POLITECNICO DI MILANO

PhD in INGEGNERIA ELETTRICA / ELECTRICAL ENGINEERING - 40th cycle

INTERDISCIPLINARY Research Field: COMMUNITY-BASED ENERGY CONTRACTS FOR URBAN DISTRICTS DECARBONIZATION

Monthly net income of PhDscholarship (max 36 months)
€ 1500.0 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	Interdisciplinary PhD Grant The PhD research will be carried out in collaboration with research groups of the PhD programme in "**DATA ANALYTICS AND DECISION SCIENCES**". While the Renewable Energy Community (REC) paradigm has recently emerged as one mean for decarbonizing urban energy demand, urban areas are characterised by a very high power demand density, set to grow due to heating and transport sectors electrification. An hybrid decarbonization approach for urban areas, unlocking the access to off-site renewable energy, could lay on Power Purchase Agreements (PPAs), which are currently available only for large corporations due to contractual risks and complexity. The objective of the proposed research is to develop instruments able to: examine the opportunities for urban citizens to contribute to off-site renewable development and to access stable electricity prices leveraging on the community concept; assess and optimize the financial benefits that community-based PPAs can bring to individual household; design processes and tools to facilitate the creation of community-based PPAs and to allow community managers to optimally manage their interactions with citizens by means of a neighbourhood-as-a-service platform.

Methods and techniques that will be developed and used to carry out the research	To optimally design the community-PPA contractual framework, multi-objective optimization techniques will be exploited, to take care of financial (NPV or IRR) and non-financial aspects (excess energy, residual demand), also leveraging on risk-related concepts (C-VaR). At a bottom level, P2P trading and energy servitization will be modelled through distributed optimization techniques, considering a multi-agent interaction (ADMM or ALADIN). Statistical models, considering both explicit and machine learning techniques, will be used to provide an assessment of most important variables and their related uncertainty, including renewable energy generation and market dynamics. Finally, the neighbourhood-as-a-service platform will provide a bi-level tool gathering both off-site and on-site evaluations cited above. Within all the research, the knowledge of techno-economic and regulatory aspects concerning energy markets and communities will be fundamental.
Educational objectives	The PhD candidate will earn a wide range of professional capabilities, including techno-economic evaluations, modelling and optimization tools, statistical inference and soft skills.
Job opportunities	Job opportunities include the academic and R&D dept. of energy-related research centers, but also companies operating in the power sector (generation, transmission, distribution), consultancy firms and non-profit governmental and private associations.
Composition of the research group	2 Full Professors 3 Associated Professors 2 Assistant Professors 10 PhD Students
Name of the research directors	Filippo Bovera, Piercesare Secchi

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	750.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Educational activities:

Financial aid per PhD student is available for purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences, instrumentations and computer, etc. This amount is equal to 10% of the annual gross amount, for 3 years.

Teaching assistantship:

Availability of funding in recognition of supporting teaching activities by the PhD student. There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

Computer availability: individual use.
Desk availability: individual use.