UNIVERSITY OF BRESCIA

PhD Program
in
TECHNOLOGY FOR HEALTH

Decision-making models to define carbon-neutral energy scenarios

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Background

UE aims to be climate-neutral by 2050. In literature usually climate change and air quality models are treated separately due to their different temporal and spatial dynamics. Since a transition to lower carbon energy system is likely to lead to fundamental restructuring of the global energy system, an integrated approach to select optimal energy production and consumption policies for both climate change and air quality is needed.

Objectives

The proposed project aims at implementing a new decision model that will select efficient reduction policies on energy production and consumption. The idea is to integrate in a new decision problem a CC model, an energy model and a set of air quality models to select optimal

Methodologies

The system can be delineated as a composition of two decisional models where objectives, decision variables and constraints can be defined. The two models to optimize are a Climate Change model and an IAM for Climate Change, Air Quality and Energy. The Climate Change model's objective function is the difference between the temperature anomaly and a reference temperature value (1.5°C or 2°C). The IAM model will have a multi-objective function (figure 1).

$$\min_{x \in X}[GHI(E(x)), AQI(E(x)), CI(x)] \;\; s.t. \;\; \begin{cases} h(x) < 0 \\ g(x) = 0 \end{cases}$$

FIGURE 1. IAM MODEL'S OPTIMIZATION PROBLEM.

Where *x* are the decision variables of the problem (the energy production mix) within the feasible solutions space *X*, *GHI* is the Greenhouse Gases Index, *AQI* is the Air Quality Index and CI is a Cost Index. *h* and *g* are constraints functions for the problem.

Expected Results and Impact

The modelling system will identify efficient policies that will impact on:

- Environment: air quality improvement, GHG emissions reduction.
- Economy: expansion of a more sustainable circular economy.
- Policy: support for policy makers for the energy transition.
- Health: efficient energy, air quality and climate policies can reduce citizen exposure to harmful air pollutants (lung and cardiovascular diseases) and extreme meteorological events such as heat waves or flooding.