Doctorado Ciencias de la Mecánica

Fully-funded PhD Studentship in Long-term Energy Pathways in Ecuador

THE DOCTORAL PROGRAM IN SCIENCES OF MECHANICAL ENGINEERING AT ESCUELA POLITÉCNICA NACIONAL IS PLEASED TO OFFER A FULLY-FUNDED PHD STUDENTSHIP

ESCUELA POLITÉCNICA NACIONAL

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DETAILS

Research theme: Long-term Energy Pathways in Ecuador - Transition Scenarios for the Transport Sector up to 2050.
Supervisors: Dr. Rafael Soria, Associate Professor in Energy Planning, Mechanical Engineering Faculty
Stipend: 1,086.00 USD per month calendar
Start date: May/June 2018
Funding Duration: 4 years, full time, exclusive dedication
Title obtained: PhD in Mechanical Engineering

Background

During the 21st conference of parties of the UNFCCC, known as the Paris Agreement, global leaders have pledged to make efforts to stabilize climate well below a 2°C, and to pursue efforts to limit to 1.5°C, increase in global temperatures compared to pre-industrial levels. These are ambitious targets: they require reaching zero net emissions of carbon dioxide (CO2) before the end of the century. To implement this long-term goal, countries around the world submitted in the lead-up to COP21 their Nationally Determined Contributions (NDCs), which are more or less detailed plans to reduce GHG emissions domestically. The first NDCs set among other things emission-reductions plan for 2025 or 2030, and they will be updated every five years starting in 2020.

Although Ecuador generates less than 0.5% of the global GHG emissions causing global climate change, it is voluntarily committed to face this challenge. In this way, in 1992 Ecuador signed the United Nations Framework Convention on Climate Change (UNFCC); in 1999, the Kyoto Protocol; in 2016, the Paris Agreement and, consequently, Ecuador participates of international negotiations about climate change and locally generates the regulatory and institutional framework to comply with the objectives set by the UNFCC.

Among academics and policymakers, Integrated Assessment Models (IAM) are the state-of-the art class of tools used to analyse consistency of short-term targets with the long term decarbonisation imperative. IAMs are a class of models that represent interlinkages between sectors of the economy, for instance between power generation, fossil fuel extraction and distribution, transportation, industry, buildings, forestry and agriculture. IAMs can also be used to analyse other policy relevant issues such as links between climate policy and energy security, energy independence, water scarcity and food security, or the risk of stranded assets when implementing abrupt emission reduction strategies.

Aim

This Doctoral thesis aims to support Ecuador to go in that direction and seeks to boost the use of IAMs, specifically of the MESSAGE tool, within the integrated energy planning (IEP) process and NDC related activities by articulating a platform where the involved actors can discuss and achieve consensus. An IAM could support the decision-making by highlighting in a consistent and integrated manner the benefits, costs and trade-offs between different scenarios and policies.

MESSAGE (Model for Energy Supply System Alternatives and their General Environmental Impacts) is a model that belongs to the family of IEP and IAM tools. It is an optimization tool used to calculate the least-cost long-term expansion scenario of the whole energy system. MESSAGE is a model of perfect foresight. This tool was initially developed by the International Institute for Applied Systems Analysis (IIASA), and later was improved by the International Atomic Energy Agency (IAEA). MESSAGE is mixed integer linear programing (MILP) tool, designed to formulate and assess alternative strategies to supply energy constrained by the fulfilment of several restrictions, for example, investment limits, fuel availability, fuel price, environmental regulations, market share by technology, reserves, maximum deployment by technology, transmission capacity, maximum GHG emissions, among others.

The objective of this Doctoral thesis is to analyse the long-term expansion of the energy system and to analyse alternative low-carbon scenarios focusing on the transport sector in Ecuador. Specifically, the objective is to analyse, from IEP perspective, which is the role of different final energy carriers (fossil fuels, electricity, blends of fossil fuels with liquid biofuels and biogas) in low-carbon transport scenarios, and its implications in terms of land use, in the mid and long-terms. Expected results from this analysis up to 2050 are:

- Maximum feasible penetration of electric vehicles (PEV), electric massive transport, and its implications to the whole energy sector (primary energy matrix, final energy matrix, imports, exports, investments in the power sector, etc.)

- Maximum feasible blends of ethanol and biodiesel in the gasoline and diesel, respectively, to avoid conflict with other land uses and with the expansion of the agricultural border.

- Maximum feasible share of biomass in the energy and power matrix. Considering the national energy agro-industrial residues potential and the "waste-to-energy" potential, a relevant question to answer is what may be the participation of these residues up to 2050 in the energy and power matrix. One of the possibilities is the conversion of these residues to biogas to feed specific fleets of vehicles, for instance, taxis or institutional fleets.

- Feasibility of having a 100% renewable energy power matrix up to 2050. This feasibility may be assessed in terms of the amounts of investment for the expansion of the generation capacities.

- Finally, it will be important to calculate GHG emissions in Land Use, Land Use Change and Forestry (LULUCF) sector and how can it change up to 2050.

Keywords

Integrated Assessment Model (IAM), Integrated Energy Planning (IEP), MESSAGE, energy policy, climate policy, Ecuador.

Person specification

- Master in Science (M.Sc.) in Energy Planning, Energy, Energy Management, Mechanical Engineering, or related field. Please attach the titles and the "Reporte de Consulta de Títulos Registrados" from the SENESCYT web site.

- Good English level (at least B2). Some knowledge in the Portuguese language will be appreciated.

- Programming experience (Gams, R, Python, C++, Matlab)

- Experience in the energy sector: energy planning, energy tools, energy modelling, energy and climate policy

- It will be appreciated some experience with georeferenced information systems (ArcGIS, QuantumGIS)

- It will be appreciated some experience with inventories of greenhouse gas (GHG) emissions in the energy and LULUCF sectors.

- Ability to work with a multidisciplinary, international, regionally dispersed research team and carry out tasks autonomously.

- Knowledge and skills in scientific writing and publications. It will be appreciated previous experience in scientific publication.

Application documents

- Curriculum vitae in English. Focus on the above person specifications.

- Motivation letter to the Director of this Project.

- Declaration of availability to work full time on this research topic during the Doctoral Program during 4 years.

Application procedure:

- To apply to this PhD position please send your application documents, to the e-mail doctorado.mecanica@epn.edu.ec, with copy to rafael.soria01@epn.edu.ec. Please use this e-mail subject : "PhD position – DDPP project".
- Please merge all documents, annexes, etc. in a single PDF.
- Prepare the submission in English

Informal enquiries on the content of the research topic should be emailed to Dr. Rafael Soria: rafael.soria01@epn.edu.ec

More details about the Doctoral Program may be found in: https://doctoradomecanica.epn.edu.ec

Deadline for applications:

May 25th, 2018

Interviews week starting:

June 1st, 2018