The Impact of Subsidies on the Demand for Electrification in Rural Kenya

Researchers:

Kenneth Lee

Edward Miguel

Catherine Wolfram

Sector(s): Environment & Energy

J-PAL office: J-PAL Africa

Fieldwork: Innovations for Poverty Action (IPA)

Location: Kenya

Sample: 2289 non-electrified households in 150 rural communities

Target group: Rural population Families and households

Outcome of interest: Energy access

Intervention type: Subsidies Pricing and fees

AEA RCT registration number: AEARCTR-0000350

Data: AEA website

Research Papers: Experimental Evidence on the Economics of Rural Electrification, Does Household Electrification Supercharge Economic Development?

Partner organization(s): Kenya Rural Electrification Authority, Kenya Power, USAID, World Bank, Weiss Family Program Fund for Research in Development Economics, University of California, Berkeley, Center for Effective Global Action (CEGA)

Over the past century, rural electrification has served as a key benchmark for economic development and social progress. Researchers conducted a randomized evaluation to measure the impact of offering subsidies to connect to the power grid on the demand for electricity in rural areas of Kenya. Few households took up the offer to connect to the grid, even at highly subsidized prices. Beyond price, issues of credit constraints, bureaucratic obstacles, and poor reliability of the electrical utility may have lowered household demand for electrification.

Policy issue

In sub-Saharan Africa, roughly 600 million people currently live without electricity (IEA 2014). Access to reliable and affordable energy can be critical for a country's sustained economic growth. Achieving universal access to modern energy is thus a primary policy goal in the region. International development assistance has focused on investments in infrastructure, including electricity systems.

Recent initiatives to improve access to electricity have focused on the transmission and distribution of electricity, while less is known on the economic and social returns to providing electricity to last-mile households – end users of grid electricity in hard-to-reach areas. It remains contested whether increases in energy access for rural households should be driven by investments in large-scale infrastructure, such as grid connections, or small-scale decentralized-solutions, such as solar lanterns and so- lar home

systems. What are the social and economic impacts of access to the electric grid in rural areas? Are the benefits of accessing the electric grid worth the costs of connection?

Context of the evaluation

In recent years, the government of Kenya has dramatically increased the coverage of the electric grid. The driving force was the creation of the Rural Electrification Authority (REA), a government agency established in 2007 to accelerate the pace of rural electrification. Initially, REA prioritized the connection of public facilities such as market centers, secondary schools, and health clinics. This expansion came at a substantial cost to the government: over US$100 million per year. By 2014, however, the national household electrification rate remained relatively low at 32 percent, with much lower rates in rural areas. As a result, setting up these remaining last-mile connections to the electric grid has become a political priority in Kenya.

Previously, any household in Kenya within 600 meters of an electric transformer could apply for an electricity connection at a fixed price of KES 35,000 (US$398 at the time of evaluation). While below the cost to supply the connection, this price was very high in a setting in which most households' annual income was below US$1,000. Among study participants, 92 percent of unconnected households used kerosene as their primary lighting source, and spent an average of US$5.55 per month on energy. A small proportion of participants from unconnected households owned solar lanterns (6 percent) and off-grid solar home systems (3 percent).



A woman walks through an informal settlement in Kenya.

Photo credit: Jonathan Torgovnik, Getty Images, Images of Empowerment

Details of the intervention

Researchers partnered with REA to measure the impact of offering subsidies to connect to the power grid on the demand for rural electrification in Kenya.

Researchers randomly selected 150 transformer communities—groups of households located within 600 meters of a transformer—in Busia and Siaya, two rural counties in Western Kenya. To limit construction costs, REA requested that researchers restricted the final selection of households to the 85 percent within 400 meters of a transformer. From that group, researchers randomly selected 2,289 households to participate in the evaluation, with roughly 15 households in each community. Researchers then randomly assigned half of the communities to receive three different levels of subsidies for electric connections, while the other half served as a comparison group. Unconnected households that were randomly assigned to receive the intervention were offered to connect to the grid at one of the following subsidized prices:

- *High subsidy group*: 380 unconnected households were offered a 100 percent subsidy (US$398) and thus received the connection for free.
- *Medium subsidy group*: 379 unconnected households were offered a 57 percent subsidy (US$227) and paid US$171 to connect to the grid.
- *Low subsidy group*: 380 unconnected households were offered a 29 percent subsidy (US$114) and paid of US$284 to connect to the grid.
- *Comparison group*: 1,150 unconnected households received no subsidy and faced the regular connection price of $398.

Households were given eight weeks to accept the offer and deposit full payment into REA's bank account. After verifying payments, REA began connecting households to the grid with an average time of seven months to complete the connection. Between August 2013 and December 2017, researchers collected data on electricity consumption and demand, as well as household wellbeing, including on education and health.

Results and policy lessons

Demand for electricity connections fell rapidly as prices increased. The costs of connecting households to the grid were higher than the economic and social benefits for households in this setting. Beyond price, issues of credit constraints, bureaucratic obstacles, and poor performance of the electrical utility may have lowered household demand for electrification.

Demand for connection to the electric grid: The price to join the power grid strongly impacted households' decisions to purchase a connection. Offering households a free grid connection increased households' likelihood of take-up by 95 percentage points. However, demand fell sharply with lower subsidies. In the medium subsidy group and the low subsidy group, households were only 21 percent and 5 percent more likely to take-up the offer compared to households in the comparison group who paid full price. Meanwhile, only 1 percent of households in the comparison group, who did not receive any subsidy, chose to connect to the grid.

Obstacles to Take-Up: Apart from price, issues related to credit constraints, bureaucratic obstacles, and low electrical grid reliability may have diminished household demand for electrification. The impacts of credit constraints on the demand for electricity connections may have been exacerbated by the fact that households had to redeem their subsidy within a short time of the offer.

Corruption and Mismanagement: Audits of the electric contractors' work revealed over-reporting of labor and transport costs and some evidence of leakage in the form of missing electrical poles. This indicated that electric grid construction costs may be inflated due to mismanagement and corruption, suggesting that improved monitoring and enforcement of contractors could reduce costs.

Welfare Impacts: For households who received an offer for a subsidized grid connection, there was no change in asset ownership, household expenditures, health outcomes, or student test scores. Overall electricity consumption remained low among newly

connected households. However, households' investment in an electricity connection may have forgone other investments, such as household consumption, or investments in health or education.