

BORSA N. 6

DAUSY

D.M. 351/2022

Ambito: Pubblica Amministrazione

Tematica: “Decision and Control Techniques for Energy Management of Smart Cities”

Research theme title:

Decision and Control Techniques for Energy Management of Smart Cities

Contacts:

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Curriculum of DAUSY:

C3 AS for Monitoring and Security

Hosting University/Research Centre

Polytechnic of Bari, Italy

Department:

Department of Electrical and Information Engineering

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Prospective Supervisors:

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Description:

A smart city is a sustainable and efficient urban centre that provides a high quality of life to its inhabitants through optimal management of its resources. Energy management is one of the most demanding issues within such urban centres owing to the complexity of the energy systems and their vital role. As a consequence, to increase smartness, cities should improve present systems and implement new solutions in a coordinated way and through an optimal approach, by profiting from the synergies among all the involved urban actors.

Against this background, this project will develop decision and control tools that address the emerging need of intelligent energy management systems for smart cities and related subsystems such as energy clusters, districts, communities, smart buildings, and smart homes. On the one hand, optimization tools devoted to the strategic management of urban energy systems will be investigated to make urban infrastructure and facilities more energy efficient and environmentally friendly in a cost effective manner. On the other hand, this project will define decision and control techniques for the operational management of urban smart energy systems, with the final aim of ensuring the transition towards a low-carbon energy sector and the efficient and sustainable use of natural resources from users' perspective.

The research will be applied to real urban case studies in collaboration with the Smart Cities and Communities Laboratory of the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA).

Specific Information:

Applicants must hold a master's degree, preferably in Engineering, with a good background in relevant areas of interest (i.e., optimization, and control). Solid mathematical and coding skills are encouraged. Proficiency in both spoken and written English is required. The candidate should be highly motivated and interested in undertaking innovative and challenging research activities involving both theoretical analysis and experimental validation.

References:

- [1]. Calvillo, Christian F., Alvaro Sánchez-Miralles, and Jose Villar. "Energy management and planning in smart cities." *Renewable and Sustainable Energy Reviews* 55 (2016): 273-287.
- [2]. Carli, R., Dotoli, M., Pellegrino, R., "A Hierarchical Decision Making Strategy for the Energy Management of Smart Cities", *IEEE TASE (Transactions on Automation Science and Engineering)*, vol. 14, no. 2, pp. 505-523, 2017.
- [3]. Carli, R., Dotoli, M., Pellegrino, R.; Ranieri, L., "A decision making technique to optimize a building stock energy efficiency", *IEEE SMC-A (Transactions on Systems, Man and Cybernetics: Systems)*, vol. 47, no. 5, pp. 794-807, 2017.
- [4]. Carli, R.; Dotoli, M.; Pellegrino, R., "A decision-making tool for energy efficiency optimization of street lighting," *Computers and Operations Research* (2018), vol. 96, pp. 223-235, 2018.
- [5]. Scarabaggio P.; Grammatico S.; Carli, R.; Dotoli, M., "Distributed Demand Side Management with Stochastic Wind Power Forecasting", *IEEE Transactions on Control Systems Technology (TCST)*, vol. 30, no. 1, pp. 97-112, 2022.
- [6]. Carli, R. and Dotoli, M., "Decentralized Control for Residential Energy Management of a Smart Users' Microgrid with Renewable Energy Exchange," *IEEE/CAA Journal of Automatica Sinica*, vol. 6, no. 3, pp. 641-656, 2019.
- [7]. Carli, R.; Dotoli, M.; Jantzen, J.; Kristensen, M.; Othman, S. B., "Energy Scheduling of a Smart District Microgrid with Shared Photovoltaic Panels and Storage: the case of the Ballen marina in Samsø", *Energy – The International Journal*, 198, 117188, 2020.

- [8]. Hosseini, S. M.; Carli, R.; Dotoli, M., "Robust Optimal Energy Management of a Residential Microgrid under Uncertainties on Demand and Renewable Power Generation," IEEE Transactions on Automation Science and Engineering (TASE), vol. 18, no. 2, pp. 618-637, 2021.
- [9]. Carli, R.; Cavone, G.; Pippia, T.; De Schutter, B.; Dotoli, M., "Robust Optimal Control for Demand Side Management of Multi-Carrier Microgrids", in IEEE Transactions on Automation Science and Engineering (TASE), 2022.

Type of scholarship:

DM 351/2022 - Project on Public Administration

Study and research period outside the Hosting Institution:

1. Study and research period at research center:
 - period length: 6 months;
 - Hosting center:
 - ENEA - Smart Cities and Communities Laboratory
 - Via Anguillarese, 301 00123 S.Maria di Galeria (Roma)
 - <https://www.casaccia.enea.it/> - <https://energia.enea.it/divisioni/smart-energy/>
2. Study and research period abroad:
 - period length: 6 months;
 - Hosting institution:
 - Universitat Politècnica de Catalunya - Automatic Control Department
 - Llorens i Artigas 4-6 08028 Barcelona, Spain
 - https://www.iri.upc.edu/research/automatic_control