An Agent Based Model for Renewable Electrification Planning

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Literature acknowledges that increasing the electrification rate in developing countries is key for a sustainable future. However, the increase in electrification cannot follow the trends that developed countries have taken. Instead a new path should be cut, one that uses appropriate fuels and infrastructure patterns. Shifts away from centralized infrastructure schemes and fossil fuels towards decentralized generation and renewable energy fuels are suggested widely as the solutions. However, planning of adequate electricity systems will likely depend on regions' particular situations.

The planning of electrical grids requires good modeling and data that allow the consideration of different scenarios. There are few models for policy makers to study the optimal deployment of renewable energy stores and mix of centralized grid extension with decentralized generation. An agent-based model is presented that allows policy makers to explore this issue.

The model considers renewable energy stores; population density, location, size and electricity demand; and costs of generation and transmission assets. The model allows policy makers to explore decisions schemes to minimize the cost of the overall electricity network through the appropriate use of renewable energy stores, grid extension, and decentralized generation. This model provides an intuitive graphic user interphase appropriate for policy makers to run their own studies and scenario building.

The model is used in this paper to create a generalized decision space that provides trends for guidance in the general creation of electricity networks. The trends are created through the use of expected values in rural areas and developing countries the parameters in the model and the exploration of six different decision schemes. The decision schemes illustrate decision makers and consumers' preference for initial location of an electric generation project and economic indicators for expansion.

The results of the generalized scenario show the appropriate levels of network expansion and decentralization and expected trends of transmission and generation costs as related to the different parameters studied. These results provide policy makers with information that can help their own planning process considering their particular conditions.