POLITECNICO DI MILANO

PhD in SCIENCE, TECHNOLOGY AND POLICY FOR SUSTAINABLE CHANGE - 39th cycle

THEMATIC Research Field: INTEGRATED MODELING OF ENERGY TRANSITION PATHWAYS: METHODS DEVELOPMENTS AND APPLICATION TO ITALY

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0   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	We live in an extremely complex and interconnected world. Recently, a series of unexpected global challenges have been changing global geopolitical priorities in the energy sector with a risk of undermining the efforts taken towards the energy transition. It is therefore more crucial than ever to identify sustainable and realistic long-term decarbonisation pathways, based on three fundamental pillars: (1) technical feasibility, (2) compliance with national economic and financial equilibria and (3) social justice, with a particular attention to jobs' creation. Moreover, considering that this transition is mostly policy-driven, long-term planning is mandatory and the role of governments in the transition is crucial in two ways: by boosting investment increase in productivity, GDP and jobs, innovative methods for energy planning and for the assessment of its impacts on the socio-economic system, the environment and resilience to climate change are considered central for the national future research in the sector. In this frame, the research aims at **supporting and informing policy making process with state of the art and evidence-based tools, developing and integrating energy and economic models, and applying them to a set of case studies.** Analysis of energy transition pathways in Italy is defined as the key case study.
Methods and techniques that will be developed and used to carry out the research	Our study proposes a novel approach to perform scenario analysis, able to provide consistent pathways and to

	analysis, able to provide consistent pathways and to investigate the above-mentioned gaps. The study aims at identifying the **technological drivers** with the greatest potential impact and the **investments needed** to support this technological upgrade, within the framework of currently stated **policy interventions** designed to define sustainable transition pathways.Specifically, energy systems optimization models will be developed to represent technology transition with high physical detail, while industrial ecology multi-sectoral models (input-output models) will be defined to assess the economy-wide prospective impact of such transition processes.The key feature of the proposed model is the integration between the Input-Output and energy system optimization models, both structured upon Input-Output datasets with a common regional and sectoral breakdown. This approach provides a set of robust outputs, meaning that each module generates results that are ?sensible? to what happens in the other, considering structural changes in the economy induced by technological changes and vice-versa.The research is based mainly on Python programming language (with focus on Objective Oriented Programming) and data engineering (mainly structured database manipulation and business intelligence software).
Educational objectives	The prospective competences and educational gains of the candidate are: - Ability to setup and use energy system models and dynamic Input-Output models - Capability to integrate such models by selecting appropriate variables and including relevant feedback - Ability to quantify the impact of energy transition pathways for Italy
Job opportunities	Energy/Economic Analyst for energy utilities and/or for NGOs and international organizations or public

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	institutions. For example: - Governmental and Regional authorities and agencies - Energy and petrochemicals organizations (e.g. ENI, ENEL) - IEA, IRENA - Academic international institutions active in this field (e.g. AACHEN, KTH, ETH)
Composition of the research group	2 Full Professors 4 Associated Professors 3 Assistant Professors 9 PhD Students
Name of the research directors	Prof. Emanuela Colmbo / Prof. Matteo V. Rocco

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	700.0 €
By number of months	6

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

Educational activity:

Financial aid per PhD student is available for purchase of study books and material, funding forparticipation in courses, summer schools, workshops and conferences, instrumentations andcomputer, etc. The amount is about Euro 5700.

Teaching assistantship:

Availability of funding in recognition of supporting teaching activities by the PhD student. Thereare 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.

Research period abroad:
Our candidates are strongly encouraged (6 months minimum is mandatory) to spend a research period abroad, joining high-level, research groups in the specific PhD research topic, selected in agreement with the Supervisor. An increase in the scholarship will be applied for periods up to 6 months (approx. 700 euro/month- net amount).

Awards:
Awards will be recognized to the PhD candidate up to Euros 2000 (gross amount) per year, in case of exceptional achievements in the research project, subject to the evaluation of the research director.