Student Presentation

Simulating Bottom-up Supply-Side Residential Energy Systems with Non-linear Conversion Efficiency: A System Dynamics Approach

Bilal Bugaje (University of Nottingham)

Recent years have witnessed an increased interest in distributed energy generation and a larger number of stakeholders getting involved in energy planning. These trends provide an opportunity for new tools to model energy systems from the bottom-up. Existing models obscure crucial features of bottom-up energy models, like energy conservation, energy loss and the causal relationships among system elements. In addition to simple diagrammatic modelling of these features, a systems approach may have other benefits to models of supply-side residential energy systems, especially given that energy planning deals with systems that traverse multiple disciplines. This paper proposes an application of System Dynamics to model the supply-side of residential energy systems from the bottom-up. A case study is demonstrated where models are created and validated using data from project SENSIBLE in Nottingham, UK. The models feature energy conservation, energy conversion loss based on a non-linear efficiency curve, and causal connectedness. Furthermore, a System Dynamics approach can contribute towards a systematic validation of the bottom-up modelling process in the form of validity tests. System Dynamics can be a valid option among the tools used for modelling residential energy systems using a bottom-up approach. This study represents the first attempt to develop a bottom-up supply-side simulation of an energy system using System Dynamics.