

PhD in Energetics

Research Title: Balancing energy supply and demand in post-carbon cities and societies

Funded by	Energy Center Lab (EC_lab) of Politecnico di Torino
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Context of the research activity	<p>Half of the world's population are city dwellers that are estimated to rise to 75 per cent by 2050. This massive urban growth makes the future of our economies, climate and energy supply increasingly challenging. It is necessary to re-think the city concept in terms of urban layout, infrastructures, technologies and energy supply.</p> <p>Consequently, which are the features of the city of future to become a more and more sustainable one? How can we provide our communities with an even greener and more secure and affordable energy supply? Which are the key energy technologies and infrastructure to develop or consolidate?</p> <p>The electrification of our cities could help address three of the major challenges we face in the urban energy planning of urban areas: noise pollution, air pollution and the international requirements of CO₂ emissions.</p> <p>A new multidisciplinary laboratory will bring together the required skills to develop models and scenarios for the energy transition, with the aim to design more interconnected energy systems, and to foresee their behavior and impact on different spatial and temporal scales. Urban energy planning and transition is the starting focus of the EC-Lab.</p>
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Objectives	<p>The key objective is to develop a study concerning the balancing between energy supply and demand in a future post-carbon city. In detail, different scenarios will be defined and simulated in order to identify policy measures that can lead to the energy retrofit of the urban existing building stock, the replacement of the old systems and plants with all-electric ones, the definition of new</p>
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	<p>way of urban distributed energy production and storage. In order to compare and assess the different scenarios an evaluative framework based on cost-benefits analysis will be proposed and a tool for supporting the public decision-maker will be developed. Furthermore, in the scenarios evaluation the analysis of the energy price evolution will be considered.</p> <p>The main research activities are detailed below:</p> <ul style="list-style-type: none"> • Definition and modelling of the <i>Reference City</i> that is representative of a current city in terms of urban layout, energy and environmental features. • Definition and energy modelling of different retrofit scenarios for the existing building stock with the characterization of the new energy demand and its time profile. • Estimation of the potential of local energy supply resources. Understanding energy metabolism of urban centers. Distributed generation and storage technologies. Integration of energy infrastructure. • Characterization of the present paradigm and patterns in energy supply and distribution. • Cost-benefit analysis of alternative policies to develop smart grid projects and sustain energy efficiency solutions at urban level. • Estimation of co-benefits and externalities related to energy requalification scenarios and development of Multicriteria Analysis for supporting the decision-making process.
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<p>Skills and competencies for the development of the activity</p>	<ul style="list-style-type: none"> • Good background in the areas of energy, environment, financial and economic sciences. • Basic knowledge of (international, national or local) policies to develop smart grid projects and sustain energy efficiency plans. • Basic knowledge in the field of evaluation tools and decision support systems. • Prior experience with multi-disciplinary team-working.
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