The role of spatial dimension in modelling decarbonised energy systems

Research keywords:	Energy systems modeling Decarbonisation scenarios Geographical distribution of: energy demand, supply and infrastructures
Reference ERCs:	PE8_6 Energy processes engineering SH7_6 Environmental and climate change, societal impact and policy SH7_9 Energy, transportation and mobility
Reference SDGs:	GOAL 7: Affordable and Clean Energy GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action
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Research topic

The relative position of supply, demand and infrastructure in an energy system has a significant impact on the viability of some of the key technological solutions for the decarbonization. Some examples are: the development of the electricity network, the gas network and the district heating networks; solutions to improve the efficiency of building envelopes and heat generation; the capture, use and storage of CO2; the development of industrial districts and local hydrogen networks; the production of biogas, biomethane and synthetic methane and the choice between placing it on the grid or use on site; electric vehicles and the impact of recharges on the distribution network; the environmental impact of local pollutants. In the creation and use of models of energy systems, the demand, technologies and energy carriers undergo in most cases a process of aggregation, in terms of geography and technological affinity. However, the need for greater spatial disaggregation is increasingly evident in modeling practice. The research project is therefore aimed at: (a) identify and analyze the dynamics in which spatial disaggregation may be relevant for the decarbonization of the modeled energy system; (b) search for a methodology that is able to objectively and transparently define the optimal level of spatial aggregation in the various areas of interest, given certain boundary conditions, the availability of data and the computational limits of the tools used; (c) develop modeling solutions that can take into account optimal spatial aggregation levels, that are transparent in mathematical formulation and publicly available.

Research team and environment

The RELAB group, at the department of energy of Politecnico di Milano, is composed of an international and multidisciplinary team of professors, researchers, technicians, PhD students and research fellows. More than 30 graduate specialists from various thematic areas work in the following fields: thermally driven cycles, district heating and cooling, smart districts, LCA, national and regional energy systems energy scenario analysys. The latter branch of the group, managed by Fabrizio Fattori, will be the one where the candidate will be integrated. See more at: http://www.Relab.Polimi.It/

Suggested skills

The candidate would desirably be enthusiastic, passionate and with a deep interest in the subject of the research. Should show problem-solving attitude and capabilities of finding logical solutions to problems. It is suggested to have the ability to plan and prioritize work, meet deadlines and deliver work on time; to have organizational skills being capable to pay attention to details and setting clear goals.GOAL 13