Decision-making models for the definition of carbon-neutral energy scenarios

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Background

Air pollution and GHGs have dangerous impacts on human health and have disruptive effects on biological and ecological systems. The main drivers of these pollutions are human activities, whose emissions alter the composition of the atmosphere. Energy production and transport sectors are responsible for more than 50% of total CO_2 emissions. Useful tools to help decision-makers in planning air quality policies to mitigate this event are the Integrated Assessment Models (IAM).

Objectives

Development of an evaluation model aimed at supporting policymakers in the design of carbon-neutral scenarios, focusing on mobility measures. An Integrated Assessment Model estimates the optimized scenario that considers energy demand and its impact on air quality, total costs, GHG emissions and human health effects.

Methodologies

The decision problem is formalized as a multi-objective optimization problem that includes an air quality index, a greenhouse gas emission index and mitigation measures cost index. The control variables are the methods of energy production, the increase in demand for which is estimated considering the energy required to power the vehicle fleet. The solutions to the multi-objective problem are efficient emission control policies in terms of air quality, climate change mitigation and costs.

FIGURE 1. CO₂ EMISSION BY SECTOR, FROM CLIMATE TRANSPARENCY REPORT 2020.

Expected Results and Impact

To implement a system of models capable of defining beneficial policies for reducing CO_2 emissions and the negative effects on human health caused by air pollution. The expected result is to formalize a methodology to identify the strategies that minimize GHG emissions through the definition of new energy trajectories, with the respective environmental and health assessments. At the end of the study, guidelines will then be defined to tackle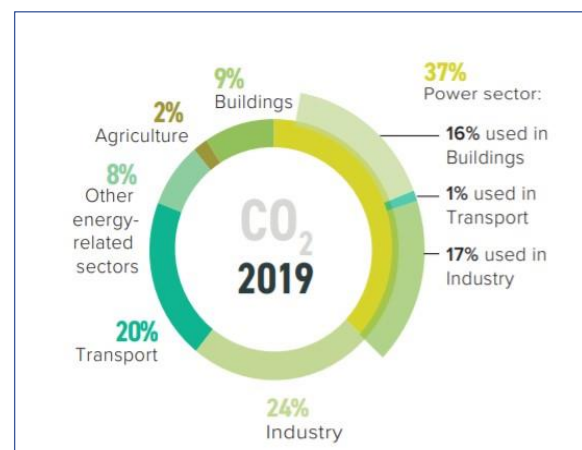 a sustainable energy transition path.