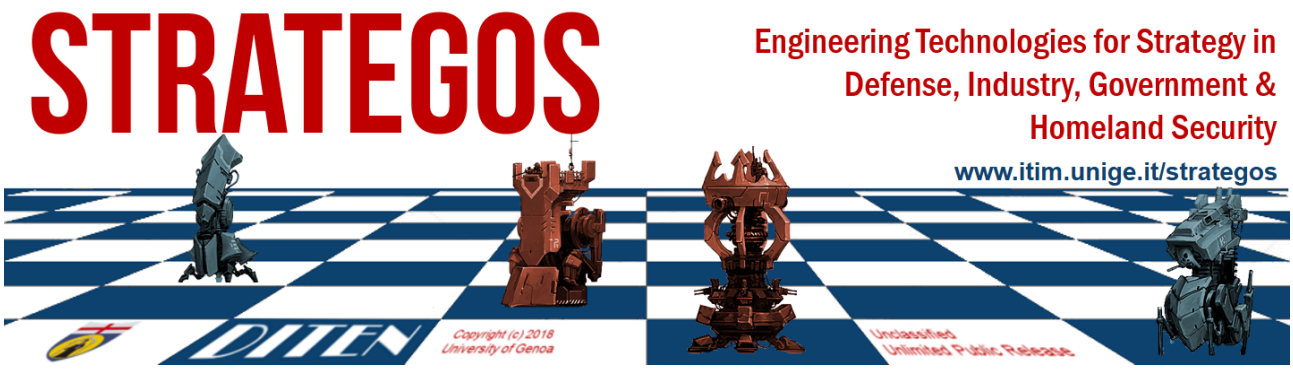

STRATEGOS

Master of Science on Modelling, Engineering and Strategies on Operations and Systems

Course: STRATEGIES FOR ENERGY

SSD ING-IND/31

Credits: 4

Tentative Schedule:

2nd semester

Teachers, Email, URL:

MASSIMO BRIGNONE, Massimo.brignone@unige.it

https://rubrica.unige.it/personale/UkNHXFpu

Assistants for Exercises & Simulation Lab Experience:

NA

Education Objectives:

The main aim of the course is to discuss both the practical and theoretical aspects of strategies for energy management. More precisely the milestones for the course could be declined as follows: Strategies for controlling energy flows; Optimization and management strategies; Practical aspects applied to smart energy microgrid.

Course Program & Elements:

Today Energy is Smart and Strategies for managing it are necessary.

Smart Grids

The new energy prosumers are Smart Grids, that have attracted the attention of academic institutions and industry players, becoming one of the most promising technological developments and, at the same time, one of the most fascinating challenges. What is the revolution contained in the smart grids concept? In the course, an answer to this question is proposed. This is done providing a sketch of the historical evolution of the electric energy supply starting from traditional electric networks and accounting for the main technological innovations occurred during the last century and the present one.

Devices and Equipment of a Smart Microgrid

The main technologies adopted in distributed generation installations and smart microgrids will be described. The attention will be focused on plants that produce electrical energy (photovoltaic fields, hydro, and wind plants), thermal energy (solar thermal collectors, boilers, heat pumps), and cooling energy (compression and absorption chillers). Moreover, cogeneration and tri-generation technologies are analyzed, as well as electrical storage systems.

Optimization for Microgrid

Planning and managing a microgrid from an economical point of view is a crucial point. The statement of the decision problem has been explained, as well as the list of the decision variables and the system model. The formalization of the overall optimization problem will be discussed introducing an energy management system whose main aim is to minimize the overall production costs while satisfying all the thermal and electric network constraints within a microgrid. To do this, first an adequate model of all the installed components is necessary, while different electric network models could be used.

Forecasting strategies

One of the crucial point in each energy management system is the reliability of energy forecast. The state of the art of the main forecasting methods used to predict the energy production from renewable sources

and the thermal and electrical loads, will be presented. These methods can be efficiently employed to improve both the planning and the management of smart energy infrastructures characterized by the presence of variable renewable sources and loads.

Teaching Approach:

Frontal lectures presenting theory and practical application of methodologies related to strategy in energy management. Individual and team work projects. Simulation experiences in Matlab® framework which use directly the presented methodologies and techniques in realistic energy problems

Evaluation and Final Exam:

Students will be evaluated on simulation exercises and seminars/projects devoted to address specific issues within realistic problems in energy. Final Exam will be carried out by Oral Exams including review of the developed simulation exercises/projects

Timetable:

To be Finalized (TBF)

Time Zone:

CET (A, GTM+1)

Prerequisites:

The Course does not require specific prerequisites. However, a basic knowledge of Matlab® could be useful.

References

- ***Delfino, F., et al., Microgrid Design and Operation: Toward Smart Energy in Cities, Artech House power engineering series, 2018***
- ***Bracco, S., et al., "An Energy Management System for the Savona Campus Smart Polygeneration Microgrid," IEEE Systems Journal, Vol. 99, 2015.***
- ***Bonfiglio, A., et al., "An Optimization Algorithm for the Operation Planning of the University of Genoa Smart Polygeneration Microgrid," Proceedings of IREP 2013 Symposium-Bulk Power System Dynamics and Control–IX, Rethymnon, Greece, August 25−30, 2013***
- ***Bonfiglio, A., et al., "Definition and Experimental Validation of a Simplified Model for a Microgrid Thermal Network and Its Integration into Energy Management Systems," Energies, Vol. 9, 2016, p. 914.***
- ***Bendato, I., et al., "A Real-Time Energy Management System for the Integration of Economical Aspects and System Operator Requirements: Definition and Validation," Renewable Energy, Vol. 102, 2017, pp. 406–416***