

Who Benefits Most from Rural Electrification? Evidence in India

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The goal of rural electrification programs in developing countries goes, over the long run, beyond providing rural households with affordable modern energy. Rural electrification is expected to improve people's quality of life and spur growth on a range of socioeconomic fronts.

As a replacement for kerosene-based lighting sources that emit a dull light and are inadequate for reading or close work, electric lighting is much brighter and it also lowers indoor pollution.

Electric lighting can also help income-generation activities through business operations being able to stay open longer and promoting productive uses. In addition to its various consumption roles, electrification has a distinctive productive role since electricity-powered machinery and tools can replace inefficient manual ones, resulting in more revenue and profit for household-based production activities that use such tools. This paper analyzes the impact of electrification on a wider range of household outcomes in rural India and determines who benefits most from rural electrification. This paper, using an econometric analysis, estimates the average and distribution benefits of rural electrification using rich household survey data from India.

Despite rapid urbanization, about three-quarters of India's population still reside in rural areas. Most rural people continue to rely on traditional biomass fuels to meet most of their energy needs. This is true even for households with electricity. For lighting, kerosene is the primary energy source for households without electricity. Even among households with electricity, kerosene is an important backup lighting source.

Household electrification rate in rural areas —nearly 60 percent on average—is significantly less than that in urban areas (more than 94 percent). Low household-connection rates are often attributed to low incomes, high connection costs, poor-quality housing construction, and unreliable electricity services. Education and wealth indicators positively affect grid connectivity and consumption. Demand for electricity declines as its price increases, and the cross-price effects of fuel wood and kerosene are significant for electricity consumption. In households with electricity, children—both boys and girls—spend more time studying than in households without electricity. Also, in households with electricity, compared to those without a

connection, both males and females spend more time in productive activities. Household income and expenditure on food and non-food items are higher for electricity users than non-users.

However, higher average value of outcomes for electricity users does not imply a causal impact.

Econometric estimation, which establishes causality between electrification and welfare gains, shows that household electrification lowers domestic kerosene consumption by 35 percent. Household electrification reduces biofuel collection time for household adults by more than 3.3 hours per month. Electrification access increases school enrollment by about 6 percent for boys and 7.4 percent for girls. It also increases their weekly study time by more than an hour. The average completed schooling year increases by about 0.3 and 0.5 for boys and girls, respectively, as a result of electrification.

The impact of electrification on labor supply is positive for both men and women. Household access to electricity increases employment hours by more than 17 percent for women and 1.5 percent for men. Electrification increases household per capita income by nearly 38.6 percent (mostly due to increase in nonfarm income). Household per capita expenditure increases by more than 18 percent, and poverty incidence decreases by 13.3 percentage points as a result of electrification.

The impacts of electrification across income and expenditure quantiles vary, with richer households tending to benefit more than poorer ones. In fact, households in the lower two expenditure quantiles (15th and 25th percentiles) accrue very little (statistically zero). In terms of income, households from all quantiles benefit from electrification; for those in the lowest quantile (15th percentile), the impact is about 26 percent, compared to nearly 46 percent for the richest households (85th percentile).

Finally, quality of service affects household's grid connectivity and electricity consumption, and subsequently electrification benefits. Villages without power outages have an electrification rate of 81 percent, while those with more than 20 hours of power outages per day have an access rate of only about 38 percent. This implies that quality of service can affect electrification benefits a lot as ensuring just access is not enough. This requires a thorough analysis of the supply side bottlenecks.