



# How to Target Residential Electricity Subsidies in India:

Step 2. Evaluating policy options in the State of Jharkhand

GSI REPORT



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#### Step 2. Evaluating policy options in the State of Jharkhand

September 2020

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## Executive Summary

### Why Explore Electricity Subsidy Targeting?

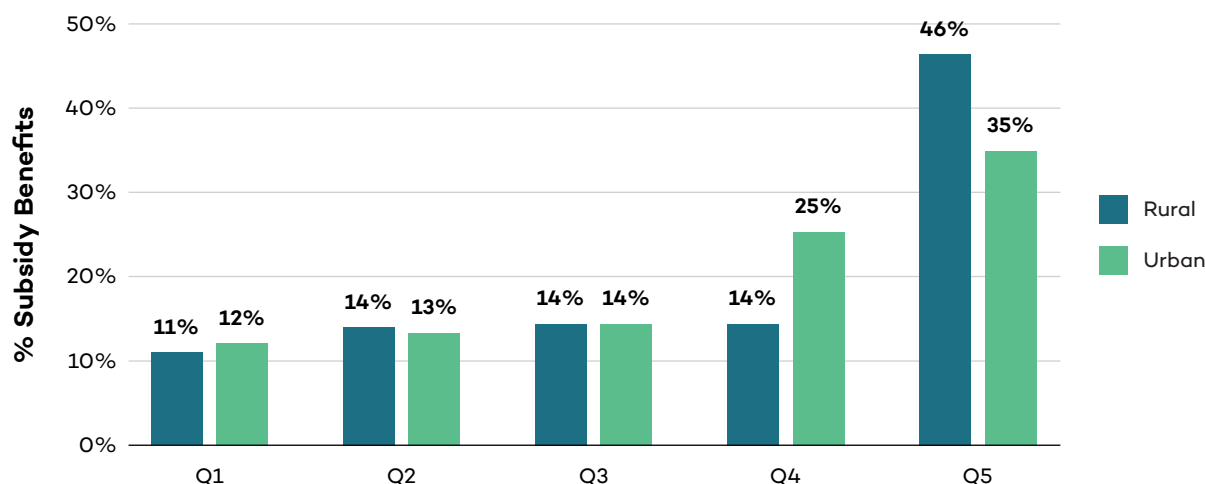
In fiscal year (FY) 2019, India’s subsidies for electricity consumption amounted to INR 110,391 crore (USD 15.6 billion). Price support is vital for low-income households, but, at the same time, electricity distribution companies (DISCOMs) have been struggling. Tariffs are too low to cover costs, and the gap is not fully compensated by state subsidy payments and cross-subsidies. This has only worsened with the COVID-19 crisis, with DISCOMs unable to reduce their costs in proportion to reduced revenues. Higher prices are obviously a problem for the poorest—but so are insolvent DISCOMs. Covering the cost of supply is essential to expanding and improving the quality of electricity, as well as transitioning to a more sustainable electricity mix. This has given rise to discussions about the potential for “subsidy targeting”: focusing subsidy benefits on those most in need while reducing them for better-off consumers.

### Our Approach

This report seeks to promote a discussion on targeting, using robust survey data from over 900 households in Jharkhand on energy consumption, expenditure, and assets. We assess: (1) the distribution of existing subsidies and (2) the performance of different targeting strategies.

#### 1. Distribution of Existing Subsidies

**Figure ES1.** Distribution of total subsidies (in %) by rural and urban wealth quintiles



Note: The distribution of benefits above is illustrated across “quintiles”: equally sized groups made up of exactly 20% of the population, ordered by relative wealth levels. Quintile 1 is made up of the poorest households and quintile 5 the wealthiest households. The data above define “wealth” using a wealth index: a score for households based on non-electric assets and socioeconomic status. A similar regressive distribution is observed when quintiles are defined by self-reported monthly household expenditure. See the full report for results broken down by different methods for identifying poorer and richer households.





Jharkhand currently subsidizes electricity for all metered and unmetered households, with subsidy levels varying with increasing monthly electricity consumption. We found that the distribution of existing subsidies is regressive, namely:

- Among rural households, the top two quintiles—the richest 40% of households—received 61% of subsidy benefits, and the bottom two quintiles received 25%.
- Among urban households, the top two quintiles received 60% of benefits, and the bottom two received 25%.

## 2. How Could Subsidy Targeting Be Improved?

We evaluated three mechanisms to improve subsidy targeting, resulting in the following changes in subsidy distribution and savings to subsidy expenditure.

**Table ES1:** Summary of approaches to improve electricity subsidy targeting in Jharkhand

Scenario		% of benefits received by		Subsidy savings (INR)	Notes
		Bottom 40%	Top 40%		
Business as usual 2019	Rural	25%	61%	--	Residential subsidy expenditure in Jharkhand for 2019 was INR 984 crore (USD 140 million)
	Urban	25%	60%	--	
<b>Revise subsidy slabs:</b> Highest subsidy for 50 kWh per month, progressively reducing subsidies for higher consumption levels, up to 300 kWh per month	Rural	35%	46%	306 crore (USD 44 million)	A share of savings could be used to increase the size of the subsidy for the 50 kWh and less households
	Urban	37%	48%		
<b>Poverty ration card targeting:</b> Targeting subsidies to households with a poverty ration card (like BPL, AAY or PH)	Rural	28%	56%	163 crore (USD 23 million)	Would need to be combined with efforts to ensure all marginalized households have poverty cards. A share of savings could be used to increase the size of the subsidy for the 50 kWh and less households
	Urban	31.4%	55.1%		

Source: The distribution of benefits in this analysis is based on the wealth index approach. See Section 5 for a detailed explanation of these targeting options.

Note: AAY = Antyodaya Anna Yojana; BPL = Below Poverty Line; PH = Priority Household



## Recommendations for Jharkhand

### Short Term

For FY 2021, Jharkhand's state DISCOM, Jharkhand Bijli Vitran Nigam Limited (JBVNL) has proposed a "one state, one tariff" structure to replace the increasing block tariff, though the subsidies will continue to be disbursed in slabs. In the short term, we recommend a highly cautious approach to revising slabs: the ongoing COVID-19 crisis is severely affecting the affordability of living for many households. With this in mind, the state DISCOM can:

- Consider removing the subsidy for households consuming more than 300 kWh of electricity per month, as very few households consume above this volume.
- Collect data on household consumption patterns to assess the suitability of different per kWh cutoffs for different magnitudes of subsidy per kWh. This report has examined one scenario where the highest subsidy is given to households consuming 50 kWh and below, with progressively lower subsidies up to 300 kWh, but this should be assessed in light of seasonal variations in consumption.

### Medium Term

In the medium term, once the economy and household welfare begin to recover, a more active reform agenda can be pursued. JBVNL, the Jharkhand State Electricity Regulatory Commission (JSERC), and the state government can:

- Revise subsidy slabs to introduce a cutoff between 50 kWh and 200k kWh and decrease the subsidy for higher slabs, taking into account seasonal variability in consumption. While this may run counter to the general trend in tariff rationalization, it seems to best reflect actual data on consumption and relative wealth levels, and it does not prevent JBVNL from rationalizing slabs elsewhere.
- Exclusively target poverty ration card-holders: those that own a BPL, PH or AAY card, excluding households with no card or APL cards. Some provisions will have to be made to include marginalized households that do not own poverty ration cards.

## How Does Subsidy Targeting Need to Link up With Other Power Sector Reforms?

Efforts to improve targeting may need to happen in tandem with other reforms. The 2017 Draft National Energy Plan called for DISCOMs to set tariffs at full costs and provide subsidies as a bank transfer after-sale, the Direct Benefit Transfer (DBT) model. This has taken a step closer to implementation through recent proposals to amend the Electricity Act 2003: if passed, states would be required to provide subsidies through a DBT that may only transfer subsidy to consumer accounts maintained by the DISCOM. The final operational



model will depend on the results of any pilot undertaken. At the same time, relaxing state borrowing limits for COVID-19 impacts has been explicitly linked to piloting the DBT and reducing DISCOM losses. We recommend that central and state government authorities ensure a joined-up approach to planning for both targeting and DBT implementation.

## Recommendations for Other States in India

This report focuses on Jharkhand because we believe that bottom-up, state-level data is required for recommendations on smart subsidy design that is appropriate for different contexts without compromising access and affordability. These recommendations may not apply directly to other states because of different tariffs, energy consumption patterns, and poverty distribution.

We recommend:

- Other states should adopt a similar evidence-based approach to inform targeting. For DISCOMs, a cost-effective method could be to conduct telephone surveys several times per year using a simplified version of the questionnaire employed by this study. The Ministry of Power and state-level regulators could make collecting data to analyze targeting a criterion for scoring DISCOM performance.
- Where the Ministry of Statistics and Programme Implementation is collecting detailed poverty datasets, such as through the census and the National Sample Survey Office, it should include questions on monthly household consumption of electricity and liquefied petroleum gas so that wider datasets on household energy affordability and poverty are routinely available.



## Acronyms and Abbreviations

<b>AAY</b>	Antyodaya Anna Yojana
<b>APL</b>	Above Poverty Line
<b>BPL</b>	Below Poverty Line
<b>DBT</b>	Direct Benefit Transfer
<b>DISCOM</b>	(electricity) distribution company
<b>FY</b>	fiscal year
<b>IBT</b>	increasing block tariff
<b>JBVNL</b>	Jharkhand Bijli Vitran Nigam Limited
<b>JSERC</b>	Jharkhand State Electricity Regulatory Commission
<b>LED</b>	light-emitting diode
<b>NREGA</b>	National Rural Employment Guarantee Act
<b>PH</b>	Priority Household
<b>PMT</b>	proxy means test
<b>SECC</b>	Socio Economic Caste Census





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## 1.0 Introduction

India's energy sector is undergoing rapid transformation. In 2000, only 43% of the population had access to electricity, which almost doubled to 94.6% by 2018 (International Energy Agency, 2018). Government policies have played an important role in driving this change. But, as more consumers connect to the grid, there is increasing pressure on limited government financial resources. In fiscal year (FY) 2019,<sup>1</sup> India's subsidies for electricity consumption amounted to at least INR 110,391 crore (USD 15.6 billion)<sup>2</sup> (Power Finance Corporation [PFC], 2020). This accounts only for state government subsidy transfers to electricity distribution companies (DISCOMs). It doesn't include the further price support provided through cross-subsidies, DISCOM deficits, and financial bailout packages offered to DISCOMs, which would be at least as large again (Garg et al., 2020). Expenditure is only expected to grow, given long-term trends in rising electricity demand.

This financial transition has given rise to discussions about the potential for “subsidy targeting”: focusing subsidy benefits on a narrower subset of beneficiaries. This approach would provide higher benefits to those most in need. It would also improve the finances of DISCOMs, allowing them to better invest in infrastructure, new connections, and quality of supply, as well as encouraging higher-income consumers to use energy more efficiently.

There has been little recent research, however, on the distribution of existing subsidies and exactly how targeting could be implemented to impact this subsidy distribution. This report seeks to fill these gaps with survey data collected in the State of Jharkhand. First, we analyze the household incidence of electricity subsidies using a novel method to assess the distribution of electricity subsidies across different wealth quintiles. Second, we analyze the potential of three mechanisms to better target subsidies: (1) the government's existing poverty database; (2) revised volumetric bounds for receiving subsidized tariffs; and (3) proxy means-test-based targeting. These targeting methods have been shortlisted from a larger set of targeting interventions published in the International Institute for Sustainable Development's previous work (Sharma et al., 2019). That work examined several targeting interventions, including opt-out, volumetric, categorical and income, consumption, assets or proxy-based targeting schemes. The report also recommended an opt-in scheme that would allow households to voluntarily decide if they need to register for a scheme and prevent any exclusion errors.

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<sup>1</sup> FY 2019 refers to the year beginning in April 2018 and ending in March 2019, and likewise for other FY periods.

<sup>2</sup> USD conversions in this report for different years are made using exchange rates available at <https://data.oecd.org/conversion/exchange-rates.htm>



## 2.0 Background: Electricity subsidies in Jharkhand

### 2.1 Subsidy Design, Subsidy Costs, and DISCOM Finances

Like most states in India, the publicly owned electricity DISCOM in Jharkhand, Jharkhand Bijli Vitran Nigam Limited (JBVNL), sells electricity at a subsidized price to households and agricultural consumers (Jharkhand State Electricity Regulatory Commission [JSERC], 2019a). Its main objective is to make electricity affordable for these consumers.

The subsidy is paid for in three ways. First, the state government pays for a share through an annual subsidy transfer to JBVNL. Second, industrial and commercial consumers pay a share, through “cross-subsidies”—that is, tariffs above the cost of supply. Third, JBVNL absorbs any remaining costs as a loss. Not all costs emerge from subsidizing electricity; some costs are also linked to other inherent inefficiencies in DISCOMs. This third category, DISCOM losses, prevents JBVNL from investing in infrastructure and ensuring a high-quality electricity supply. Losses are paid by the state and national governments when the latter provide periodic bailouts to rescue ailing DISCOM finances.

There is no data on the exact cost of the electricity subsidy in Jharkhand, because it is hard to track, and there is no fully transparent reporting across all three payment approaches. Generally, in spite of the lack of data transparency on subsidy costs at the state level, JBVNL communicates the exact subsidy received to consumers via their monthly bills.

The best estimate for electricity subsidies at the state level is to multiply the volume of residential and agricultural electricity consumption by the total gap between the cost of supply and the subsidized tariffs.<sup>3</sup> Considering costs since FY 2016, this approach shows that the subsidy cost has been significant (see Figure 1). In FY 2018, power purchase costs were higher, new rural consumers were added, and DISCOM inefficiencies were higher, particularly those linked to billing and collection. These three elements led to significantly high subsidy transfers for those years. In FY 2019, the total subsidy received was INR 1,250 crore (USD 178 million),<sup>4</sup> of which INR 984 crore (USD 140 million), or 79%, was expected to be for residential consumers (Jharkhand State Energy Department, 2018; PFC, 2020a). Residential consumers are the biggest beneficiaries because, in FY 2020, they made up 4.1 million of JBVNL’s 4.5 million consumers and accounted for 61% of its total anticipated sales volumes (MU), while agricultural consumers made up 60,000 of JBVNL’s total and only 2% of sales (JSERC, 2019b, p. 118).

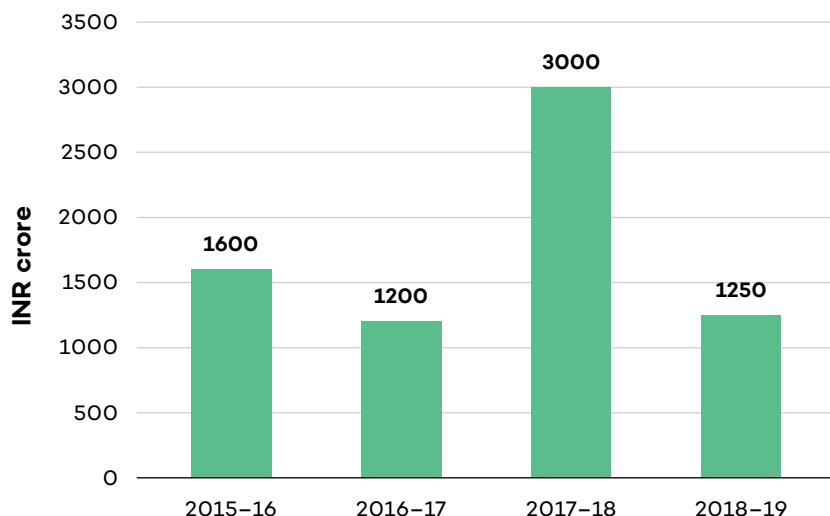
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<sup>3</sup> This approach ought to capture the value of state transfers and cross-subsidies, but (1) it is highly dependent on adequately detailed information being shared by DISCOMS on average tariffs and consumption volume of electricity consumers and (2) it may not capture full data on subsidy-related losses.

<sup>4</sup> Subsidy for FY 2019 of INR 1,250 crore (USD 178 million) was 21% of the annual revenue requirement of FY19 that stood at INR 6,064 crore (USD 790 million) (JBVNL, 2020).

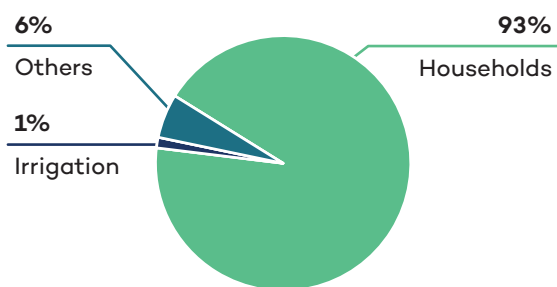


**Figure 1.** Total government subsidy (FY 2016–19) (INR crore)

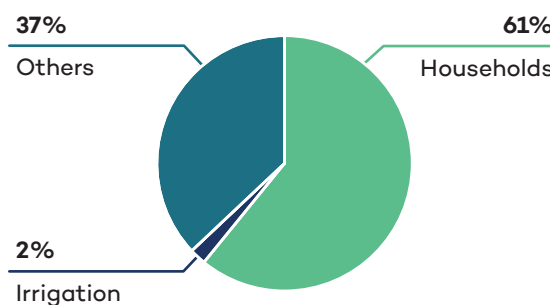


Source: PFC, 2020b, 2020c.

**Figure 2.** Category-wise consumers as a percentage of all consumers of JBVNL in FY 2019



**Figure 3.** Consumer category-wise sales volumes (MU) as a percentage of all consumers of JBVNL in FY 2019



Source: JSERC, 2019b.

The efficiency of this kind of subsidy policy depends on how good a balance it strikes between achieving its objective (making electricity affordable, improving service) and its costs, considering any unintended negative impacts.

The main way to improve electricity subsidy efficiency is by targeting consumers who struggle most with affordability. Electricity subsidy policies in India are largely targeted on the basis of volumetric consumption. JBVNL, like many other state DISCOMs, follows an increasing block tariff (IBT) to determine electricity tariffs for metered urban households. This means that units of electricity consumption are grouped into “blocks,” with the price increasing with each successive block of electricity consumed. This system may change soon—for FY 2021, JBVNL has proposed a “one state, one tariff” structure to replace the IBT. While it is reported that the subsidy will continue to be disbursed by slab (JBVNL, 2020), details of the structure are not yet clear, and the proposed changes will require the regulator’s approval. As a result, this study focuses on Jharkhand’s existing tariff design, where subsidies are provided for all blocks of consumption.





Under Jharkhand's existing tariff structure, the biggest subsidy in 2019, INR 4.25 (USD 0.06) per kWh, was provided to households who benefited from the Kutir Jyoti<sup>5</sup> scheme, which provided electricity connections to poor rural households. But all households receive a subsidy—even urban households that consume over 800 kWh per month receive a subsidy of INR 1.00 (USD 0.01) per kWh (Jharkhand State Energy Department, 2019). This suggests that the subsidy could be better targeted—but it is hard to say for sure without better data on how well household electricity consumption is correlated with household wealth and who would be included and excluded by additional efforts on targeting.

**Table 1.** Subsidy for JBVNL consumers for FY 2020

Category	Subsidy slab (units)	Subsidy by state govt (INR)
Kutir Jyoti metered	All units	4.25/kWh
Kutir Jyoti unmetered	-	125/connection
Rural metered	All units	3.90/kWh
Rural unmetered	-	25/connection
Urban metered	0–200 units	2.75/kWh
	201–500 units	2.05/kWh
	501–800 units	1.85/kWh
	> 800 units	1.00/kWh

Source: Jharkhand State Energy Department, 2019.

## 2.2 Impacts of the COVID-19 Crisis

This study began in early 2019, a period in which India's economy was stable and growing, albeit more slowly than in previous years. Our survey data on household well-being was conducted in October 2019. Since this time, the national context has changed radically as a result of the COVID-19 crisis. It is important to emphasize the impact this has had on energy affordability and poverty more broadly, as well as the power sector, and to take this into account during data analysis and policy recommendations.

The first case of COVID-19 in India was reported on January 30, 2020 (Reid, 2020). As the number of cases rose to 500, Prime Minister Narendra Modi announced a 21-day nationwide lockdown, starting March 25, 2020 (Gettleman & Schultz, 2020). The period of the lockdown was periodically extended until the government began to slowly unlock the country, starting June 1, 2020 (TNN, 2020).

As the lockdown period was repeatedly extended, the socioeconomic impacts became more apparent. Unemployment rates soared to 26% in early April but recovered to pre-lockdown

<sup>5</sup> The Kutir Jyoti scheme is a special lower-tariff consumer category for poor rural households (Garg & Bajaj, 2007; Subramaniam, 2007).



levels in mid-June (Vyas, 2020). A draft report by the World Bank warns that the pandemic may dampen India's gains from previous poverty eradication efforts (Vishnoi, 2020). Low-income groups, such as farmers, domestic workers, small business owners, and daily wage earners, whose informal employment is often coupled with little job security, were the most affected. According to a Dalberg study covering 15 states in India from April to June, primary income earners in over half of the 47,000 low-income households surveyed lost their jobs, rendering about 23% of these households income-less (Totapally et al., 2020). Further, there was a retained drop in total household incomes on average to 40% of pre-lockdown levels, with Jharkhand households, on average, losing 54% of their incomes between May and June (Totapally et al., 2020). Many households have resorted to borrowing to make up for the shortfall, resulting in the bottom quintile accumulating an average debt of INR 7,370 per household. Further, within low-income groups, the most immediately visible impacts were on migrant workers in cities. At once, about 100 million migrant workers experienced an immediate halt in their daily income with no safety net in place (Sanghera, 2020). This triggered a massive outflux of workers, by foot, from urban to rural areas. Many that returned home do not expect to find jobs again during the pandemic (Totapally et al., 2020).

It is not yet clear how these impacts will continue to unfold and when economic recovery will help to improve people's circumstances—but overall, the impact of the COVID-19 pandemic has been indisputably inequitable. India's high level of income inequality, with little financial protection for low-income and socially marginalized groups, only exacerbates this tension (Ahmed et al., 2020; Carswell et al., 2015). This inequality is evident when considering the nature of employment of the Indian population: about 90% of the labour force is engaged in the informal sector (Buheji et al., 2020). Not only does the pandemic increase negative impacts on the poor but also the incidence of poverty. A rapid assessment from Banaras Hindu University estimates that, as migrant workers return to their villages, the productivity shock may push about 400 million workers in the informal sector into poverty and create additional pressures on rural economies (Singh, 2020).

Among several economic relief packages, the first, announced by the Prime Minister on March 26, 2020, was the most significant for poor households. This package, the Pradhan Mantri Garib Kalyan Yojana, targets low-income households through Direct Benefit Transfer (DBT) systems, with a total value of INR 1.7 lakh crore (USD 22.6 billion). The scheme was first launched in 2016 in order to address the impact of demonetization on the poor and marginalized. In order to leverage the same scheme four years on, its scope needed to be expanded. By assimilating other schemes—particularly, PM Garib Kalyan Ann, PM KISAN, MNREGA, Jan Dhan, Ujjwala, and Divyang—it was able to disburse food grains to the poor, transfer cash to farmers, increase wages in a national rural public works scheme, transfer cash to households that were recently targeted for financial inclusion, provide free liquefied petroleum gas cylinders for 3 months, and provide cash transfers to widows and differently abled citizens (Press Information Bureau [PIB], 2020a).

Though 84% of low-income households have been covered by at least one cash transfer scheme, coverage under the schemes has been lacking (Totapally et al., 2020). Jan Dhan's coverage leads with 56% coverage of low-income households, while the Ujjwala scheme, PM Kisan, and MNREGA cover only 38%, 32%, and 42% of low-income households, respectively. Meanwhile, up to 84% of farming households may not be registered for PM



Kisan at all (Totapally et al., 2020). Vulnerable social groups under these schemes are only slightly better covered, with the exception of PM Kisan, under which vulnerable social groups are slightly more poorly covered compared to general category households (Totapally et al., 2020). Further, though a large number of households have received a cash transfer from these schemes, 14% are still waiting. Moreover, the cash transfers worth INR 2,220 on average seem to be insufficient to cover even a 60% share of essential expenditures for a majority of low-income households (Totapally et al., 2020). When comparing this to FY 2012 expenditures in Jharkhand, the transfers continue to be wanting; on average, households spent INR 4,784 for rural and INR 9,659.4 in urban areas in FY 2012 (Government of Jharkhand, n.d.a).

The awareness levels on who can access these schemes among the target population are commendable. According to the Dalberg study, about 90% of the households surveyed had partial or complete awareness about the entitlement eligibility of these schemes (Totapally et al., 2020). In addition, the government amended the Employees' Provident Fund regulations to support workers in the organized sector, created a welfare fund to support construction workers, and launched an insurance scheme for health workers (Totapally et al., 2020). The extent to which these latter measures have been able to compensate for the economic and social shocks, however, remains to be analyzed.

The impact on the power sector has also been disruptive at various stages throughout the value chain. The sector witnessed a demand shock following the lockdown's impact on commercial, industrial, domestic, and agricultural consumption. There has been a large shift in demand toward the domestic sector, while commercial and industrial operations have witnessed closures with dampened demand (Surya, 2020). This has further exacerbated the finances of DISCOMs like JBVNL, which provide below-cost electricity to the domestic and agricultural sectors with the help of cross-subsidies from commercial and industrial consumers. Further, DISCOMs are unable to project accurate bills, as manual meter readings have been stalled by the government to protect employees, and many consumers have struggled to adapt to online payment systems. This has caused delays in bill revenue collection. At the same time, DISCOMs have been unable to reduce their power procurement costs proportionally to the drop in demand, due to various obligations to energy generators (Beaton et al., 2020).

According to the latest data, DISCOM dues to electricity generators have accumulated to over INR 120,263 crore (USD 16.07 billion) as of June 2020, greater than a 56% increase from late 2019 (Beaton et al., 2020; Payment Ratification And Analysis in Power procurement for bringing Transparency in Invoicing of Generators [PRAAPTI], 2020). As projections for the country's GDP growth have been revised to more modest levels (Noronha, 2020), power demand is expected to have similar contractions.

It is also important to note the state-wise differentiated impacts across the country owing to the different economic structures and migration patterns of states, especially as the status of lockdown varies in different states. A study that compares electricity consumption to economic activity found that Jharkhand's electricity consumption declined by 4% and 4.2% in March and April 2020, respectively, and recovered to a 0.9% decline in May (on a year-on-year basis) (Beyer et al., 2020). However, this decline in electricity consumption is not significant



compared to other states, such as Himachal Pradesh, Bihar, Odisha, and Chhattisgarh, who observed declines of over 10% on average (Beyer et al., 2020).

In response to these growing challenges, in May, the Finance Minister mandated the PFC and the Rural Electrification Corporation to provide DISCOMS with an INR 90,000 crore (USD 12.1 billion) relief package loan in two instalments to help pay their dues. However, state governments are hesitant to provide loan guarantees, owing to their own revenue contractions (IANS, 2020). It also seems unlikely that the relief package will do much more than address very short-term needs: the loans are only to be used to pay off dues to electricity generators and not to address the root causes of DISCOMS' financial problems, like the cost of power procurement, inaccurate and delayed billing, tariff structures, and large subsidies (Beaton et al., 2020).

The central government has also established conditions under which states can increase their borrowing limits—but only if they implement a number of ambitious reforms, including introducing a DBT scheme for electricity subsidies in at least one district and reduce DISCOM losses. This is aligned with government proposals from the 2017 Draft National Energy Plan, and more recently, the Draft Electricity (Amendment) Bill, 2020 and a revised national Tariff Policy. The bill, in particular, aims to ensure consumer centricity, promote ease of doing business, enhance power sector sustainability, and promote green power through actions such as devising a cost-reflective tariff to enable cost recovery for DISCOMS and a payment security mechanism, reducing cross-subsidies, and including renewable energy (Ministry of New and Renewable Energy, 2020). A DBT delivery mechanism, like in the liquefied petroleum gas sector (PIB, 2020b), would operate by requiring consumers to purchase electricity at market price and then have a subsidy credited directly to their bank accounts. This is intended to allow DISCOMS to have cost-reflective tariffs, thereby closing the gap between costs and revenues. It can become a mechanism through which better targeting policies are easily introduced. It also seems unlikely, however, that such an ambitious reform can be achieved over a short timescale (Beaton et al., 2020).



## 3.0 Approach

In order to better understand the efficiency of existing electricity subsidies in Jharkhand and options to improve targeting, this study conducted a large-scale household survey so that up-to-date and robust data could compare household electricity consumption with household well-being.

### 3.1 Survey Design

The survey was designed so that the results would be representative of the state-level population. Our sampling strategy split Jharkhand districts into two groups—east and west—of almost equal size. This stratification ensures geographic representativeness. In each group, we randomly selected six districts, with probabilities based on their relative population size. We then divided all rural villages in the 12 selected districts into two groups of equal size: one contained the largest villages and the other the smallest. We then did the same for urban wards. We selected two villages and two wards from each group, with probabilities weighted by the relative size of their population. In each village and ward, we randomly selected 10 households. This was done in each village and ward, by choosing a public place like a large public school or a government office and then using a counting method to arrive at 10 households. In this way, we selected 10 households from eight units (two small villages, two large villages, two small wards, and two large wards<sup>6</sup>) from each of the 12 districts (six in the west, six in the east of the state), for a total of 960 respondents. To ensure that our results are accurate at the population level, we used probability weights to account for our stratified sample. Our weights account for the likelihood that a district is selected and, within this district, that a household is interviewed. We generate both a set of overall weights and a set of separate weights for urban and rural households. We use the latter when we split the sample.

Morsel Research and Development India, a Lucknow-based research company, conducted in-person household surveys in Hindi from September to October 2019. Interviews were conducted with the heads of households. Men were household heads in 82.5% of the sample: 86.8% of rural households and 78.5% of urban households.

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<sup>6</sup> The survey used the categorization of rural and urban as defined in the 2011 census, where urban is identified as areas that are administered by either a municipality, corporation, or a cantonment and areas with a high population density of at least 400 persons per km<sup>2</sup>, a minimum population of 5,000 and where agriculture is not the dominant profession. Rural areas are those not identified as urban (Census India, 2011). The DISCOM uses a simpler definition where rural areas are those administered by a *gram panchayat* and urban areas by municipalities, corporations, cantonments, and other urban development authorities. Our survey uses the rural-urban categories listed in the census, which is only updated once every decade. This may lead to some differences, as some rural areas in our survey may now be categorized as urban by the DISCOM.



**Figure 4.** Survey design



Source: Authors' interpretation

## 3.2 Approach for Estimating Electricity Subsidy Benefits

The survey asked households<sup>7</sup> to share all of the information that is required to estimate electricity subsidy benefits at the household level: whether it is in possession of a meter, whether it was a Kutir Jyoti beneficiary, and its total electricity consumption. Electricity consumption is a particularly important metric and one where there is a significant risk that households may not report data accurately, either because of misunderstanding or poor recollection. The survey addressed this by:

- First, asking households to share a copy of their last electricity bill or their billing-related consumer number, so consumption data could be directly transcribed.
- Second, to report the number of appliances in the household and the average number of hours per day that each appliance was used.

Only 549 out of 960 households possessed their electricity bill or consumer number.<sup>8</sup> In the absence of a bill, this research used appliance usage to estimate electricity consumption. Standard wattage ratings for appliances were used to estimate a monthly electricity consumption volume. The accuracy of this approach was then tested by examining the 549 households that both possessed a bill and had provided detailed data on their appliances. We found the appliance-based approach had an average difference of 40 kWh from the average monthly bill-based consumption. Though an average monthly difference of 40 kWh per household is significant, since average monthly consumption is 90 kWh (based on the bill), in the absence of bills and for uniformity, we used the appliance-based approach to estimate electricity consumption for the entire sample. This approach is not likely to impact subsidy calculations since the initial cutoff for a subsidy in the DISCOM tariff is 200 kWh. For more details on this approach, see Annex A.

In terms of metering, 451 urban households (93% of sampled urban households) and 317 rural households had a meter (65% of sampled rural households), and overall, 768 households or 79% of the sample had meters. Metering is high even though the households are not in possession of their bills, suggesting billing or meter reading inefficiency.

<sup>7</sup> This research focuses on the household level to estimate electricity consumption and associated subsidy received. It does not examine per capita electricity consumption and per capita subsidy. Household electricity consumption is linked to the number of household members, which will vary with states. When this research is adapted for other states, a per capita approach can be considered to examine inter-state comparisons.

<sup>8</sup> This report does not consider any discrepancies on account of incorrect meter reading due to a lack of data. Incorrect billing can have an impact on subsidy estimation and categorizing consumers in the correct subsidy slabs.





### 3.3 Categorizing Households Into Groups by Relative Levels of Wealth

In order to examine the distribution of subsidies to poorer and richer households, it was necessary to categorize households according to their relative levels of wealth. There is no one accepted way to define richer or poorer households, and the definitions that are adopted can have a significant influence on the analysis. For this reason, the study compares relative wealth levels through three different approaches: (1) a “ration card approach,” where a binary status of “poor” or “not poor” is designated based on the possession of an official government ration card; (2) an “expenditure” approach, where quintiles are established based on self-reported household expenditure; and (3) a “wealth index” approach, where quintiles are established based on a multi-criteria wealth score, including reported income, reported expenditure, and ownership of assets.

#### 3.3.1 Ration Card Approach

The first approach divides the sample into poor and non-poor households, defined according to the type of official ration cards they possess. Households with Below Poverty Line (BPL) cards, Priority Household (PH) cards and Antyodaya Anna Yojana (AAY)<sup>9</sup> cards were all included as poor for this analysis, as these households receive subsidized food and fuel. All the remaining households, namely those that possess an Above Poverty Line (APL) card and those who don’t possess any cards (also called “no card”), were designated as non-poor. By this method, 81% of surveyed households were identified as poor (see Figure 5 below).

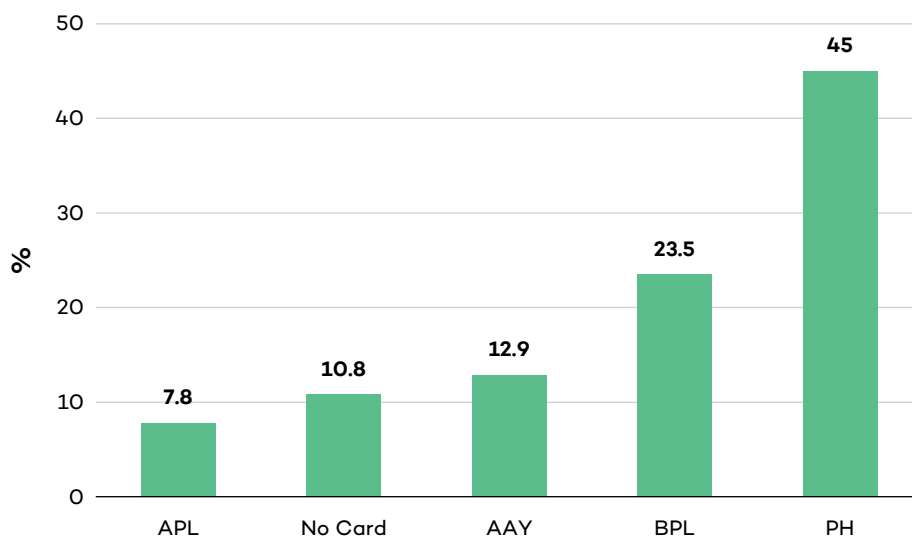
Not all households who possess “no card” are necessarily non-poor. Some deserving households may not hold a card because of barriers to registration or because they cannot comply with residency laws. This is evident from our comparison of different approaches to identifying poverty status in Section 3.4 below, which demonstrates that some households with no ration cards are present in even the lowest groups of reported monthly household expenditures (see Figure 6). The same analysis shows that many households that report the highest levels of expenditure are also in possession of a poverty card. This highlights the extent to which the poverty card approach is only as robust as the methods used to target and distribute such cards. In the past, studies (Ram et al., 2009) have argued that there are errors in the government’s identification methodology, and this prevents better targeting of the poor.

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<sup>9</sup> India’s targeted public distribution system has different types of ration cards that each entitle beneficiaries to different quantities of subsidized food grains and fuel. Since the implementation of the National Food Security Act in 2014, BPL ration cards have been re-branded as Priority Households (PH) (Puri, 2017, p. 19) and in 2019 both were entitled to 3 kg of subsidized rice per month in urban areas and 5 kg of subsidized rice per month in rural areas of Jharkhand (Government of Jharkhand, n.d.b). This entitlement for AAY ration cards, seen as the poorest of the poor, is 21 kg in urban areas and 35 kg in rural areas of Jharkhand (Government of Jharkhand, n.d.b). APL ration card holders are not entitled to subsidized food or fuel.



**Figure 5.** Surveyed households disaggregated by type of ration card



Source: Survey data

### 3.3.2 Expenditure Approach

The second and third approaches both organized households into five equally sized categories called quintiles (representing 20% of the sample), from the poorest households (quintile 1) to the richest households (quintile 5), based on their self-reported monthly household expenditure or their wealth index.

Self-reported monthly household expenditures—henceforth only called “expenditures”—is a common proxy for relative wealth levels in poverty analysis. It tends to be smoother over time than income and therefore reflects welfare more reliably.

The average reported monthly household expenditures for surveyed households in rural areas was INR 5,819 (USD 83); in urban areas, it was INR 7,000 (USD 99) (a breakdown of expenditure ranges for different quintiles from surveyed households is presented in Table 2). Accounting for inflation, the official average monthly rural expenditures in 2019 would have been INR 7,284,<sup>10</sup> and corresponding data for urban would be INR 14,180 (USD 207).<sup>11</sup> Both official rural and urban monthly household expenditures are substantially higher than what is reported by surveyed households, suggesting either that respondents

<sup>10</sup> This is calculated based on the official FY 2012 household expenditure, which was INR 4,784 in rural areas and INR 9,659.4 in urban areas. And using a rural consumer price index (CPI) of 92.8 for FY 2012 and 141.3 in FY 2019; urban CPI of 93.8 in FY 2012 and 137.7 in FY 2019 (Reserve Bank of India, 2019). These values were used in the following formula to arrive at the

$$FY\ 2019\ household\ expenditure = \frac{Household\ Expenditure\ in\ FY\ 2012 \times CPI\ in\ FY\ 2019}{CPI\ in\ FY\ 2012}$$

<sup>11</sup> Government data from FY 2012 on average monthly per capita consumer expenditure (MPCE) in Jharkhand is INR 920 in rural areas and INR 1894 in urban areas (Government of Jharkhand, n.d.a). Based on average household size in FY 2012 of 5.2 in rural and 5.1 in urban Jharkhand (Census India, 2012), the corresponding monthly household expenditure for FY 2012 is INR 4,784 in rural and INR 9,659.4 in urban Jharkhand. The average household size for surveyed households is 5.6.



under-reported their expenditures or a bias in the sample toward lower-income households. For, FY 2012, Jharkhand's poverty line was marked at a monthly household consumption expenditure of INR 3,890 (USD 83) in rural and INR 4,967 (USD 106) in urban areas,<sup>12</sup> with 37% of the population BPL (Department of Finance, Jharkhand, 2014, p. 13). These expenditure figures for poverty are the last known estimates, as the measurement of poverty is now based on a deprivation index; according to that index, in FY 2016, 46.5% of the population was poor (Centre for Fiscal Studies, 2020, p. 15). Based on this poverty rate and expenditure data, the lowest two quintiles capture the majority of the population that is defined as poor by state definitions.

**Table 2.** Range of household monthly expenditure ranges, by quintiles (INR)

	Rural	Urban
Quintile 1	1,000–3,000	1,000–3,200
Quintile 2	3,001–4,500	3,201–4,500
Quintile 3	4,501–5,000	4,501–5,500
Quintile 4	5,001–8,000	5,501–8,000
Quintile 5	8,001 and above	8,001 and above

Source: Survey data

### 3.3.3 Wealth Index Approach

The wealth index attempts to give a broader review of what makes households worse or better-off financially, accounting for factors such as non-electric assets and households' socioeconomic status.

The wealth index was established by drawing on the variables used to identify poverty by India's national Socio Economic Caste Census (SECC), 2011, supplemented by some additional variables chosen by the authors: the education of the household head, the level of debt, various transportation items (bikes, cars, etc.), cattle ownership, non-electric assets, availability of drinking water, indoor toilets, whether the home is owned, how much land the household owns, whether the household buys subsidized grain, and whether the respondent worked under the rural employment National Rural Employment Guarantee Act (NREGA) scheme. Only genuinely poor households are assumed to access subsidized food grains, in addition to wages available as unskilled labour under the rural employment guarantee scheme, NREGA. These two variables are a strong identifier of poor households and hence included in addition to the SECC variables.

We combine these variables using factor analysis. The output of factor analysis is a variable that has a mean of 0 and a standard deviation of 1. A larger score means that the household

<sup>12</sup> Based on the poverty line's per capita consumer expenditure of INR 748 in rural areas and INR 974 in urban areas (Department of Finance, Jharkhand, 2014).



is wealthier compared to the other households in the dataset. Households were then divided into five categories based on their wealth index. These quintiles are all of equal size (i.e., they contain the same number of households). Poverty levels are high in Jharkhand and therefore households in the wealthiest quintile may not necessarily be “rich” but should be seen as wealthier than those in the bottom quintiles.

Separate wealth indexes were established for urban and rural households, reflecting the different ways in which wealth materializes in the belongings of urban and rural areas. For this reason, under this metric, the wealth index of a rural household cannot easily be compared to the score of an urban household. The cost of splitting the data is to increase uncertainty around our estimates, but, as we show below, we still obtain reasonably precise results. Expenditure ranges for different rural and urban quintiles in this study are captured in Table 3. For more details on the construction of this wealth index, see Annex B.

**Table 3.** Inter-quintile ranges: Household monthly expenditure ranges for the wealth index in different rural and urban quintiles (INR)

	Rural	Urban
Quintile 1	3,000–5,500	3,000–6,500
Quintile 2	3,750–7,000	3,500–6,000
Quintile 3	4,000–7,500	4,000–8,000
Quintile 4	4,000–10,000	4,000–7,500
Quintile 5	5,000–10,000	5,000–10,000

Source: Survey data

Note: The INR figures in the table depict typical expenditure levels for each wealth quintile. These ranges represent the expenditure level at the 25th and 75th percentiles (i.e., the inter-quartile range). Inter-quartile ranges represent the range in which 50% of the respondents are located and therefore remove outliers. These ranges can be overlapping across wealth quintiles.

### 3.4 Comparing the Approaches

Figure 6 shows the distribution of ration cards by quintiles defined by expenditure; Figures 7 and 8 show the distribution of ration cards by rural and urban quintiles defined by the wealth index. For all types of measurements, there is a greater number of households with no card or an APL card in the wealthier quintiles. But households with some kind of poverty ration card still make up the majority of even the wealthiest quintile. If ration cards are poorly correlated with poverty and therefore visible in high numbers in wealthier quintiles, this could be a compelling reason to consider alternative approaches to assessing subsidy targeting in India.

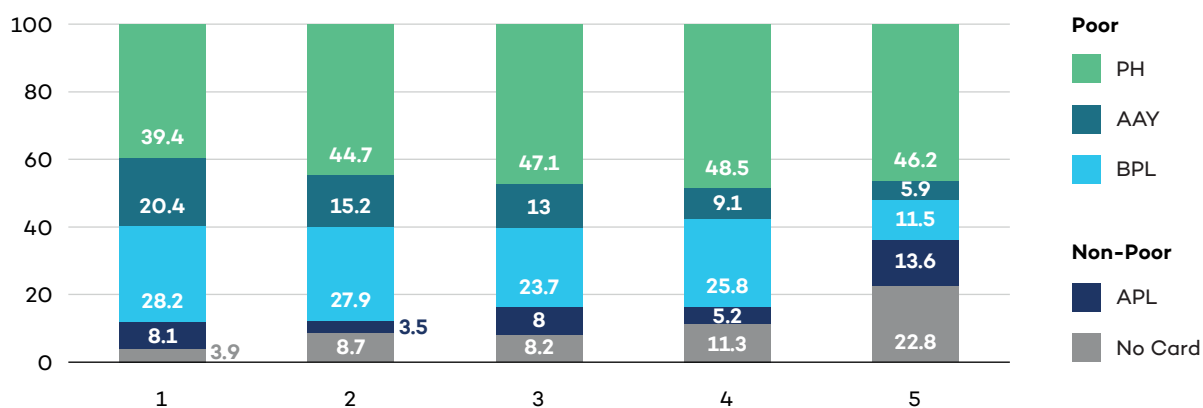


### Box 1. Chi-square testing and statistical significance

This report uses chi-square tests to examine the plausibility that two (or more) variables are distributed in the same manner in the sample and in the whole population. For example, when we divide the population into rural and urban segments, we may ask, is the proportion of poor, middle-class, and rich households the same in urban and rural populations? In such a situation, the chi-square test allows us to verify whether the distribution of respective categories (poor, middle class, rich) in our sample is different in both rural and urban settings and if this pattern is likely to be true if we sample the whole population.

In a chi-square test, the starting hypothesis (typically called the “null hypothesis”) is that the variables are independent and distributed in the same manner. We then evaluate whether the patterns across variables are different enough to decide whether we should reject this (“null”) hypothesis. If the data aren’t conclusive enough, we say that we “fail” to reject the null hypothesis and that the data are consistent with the variables being distributed the same way across groups (sometimes also referred to as a statistically “insignificant” result). Otherwise, we may reject the null hypothesis and conclude that the variables are not independent (what is often referred to as statistically significant).

Figure 6. Ration card ownership by expenditure quintiles (%)

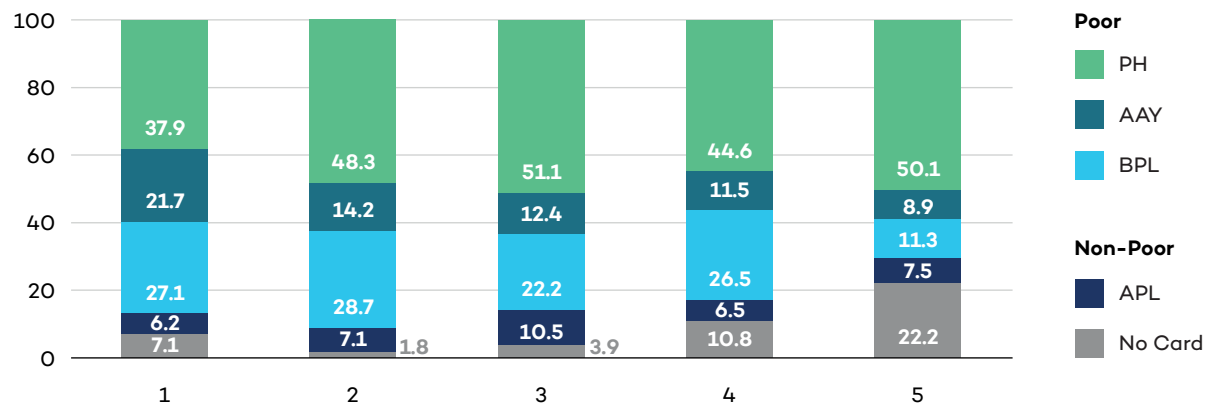


Source: Survey data

Note: A chi-squared test rejected the hypothesis that the distribution of households was the same across each quintile. Also see Table 2 for expenditure ranges (in INR) for different quintiles.



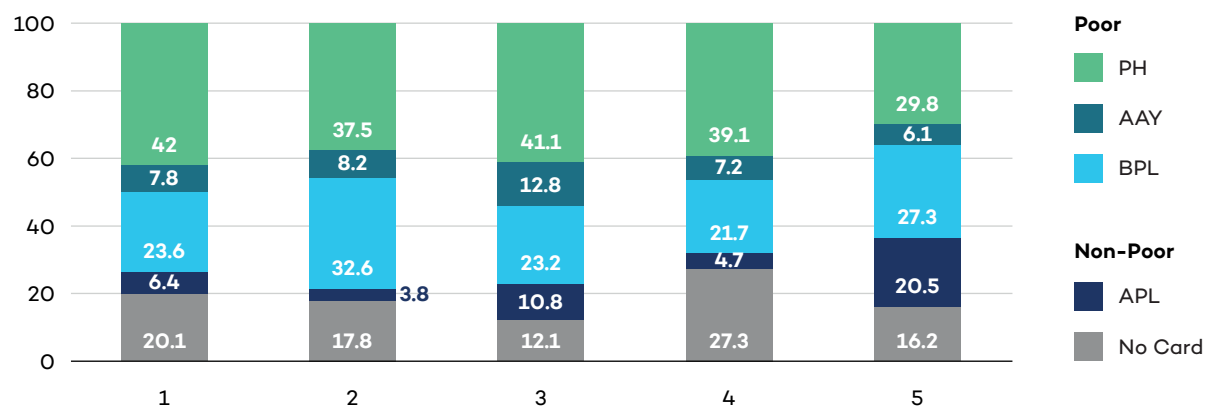
**Figure 7. Ration card ownership by rural wealth quintiles (%)**



Source: Survey data

Note: A chi-squared test rejected the hypothesis that the distribution of households was the same across each rural quintile. It failed to reject this hypothesis for urban households.

**Figure 8. Ration card ownership by urban wealth quintiles (%)**



Source: Survey data

Note: A chi-squared test rejected the hypothesis that the distribution of households was the same across each rural quintile. It failed to reject this hypothesis for urban households.





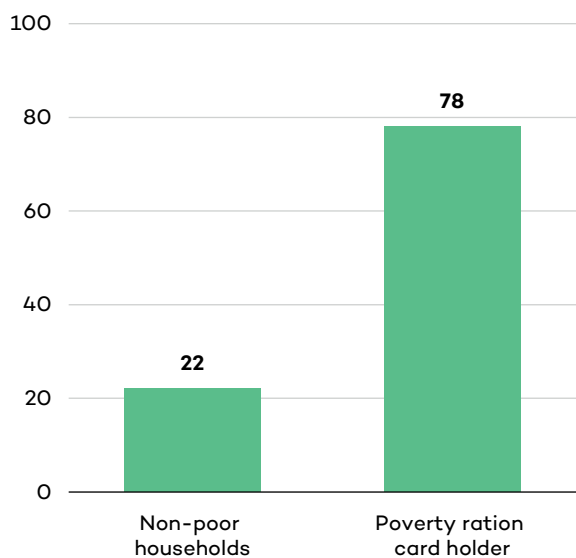
## 4.0 Who Gets Electricity Subsidies Today and Is the Distribution of Benefits Fair?

### 4.1 Subsidy Incidence

#### 4.1.1 Subsidy Incidence with a Ration Card Approach

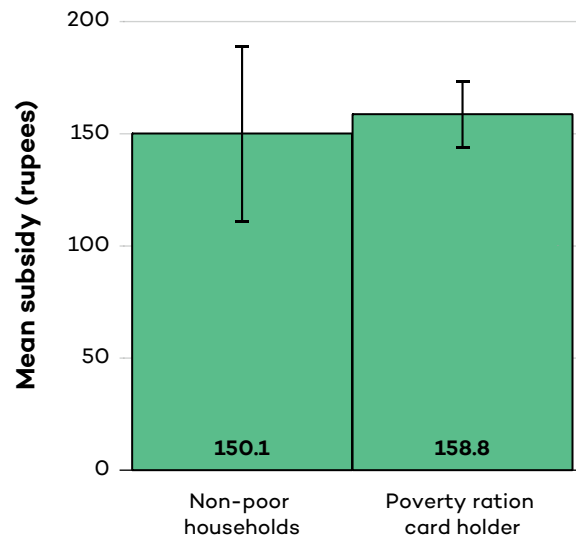
Over 80% of surveyed households possessed a BPL, AAY, or PH ration card, meaning they are considered “poor” by state authorities. As illustrated in Figure 9, the households that hold a poverty ration card received 78% of all subsidy benefits, leaving just 22% of the subsidy for the non-poor. If we agree that ration cards are well correlated with poverty, we see reasonably good targeting performance, albeit about a fifth of the funding goes to non-eligible beneficiaries. As illustrated in Figure 10, a poor household, on average, receives a subsidy of INR 159 (USD 2.25) per month, as opposed to INR 150 (USD 2.13) per month for a non-poor household. The difference between the two is statistically insignificant—at a state level, we did not detect any clear difference in any average subsidy received by poor and non-poor households by this measure.

**Figure 9.** Share (%) of electricity subsidies received by ration card ownership



Source: Survey data

**Figure 10.** Mean electricity subsidy by ration card



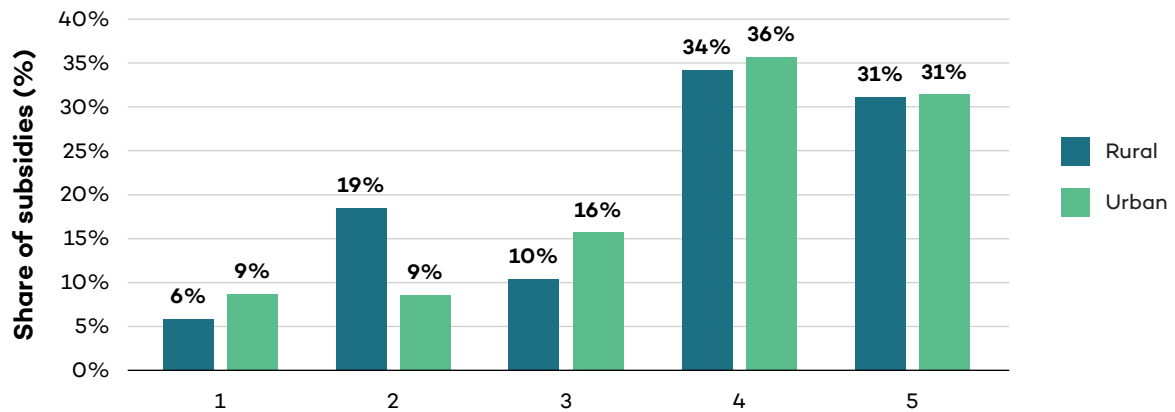
Source: Survey data



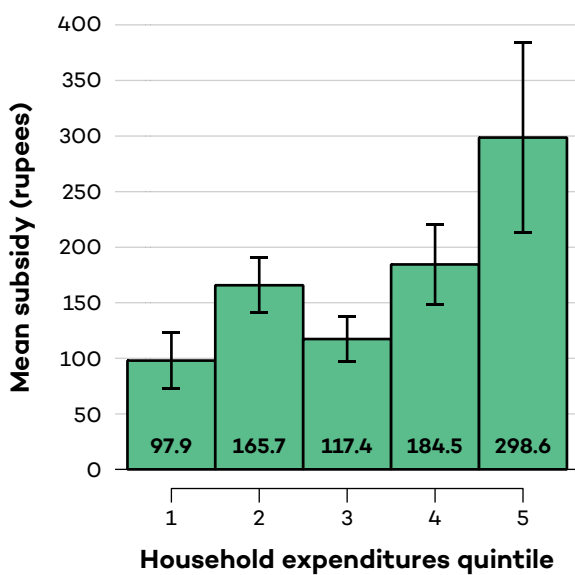
### 4.1.2 Subsidy Incidence with an Expenditure Approach

Comparing other approaches, however, suggests that there may be significant inclusion and exclusion errors in the distribution of ration cards. Using an expenditure approach, as illustrated in Figure 11, subsidy incidence is more regressive in urban areas. Rural households in the top two quintiles receive 65% of the benefits, but the poorest two quintiles receive 24% of benefits. In contrast, in urban areas, the top two quintiles receive 67% of total subsidy benefits while the bottom two quintiles receive only 17% of benefits. This amounts to the richest households receiving, on average, INR 177–201 (USD 2.5–2.8) more in benefits per month than the poorest households.

**Figure 11.** Share (%) of total electricity subsidies received by different expenditure quintiles (rural and urban)

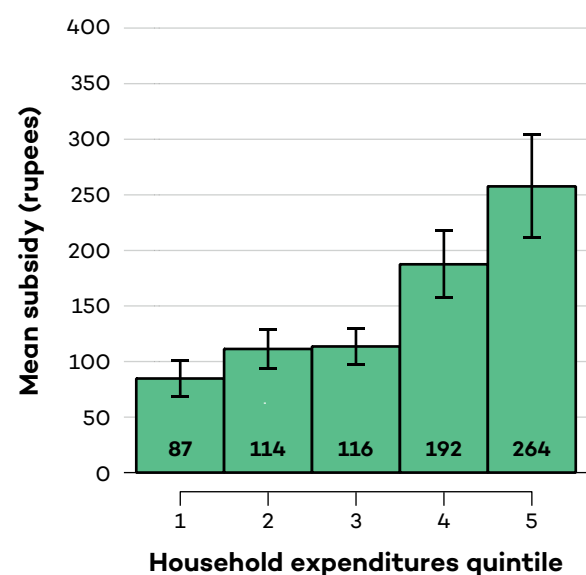


**Figure 12.** Mean monthly subsidy (INR) among different rural expenditure quintiles



Source: Survey data

**Figure 13.** Mean monthly subsidy (INR) among different urban expenditure quintiles



Source: Survey data

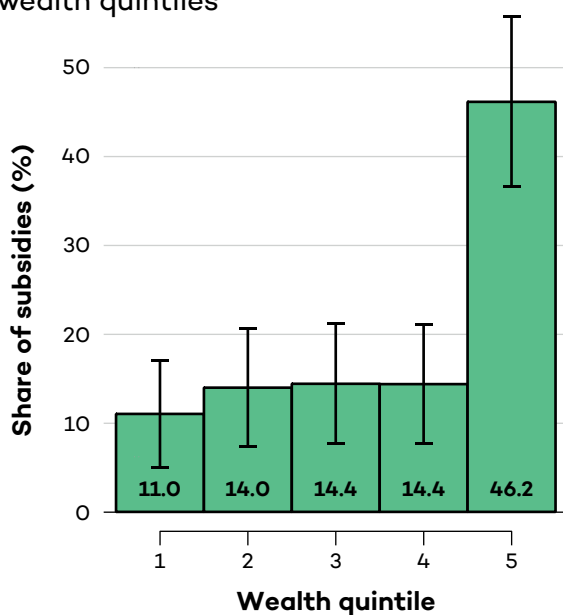


### 4.1.3 Subsidy Incidence with a Wealth Index Approach

The wealth index is constructed separately for urban and rural households, so this analysis can only report subsidy incidence separately and not for the whole state. For more details on the wealth index construction, refer to Annex B.

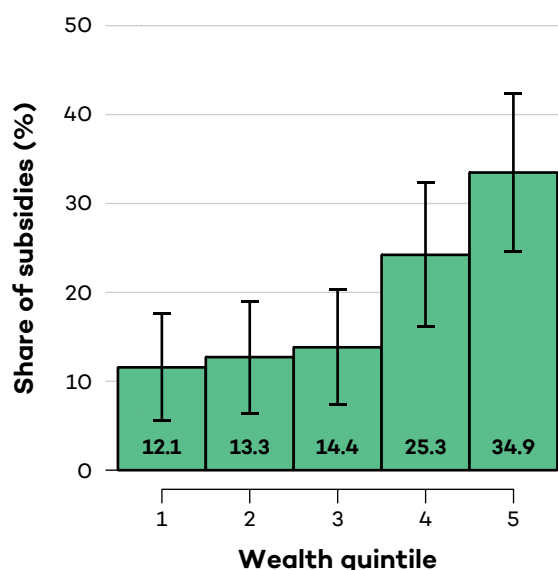
As with the expenditure approach, the wealth index approach also suggests that subsidies in Jharkhand are currently regressive. Figure 14 illustrates, among rural households, that the richest two quintiles received 61% of subsidy benefits, and the poorest two quintiles received 25%. The richest quintile alone received 46% of the total benefits. Figure 15 reveals a similar pattern among urban households: the richest two quintiles received 60% of benefits, and the poorest two quintiles received 25%. The wealth index approach finds an even larger gap between the absolute benefits received by the richest and poorest quintiles<sup>13</sup>: INR 268 (USD 3.8) per month in rural areas and INR 154 (USD 2.2) per month in urban areas (see Figures 16 and 17). In rural areas, there was no statistically significant difference in the subsidy received by households in the bottom four quintiles, but there was a very large difference between them and the highest quintile. In urban areas, a similar pattern was observed but with the divide being between the lowest three quintiles and the top two quintiles.

**Figure 14.** Share (%) of total electricity subsidies received by different rural wealth quintiles



Source: Survey data

**Figure 15.** Share (%) of total electricity subsidies received by different urban wealth quintiles

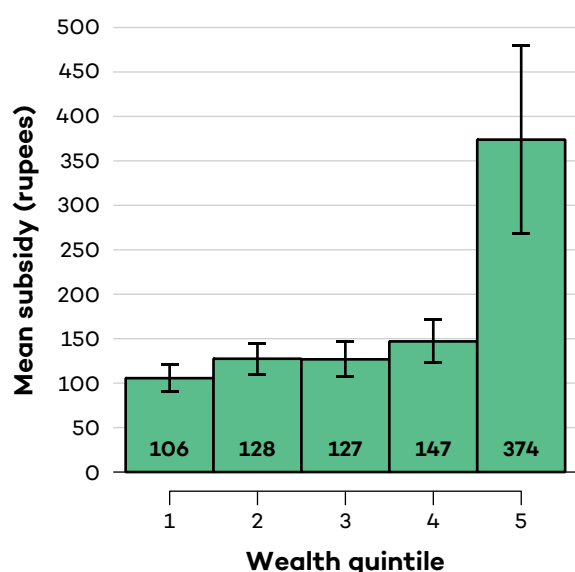


Source: Survey data

<sup>13</sup> This observation that the regressive nature of a subsidy is more pronounced may be because of the sensitivity of the wealth index in comparison to the household expenditure approach. The wealth index takes a broader review of what makes households worse or better off, accounting for factors such as non-electric assets and households' socioeconomic status. See section 3.3.3 on wealth index construction.

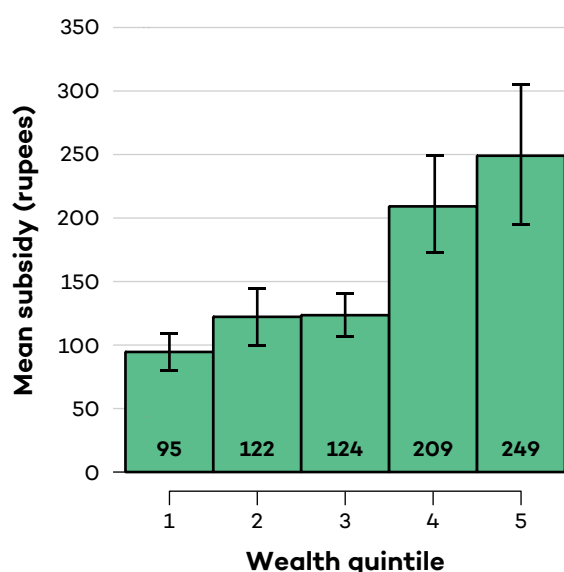


**Figure 16.** Mean monthly subsidy (INR) among different wealth rural quintiles



Source: Survey data

**Figure 17.** Mean monthly subsidy (INR) among different wealth urban quintiles



Source: Survey data

## 4.2 Electricity Consumption

Subsidy incidence is largely determined by electricity consumption: it defines the total volume of electricity for which a subsidy is transferred and the magnitude of the per kWh subsidy in most cases. For this reason, examining electricity consumption can help shed light on some of the incidence trends that have been observed.

A large number of states in India offer 50 kWh per month as the initial cutoff for offering subsidized electricity to poor households (Mayer et al., 2015). This level of electricity entitles households to meet their basic electricity needs. Table 4 lists typical appliances and their hours of usage for a household with a monthly electricity demand of 50 kWh, though this listing does not account for seasonal variations<sup>14</sup> (Mayer et al., 2015).

<sup>14</sup> Average rural household electricity demand in some states is estimated at 39 kWh per month, which is estimated to be half of the average national consumption (Agrawal et al., 2019).



**Table 4.** List of appliances and hours of use for a household consuming 50 kWh per month

Appliances	Appliance wattage	Hours of use per day	No. of electricity units consumed in a month (kWh)
Two compact florescent lightbulbs	20W	6 hours	7
Two fans	75W	8 hours	36
One light-emitting diode (LED) TV 22-inch screen	30W	6 hours	5
Two mobile phones	4W	4 hours	1
<b>Total electricity units consumed in a month</b>			<b>49</b>

Source: Authors' analysis

Note: This table illustrates basic monthly electricity consumption for Jharkhand, where the average monthly electricity consumption for the state is found to be 90 kWh. Basic demand will vary significantly between states on account of seasonality and inter-state variations in average consumption.

At the time of data collection in October 2019, average monthly electricity consumption for households with billing data was 90 kWh (see Section 3.2). The majority of surveyed households (63%) were consuming less than 100 kWh per month,<sup>15</sup> 40% of households were consuming less than 30 kWh per month (see Figure 18), and 37% of households were consuming more than 100 kWh per month, with only 11% households consuming greater than 200 kWh per month. Because the data was gathered in autumn, this electricity consumption may be lower than the summer months, where cooling appliances may be running for longer hours.

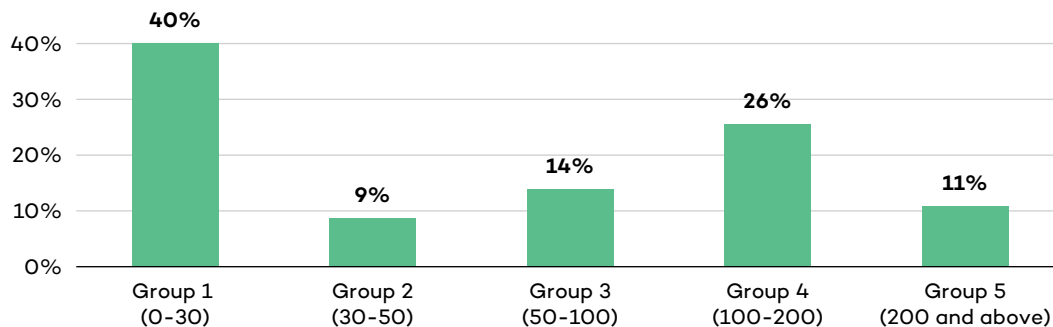
The findings on monthly average household electricity consumption are in line with an estimated 2017 national average, where 80% of households consumed less than 100 kWh per month; it is significantly lower than cities like Delhi, where, on average, a household consumes about 250–270 kWh per month (Chunekar et al., 2016).

The survey revealed that a large percentage of households own lighting appliances like LED bulbs and incandescent bulbs, and half of the households had ceiling fans or table fans, but very few had TVs. Very few households also had high wattage appliances like coolers, electric irons, washing machines, mixer grinders, and agricultural machinery—explaining why electricity consumption is typically lower than in large metro areas like Delhi. See Table A1 in Annex A for a detailed breakdown of appliance ownership in surveyed households.

<sup>15</sup> Monthly household electricity consumption can vary significantly between seasons, and the difference is more pronounced for households using high wattage appliances for heating or cooling spaces. One study found that, in Delhi, refrigerator use was lower in the winter months and, overall, the average monthly consumption varied between 28 to 110 units between seasons (The Energy Resources Institute, 2008).



**Figure 18.** Percentage of surveyed households with electricity bills among different monthly electricity consumption blocks

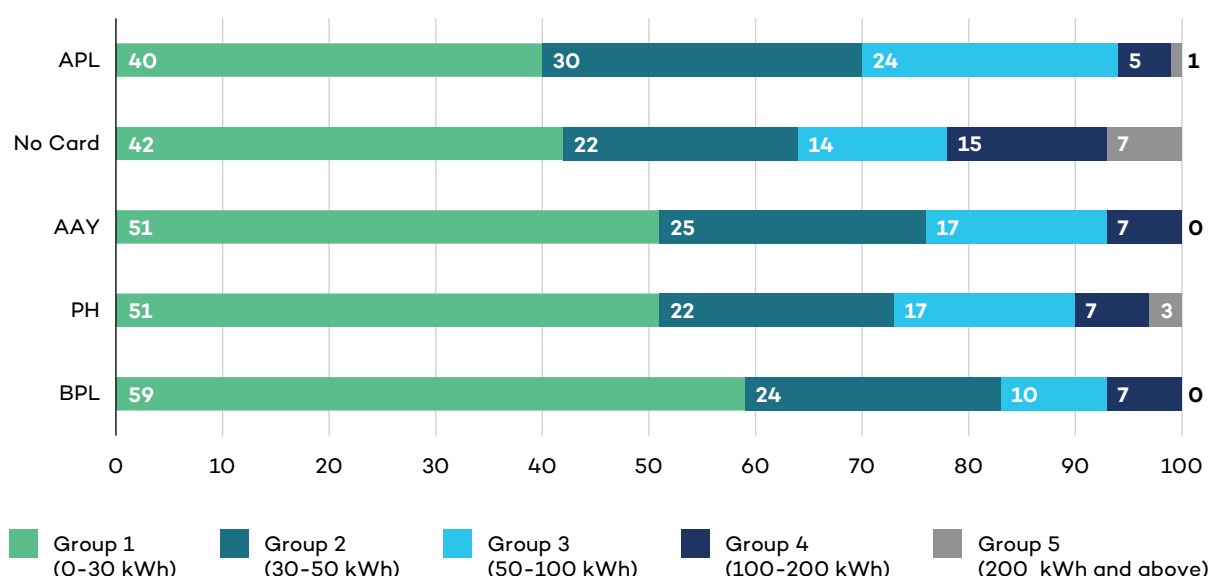


Source: Survey data

### 4.2.1 Electricity Consumption with a Ration Card Approach

Figure 19 shows electricity consumption by ration card ownership. On average, poverty ration card-holding households consume less electricity than households with an APL card or no card. But there is also not a particularly strong correlation between ration card ownership and electricity consumption. For example, among all sub-groups, more than 50% of households consume less than 50 kWh per month. This suggests that perhaps the consumption of less than 50 kWh per month is meeting basic needs (see Table 4), and therefore inelastic (i.e., wealthier) households do consume more electricity, but poor households may not be able to lower their consumption any further to meet their basic needs.

**Figure 19.** Electricity consumption by ration card ownership (%)



Source: Survey data

Note: A chi-squared test failed to reject the hypothesis that the distribution of households was the same across each card status.

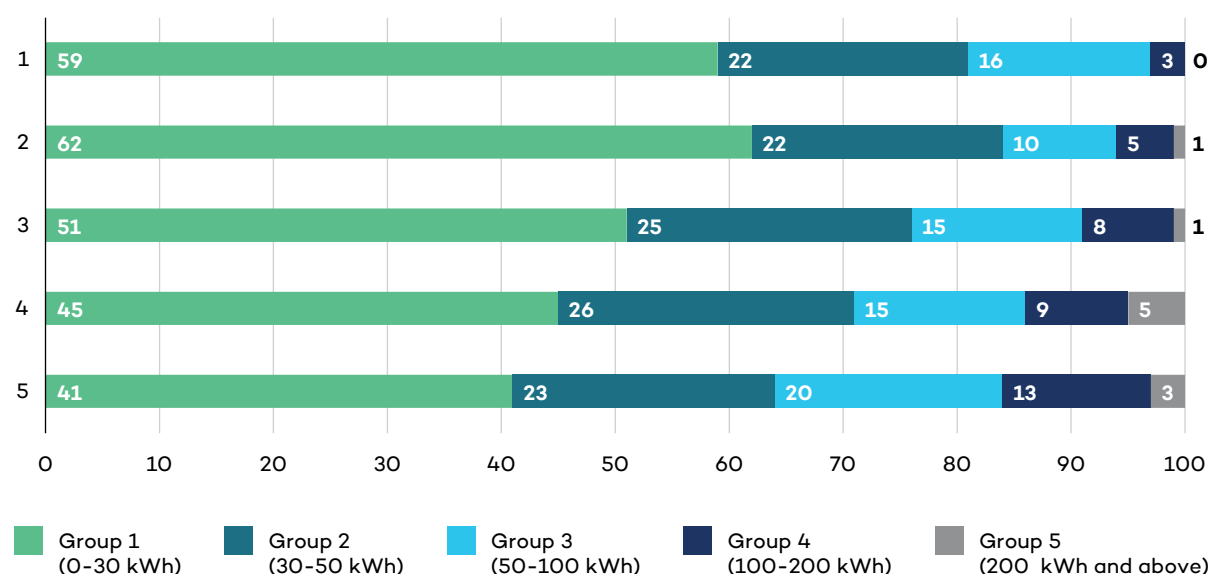




### 4.2.2 Electricity Consumption with an Expenditure Approach

Figure 20 shows similar results with an expenditure approach: a larger share of richer quintiles fall into higher consumption blocks than poorer quintiles, but there is not a particularly strong correlation between reported expenditure and consumption volume. In the poorest quintile, 59% consume 30 kWh per month or below compared to 41% in the richest quintile, a difference of only 18%.

**Figure 20.** Electricity consumption by expenditure quintiles (%)



Source: Survey data

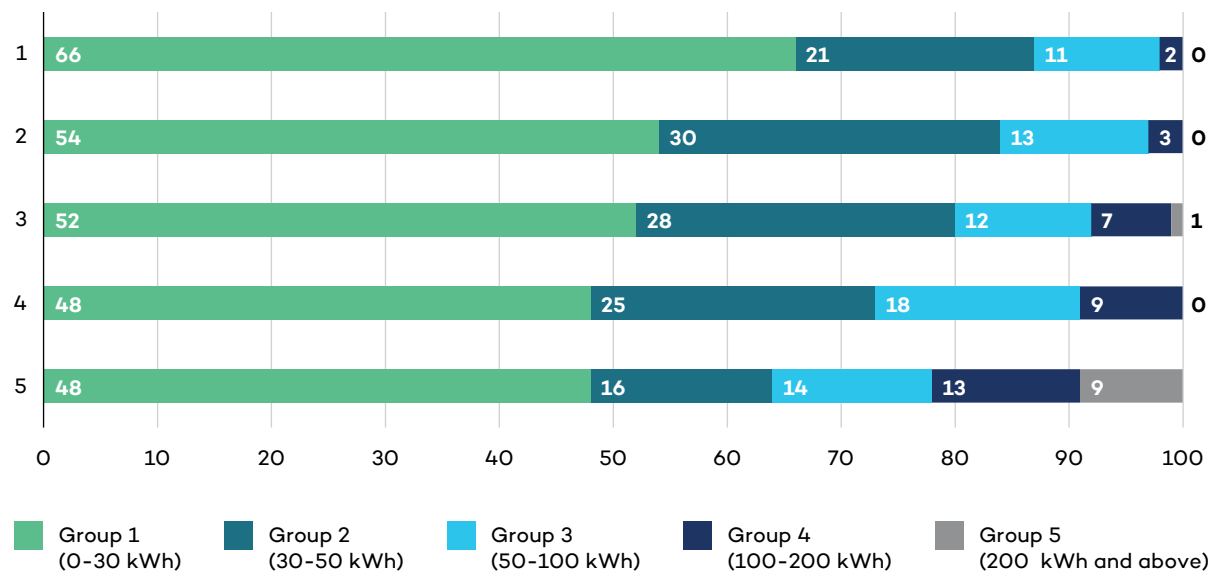
Note: A chi-squared test rejected the hypothesis that the distribution of households was the same across each expenditure quintile.

### 4.2.3 Electricity Consumption with a Wealth Index Approach

Results are similar with a wealth index approach, as shown in Figures 21 and 22. The poorest quintiles for both rural and urban areas have more households in the lowest consumption block, while the richer quintiles have more households in the higher consumption blocks. The correlation appears to be strongest in rural areas, but, in general, a household’s wealth quintile does not appear to be strongly predicted by electricity consumption.



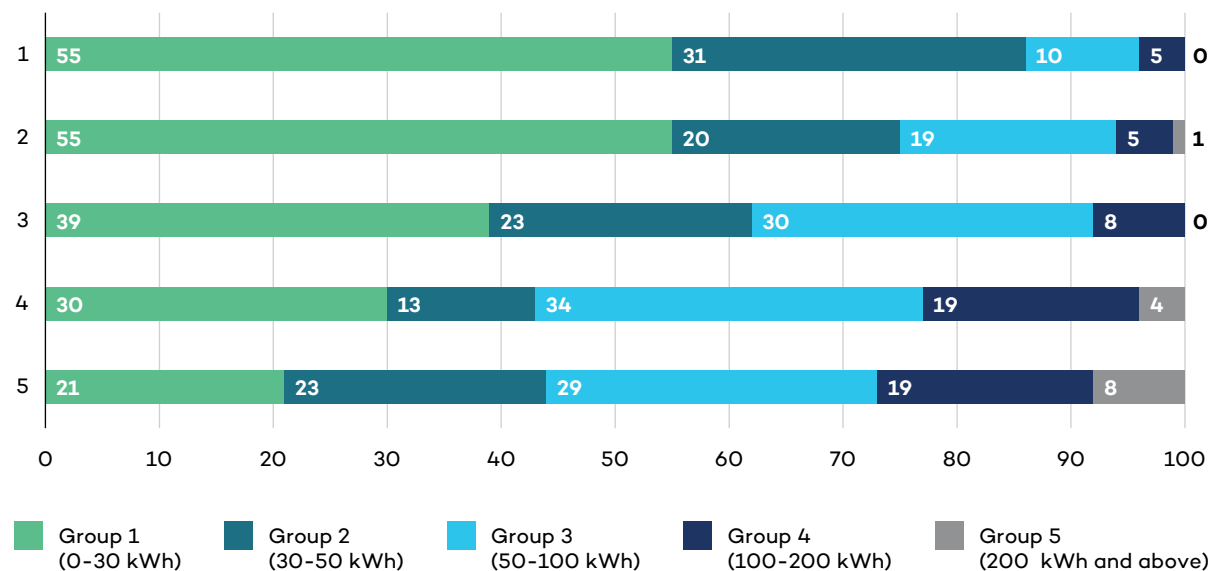
**Figure 21.** Electricity consumption by rural wealth index quintiles (%)



Source: Survey data

Note: A chi-squared test rejected the hypothesis that the distribution of households was the same across each expenditure quintile.

**Figure 22.** Electricity consumption by urban wealth index quintiles (%)



Source: Survey data

Note: A chi-squared test rejected the hypothesis that the distribution of households was the same across each expenditure quintile.

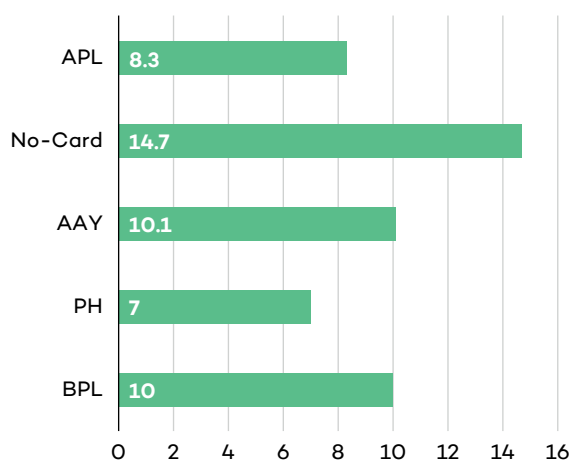


### 4.3 Electricity Affordability

Literature on affordability suggests that electricity to meet basic demands should cost less than 5% of a household’s income (Bhatia & Angelou, 2015). We examined the 549<sup>16</sup> households who shared their bill details and found that, on average, they were spending in excess of 5% of their reported household expenditure. This is based on two assumptions—first, that a household’s basic needs are met at 50 kWh per month since it is an initial cutoff for subsidized electricity offered by many states (Mayer et al., 2015); second, this study has used expenditure as a proxy for income, as income data is unreliable and under-reported. This finding—that households are spending more than 5% of their expenditure on electricity—is not unexpected, as 51% of households are consuming more than their basic needs, with 11% consuming in excess of 200 kWh and above (see Figure 18). However, these results are not very robust, as households appear to be under-reporting expenditures, as noted in Section 3.3.2.

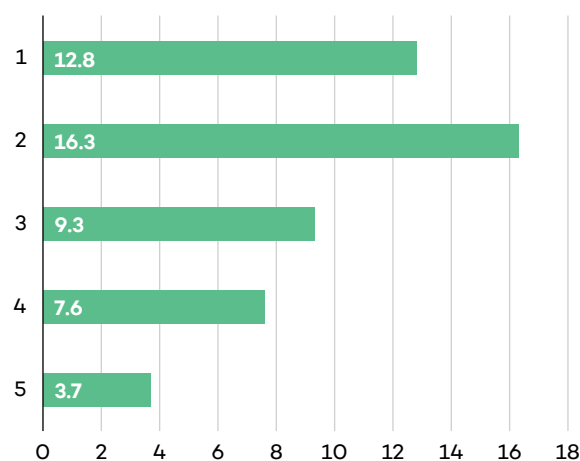
Analyzing expenditure by ration cards reveals that households with no cards spent more on electricity compared to poverty card-holders, but there was little difference between APL card-holders and others—in fact, APL card-holders spent less on electricity on average than BPL card-holders (Figure 23). But the trend is reversed when examining expenditure quintiles.<sup>17</sup> The poorest quintile spends 12.8% of their household expenditure on electricity, while the wealthiest quintile spends only 3.7% (Figure 24). This suggests that subsidized electricity in high consumption blocks is making electricity inexpensive for the wealthiest quintiles.

**Figure 23.** Electricity expenditure (as a % of monthly expenditure) among ration card households



Source: Survey data

**Figure 24** Electricity expenditure (as a % of monthly expenditure) among expenditure quintiles



Source: Survey data

<sup>16</sup> Our survey gathered billing data for 549 households. The data was unclear for some households, and some households were unwilling to share it. The majority of the households did not have bills.

<sup>17</sup> The study does not analyze electricity expenditure through the wealth index approach, as splitting the 549 households for the rural and urban wealth index became small, and the resulting analysis could not be used to draw statistically significant conclusions about the total population.



## 5.0 How Would Different Targeting Options Change Subsidy Distribution?

This study finds that electricity subsidy distribution is regressive, with most subsidies benefiting the non-poor. Improved subsidy targeting can allow for subsidies to be better clustered on the poor while reducing the fiscal stress on JBVNL and the government. This will allow for improved service delivery in other areas, but it also needs to be planned very carefully so that it does not harm vulnerable households or seriously affect the affordability of electricity.

This analysis reviews three possible options for improving the targeting of electricity subsidies.

1. Only providing electricity subsidies to households that hold poverty ration cards.
2. Adjusting volumetric cutoffs for subsidies so higher-volume users pay higher costs.
3. A proxy means test.

The analysis in this section focuses on the wealth index and not on expenditure data for a number of reasons. First, expenditure data can be unreliable. For example, the average urban household expenditure data from this study is INR 7,000 (USD 99), and this is lower than the official FY 2012 data that shows INR 9,659.4 (USD 207) (see Section 3.3.2 for the expenditure approach). Second, expenditure is linked to income. Many households have fluctuating income streams and, thus, their responses on income or expenditure vary considerably depending on what time of the year they are interviewed. To increase the robustness of these targeting options, we therefore rely on the wealth index, designed on the basis of asset ownership and the household's socioeconomic situation. This index is more robust, and it distinguishes between different norms for urban and rural households. We ran the same analysis using expenditure data and observed similar results. For more details, see Annex C.

In each option, we use the wealth index created through household survey data to identify to what extent each of these options would affect subsidy incidence and to what extent it would create fiscal savings.

### 5.1 Option 1: Targeting poor households through ration cards

The first option is to target electricity subsidies exclusively to poor households identified by the government through three ration cards: BPL, AAY, and PH. As discussed in the previous chapter, our sample suggests that 18% of electricity subsidies in Jharkhand go to households that do not hold BPL, Antyodaya, or PH cards. This option suggests excluding 19% of households, of which 11% have no card and 8% have an APL card (see Figure 5). For both rural and urban wealth quintiles, the no-card households are largely dominated by wealthier quintiles (see Figures C1 and C2 in Annex C). But the poorest quintiles are also represented in this group, suggesting that some poor households have incorrectly not received poverty ration cards and therefore may be excluded from receiving electricity subsidy benefits too.

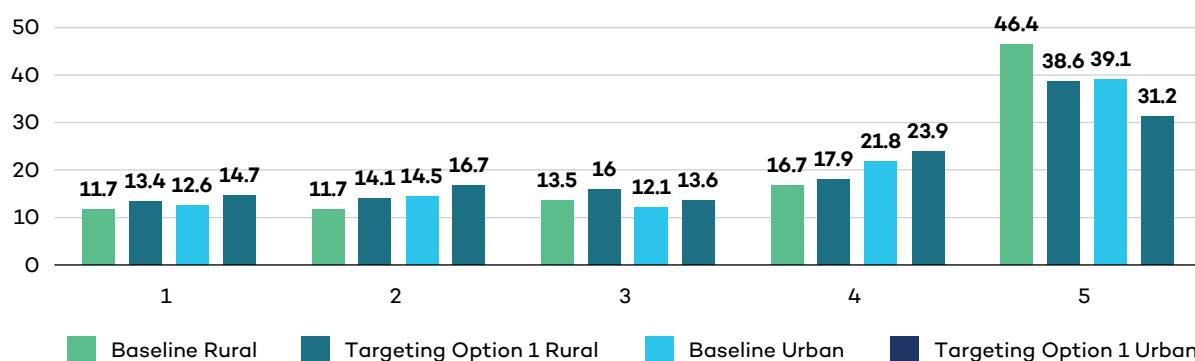


**Impacts on subsidy incidence:** Subsidy incidence appears to change slightly for the better. This includes the share of total subsidies that go to rural households: increasing for every rural quintile except for the richest. Under this scenario, the two poorest rural quintiles now receive 28% of the total subsidy (4% more than the current situation), and the two richest rural quintiles now receive 56% of the total subsidy (7% less than the current situation).

**Implications of this targeting option:** We kept the subsidy per household constant and only decided on the exclusion of non-poor households—so the actual average subsidy per month per household does not change. As a result, after the exclusion of APL and no-card households, we observe a declining average subsidy per quintile, reflecting that a share of households in each quintile has been excluded. In this first alternative targeting option, the sharpest fall in average subsidy is observed among the wealthiest quintile, suggesting that a large group of excluded households are those who have the capacity to pay. This reflects the fact that the households without cards make up a large proportion of the wealthiest quintiles (see Figures C1 and C2 in Annex C).

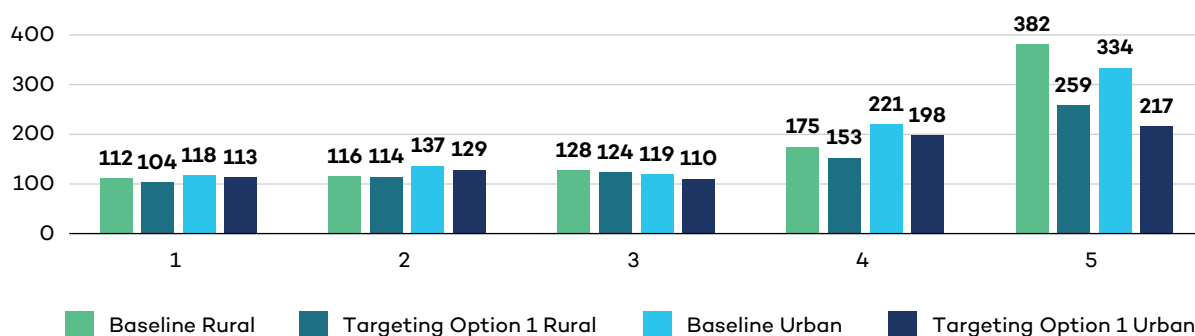
**Impacts on subsidy costs:** Excluding such households from receiving electricity subsidies would reduce annual costs by INR 163 crore (USD 23 million) or 17% of total subsidy in 2019.

**Figure 25.** Changes in subsidy incidence with targeting option 1 (% of electricity subsidies)



Source: Survey data and authors' analysis

**Figure 26.** Changes in mean subsidy for different quintiles (INR) with targeting option 1



Source: Survey data and authors' analysis



## 5.2 Option 2: Rationalizing volumetric limits for electricity subsidies

A second targeting option is to revise the volumetric cutoffs for different subsidy rates in JBVNL's increasing block tariff (IBT) schedule. A revised IBT tariff structure was created, as summarized in Table 5, where subsidies for Kutir Jyoti households remained untouched. Volumetric limits for both rural and urban households were set at 50 kWh, 100 kWh, 200 kWh, and 300 kWh per month, thereby reducing and simplifying the number of categories. Households consuming more than 300 kWh per month had their entire subsidy withdrawn. Revised subsidies were only marginally reduced so as to minimize any opposition if such a policy were implemented.

**Table 5.** Revised IBT structure for Jharkhand

Category	Original subsidy slab (units) in Tariff Order	Original subsidy by state govt (INR) in Tariff Order	Proposed subsidy slabs (units)	Proposed subsidy (INR)
Kutir Jyoti metered	All units	4.25 / kWh	All units	4.25 / kWh
Kutir Jyoti unmetered	–	125/conn	–	125/conn
Rural metered	All units	3.90/kWh	0–50 units	3.90/kWh
			51–100 units	3.25/kWh
			101–200 units	2.75/kWh
			201–300 units	1/kWh
Rural unmetered	–	25/conn	–	25/conn
Urban metered	0–200 units	2.75/kWh	0–50 units	2.75/kWh
	201–500 units	2.05/kWh	51–100 units	2.25/kWh
	501–800 units	1.85/kWh	101–200 units	1.75/kWh
	> 800 units	1.00/kWh	201–300 units	1/kWh
Any HH > 300 units	–	–	No more subsidy for any kWh consumed	

Source: JBVNL tariff order 2019 and authors' analysis

The premise behind any IBT structure is that poor households will consume lower quantities of electricity, so charging less for the first units of consumption will help households meet their essential needs. There is no one fixed approach to defining essential needs, but most states in India define their lowest tariffs with a cutoff at 30 kWh per month or 50 kWh per month (Mayer et al., 2015; Siyambalapatiya, 2018). We set the cutoff for the lowest tariff at 50 kWh, based on an analysis of the electricity required for the usage hours of two light bulbs,



two fans, one LED TV screen, and two mobile phones, as summarized in Table 4. Even in the richest households in Jharkhand, the majority of households (63%) consume under 100 kWh per month, so the subsidy is only significantly reduced after this level.

**Impacts on subsidy incidence:** This revised tariff structure would reduce the percentage of subsidies received by the wealthiest rural and urban quintiles, as shown in Figure 27. The two poorest rural quintiles would receive 35% of the total subsidy (12% more than what they receive today), and the two richest rural quintiles would receive 46% of the total subsidy (17% less than what they receive today). A similar pattern is seen in urban households, where the two poorest urban quintiles would receive 37% of the total subsidy (10% more than what is the case today), and the two richest urban quintiles would receive 48% of the total subsidy (13% less than today). The change in subsidy incidence is still regressive, but it must be noted that, while targeting programs can deliver more benefits to the poor, many targeted programs continue to remain regressive (Coady et al., 2004).

**Implications of this targeting option:** Using this revised tariff structure reduces the large additional benefits that higher-income households receive compared to poorer households. But we noted that poorer households would also see their average subsidy allocation decrease in comparison with today, as shown in Figure 28. This happens because some high-electricity-consumption households are among the poorer quintiles, and the loss of subsidy for such households brings down the average for those quintiles. This could be mitigated by using a share of subsidy savings to increase the value of the subsidy for the poorest households. The introduction of a volume-differentiated tariff could also be used to help manage these impacts so that households consuming above a certain threshold—say, 100 kWh—would not be eligible for the highest subsidy on their initial units of consumption.

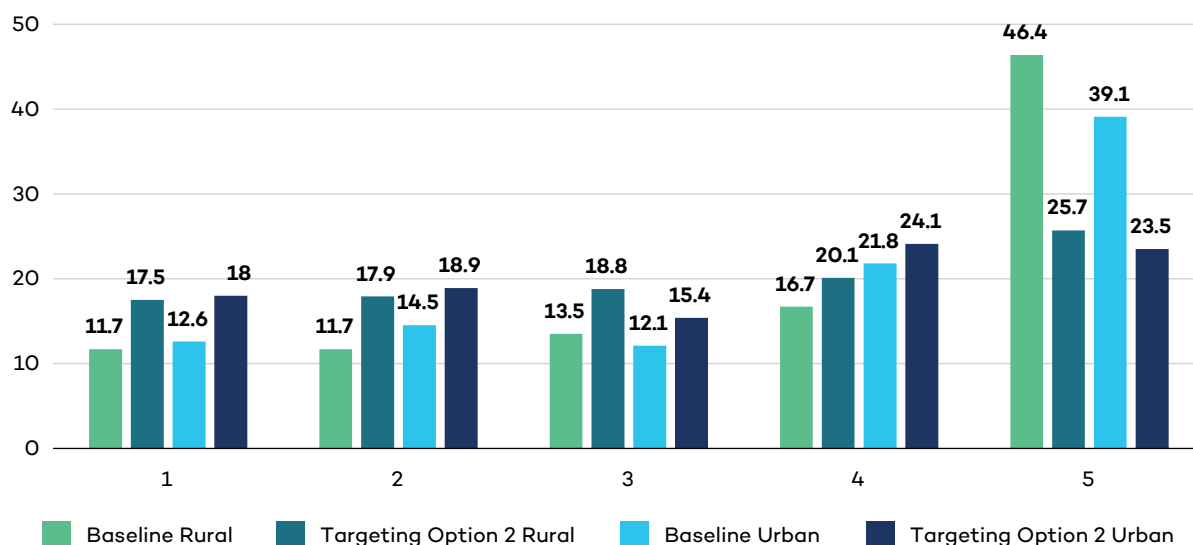
**Impacts on subsidy costs:** When we use this alternative targeting option, we notice that the State of Jharkhand saves a considerable sum in subsidy spending. Subsidies would decline by 31% of the total subsidy in 2019, meaning the state would save about INR 306 crore (USD 44 million) annually.

In any attempt to revise a tariff structure, “the devil is in the details”—that is, tariff structures could be revised in a multitude of ways with very different outcomes. We have used our best judgment in order to suggest one such option in this scenario, but it should be emphasized that the value of the dataset we have created is that it can allow for a state DISCOM and regulatory agency to explore multiple scenarios, iteratively, to decide which targeting option is preferred. For example, different tariff cutoffs could be chosen, and, as noted above, even higher subsidy rates could be provided to the lowest consumption blocks. Similarly, deeper structural changes could be made, such as switching from an IBT to a volume-differentiated tariff, where households consuming above a certain threshold, based on the information collected in this survey—say, 100 kWh—would not be eligible for subsidies on their first units of consumption. In this report, we have not attempted to run multiple simulations along these lines because it is resource intensive, and it can be challenging to present results. We would welcome any requests from policy-makers or other researchers to explore the data further in this way.



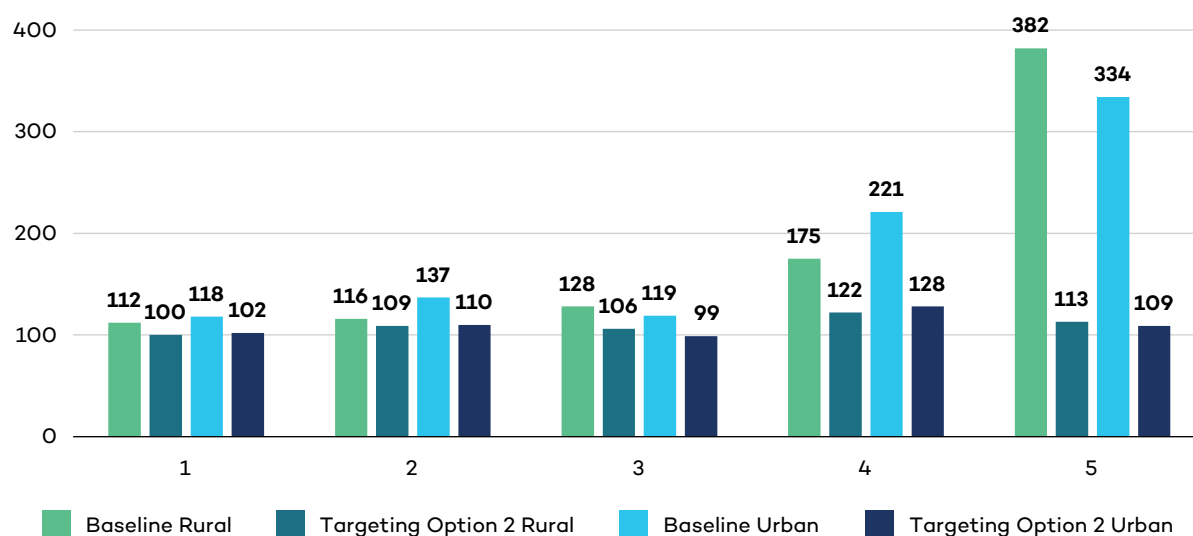


**Figure 27.** Changes in subsidy incidence with targeting option 2 (% of electricity subsidies)



Source: Survey data and authors' analysis

**Figure 28.** Changes in mean subsidy for different quintiles (INR) with targeting option 2



### 5.3 Option 3: Proxy-means test approach

A proxy means test (PMT) is an attempt to predict whether households are richer or poorer based on “proxies”—characteristics that are closely correlated with poverty or wealth. We explored a PMT that determines household eligibility based on “exclusion” factors that automatically exclude households from benefits and “inclusion” factors that automatically make households eligible for benefits. The factors were chosen based on a set of characteristics that are already tracked by the Jharkhand government and used to identify poverty under



India's SECC methodology (see Annex B for details on SECC variables). In taking this approach, our goal was not to attempt to determine the optimum proxies for subsidy targeting—rather, it was to test the viability of using an existing approach that would be familiar to state policy-makers.

A household is automatically excluded (25.5% of surveyed households) when it scores positively on one of the following:

- It owns 2.5 acres or more of land with at least one piece of irrigation equipment.
- Any member earns more than INR 10,000 (USD 142) per month.
- It has a Kisan credit card with a limit of INR 50,000 (USD 710) and above.

A household is automatically included (51.7% of surveyed households) when it scores positively on one of the following:

- No source of income or manual scavenging as the primary source of household income.
- It is based in a structure made up of only one room with kucha<sup>18</sup> walls and a kucha roof.
- There is no adult member between the ages 18 and 59.
- It is a female-headed household with no adult male members between the ages 16 and 59.
- There is no literate adult above 25 years of age.
- A member of the household has a disability.
- The household is from a scheduled caste or scheduled tribe.

Households that scored positively for at least one exclusion factor were excluded, regardless of the household score on any inclusion factors. Of the total number of households that were excluded (25.5% of surveyed households), 14.7% of surveyed households scored positively to one at least one exclusion and at least one inclusion criteria.

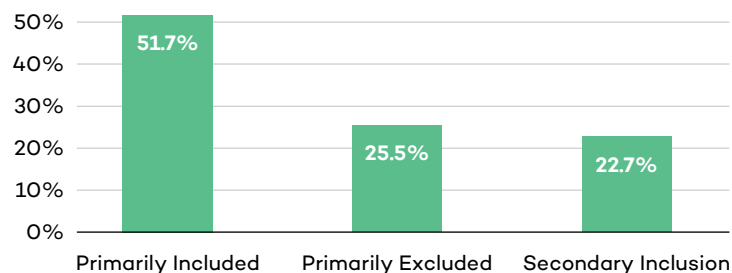
The *remaining households* (22.7% of surveyed households) were then included and labelled as “secondary inclusion” in Figure 29. We also considered another model where we excluded these households, but it showed that a significant number of poor households would be excluded, and hence we rejected that option given the high levels of poverty in Jharkhand (see Annex D for a detailed working of this “high exclusion” model).

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<sup>18</sup> Kucha refers to materials that do not use fired materials for walls or roofs like bricks, blocks, tiles or concrete. It implies mud walls, a temporary roof of thatch, or country tiles.



**Figure 29.** Distribution of sample by inclusion and exclusion factors



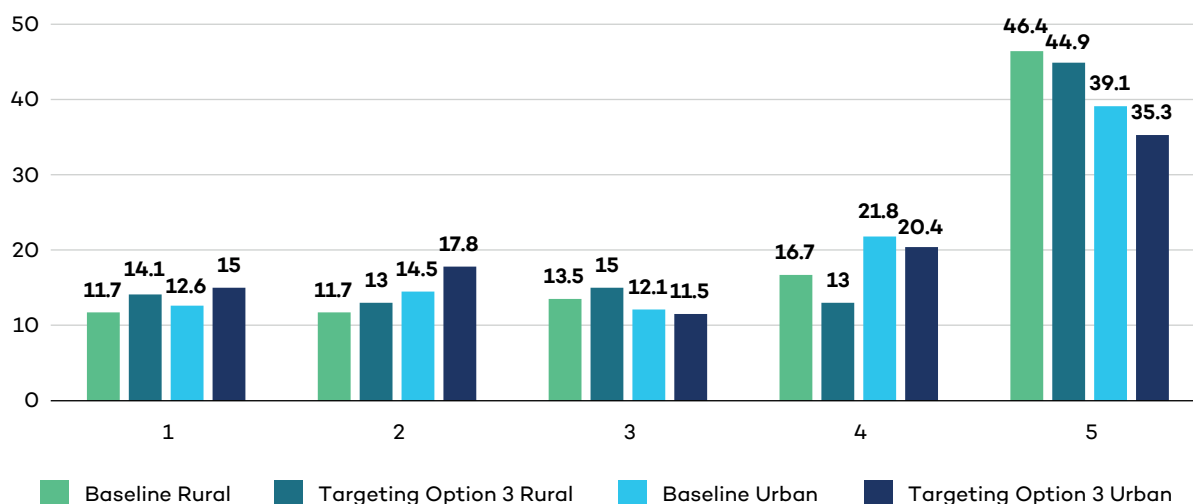
Source: Survey data and authors' analysis

**Impacts on subsidy incidence:** The subsidy incidence does not change significantly. As summarized in Figure 31, in urban areas, the poorest two quintiles would receive 33% of total subsidies, compared to 27% today. The two richest quintiles would receive 55%, compared to 60% today. In rural areas, the two poorest quintiles would receive 27% of total subsidies, compared to 23% today; and the two richest quintiles would receive 58%, compared to 63% today. This implies that a more inclusive PMT with this design would not necessarily make subsidy distribution more progressive.

**Implications of this targeting option:** The average subsidy received per quintile falls, but the reduction is less pronounced (see Figure 31). In both rural and urban areas, the mean subsidy per month for the lowest two quintiles falls to INR 94 (USD 1.3) and INR 110 (USD 1.5), respectively. In comparison, the same groups today benefit from an average subsidy of INR 114 (USD 1.61) and INR 127 (USD 1.8) per month, respectively.

**Impacts on subsidy costs:** With this type of PMT design, the cost of subsidies would still decline by 33% of total subsidy in 2019, saving the government INR 327 crore (USD 47 million) annually.

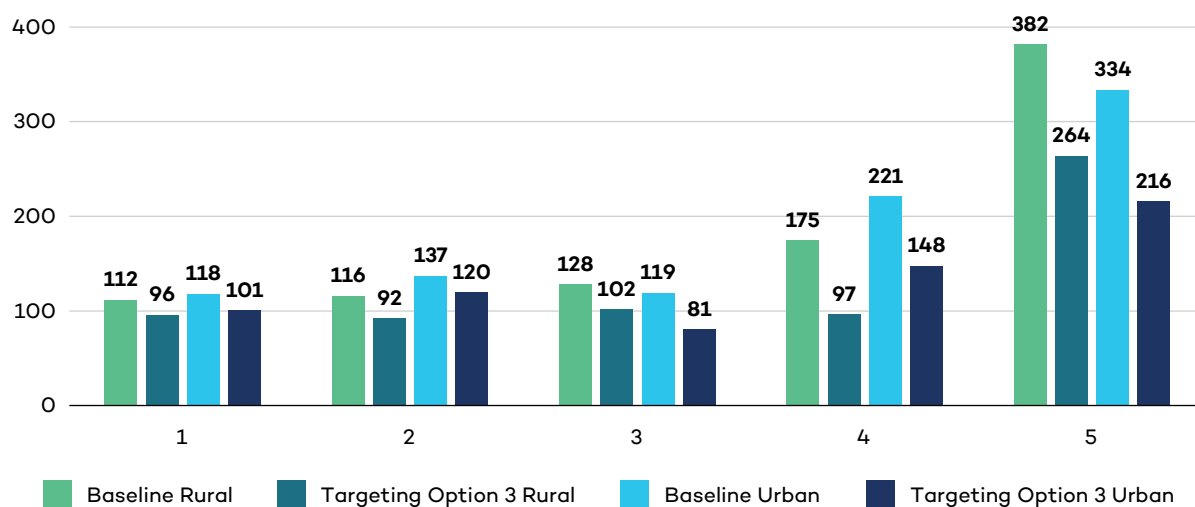
**Figure 30.** Changes in subsidy incidence with targeting option 3 (% of electricity subsidies)



Source: Survey data and authors' analysis



**Figure 31.** Changes in mean subsidy for different quintiles (INR) with targeting option 3



Source: Survey data and authors' analysis

### 5.3.1 Effectiveness of the PMT Approach

In principle, PMTs represent a consistent, evidence-based way to decide how scarce resources can be effectively allocated for people who are most in need. In practice, they are only as strong as the proxies on which they are based. We observe a number of reasons to be cautious about adopting this SECC-based PMT approach in Jharkhand. First, 14.7% of households scored positively on both inclusion and exclusion factors. Second, we note that a lot of households (22%) remain after the application of inclusion and exclusion factors, suggesting that some further consideration of proxies is needed. Third, we notice that, of the 25.5% of households that are excluded, many are in the poorer quintiles established in our wealth index, suggesting a high degree of exclusion error. Fourth, we notice that, of the 51.7% of households that are included, many are in the wealthiest quintiles, suggesting a high degree of inclusion error.

As with tariff structure revisions, it should be noted that any attempt to develop a PMT is highly dependent on the PMT structure that has been chosen. In this scenario, we have focused on the recognized PMT approach that is used by the SECC. It can again be emphasized that the value of the dataset we have created is that it contains detailed information about numerous kinds of household characteristics, including household size, employment status, enrolment in other national and state-level poverty schemes, and asset ownership. This can allow a state DISCOM and regulatory agency to explore multiple scenarios for PMT design, iteratively, to explore whether alternative options might be worth exploring. In this report, we have not attempted to run multiple simulations along these lines because it is resource intensive, and it can be challenging to present results. We would welcome any requests from policy-makers or other researchers to explore the data further in this way.



## 6.0 Conclusions and Recommendations

The Government of Jharkhand has made significant efforts to make electricity affordable for households through subsidized tariffs. Yet this study finds that poor households are receiving only a small percentage of household electricity subsidies.

This study has focused on “subsidy targeting” by analyzing the distribution of existing subsidies in Jharkhand and exactly how better targeting of poor households could work in practice. The study estimates the distribution of subsidies to poorer and richer households by categorizing households according to their relative levels of wealth. As there is no one accepted way to define richer or poorer households, the study chose to compare relative wealth levels through three different approaches: (1) ration cards, (2) household expenditure, and (3) a wealth index—a multi-criteria score based on ownership of non-electric assets and socioeconomic status.

The study finds that a large share of subsidy benefits is not reaching poor households.

Main findings:

<b>Ration Card Approach</b>	The poverty ration-card-owning households receive 78% of the total subsidy, while the non-poor receive 22% of the subsidy.	
<b>Expenditure Approach</b>	The richest two quintiles receive 51% of the total subsidy, while the poorest two quintiles receive only 31% of total subsidy	
	Among rural households, the top two quintiles receive 65%, but the poorest two quintiles receive 24% of the total subsidy.	Among urban households, the top two quintiles receive 67%, and the bottom two quintiles receive only 17% of the total subsidy benefits.
<b>Wealth Index Approach</b>	Among rural households, the richest two quintiles receive 61%, and the poorest two quintiles receive 25% of the total subsidy.	Among urban households, the richest two quintiles receive 60%, and the poorest two quintiles receive 25% of the total subsidy.

The study analyzed three alternate targeting approaches that would increase the share of subsidy benefits received by poor households, summarized in Table 6.

**Table 6.** Summary of approaches to improve electricity subsidy targeting in Jharkhand

Scenario		% of benefits received by		Subsidy savings (INR)	Notes
		Bottom 40%	Top 40%		
Business as usual 2019	Rural	25%	61%	--	Residential subsidy expenditure in Jharkhand for 2019 was INR 984 crore (USD 140 million)
	Urban	25%	60%	--	
<b>Revise subsidy slabs:</b> Highest subsidy for 50 kWh per month, progressively reducing subsidies for higher consumption levels, up to 300 kWh per month	Rural	35%	46%	306 crore (USD 44 million)	A share of savings could be used to increase the size of the subsidy for the 50 kWh and less households
	Urban	37%	48%		
<b>Poverty ration card targeting:</b> Targeting subsidies to households with a poverty ration card (like BPL, AAY or PH)	Rural	28%	56%	163 crore (USD 23 million)	Would need to be combined with efforts to ensure all marginalized households have poverty cards. A share of savings could be used to increase the size of the subsidy for the 50 kWh and less households
	Urban	31.4%	55.1%		
<b>A PMT approach,</b> based on the SECC, to predict whether households are richer or poorer	Rural	27%	55%	327 crore (USD 47 million)	A cautious approach needs to be taken when adopting this SECC-based PMT approach in Jharkhand, as we observed high exclusion error because many of the excluded households were in the poorer quintiles
	Urban	33%	58%		



## RECOMMENDATIONS

Since the COVID-19 crisis, many households in India have seen a dramatic fall in incomes and are anticipated to fall back into poverty. This, coupled with Jharkhand's existing high levels of poverty, strongly suggests that the choice of any new targeting mechanism must be undertaken with care to not increase the hardships for any poor households.

Based on the results of the different targeting approaches tested, this report recommends some short- and medium-term recommendations.

Short-term recommendations for JBVNL, the JSERC, and the state government:

- **Remove the subsidy for households consuming more than 300 kWh per month:** In the existing IBT structure, JBVNL is offering a subsidy even to urban households consuming over 800 kWh per month. In the short-term, we recommend that the cutoff for subsidies be set at 300 kWh per month. This cutoff will be easy to implement since most households in Jharkhand are consuming less than 100 kWh per month.
- **Lower the initial cutoff in the IBT currently set at 200 kWh per month for urban and rural households after understanding consumption patterns with seasonality:** JBVNL's existing IBT has an initial cutoff at 200 kWh for urban households and no metering slabs for rural households; however, average monthly consumption is only 90 kWh, and 89% of the state's households consume less than 200 kWh per month, suggesting that a lot of higher-consumption households benefit from the subsidy. We recommend that the DISCOM lower the initial cutoff from 200 kWh to 50 kWh per month for both rural and urban households, noting that this should be assessed in light of seasonal variations in consumption. This block of consumers can be offered the same subsidy it gives for household consumption up to 200 kWh units. This current subsidy should be maintained for the time being, given the impacts of COVID-19 on households. The number of households consuming within this cutoff could then be examined throughout the year to consider its adequacy as a minimum consumption bracket during seasonal consumption patterns. For more changes to slabs and corresponding subsidy changes, see the revised IBT structure in Table 5.

Medium-term recommendations for Jharkhand:

- **Revise the IBT slabs:** We recommend maintaining the initial cutoff at 50 kWh but introducing new slabs with smaller cutoffs and with decreasing subsidy levels for the higher slabs, particularly for the 200 kWh per month group. While this may run counter to the general trend in tariff rationalization, it seems to best reflect actual data on consumption and relative wealth levels, and it does not prevent JBVNL from rationalizing slabs elsewhere. Revising the IBT and reducing the per-unit subsidy for higher consumption slabs will also decrease subsidy benefits for some poor households with high consumption. This scenario can be mitigated by using a share of subsidy savings to increase the value of the subsidy for the poorest households. Based on the subsidy and consumption from 2019, we estimate that this targeting mechanism could save INR 306 crore (USD 44 million) of subsidy expenditure. Further exploration





of our survey data could be conducted to explore a larger number of options for IBT revisions, including an increase in the subsidy rate for the lowest-consuming groups.

- **Target households that own a BPL, PH, or AAY cards and exclude households with no card or APL cards.** The latter in our sample is 19% of households, of which 11% belongs to the no-card households, and 8% belongs to the APL households. We observed that many poor households currently do not own any poverty cards, so some provisions will have to be made to include such households. Applying this targeting mechanism will save the government INR 163 crore (USD 23 million) annually or 17% of the total subsidy in 2019. A share of subsidy savings could also be used to increase the rate of subsidy for the lowest-consuming groups or for APL households.
- **Closer coordination between JBVNL with the Jharkhand government's departments for civil supplies, rural development, and the Ministry of Minority Affairs:** Identifying poor households is complex and dynamic, and it requires up-to-date databases with different variables on assets and socioeconomic status. This report created a wealth index to better analyze subsidy targeting. Rather than wasting resources on collecting this information for creating a wealth index, JBVNL can closely coordinate with different government agencies that maintain registries on poor households accessing different welfare schemes—like the purchase of subsidized grains available with the civil supplies department or access to jobs via NREGA, available with the department for rural development. This will help JBVNL understand linkages between energy and poverty and finally create its own registry of poor households or use a government agency's registry that closely matches its criteria of identification.
- **Integrate planning on targeting and the DBT:** The central government is proposing to implement a DBT in the electricity sector, where households will pay the market price for electricity, and the subsidy will be directly credited to their bank accounts (PIB, 2020b). More recent announcements by the government ask for the subsidy to be credited to the account of consumers maintained by DISCOMs (Economic Times, 2020). Implementation of the DBT in the electricity sector can help to enable targeting and improve the subsidy disbursement mechanism. Implementation will require coordinated action between several stakeholders, like JBVNL, JSERC, banks, the state department of energy, and consumers (KPMG & Department for International Development, U.K., in press). To minimize the impact on poor households, any implementation must be undertaken in phases with pilot projects before implementation to allow DISCOMs time to collect consumer details like Aadhaar and also prepare for any ground-level challenges (KPMG & Department for International Development, U.K., in press).

Recommendations for other states and the central government to better target electricity subsidies to poor households:

- **Map the knowledge gap:** Many of the targeting approaches analyzed and recommended in this study are designed for high poverty levels in Jharkhand. These may not be directly applicable in other states with different levels of poverty and different patterns of electricity consumption. But the approach that has been



followed in this study could easily be adapted to other state contexts in order to identify appropriate state-specific solutions. State governments require a dedicated research effort to understand how effectively electricity subsidies are targeted to the poor. Further, governments should routinely repeat this exercise to reduce the time gap between the availability of data and subsidy policy design. Part of the problem is the lack of recent quality data on household electricity consumption and household welfare. For DISCOMs, a cost-effective method could be to conduct telephone surveys several times per year using a simplified version of the questionnaire employed by this study. This can also be solved if the Ministry of Statistics and Programme Implementation includes a detailed energy consumption survey through both the census and the National Sample Survey Office and makes this data routinely available. Lastly, collecting data to analyze targeting could be made a criterion for scoring DISCOM performance by the Ministry of Power and state-level regulators.

- **Test targeting interventions:** State governments and DISCOMs should invest in testing the different interventions analyzed in this study to understand which can best target subsidies without compromising energy access and affordability.
- **Future research:** This research focused on subsidy incidence, and the chosen sample size carefully matched this basic question. However, additional questions on electricity consumption and affordability were constrained by the sample size. Future research focusing on these questions should consider the need for larger surveys to adequately capture rural-urban disaggregation while ensuring results are statistically significant. The questionnaire and dataset from this report will be published in the future so researchers can benefit from this knowledge and adapt it further.



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## Annex A: Estimating Electricity Consumption

This study took two approaches to estimating household electricity consumption. The first and most direct was asking households for their most recent electricity bill or electricity consumer number. When a household could not share their bill or felt uncomfortable doing so, we took a second proxy measure approach where we estimated monthly household consumption by asking households their usage of appliances. Our survey attempted both approaches, but we found that only 40% of the sample was able or willing to share their electricity bill. This study therefore uses the second approach, appliance-based estimation, to arrive at the monthly household consumption of electricity for households that did not share their bill.

The appliance-based estimation asked households about ownership and the per-day hourly usage against a list of 21 appliances. This data was then used to estimate monthly kWh for each appliance using the formula:

$$\frac{(\text{Wattage} \times \text{number of appliances} \times \text{average daily hours of use} \times 30 \text{ days})}{1,000}$$

This data was then summed for all appliances for each household to arrive at the monthly household electricity consumption. The list of appliances and their wattage are listed in Table A1. The only limitation in this approach was found to be with inverters: devices that are used to store grid electricity in a battery so it can be used to power appliances later. Households with inverters report far higher electricity usage, resulting in an inflated electricity consumption value. We overcame this limitation by replacing reported usage hours for the inverter with blackout hours, based on a simple assumption that the household would only need to use an inverter during a blackout. This treatment was only done for inverters.

**Table A1.** List of appliances presented to households in the questionnaire

S. No.	Appliance	Wattage (numbers in watts unless otherwise indicated)	Source for wattage	Average number of surveyed households that have one or more of these
1	Incandescent bulbs	97	Agrawal et al., 2019	47%
2	Compact florescent light (CFL)	16	Agrawal et al., 2019	2%
3	Light-emitting diode (LED)	8	Agrawal et al., 2019	69%
4	Tube light	27	Agrawal et al., 2019	1%





<b>S. No.</b>	<b>Appliance</b>	<b>Wattage (numbers in watts unless otherwise indicated)</b>	<b>Source for wattage</b>	<b>Average number of surveyed households that have one or more of these</b>
5	Ceiling fan	69	Agrawal et al., 2019	48%
6	Table fan	61	Agrawal et al., 2019	31%
7	TV	50	Agrawal et al., 2019	36%
8	Cooler – 9 litres/12 litres/20 litres/31 litres	132/170/180/185	Symphony Ltd, 2017	2%
9	Electric stove	1,192	Agrawal et al., 2019	0%
10	Laptop/computer	50	Agrawal et al., 2019	1%
11	Refrigerator average 190 Litres	28	LG refrigerator (LG, n.d.)	7%
12	Iron	858	Agrawal et al., 2019	6%
13	Mixer/grinder (30 minutes every day)	376	Agrawal et al., 2019	8%
14	Music system (10 minutes every day)	15	Agrawal et al., 2019	1%
15	Air conditioner	1,000	Agrawal et al., 2019	0%
16	Washing machine – 8 litres	160/260	160/260 Havells, 2020	1%
17	Electric fodder	1HP / 2 HP	Household responses in survey	0%
18	Submersible pump	0.5HP/ 1HP	Household responses in survey	2%
19	Sewing machine	75	Matanuska Electric Association, n.d.	0%



S. No.	Appliance	Wattage (numbers in watts unless otherwise indicated)	Source for wattage	Average number of surveyed households that have one or more of these
20	Water kettle	1,200	Consumer Voice 2011; Bajaj Cordless brand	0%
21	Inverter	1,000	Household responses in survey	4%

### Box A1. Energy efficiency

Jharkhand's state Department of Energy has been promoting energy efficiency in the state through several schemes that encourage households to switch to energy-efficient appliances. Households are particularly encouraged to switch away from incandescent and CFL bulbs. To ensure affordability, schemes like the Domestic Efficient Lighting Scheme (DELP) provide energy-efficient LED bulbs to households at subsidized prices. Similar schemes also operate for street lighting and agricultural consumers (Deloitte, 2019).



## Annex B. Wealth Index

The wealth index is influenced by and lists many of the variables in the Socio Economic Caste Census (SECC). The final list of variables used in the construction of the wealth index is listed in Table B1. The wealth index uses factor analysis to combine these variables. The output of factor analysis is a variable that has a mean of zero and a standard deviation of one. A larger score means that the household is wealthier compared to the other households in the dataset. Households were then divided into five categories based on their wealth index. These quintiles are all of equal size (i.e., they contain the same number of households).

Separate wealth indexes were established for urban and rural households, reflecting the typically large divide in well-being between urban and rural areas. For this reason, the wealth index of a rural household cannot easily be compared to the score of an urban household.

**Table B1.** List of variables used in the construction of the wealth index

No.	Type of Variable	Variable
1	Exclusion	Households with any member earning more than INR 10,000 per month
2	Exclusion	Households owning 2.5 acres or more of irrigated land with at least one piece of irrigation equipment
3	Exclusion	Household owning 5 acres or more of irrigated land for two or more crop seasons
4	Exclusion	Households owning 7.5 acres or more of land with at least one piece of irrigation equipment
5	Exclusion	Households having Kisan credit card with the credit limit of INR 50,000 and above
6	Exclusion	Households with three or more rooms with pucca walls and pucca roof
7	Inclusion	Destitute or living on alms
8	Inclusion	Manual scavengers
9	Inclusion	Primitive tribal groups
10	Inclusion	Only one room with kucha walls and kucha roof
11	Inclusion	No adult member between ages 18 to 59
12	Inclusion	Female-headed households with no adult male member between age 16 and 59
13	Inclusion	Scheduled caste or scheduled tribe households
14	Inclusion	No literate adult above 25 years

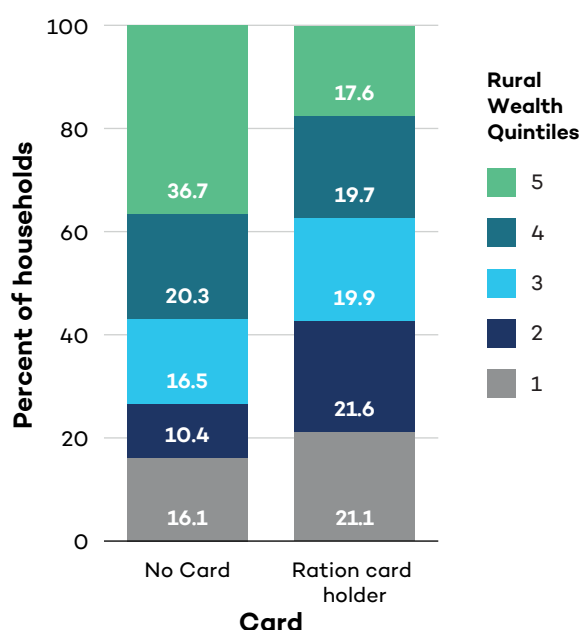


No.	Type of Variable	Variable
15	Inclusion	Landless households deriving a major part of their income from manual casual labour
16	Inclusion	If household member(s) were employed under NREGA in the last one year
17	Inclusion	If the household purchased subsidized food grains in the last 30 days



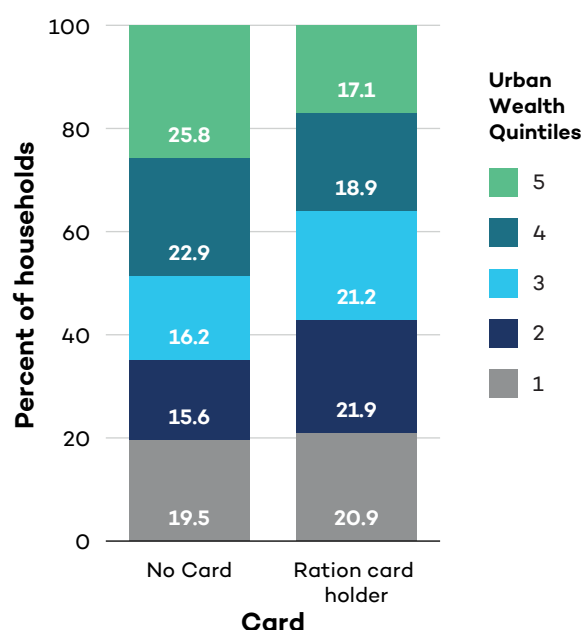
## Annex C. Supporting Figures and Tables

**Figure C1.** No-card households among different rural wealth quintiles



Source: Survey data and authors' analysis

**Figure C2.** No-card households among different urban wealth quintiles



Source: Survey data and authors' analysis

### Testing Different Targeting Approaches Using the Expenditure Approach

Using the expenditure approach was not the first choice for analyzing different targeting options because of the unreliability of expenditure data. This section shows the results we found for our three different targeting options using expenditure data. The results below show the same general trend as those using the wealth index, revealing the robustness of the wealth index. Similar to the wealth index approach, the application of different targeting options decreases the subsidy received by the richest quintiles and provides small increases for the poorest quintiles. In each option, we use the expenditure data (monthly household expenditure) to see changes in subsidy incidence.

**Table C1.** Share (%) of total electricity subsidies received by different expenditure quintiles

Expenditure Quintiles	1	2	3	4	5
Business as usual	18.4	12.4	17.7	28.4	23.1
Targeting Option 1 (Ration card)	20.4	13.8	19.1	26.2	20.4
Targeting Option 2 (revising volumetric limits)	17.6	15	19.1	26.3	22
Targeting Option 3 (PMT approach)	27.1	15	18.6	23.6	15.7

Source: Survey data



## Annex D. PMT Targeting Model With High Exclusion

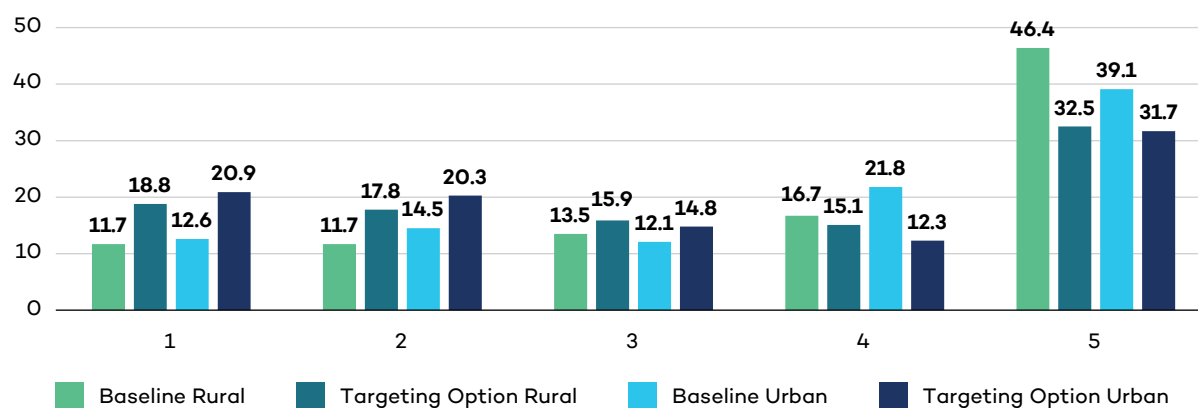
This annex shares details of a PMT model that excluded a high number of households. Under the PMT model (that uses Socio Economic Caste Census variables), 25.5% of the households were excluded, 51.7% were included, and 22.7% of households had been neither excluded nor included. This model excluded the remaining 22.7% of households. Given high levels of poverty in Jharkhand, we rejected including the following model in the main study because it showed that many poor households would get excluded.

**Impacts on subsidy incidence:** There is a significant improvement in the distribution of subsidy benefits. As summarized in Figure D1, the share of subsidies received by the two poorest urban quintiles increases sharply from 27% to 41% with the existing subsidy design. The percentage of the two richest urban quintiles drops to 44%, from 61% with the existing design. In rural areas, results are similar.

**Implications of this targeting option:** While subsidy distribution improves, the average subsidy benefit received by the poorest households declines significantly. For the lowest two quintiles in rural and urban settings, it drops to around INR 80 (USD 1.13) and INR 90 (USD 1.27), respectively, compared to a current average subsidy of about INR 114 (USD 1.61) and 127 (USD 1.8) per month. This means that a significant number of poor households would be excluded from the subsidy if this targeting method were used.

**Impacts on subsidy costs:** With this more stringent version of the PMT, the government would reduce subsidy costs more than any other scenario, because the largest number of households would be excluded. In total, subsidy costs would decline by 56%, and the government would save INR 553 crores (USD 79 million) annually.

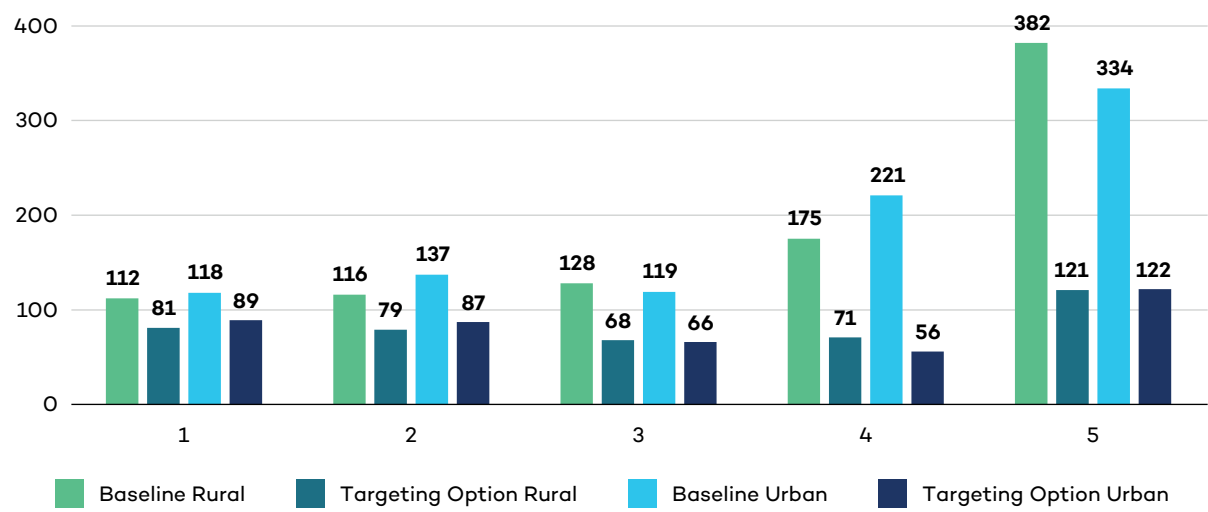
**Figure D1.** Changes in subsidy incidence using this targeting option (% of electricity subsidies)



Source: Survey data and authors' analysis



**Figure D2.** Changes in mean subsidy for different quintiles (INR) using this targeting option



Source: Survey data and authors' analysis



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