Should Regulators Make Electric Utilities Pay Customers for Poor Reliability?

HARVARD Kennedy School
BELFER CENTER
for Science and International Affairs

June 2020
belfercenter.org/ENRP

Kinnaur Kailash, Kalpa, Himachal Pradesh, India. Source: Saurav Kundu via Unsplash.

POLICY BRIEF

Should Regulators Make Electric Utilities Pay Customers for Poor Reliability?

India's Power Outage Compensation Policies

AUTHORS

Shefali Khanna
skhanna01@fas.harvard.edu

Kevin Rowe
krowe@g.harvard.edu

Shefali Khanna and Kevin Rowe are Ph.D. candidates in Public Policy at Harvard Kennedy School. This brief is part of Khanna and Rowe's ongoing research collaboration as recipients of the 2018-2019 Joseph Crump Fellowship.

Overview

In September 2017, the Delhi Electricity Regulatory Commission (DERC) required that the city's regulated electricity distribution utilities pay compensation to customers experiencing power outages of three hours or longer. The measure was intended to incentivize the utilities to invest in the infrastructure and management practices needed to deliver higher levels of service quality. In 2019, India's central government announced that it was considering rolling out a similar policy for utilities across the country. Can outage compensation policies help India's power system achieve better reliability for all customers?

This policy brief describes the persistent challenge of poor electricity reliability in India and how it interacts with key regulatory policies, analyzes Delhi's experience with outage compensation since 2017, and highlights areas for additional economic and policy research on this topic.

Main Findings

- Poor electricity reliability in India persists in part because retail pricing policies that subsidize consumption for the poor also tend to disincentivize utilities from investing in higher levels of service quality, particularly for the most generously subsidized customers.

- Delhi's experience suggests that outage compensation policies can counteract these incentives but cannot circumvent the tradeoff between keeping prices low and incentivizing higher levels of service quality.

- Additional research is required to understand how much customers in developing countries like India value electricity reliability, to better inform pricing and related policies that affect the incentives of utilities.

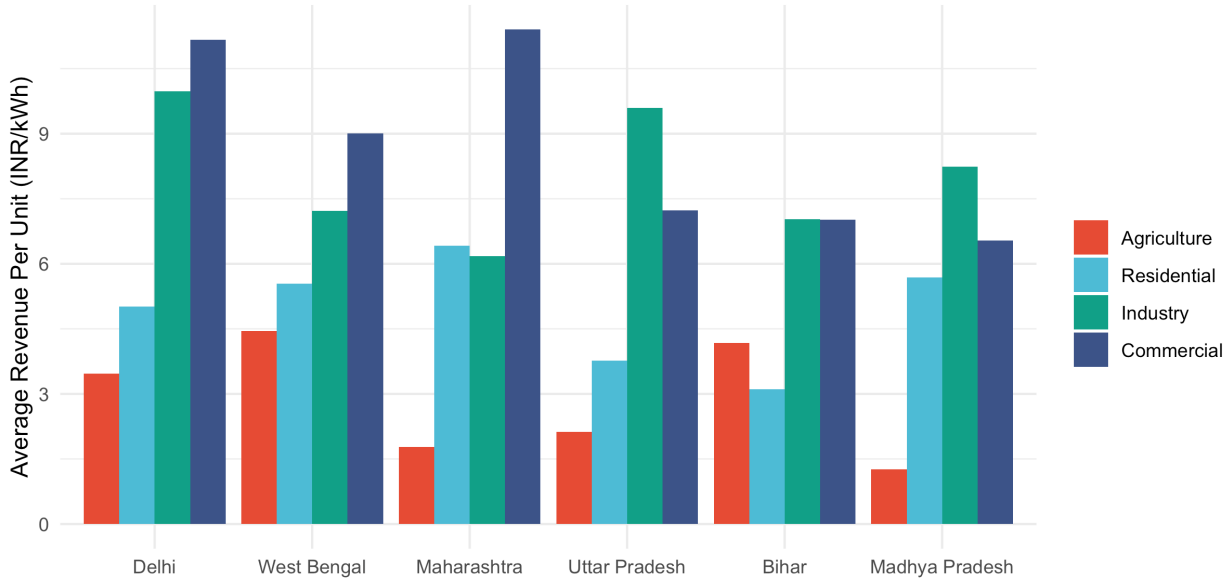
1. India's Power Outage Problem

In May 2018, the Government of India announced that it had completed electrification of all villages across the country. [1] While millions of households remain without an electricity connection, the focus of expanding electricity access in India has moved from building out the electricity transmission and distribution grid to improving service quality for grid-connected customers. Raising electricity reliability is a central focus: a recent survey of six of India's most populous states found that on average, households face 11 hours of electricity outages per day.[2]

Poor electricity reliability across much of India reflects a tradeoff between affordability and service quality – a tradeoff facing electricity policymakers across the developing world. Highly subsidized regulated retail electricity prices for residential and agricultural customers keep electricity affordable for most households in India, but they also undermine the finances of the regulated distribution utilities that supply power to retail consumers. In many states, prices for agricultural and poor residential customers are set so low that they only recover a fraction of the cost to the utilities of supplying power to these consumers. In these states, utilities are forced to choose between supplying power to many of their consumers at a loss or rationing power through rolling blackouts called "load shedding."

Moreover, because electricity rates in most states keep prices high for commercial and industrial customers to compensate for large subsidies to residential and agricultural customers, utilities have strong financial incentives to maintain the highest levels of service quality for commercial and industrial customers while imposing blackouts on residential and agricultural customers. Figure 1 illustrates the magnitude of these cross-subsidies across customer groups in Delhi and India's five most populous states. At the extreme, commercial customers in Maharashtra paid four times more than agricultural customers per kilowatt hour (kWh) in 2017. Meanwhile, agricultural customers faced more than 10 times as many hours of power outages as commercial customers during this same period.[3]

Figure 1. Average Revenue Per Unit by Customer Catagory, Delhi and Five Most Populous States, 2017-2018.



Data Source: *Power Finance Corporation (2019). Report on Performance of State Power Utilities, 2017-2018.*

2. Delhi's 2017 Outage Compensation Policy

While Delhi has one of India's most reliable electricity systems, power outages remain weekly or monthly occurrences for millions of customers and disproportionately affect the poorest customers. In September 2017, the Delhi Electricity Regulatory Commission (DERC) required that the city's regulated electricity distribution utilities pay compensation to customers experiencing power outages of three hours or longer. The measure was intended to incentivize the utilities to invest in infrastructure and management practices needed to deliver higher service quality.

While much of India's electricity distribution segment consists of state-owned distribution-only or integrated generation, transmission, and distribution utilities, several of India's large cities have employed public-private partnership models in distribution (Pargal and Banerjee, 2014). Under these regimes, private companies acquire distribution grid assets and the right to exclusive retail service territories under strict pricing and service quality regulations by an electricity regulatory commission. Generally, these franchising schemes guarantee the franchisee a rate of return conditional on a set of performance criteria related to improving service quality.

Delhi pursued the partial privatization of its electricity distribution system under this model alongside the "unbundling" of the Delhi Vidyut Board, the territory's vertically-integrated, state-owned electricity company, in 2002. The unbundling policy established regulated generation and transmission utilities, an independent system operator called the State Load Dispatch Centre, and a regulatory commission. The distribution segment was divided into five entities, two small legacy distribution utilities serving central government and military areas in central New Delhi, and three public-private distribution franchises. Private operators for the distribution franchises were selected through a competitive bidding mechanism in which candidate operators bid for five-year aggregate technical and commercial (AT&C) loss reduction targets achievable for a guaranteed rate of return on equity of 16 percent. ATC losses refer to revenue that is not recovered on energy served due to line losses (technical) and theft and non-payment (commercial).

At the time of the partial privatization in 2002, the AT&C losses of the DVB were approximately 50 percent. This is to say that the DVB collected revenue on only about half of the energy it supplied to the distribution grid. While Delhi has few agricultural markets, which are the source of high AT&C losses in many states, it saw exceptionally high rates of theft and bill non-payment. Until the reforms, regulations had prevented the DVB from serving informal settlements that were home to several million people. As a result, these settlements were served exclusively by illegal connections. Over the past 17 years, Delhi's three private distribution franchises have dramatically improved reliability in the capital. According to the Power Finance Corporation, by the mid 2010s the AT&C losses of Delhi's distribution utilities were among the lowest in the country, ranging between 9 and 15 percent.[4]

While Delhi's utilities achieved dramatic improvements in service quality and financial performance in the decade and a half following privatization, poor reliability has remained a persistent challenge for customers paying the lowest rates. Between 2007 and 2017, outage durations fell by more than 60 percent for customers in the top two-thirds of average rates.[5] Customers in the bottom third of rates saw only modest improvements in reliability during this period and faced about 2.5 hours of outage on average each month. This gap in reliability between the customers paying the most and those paying the least was a main motivation prompting Delhi's regulators to push outage compensation.

The 2017 DERC Supply Code, issued in September 2017, mandates that electricity distribution companies in Delhi compensate customers INR 10 ($0.13) per hour of unscheduled power cuts up to a maximum of INR 200 ($2.61) per hour if power supply is not restored within a specified timeframe. [6] [7] The third amendment to the 2017 Supply Code, enacted in December 2018, revised the compensation scheme so that customers would henceforth receive INR 50 ($0.65) per hour for the first two hours of unscheduled power cuts and INR 100 ($1.31) for each additional hour.[8] The compensation is paid directly to customers as an adjustment on their electricity bill. The 2018 amendment also requires that the distribution companies pay all affected customers automatically without requiring a claim to be filed by individual customers.

Delhi's compensation policy directly counteracts the adverse incentive to differentiate service quality based on the price customers pay. Because of the cross-subsidies in Delhi's regulated electricity prices, serving one kWh to commercial customers in Delhi returns more than three times as much revenue to the utilities than does serving one kWh to residential customers. As a result, the utilities are strongly incentivized to maintain higher levels of reliability to these higher paying customers. By requiring utilities to pay per customer, the outage compensation policy does not privilege higher paying customers. Figures 2 and 3 show that reliability improved most among lower paying residential customers following the implementation of the 2017 policy. The improvements were greatest in areas with more informal settlement customers, who are generally very poor.

While we cannot attribute the reliability improvements seen in Figures 2 and 3 to the compensation policy exclusively, operational changes implemented at Delhi utilities in response to the policy suggest that it succeeded in incentivizing reliability improvements for the poorest customers. For example, one of Delhi's utilities implemented a new system of prioritizing investment and maintenance on grid infrastructure that considers the number of customers affected - in addition to the amount of foregone revenue - by outages resulting from failures of those devices.

Figure 2. Mean Hours of Outage by Feeder Customer Composition

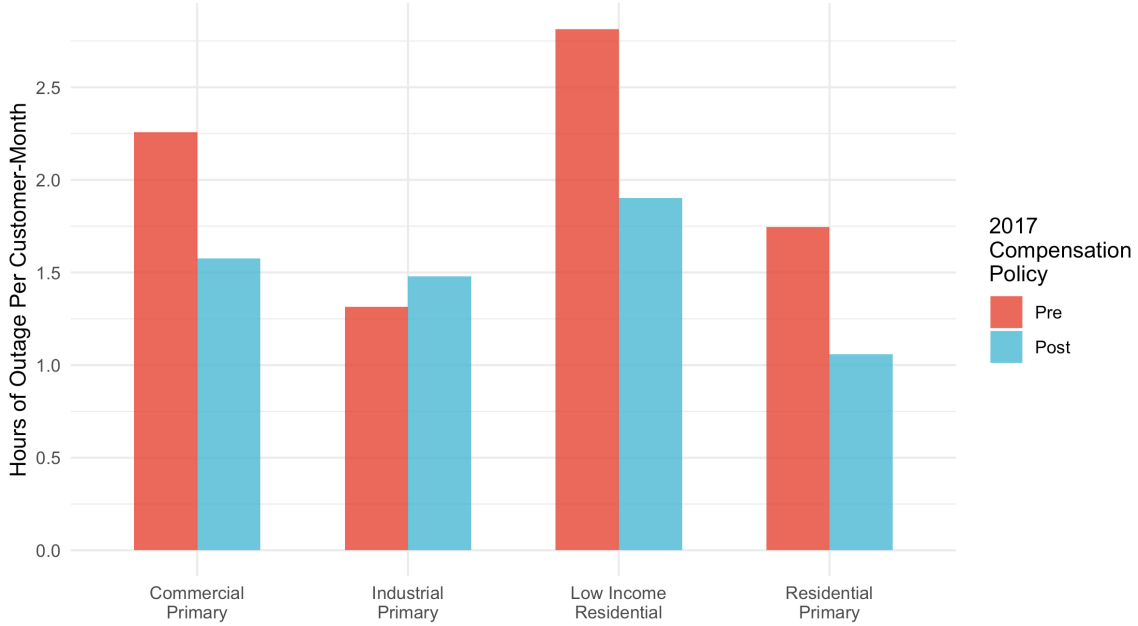
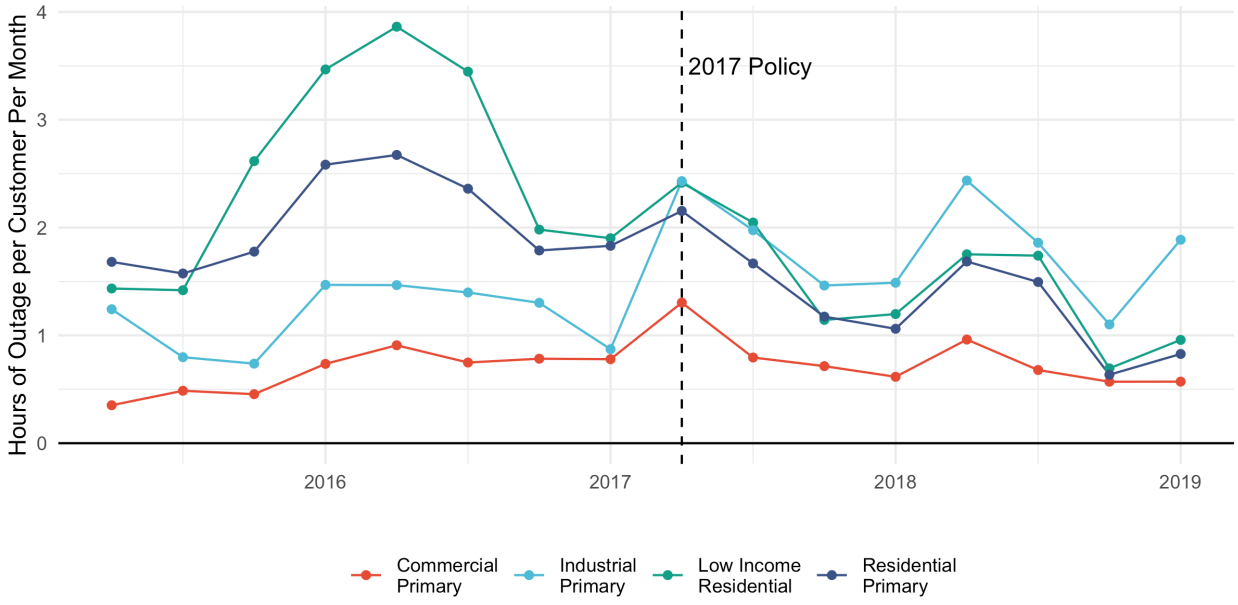


Figure 3. Mean Hours of Outage by Types



3. Recommendations for Economic and Policy Research on Reliability in India

In 2019, India's central government announced that it was considering rolling out a similar policy for utilities across the country. [9] The policy would likely induce utilities to reprioritize investments and maintenance decisions in the way seen in Delhi, and to purchase more costly wholesale energy during peak times rather than ration power through blackouts. The implication for the finances of the country's utilities, however, may be substantial. In 2019, India's distribution utilities were more than USD 56.6 billion in debt, equivalent to about 1.9 percent of GDP. [10]

For many utilities, outage compensation policies would make the already stark choice between serving the most subsidized consumers at a loss or conducting rolling blackouts even starker. The additional financial losses that accrue as a result would need to be made up either by state budgets or future rate increases on electricity customers.

For these reasons, outage compensation policies are unlikely to resolve the tradeoff between prices and quality in India's electricity distribution sector. Doing so relies critically on rate design and subsidy policies. Cross-subsidized retail tariffs are often justified as a means to make electricity more affordable to the poor. However, such rate structures disincentivize utilities from improving quality of service for poor customers and extending access to unelectrified communities, which often results in a low-price, low-quality equilibrium.

For several decades, economists have urged that retail tariffs for electricity be set at a level that would allow utilities to recover their costs. Instead of reducing prices for the poor, they argue governments should offer direct benefit transfers to consumers who cannot afford to pay their bills. However, "getting the price right" in order to be able to ensure 24/7 power supply for every customer may not be socially efficient if the value of electricity reliability is heterogeneous across and within customer types.

Therefore, we propose estimating the value of electricity reliability in order to be able to inform the tradeoff between affordability and reliability that regulators face not only in determining retail prices, but also in designing demand response programs.

Utilities contract a large amount of generation capacity to meet their anticipated demand during a few hours in the year, which results in a substantially higher average cost of supply that gets socialized through the tariff structure. Knowing when customers value electricity the most could also help to optimize utilities' power procurement decisions. The presence of rationing suggests that tariffs are too low, while the prevalence of backup power – mainly diesel generator sets and battery inverters – installed in businesses and households suggest that many would be willing to pay more

for more reliable electricity. However, the redistributive and growth implications of raising tariffs to reduce rationing are far from clear. Higher tariffs may undermine electricity access goals by pricing out the poorest consumers.

Pervasive non-payment also imposes a financial burden on utilities across India. Low rates of revenue collection make it difficult for utilities to maintain and upgrade infrastructure, which could further worsen service quality. [11] Non-payment serves as an additional tax to the extent that unrecovered costs are rolled into retail tariffs, which suggests that understanding the payment response to long-term improvements in electricity reliability could also go a long way to inform tariff design.

References

1 Press Information Bureau, Ministry of Power, Government of India (2019). "Electrification of Villages." https://pib.gov.in/Pressreleaseshare.aspx?PRID=1592833.

2 Aklin, M., Cheng, C.-y., Urpelainen, J., Ganesan, K., and Jain, A. (2016). "Factors Affecting Household Satisfaction with Electricity Supply in Rural India." *Nature Energy*, 1(11):16170.

3 Rowe, K. (2020). "The Welfare and Distributional Implications of Non-Price Rationing of Electricity in India." *Mimeo.*

4 Power Finance Corporation Ltd. (2016). *Report on Performance of State Power Utilities 2013-14 to 2015-16*. https://www.pfcindia.com/DocumentRepository/ckfinder/files/Operations/Performance_Reports_of_State_Power_Utilities/1_Report%20on%20the%20Performance%20of%20State%20Power%20Utilities%202013-14%20to%202015-16.pdf.

5 Data for this statistic was obtained from one of Delhi's three private utilities through a non-disclosure agreement.

6 Delhi Electricity Regulatory Commission (2017). DERC (Supply Code and Performance Standards) Regulations, 2017. http://www.derc.gov.in/Regulations/DERCRegulations/Regulations%202017/DERC%20(Supply%20Code%20and%20Performance%20Standards)%20Regulations,%202017/Regulations%20-%2007.07.2017.pdf.

7 The standard for power supply restoration is up to three hours for zones with AT&C losses not exceeding 10%, up to four hours for zones with AT&C losses between 10 and 20% and up to six hours for zones with AT&C losses above 20% from the time the first complaint is filed.

8 Delhi Electricity Regulatory Commission (2018). "Notification". http://www.derc.gov.in/Regulations/DERCRegulations/Regulations%202018/3rd%20%20Amendment%20Regulations-18.12.18.pdf.

9 *Times of India (*2019). "Discoms will soon have to pay users for power cuts." https://timesofindia.indiatimes.com/india/discoms-will-soon-have-to-pay-users-for-power-cuts/articleshow/70184404.cms. *Economic Times* (2020). "Amit Shah-led GoM to vet National Tariff Policy." https://economictimes.indiatimes.com/news/economy/policy/amit-shah-led-gom-to-vet-national-tariff-policy/articleshow/73112794.cms?from=mdr.

10 ETEnergyWorld (2020). "India's power distribution sector facing debt pile of over Rs 4 lakh crore: ADBI." https://energy.economictimes.indiatimes.com/news/power/indias-power-distribution-sector-facing-debt-pile-of-over-rs-4-lakh-crore-adbi/73081443.

11 Dzansi, J., Puller, S., Street, B., and Yebuah-Dwamena, B. (2019). *The Vicious Circle of Blackouts and Revenue Collection in Developing Economies: Evidence from Ghana.* IGC Working Paper.

Environment and Natural Resources Program

Belfer Center for Science and International Affairs
Harvard Kennedy School
79 JFK Street
Cambridge, MA 02138

belfercenter.org/ENRP