



PhD in SCIENCE, TECHNOLOGY AND POLICY FOR SUSTAINABLE CHANGE - 40th cycle

THEMATIC Research Field: MODELING THE DECARBONIZATION OF THE RESIDENTIAL SECTOR

Monthly net income of PhDscholarship (max 36 months)
€ 1600.0
In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	<p>The residential sector, being hard to abate, is the aim of many decarbonization policies. The EU in the last years has been producing Directives that have set new ambitious goals in terms of energy efficiency, and self-production. The inclusion of the latter has changed the paradigm under which households are now understood: from simple consumers, to prosumers. To assess how these policies will impact the sector, many modelling techniques aim at describing how energy use will change in the future, but these approaches can be updated to better capture this sector's peculiarities, highlighting both heterogeneity of households and the new role of users. At the same time, the characteristics of the building stock and the impact of climate change on its energy consumption need to be better highlighted. Furthermore, the ongoing roll-out of smart meters in EU is helping in building vast datasets that allow research to understand better the different consumption habits of households at high temporal resolution, and with that the remarkable socio-economic differences that define them. Finally, building energy, climate change and renewable uptake are also related in a non-trivial way to distributional effects, such as energy poverty, that need to be investigated more. Starting from this, the research aims at investigating the role of users in a bottom-up energy model to better refine the energy demand projections for the residential sector, especially at the European level. How prosumers interact with different energy-related</p>



	<p>investment choices, and between each other, determining macroscopic effects in energy demand and influencing the decarbonization process of the sector, are the key points of this activity.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The research will focus on bottom-up models of energy demand and machine learning approaches to enrich them. Energy-related investment such as heating and cooling devices and photovoltaic installations will be characterized by considering climatic and socio-economic variables at high spatial resolution. Also, highly spatially resolved information on the European building stock will be necessary to achieve this. Approaches such as agent-based modelling will be used to characterize prosumers behaviours and choices, under bounded rationality principles, also related to geographical cultural differences found in Europe. Machine learning approaches to cluster and disaggregate Italian electric consumption data will be implemented, so to extract statistically significant information on technology uptake that can be used in the above-mentioned model. The modelling framework should also allow an evaluation of distributional effects at the household level. The research, building on previous results, is based on Python and R programming languages.</p>
<p>Educational objectives</p>	<p>The objectives are to educate on the application of machine learning and modeling methods to the understanding of climate change mitigation and adaptation policies in the residential sector.</p>
<p>Job opportunities</p>	<p>Professional careers up in universities, research organizations, national and international institutions interested in ex-ante evaluation of energy and climate policies through mathematical models.</p>
<p>Composition of the research group</p>	<p>1 Full Professors 0 Associated Professors 3 Assistant Professors 0 PhD Students</p>
<p>Name of the research directors</p>	<p>Prof. Massimo Tavoni</p>



Contacts	
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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	800.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<ul style="list-style-type: none"> •educational activity: availability to do summer schools teaching assistantship: limited TA for the course on energy and climate modeling •computer availability: will be provided •desk availability: will be provided •any other information: The candidate will have the opportunity to be affiliated with the European Institute on Economics and the Environment, part of Fondazione CMCC, the Italian research institute on climate change of which Politecnico di Milano is one of the members.