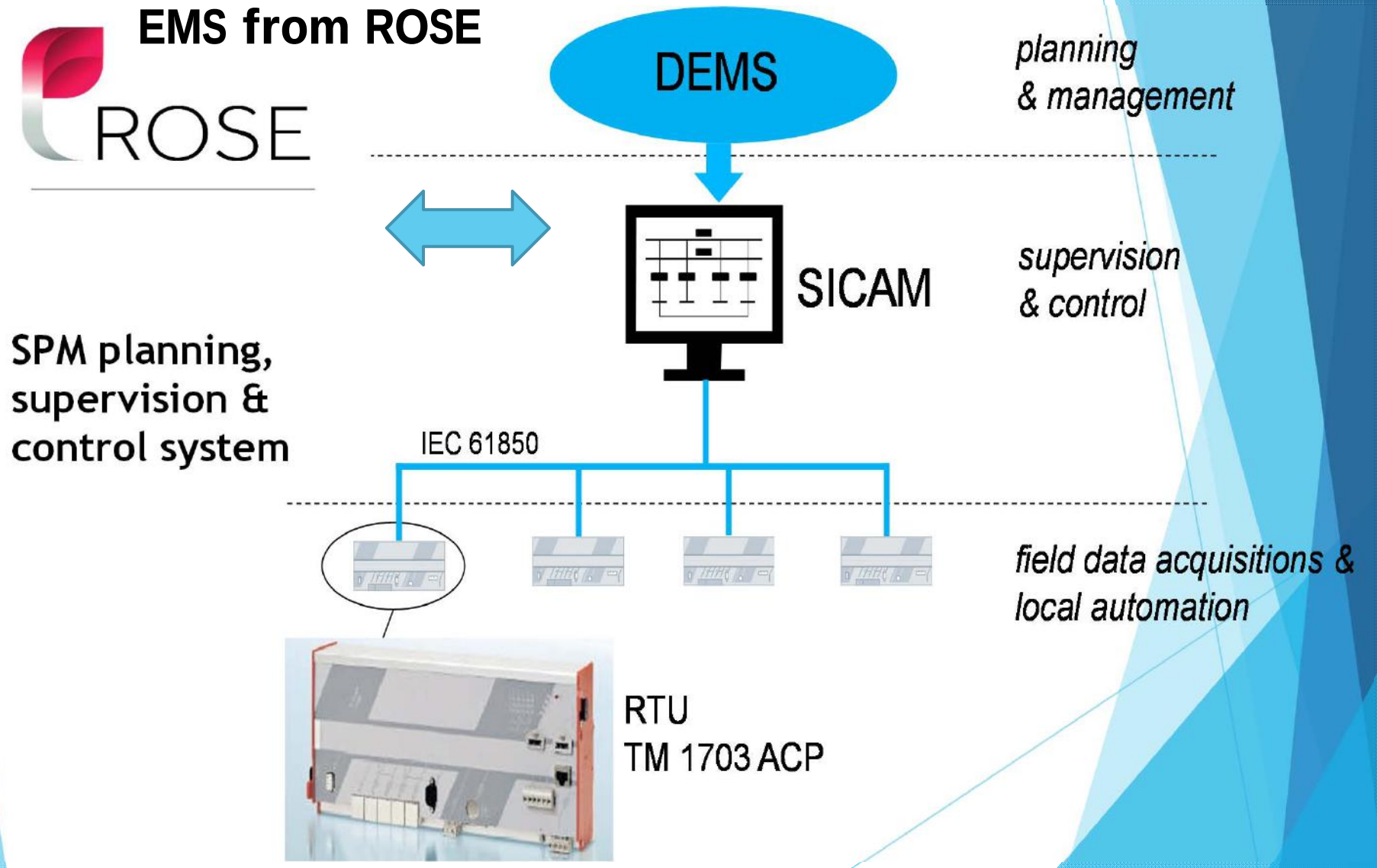
- **Special project in the energy sector funded by the Italian Ministry of Education, University and Research (amount 2.4 M€)**
- **SPM is a 3-phase low voltage (400 V line-to-line) "intelligent" distribution system running inside Savona Campus and connecting:**
  - **3 μCHP Gas Turbine (160 kwe and 280 kwth) fed by natural gas;**
  - **1 PV field (80 kWp);**
  - **3 CSP equipped with Stirling engines (3 kWe; 9 kWth);**
  - **1 absorption chiller (H_2O/LiBr) with a storage tank;**
  - **1 electrical storage: $NaNiCl_2$ batteries (100 kWh)**
  - **2 PEV charging stations.**
- **Optical fiber ring IEC 61850**




Distribution Grid
+QEG
MV/LV
Substation
SPM power network
SPM optical fiber ring
IEC 61850
+Q01
+Q04
+ Q02
+Q03

The Smart Polygeneration Microgrid (SPM) Project

EMS from ROSE



The Smart Energy Building (SEB) Project

- **Special project in the energy efficiency sector funded by the Italian Ministry for Environment (amount 3.0 M€)**
- **SEB is an environmentally sustainable building connected to the SPM, equipped by renewable power plants and characterized by energy efficiency measures:**
  - **Geothermal heat pump**
  - **PV plant on the roof (20 kWp)**
  - **Micro wind turbine (horizontal axis, 3 kW)**
  - **High performance thermal insulation materials for building applications**
  - **Ventilated facades**

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

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

Enel (ITALIAN DSO) and Unige joint project: load monitoring and energy management for buildings

EXPO MILANO 2015

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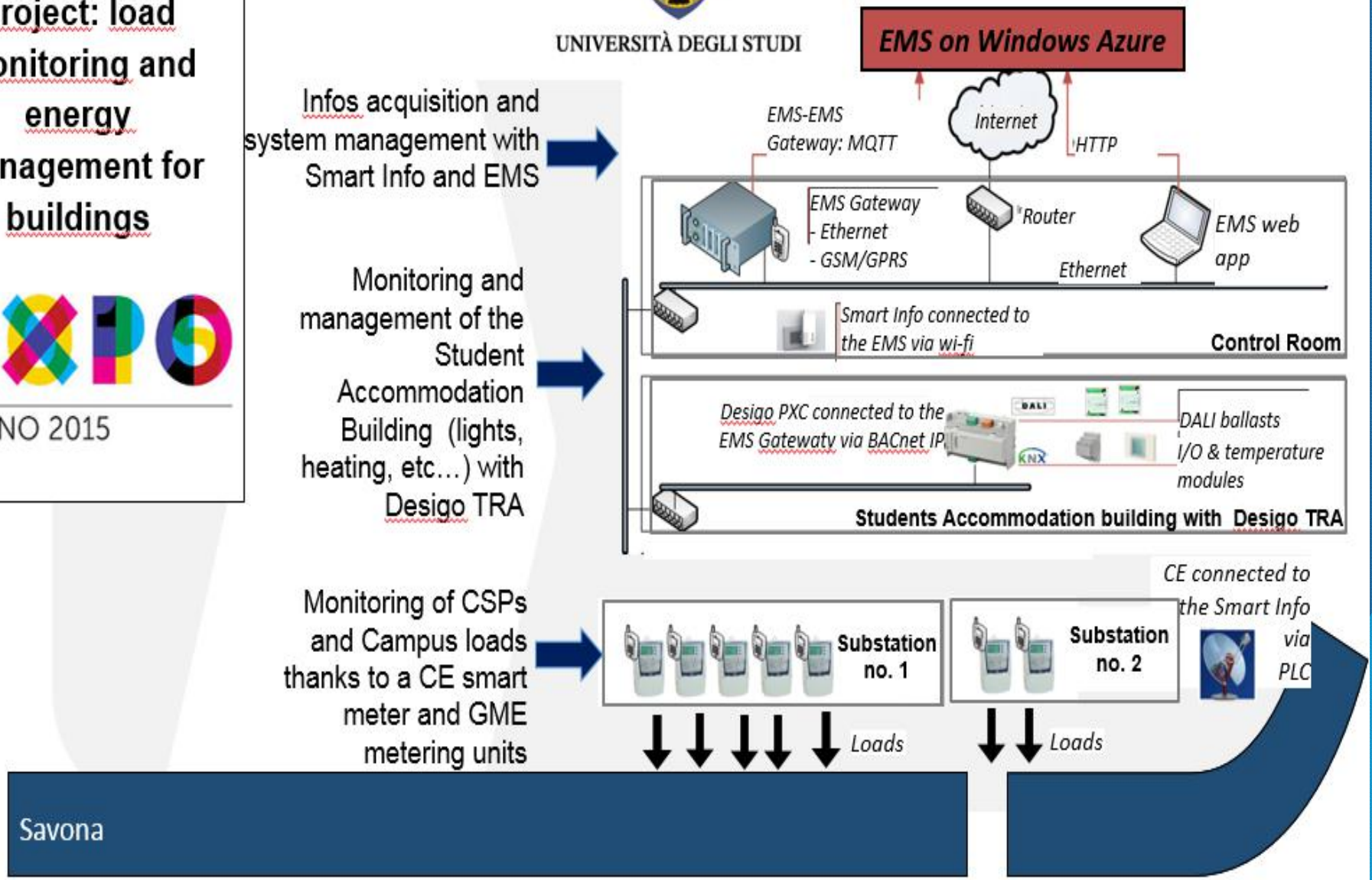
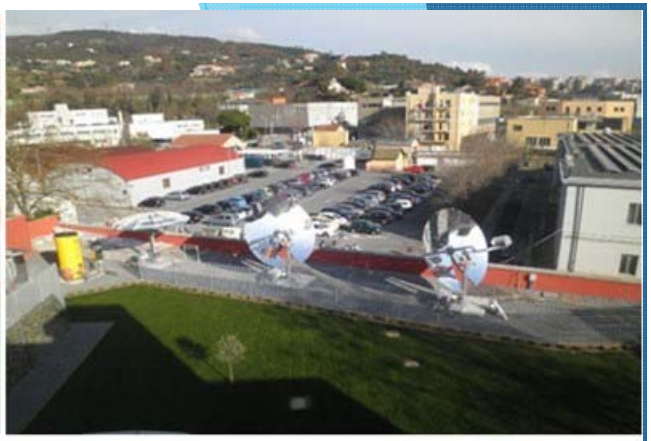
Infos acquisition and system management with Smart Info and EMS

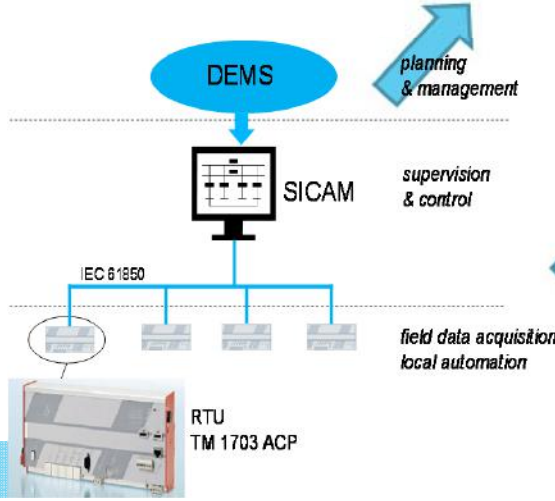
Monitoring and management of the Student Accommodation Building (lights, heating, etc…) with Desigo TRA

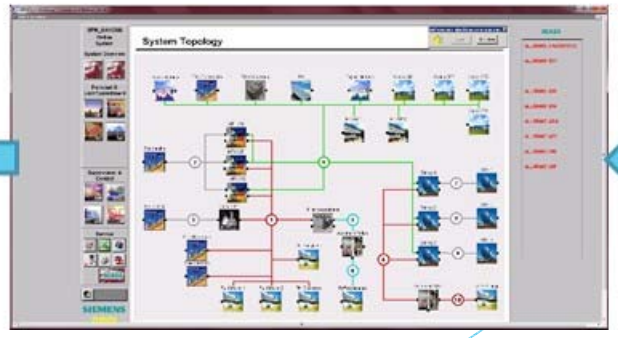
Monitoring of CSPs and Campus loads thanks to a CE smart meter and GME metering units



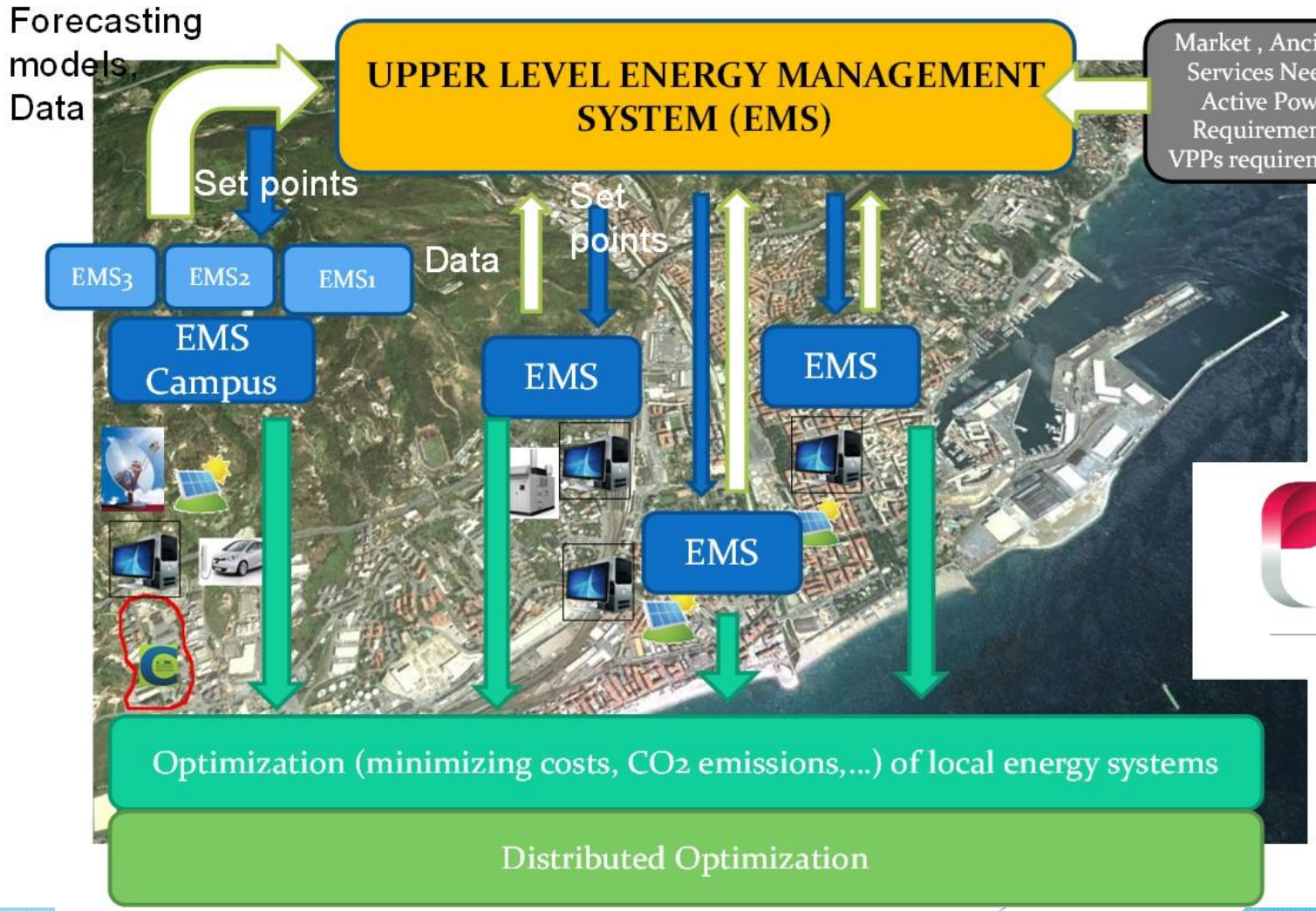



FIAMM
EnergyStorage
Solutions


DEMS
planning
& management
SICAM
supervision
& control
IEC 61850
field data acquisitions &
local automation
RTU
TM 1703 ACP


System Topology

VERSO LE SMART CITIES: I sistemi implementati nel Campus di Savona vogliono essere l'anticipazione di quello che sarà il futuro della gestione intelligente della produzione e distribuzione di energia, con vantaggi ambientali ed economici per le città, gli stati ed i cittadini.



EMS from ROSE

Thank you

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