TRANSNATIONAL ACCESS
USER PROJECT FACT SHEET

USER PROJECT	
Acronym	NOMADIC
Title	smart eNergy grid Optimization with Multi-Agent Distributed predIctive Control
ERIGrid Reference	01.011-2016
TA Call No.	1

HOST RESEARCH INFRASTRUCTURE			
Name	ICCS – NTUA – EESL (ELECTRIC ENERGY SYSTEMS LABORATORY)		
Country	Greece		
Start date	16/07/17 & 22/11/17	**Nº of Access days**	23
End date	29/07/17 & 05/12/17	**Nº of Stay days**	28

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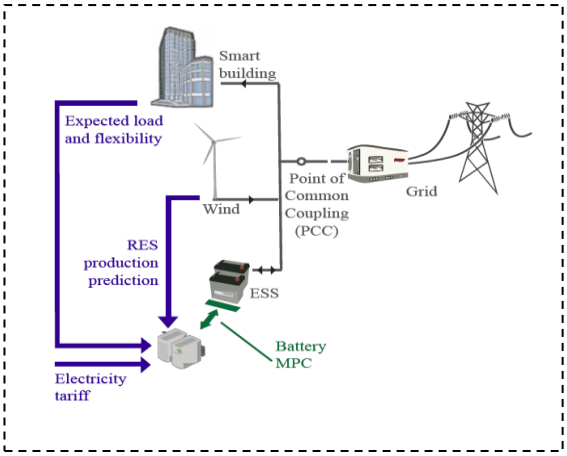
1. USER PROJECT SUMMARY (objectives, set-up, methodology, approach, motivation)



The NOMADIC project deals with the design and testing of an efficient strategy to optimize the real-time behavior of micro-grids, including different types of consumers, possibly grouped in homogenous groups, energy sources and storage units. The overall goal is to fulfill the many technical requirements, improve user comfort and economic benefits at the same time, guarantee an optimal behavior of the grid. More in detail, the addressed scenario is a grid-connected smart microgrid including an Energy Storage System (ESS), photovoltaic generators, wind turbines, hydro power plants and large amount of consumer raging from residential buildings, industries, shopping districts, offices and schools. The mentioned microgrid is connected to the main distribution grid through a Point of Common Coupling (PCC).

The goal of NOMADIC project proposal is twofold: (i) design a suitable control and management architecture to ensure the required demand in a more economic and efficient manner also integrating renewables and storages; (ii) provide a proper interaction mechanism between the many energy resources first to ensure a global optimal solution for the whole system, and then to reduce computational burden, and to enforce adaptation and self-tuning capabilities. The selected methodological tool to obtain the above goals is the distributed MPC (Model Predictive Control) technique. Two different scenarios for distributed MPC realization are proposed in which one is using cooperative approach and the other one utilized a non-cooperative approach.

The proposed approaches open an opportunity for industries, large consumers and even group of small users to participate to the power and energy markets. This opportunity will be of course another option of increasing benefits/decreasing costs of demand side's parties. On the other hand, the main distribution grid can benefit from the capability of changing demand profile microgrids which mitigates the problems of peak rebate, loss reduction in peak hours and unbalancing, etc.

As for the control point of view, with increasing number of units participating in a microgrids including Renewable Energy Sources (RESs), ESS, Loads and other Distributed Energy Resources (DERs), the need to distributed approaches arises mainly because of its high reliability, scalability and self-adaptation.

For the experimental tests in the lab we employed battery storage, utility grid and PV panels as energy sources. Some other parts of our scenarios were residential buildings and thermal storages which we simulated them in PC and to consume energy we used resistive loads in the lab.

2. MAIN ACHIEVEMENTS (results, conclusions, lessons learned)

- Study and design of a new optimization algorithms for microgrid energy management
- Smart Microgrid modeling with renewable sources, storage and smart buildings
- Optimal load flow through the grid and energy resources
- Price-based Demand/response optimization
- Run simulation with different scenarios and optimizing cost functions
- Assess the direct benefits of this architecture compared to actual grid management policies and power dispatching algorithms through experimental implementation.

- Implementation of distributed model predictive control with two different approaches

3. PLANNED DISSEMINATION OF RESULTS (journals, conferences, others)

Special attention will be paid to dissemination of results. At the international level, this will take place through reknown conferences managed by IEEE (Institute of Electrical and Electronics Enginnering) and IFAC (International Federation of Automatic Control), including SmartGrid, CDC, ISIE, CASE, INCOM, IFAC WC. At the national level, attendance to national congress and fairs is foreseen. All the team members will also try to condense the theoretical and experimental results in a journal paper.

Exploitation will be carried out both in terms of further research activities, as well as on focused consultancy towards local energy distributors and local producers of ICT devices for energy monitoring and management.