Energy system planning models for cities: On the limits of existent modeling tools and a new approach for models tailored to the needs of developing countries

Theme: Energy socioeconomics

Aminata Fall, Energy Economics Group - Vienna University of Technology, Saarplatz 2, 1190 Vienna (Austria)

The community of nations has resolved to ambitious targets for development in 2015, by adopting sustainable development goals, including on energy access (SDG-7) and livability of cities (SDG-11). When related to the concept of development, the energy sector is one among a number of other sectors such as health. However, its cross-cutting nature and the nexus it forms with other sectors make dynamics in the energy system impact, in a broader perspective, development targets.

Models are the most used instruments for description and analysis of a system. Connolly et al. (2009) identified sixty height computer based energy modeling tools, including MARKAL and MESSAGE. We tried make use of these tools in our research context, the city of Dakar in Senegal, considering three filter-steps based on the following criteria:

(1) Experience of use in a developing country returns 40 models (Urban et al., 2007).
(2) Focus on energy and electricity and exclude models which entirely focus on climate change and its impacts or address economic issues such as energy markets returns 12 models (Urban et al., 2007).
(3) Possibility to scale down from national to subnational level returns 0 model.

This paper documents reasons why existent energy models cannot be used for planning the energy system of an emergent city in a developing country. It also proposes a new approach for designing a tool that is tailored to the needs of a city like Dakar, using as methodology a combination of multi-criteria decision making analysis and mechanism design. The analysis shows the new methodology is applicable and returns more accurate results in terms of scientific validity, and potentially has an experimental validity that is yet to be confirmed in the field.

Keywords: Energy sustainability; Developing country; Cities; Complex systems; Models

Corresponding author:

ID: Aminata Fall
Mail: amissfall@gmail.com
Tel: +43 (0) 664 37 39 631