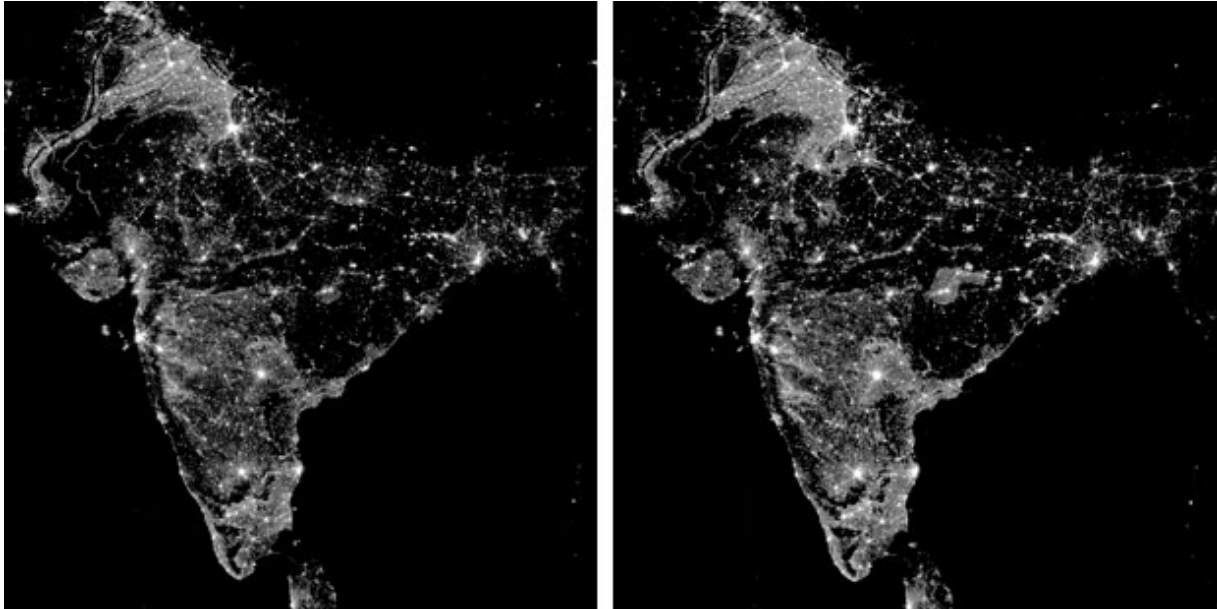


# Electrification Causes Economic Growth, Right? Maybe Not

By Peter Fairley

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Images: Fiona Burlig and Louis Preonas; Image and Data Processing: National Geophysical Data Center/NOAA

Comparing nighttime satellite images such as these from 2001 [left] and 2011 [right] enables independent tracking of changes in rural electrification.

Electrification is associated with a seemingly endless list of social and economic goods. Nations that use more power tend to have increased income levels and educational attainment and lower risk of infant mortality, to name but a few. So I was baffled to stumble across a pair of economic analyses on electrification in India and Kenya, posted last month, that cast serious doubt on what has long assumed to be a causal link between the glow of electricity and rural development.

“It is difficult to find evidence in the data that electrification is dramatically transforming rural India,” concludes Fiona Burlig, a fourth-year UC Berkeley doctoral student in agricultural and resource economics who coauthored the India study. “In the medium term, rural electrification just doesn't appear to be a silver bullet for development.”

Burlig admits she was flummoxed by the results, which are presented in a [white paper](http://ei.haas.berkeley.edu/research/abstracts/abstract_wp268.html) ([http://ei.haas.berkeley.edu/research/abstracts/abstract\\_wp268.html](http://ei.haas.berkeley.edu/research/abstracts/abstract_wp268.html)) written with coauthor and fellow doctoral student Louis Preonas for the UC Berkeley [Energy Institute at Haas](http://ei.haas.berkeley.edu/index.html) (<http://ei.haas.berkeley.edu/index.html>) (and also [engagingly posted on Burlig's blog](http://www.fionaburlig.com/blog/2016/5/3/out-of-the-darkness-and-into-the-light-development-effects-of-rural-electrification-in-india) (<http://www.fionaburlig.com/blog/2016/5/3/out-of-the-darkness-and-into-the-light-development-effects-of-rural-electrification-in-india>)).

“We were completely surprised. We expected that electricity would be great for growth. It should have all of these positives effects,” says Burlig. She then points to the more than [70 pages of analysis in the report's appendix](https://ei.haas.berkeley.edu/research/papers/WP268Appendix.pdf) (<https://ei.haas.berkeley.edu/research/papers/WP268Appendix.pdf>), where she and Preonas kicked the tires and ultimately convinced themselves that the findings were legit.

It is a delicate finding. Global finance institutions are kicking up partnerships with industrialized and developing nations alike to accelerate electricity access for the estimated 1.1 billion people worldwide who still lack it. Technology providers and entrepreneurs are helping to expand their efforts by engineering off-grid options such as solar microgrids (<http://spectrum.ieee.org/energywise/energy/renewables/electrification-rumble-renewable-minigrids-challenge-the-big-grids-primacy>).

So it feels almost morally wrong to attach a question mark to this burst of good deeds, to cast doubt on the benefits of sharing the world of opportunities that plug into an electrical socket.

Alas, the research looks compelling. Burlig and Preonas explore India's rural electrification program, exploiting one aspect of it to reveal electricity's true impact. Until 2010 only villages with 300 or more residents qualified for India's program. Burlig and Preonas evaluated the trajectories of 21,059 villages on either side of that arbitrary divide between 2001 and 2011, by which time newly electrified villages in the sample had had electricity for 3 to 5 years.

They verified increasing levels of electrification by mapping nighttime illumination using NOAA satellite imagery and measuring each village's brightest pixel. Villages that were "barely eligible" for electrification (those with 300 to 450 residents) brightened significantly between 2001 and 2011, whereas the "barely ineligible" villages (with 150 to 300 residents) did not.

Economists routinely use nighttime brightness as a proxy for economic activity because everyone knows that electrification equals development, right?! Burlig and Preonas ran the numbers instead, evaluating the villages' status via India's 2001 and 2011 censuses.

They checked for electrification impacts in five broad areas: demographics, occupational status, ownership of assets such as telephones and bicycles, school enrollments, and village-level improvements such as a new post office or mobile phone coverage. And they came up nearly empty. "The effects are very small," says Burlig.

Just one small statistically significant change appeared: on average, 1 man per village of 300 moved out of agricultural work and thus *may* have improved his earning potential.

Based on conversations in freshly grid-connected villages near Bangalore, Burlig believes that the grid connections may well be improving "overall human well-being." Some of the smallholder farmers they spoke with had satellite TV dishes on their 1 to 2 room homes, and most said that they "really liked" their electricity.

But they also universally reported that power was not impacting how they earned their income. "Anecdotal evidence [suggests] that electricity is making people happier. But it's not dramatically changing the economy in rural areas," says Burlig.

This contrasts sharply with a 2011 study of rural electrification in South Africa (<https://www.aeaweb.org/articles?id=10.1257/aer.101.7.3078>) by Dartmouth College economist Taryn Dinkelman (<http://economics.dartmouth.edu/people/taryn-dinkelman>) that identified electrification as an important development

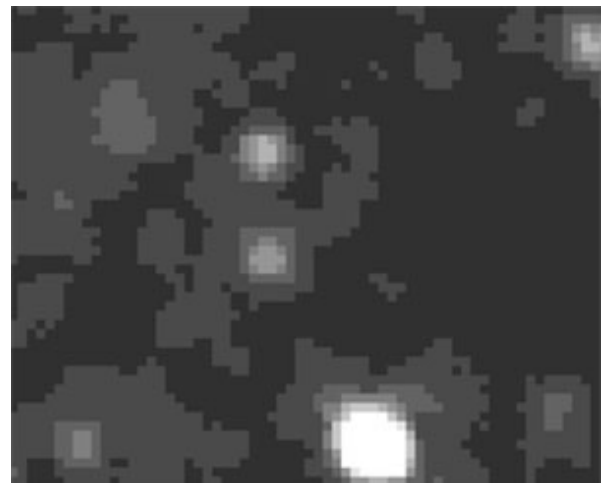


Image: Fiona Burlig and Louis Preonas; Image and Data Processing: National Geophysical Data Center/NOAA

The brightest pixel of evening light within each village's boundaries provides a measure of its electrification level.

booster. Dinkelman's analysis suggested that electrification was significantly boosting female employment within five years by releasing women from home production and enabling microenterprises.

Bolstering Burlig and Preonas' power critique is [another study on rural electrification released by UC Berkeley economists last month](http://emiguel.econ.berkeley.edu/research/experimental-evidence-on-the-demand-for-and-costs-of-rural-electrification) (<http://emiguel.econ.berkeley.edu/research/experimental-evidence-on-the-demand-for-and-costs-of-rural-electrification>) and the first ever to conduct a randomized electrification trial. The researchers, including Oxfam chair [Edward Miguel](http://emiguel.econ.berkeley.edu) (<http://emiguel.econ.berkeley.edu>) and [Catherine Wolfram](http://facultybio.haas.berkeley.edu/faculty-list/wolfram-catherine/) (<http://facultybio.haas.berkeley.edu/faculty-list/wolfram-catherine/>), partnered with Kenya's rural electricity authority to select villages at random and offer their residents grid connections at different subsidy rates. They found that consumer benefits were less than the total costs at all price structures, leading to the stunning conclusion that "residential electrification may reduce social welfare."

Wolfram has expressed concerns that rural electrification programs may misdirect limited funds, favoring electricity for homes over assuring reliable power supplies to schools, factories and hospitals. In [a post to The Energy Collective blog last year](http://www.theenergycollective.com/catherinewolfram/2271905/are-we-too-fixated-rural-electrification) (<http://www.theenergycollective.com/catherinewolfram/2271905/are-we-too-fixated-rural-electrification>) she wrote:

I am not denying that rural electrification brings benefits. Nonetheless, any expenditure of public, World Bank or NGO money has an opportunity cost, so spending money on rural electrification means we can't spend money somewhere else.

Burlig strikes a similar note, calling for more research to identify the conditions under which electrification delivers the biggest bang for development. One possibility, she suggests, is that developing countries might do better to focus limited development budgets on improving power *quality*. Reducing the frequency of blackouts in cities may unleash pent-up potential for economic growth, she says.

Coda: For India specifically, the moment for policy advice may have passed. Prime Minister Narendra Modi pledged last August to bring power to the 18,452 remaining unelectrified villages within 1,000 days. According to the government's [online electrification dashboard](http://garv.gov.in/dashboard) (<http://garv.gov.in/dashboard>), grid connections have already reached nearly 7,300 of those villages, while microgrids have electrified another 678.

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