Welfare Benefits of Decentralized Solar Energy for the Rural Poor in India

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Sector(s): Environment, Energy, and Climate Change

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Location: Rural Bihar, India

Sample: 3,069 households in 100 villages

Target group: Rural population

Outcome of interest: Energy access

Intervention type: Renewable energy Pricing and fees

AEA RCT registration number: AEARCTR-0000132

Partner organization(s): Acumen Fund, Husk Power Systems, International Growth Center (IGC), Shakti Sustainable Energy Foundation, United States Agency for International Development (USAID)

Electricity is considered critical to encouraging economic growth and reducing poverty. As the price of decentralized solar energy has continued to decline, it has excited widespread interest as an affordable and environmental alternative to centralized grid electrification efforts. To evaluate the demand for solar electricity, and the welfare impacts of access to high quality lighting, solar microgrid connections are being offered at different prices to households in rural areas of Bihar, India.

Policy issue

Worldwide, 1.3 billion people lack access to electricity. In India, 300 million people have no access to power. Electricity is considered critical to encouraging economic growth and reducing poverty. It lights homes without locally polluting air, refrigerates health center vaccines, powers school and business computers, and runs industry' s machines. But expanding energy access to rural areas (such as those in India) can present prohibitive logistical, financial, and environmental challenges.

One policy response with high potential is to promote small, decentralized electrification projects, especially using renewable energy sources, which also reduce the need to burn fossil fuels for electricity. In India, solar energy has attracted substantial interest for its potential in bringing power to unelectrified rural markets. Functioning independently of larger grid connections, solar microgrids can be used to generate electricity locally and serve the basic lighting needs of consumers. However, solar energy products are still limited and, as with centralized grids, rural maintenance can be costly and logistically challenging. Cost effectiveness concerns remain, as do questions about consumer demand and their willingness and ability to pay.

Despite its recent rise and future promise, little research has rigorously examined the effect of decentralized solar energy on the ultimate welfare of rural households and communities. There is also little research about the price sensitivity of demand for solar

energy and the competitive environment in which decentralized renewable energy providers must operate.

Context of the evaluation

Within the study sample in rural Bihar, the average household was comprised of six people, with a total annual income of Rs. 68,000 (US$1,100). Almost all households owned their home and farmland, and 59 percent were literate. Fuel-based stoves and lamps can increase indoor air pollution, and in the year prior to the survey, more than half reported worsening wheezing due to either cooking stoves or kerosene lamps and 21 percent reported a respiratory infection. Only 5 percent of households had grid electricity connections at the start of the study, although most villages had electrified public facilities. Of households with grid electricity, only one-third reported that they trusted their centralized grid connection and only 13 percent reported receiving electricity regularly when they paid for a subscription. Alternative electricity sources included local diesel generators, supplying power to nearly 20 percent of households.

Installing a solar microgrid in India. Photo: Anna da Costa | CC BY-NC-ND 2.0

Details of the intervention

Researchers conducted a randomized evaluation to test the impact of small, decentralized solar energy products on welfare. In partnership with Husk Power Systems, researchers offered a set of two solar-powered LED lights and one solar-powered mobile phone charging station to rural households in Bihar.

After an initial baseline survey of 100 villages in late 2013, researchers randomly selected 66 villages where households were

offered connections to a solar microgrid providing enough power for basic LED lighting and mobile charging. The remaining 34 villages served as the comparison group. To evaluate households' willingness to pay for solar electricity, Husk Power further divided villages offered electricity connections into two separate groups: 33 villages were offered solar products at a Rs. 200 (US$3.20) monthly rate, while 33 villages received solar offers at a cheaper Rs. 100 (US$1.60) rate. Around 15 months later, researchers conducted an endline survey to gather information on fuel collection times, respiratory health, children' s school attendance, and other characteristics from each sampled household across all villages to compare the effect of decentralized solar energy.

Results and policy lessons

Survey ongoing, results forthcoming.

Sudarshan, Anant, Michael Greenstone, Nick Ryan, and Robin Burgess. "Welfare Benefits of Decentralized Solar Energy for the Rural Poor in India." Presentation at EPIC India Seminar Series presentation, Delhi,, India, September 30, 2014.