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ENERGY IN RURAL JHARKHAND

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Jharkhand is rich in energy resources – the state accounts for the largest share of India’s coal reserves and has a substantial solar potential of around 18 GW. The Government of Jharkhand has also been making concerted efforts to improve household electrification rates and encourage the use of clean cooking fuels. However, access to affordable and reliable energy still remains a challenge. Furthermore, considering the Government of India’s ambitious renewable energy targets, transitioning towards a cleaner energy generation mix presents a number of socioeconomic implications for the coal-rich state.

To better understand these issues, ISEP conducted a state-wide survey of rural households in Jharkhand with the objectives of understanding energy access throughout the state, barriers to expanding that access, and rural workers’ dependence on employment in the coal industry. The results of the survey show that 87% of these households have access to electricity. Nevertheless, only 51% of electrified households are metered and only 54% receive monthly bills. The survey also identifies bottlenecks, namely the unreliability and poor quality of the electricity supply, that limit productive use. Regarding cooking fuel, the data suggests that 53% of rural households have access to LPG with a significant share still relying on sources such as firewood and dung cakes as their primary cooking fuel. This is due to limited awareness about government subsidy schemes, the high cost of refills, and the difficulty of obtaining refills. In addition, our analysis of people’s dependence on the coal sector for livelihoods finds that it employs only 1% of the rural population. More generally, coal jobs are considered unattractive options for most of the rural population, especially among non-tribal members. However, the workforce employed in these jobs have few alternatives that pay comparable wages.

Synthesizing these results, the report suggests several policy implications for government officials at the local, state, and national levels to improve the state’s energy future. Our report highlights the following issues:

- *While efforts to increase electrification have largely been successful, a number of households remain off the grid.*
- *Even households that are connected to the grid are often unsatisfied with the quality of electricity they receive; we show how poor supply is one of the main drivers of dissatisfaction.*
- *Inefficient metering, billing, and payment systems remain a widespread problem that contributes to the Discom’s financial woes.*
- *LPG access has improved, but usage continues to lag due to both low awareness and high variable costs.*
- *Coal communities find it difficult to reduce their dependence on the coal sector for livelihoods due to a lack of viable alternative employment opportunities.*

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DATA ACCESS

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EXECUTIVE SUMMARY AND POLICY RECOMMENDATIONS

This report is the result of a dedicated state-level study of household access to electricity and clean cooking fuel, satisfaction with energy services, and employment in and perceptions of the coal industry in Jharkhand, India. Jharkhand is among the most natural resource-rich states in India but is simultaneously one of the poorest with some of the lowest rates of access to electricity and clean cooking fuel. These low levels of energy access inhibit households' ability to engage in activities like reading and schoolwork particularly during the evening hours (Furukawa 2014; Grimm et al. 2017), while a lack of access to clean cooking fuel forces households to cook with fuels that contribute to indoor air pollution that is hazardous for health. The Government of India has attempted to raise electrification rates and the number of connections to liquified petroleum gas (LPG) through the Saubhagya and the Pradhan Mantri Ujjwala Yojana (PMUY) schemes, respectively. Both schemes aimed to provide low-income households with connections to either electricity or LPG for free or at reduced rates. Nevertheless, gaps remain, and many households have little to no access to electricity and LPG.

Thus, this study had three objectives. First, to obtain information on households' access to electricity, their satisfaction with this electricity, and the types of fuels they used for lighting, as lighting is among the most universal uses of electricity among rural households. Second, to understand households' access to, usage of, and satisfaction with various cooking fuels, particularly LPG. Third, to understand the levels of employment in the coal industry, households' perceptions of coal jobs, and coal workers' views regarding alternative employment options. For these purposes, survey data was collected through household interviews and analyzed to produce a detailed review of the state's energy profile.

Sampling, survey, and data

ISEP surveyed a total of 1440 rural households in all 24 districts of Jharkhand between July-August 2019. In each district, we randomly sampled six villages, with larger villages having a higher probability of being selected. Within each village, ten households were selected on a random basis. The sample is representative of rural areas in Jharkhand, and hence the findings can be extended to all rural areas in the state.

The questionnaire included questions related to the respondent's socio-economic status, their access to energy including electricity and cooking fuel, issues they faced with electricity supply and the overall household satisfaction level with quality of electricity services they received. The coal employment section of the questionnaire aimed to capture information regarding people's perspectives about coal jobs, their dependence on jobs in the coal industry, and their perceptions of alternatives available to them. All questions were posed to all respondents except in cases where doing so would have been logically impossible based on respondents' previous answers – for example, we did not ask respondents who did not have grid electricity how satisfied they were with their grid connection.

Overview of findings

Our survey found that 87% of households have access to electricity (from grid, micro-grid or solar home systems). However, 24% preferred to use kerosene as their primary lighting fuel. Further, about 34% of the respondents were dissatisfied with grid electricity. One of the main reasons for these responses was unreliable and poor-quality electricity supply – the average household only had access to about 10 hours of service per day, thus forcing them to rely on alternative energy sources (this number can vary by seasonal factors). The study also points out inefficiencies in the metering and billing of consumers. As per our survey only 51% of households are metered and only 54% receive bills for the electricity they consume. These gaps in metering and billing contribute to the poor financial situation of Jharkhand Bijli Vitran Nigam Limited (JBVNL), the state's primary electricity distribution company (Discom) for households, which further inhibits their ability to invest in measures that would improve the quality of service they provide.

Survey questions on clean cooking fuel suggests that while 53% of the rural households have access to LPG, far fewer use LPG as the primary fuel for cooking. Instead, a significant share of the population used biomass such as firewood. The use of multiple fuels simultaneously with LPG – such as cow-dung, coal, agro-residue, and firewood – was also prominent in the state. Our survey reveals that there are two primary reasons why households either did not have access to or did not use clean cooking fuel for all their needs. The first is lack of awareness about government schemes for subsidized connections and the second is the high cost of LPG refills.

Besides describing the current state of affairs, our study sheds light on the impact of key public programs. Schemes such as Saughabya (which seeks to provide power to households that are off the grid) or Pradhan Mantri Ujjwala Yojana (PMUY, which tries to improve access to LPG to poor families) have been at the core of the government's attempts to reduce energy poverty. Our report shows that these programs played an important role in increasing access in Jharkhand. However, the sustained use of clean energy remains a challenge for most rural households.

Analysis of coal dependence and livelihoods in the state confirms that the industry is not a major employer in Jharkhand as it employs just 1% of the rural population. Moreover, the survey results show that most respondents consider working in the coal industry as highly unattractive despite the perception that it pays high wages. Finally, coal workers' perceptions towards alternative jobs reveal that they thought it would be difficult to find another job with similar wages due to factors including their skill sets, low education rates, and limited possession of cultivable land.

Policy recommendations

- Additional efforts aimed at offering poorer households assistance in obtaining and paying for a connection, as well as ensuring that households are aware of these efforts, must be made to reach out to an estimated 13% of rural households that remain off the grid.

- Investing in infrastructure can help improve the reliability of supply and reduce voltage fluctuation, thereby increasing public satisfaction with electricity services.
- Installing meters and improving billing and payment systems should be prioritized to help improve the Discom's revenue collection and, thereby, its financial situation, while keeping in mind the impact higher costs could have on poor consumers.
- Building awareness about the LPG subsidy and other support programs is important to increase the adoption and sustained use of LPG.
- Respondents believe that coal workers earn more than they do, but coal workers see few alternative employment opportunities. The diversification of Jharkhand's rural economy is an important response to a potential decline in coal demand.

1. INTRODUCTION

Jharkhand is located in the eastern part of India and is rich in natural resources (Government of India 2016, 5). The 2019 Global Multidimensional poverty index by UNDP features it as one of the states which has improved the fastest in terms of poverty alleviation (UNDP 2019, 13). This is reflective of the advancements in health, educational facilities and standards of living in the state. Access to clean, reliable, and affordable energy for cooking and electrification is an important indicator of people's living standards and a crucial aspect of sustainable development. In recent years, Jharkhand has made considerable progress in terms of increasing energy access (CEEW, 2018), and the state has an estimated 18 GW in solar energy potential (Ministry of New and Renewable Energy 2015, ch. 1). However, sustained access to clean cooking fuel and electricity is still a challenge.

The strides in energy access can be attributed to the Government of India's Saubhagya scheme which connected about 1.5 million households in Jharkhand to the national grid (Government of India, 2019b). However, characterized by frequent power cuts, voltage fluctuations, and limited hours of electricity availability, the poor quality of electricity supply remains a persistent issue in the state's power sector (CEEW, 2018). This issue is further exacerbated by the massive financial losses of the distribution companies (Discoms) due to inefficient metering and billing. The dual challenge of ensuring affordable and reliable supply and resolving infrastructural inefficiencies in terms of billing and metering continue to adversely affect Jharkhand.

Similarly, bottlenecks such as affordability and procurement challenges limit the use of clean cooking fuel such as LPG among the rural poor in the state, while the low quality of electricity supply limits the average household to just 10 hours of electricity per day. The recent national-level schemes such as Saubhagya for household electrification and Pradhan Mantri Ujjwala Yojana (PMUY) for LPG in the state have helped increase the number of beneficiary households. However, more work remains to be done to achieve the goal of universal and reliable energy access.

Jharkhand produces about 18% of India's coal, and hosts the largest coal reserves in the country (Indian Minerals Yearbook 2018, 5-8). While few people actually work in the coal industry, this employment is concentrated in a few small areas of the state, making these communities highly dependent on coal jobs. As a result, the country-wide transition towards renewable sources of energy like solar and wind may negatively impact these coal-dependent communities. Thus, understanding coal communities' dependence on the coal industry, their perceptions of viable employment alternatives, and their views on how attractive coal jobs are more broadly can help inform policies to ensure that the transition to renewables is a just transition that does not negatively impact vulnerable coal-dependent communities.

This report is an attempt to highlight the energy access and energy transition challenges in the state. Using a rich and detailed state level survey and an analysis of ground level data, we have tried to highlight the issues that continue to limit access and pose challenges to a smooth energy transition.

Objectives

While Jharkhand has made good progress on a number of developmental indicators, certain issues continue to plague the state. To understand the state of energy access in Jharkhand, we conducted a large-scale and comprehensive household level survey. This report presents the insights and policy recommendations derived from the survey. Additionally, through the study we examine the extent of employment in the coal industry as well as coal workers' perceptions of the availability of alternative sources of employment. Therefore, the primary objectives of the study are:

1. To understand the ground realities of household level access to clean electricity and cooking fuel in the rural households of Jharkhand.
2. To analyze dependence on the coal industry and people's perception about coal jobs in the state.

Organization of the report

The report has been organized into 4 chapters:

Chapter 2 introduces the socio-economic profile of rural Jharkhand. Demographic details about population size, religion, caste divide, tribal population, language, literacy, land ownership, and ration card possession are covered in this section.

Chapter 3 presents the state of electricity access in the state. Details about primary lighting sources, levels of access among tribal populations, satisfaction and limitations to grid electricity access have been covered. This section also focuses on the Saubhagya scheme and metering and billing efficiency among households.

Chapter 4 is about the state of access to clean cooking fuel in the state. This section describes access to LPG among rural households, limitation to access, and satisfaction with use of LPG. It also talks about the impact of the PMUY scheme in increasing LPG penetration.

Chapter 5 analyses coal mining and livelihoods in Jharkhand. This section discusses employment in the coal industry, its costs and benefits and alternatives to coal jobs for workers.

Summary of results

Electricity access and use

Our survey found that about 87% of households have access to some level of electricity. However, not all households use it with 24% of respondents continuing to use kerosene as their primary lighting source. On further analysis, we found that there is widespread dissatisfaction related to electricity use. About 34% of households said they were not satisfied with the condition of electricity in their house, and 64% of

dissatisfied households pointed to unreliable supply and voltage fluctuations leading to poor quality supply as the reasons for their dissatisfaction. On the other hand, affordability limited the adoption of grid electricity among non-grid households.

Other factors affecting electricity supply in rural areas are poor metering and billing. Our survey reveals that only 51% of households were metered and 54% received bills for the electricity they consume. Our survey also shows that while electricity has reached a significant proportion of the state's population, its popularity as a primary source and its sustained use largely depend on factors like reliability, affordability and quality supply.

Clean cooking fuel

The use of LPG as a clean cooking fuel is crucial to overcome health hazards and eradicate poverty and gender differences as identified by the world community. However, in reality our survey tells us that Jharkhand's rural population is still largely dependent of biomass as their main cooking fuel. Only 53% of rural households have access to LPG. Though PMUY has been successful in increasing LPG penetration in the state, it cannot ensure that people use it as a primary fuel, with only 31% of the households reporting LPG as their main fuel.

Some of the factors that limited LPG's use as a primary fuel included high monthly expenses, attractive alternatives (namely, easily available and free biomass), procurement issues and unawareness about the subsidized connection scheme.

Coal mining and livelihoods

The coal industry in Jharkhand is limited to certain districts and is an important source of revenue for the state (Brookings India 2019, 9). However, we confirm that the importance of the coal sector does not stem primarily from the number of people who work in it. The coal sector employs a very small proportion of rural population: about 1% of respondents in our sample. To be clear: its importance cannot solely be measured by the size of its workforce. But as an employer, its role in rural areas is somewhat limited. Further analysis of people's perception reveals that the only aspect of work that the coal workers find appealing is the high wages. 69% of coal workers in our survey said they were satisfied with their salaries, while 93% of non-coal workers who expressed an opinion thought that jobs in the coal industry would pay more than their current job. Otherwise, the physically demanding and dangerous nature of the working conditions, make such jobs a very unattractive employment option in both coal and non-coal districts of the state.

Our survey also analyzed the job alternatives available to these coal workers locally. It was found that finding another job with similar wages was considered difficult by the workforce in the coal sector. Some of the reasons cited were a limited skill set, low education rate among coal workers and limited possession of

cultivable land. These suggest the need to keep dependent communities at the center of important policy decisions to enable a smooth transition.

Policy implications

Energy access and ensuring a just and equitable transition challenges in rural Jharkhand need targeted policies. Improving services to ensure reliable and quality supply of electricity can increase levels of satisfaction among consumers and encourage them to use it as their primary source of lighting. Merely connecting households, with inefficient metering and billing infrastructure has huge financial implications on the financial health of Discoms. Thus, the combined efforts of investing to meter all connected households and then effectively billing these metered households can improve the power scenario in the state. Similarly, findings on cooking fuel and the use of LPG suggests a targeted approach to build awareness in rural areas. Further, to bridge the energy access gap, the government needs to adopt a two-way approach of not just subsidizing connections at the service provider's end but also strengthening the financial status of the rural households as well.

Our study also suggests that policies must aim to make the transition easier, especially for coal workers who need to consider the availability of relevant job alternatives that pay comparable wages and are locally available. Unless offered good opportunities, coal regions will remain overly dependent on this sector.

2. A SOCIO-ECONOMIC PROFILE OF RURAL JHARKHAND

We begin by providing an overall picture of rural Jharkhand in order to provide context for the rest of the report's energy-specific findings. Drawing on a range of socioeconomic data, this section offers a backdrop for our study. We discuss some of the state's most salient facets, including the state's economic condition and how its main groups fare since it gained independence.

Jharkhand is the 28th state of India and the 14th largest state in the country with a population size of 32 million. The state is primarily rural with about 76% of its population living in villages (Government of India 2016, 6). In addition, about 26% of Jharkhand's population is tribal, and the state is home to 32 officially recognized tribes including larger tribes like the Ho, Santhal, Oraon and Munda, as well as, smaller tribes like the Karmali, Asur, Gond, or Birhor. Santhal is the largest tribe in the state comprising over 33% of the state's tribal population (Tripathi and Sinha 2017).

Government data confirms that Hinduism is the most widely followed religion in the state as about 68% of the households were identified as Hindus. Islam (15%) and Christianity (4%) are also followed by a smaller number of people (Census 2011). These are in line with the data in our survey. Sarna, a tribal religion in India, is also followed by the tribal households in the state. While Hindi is the official language of the state other languages like Bengali and tribal dialects such as Nagpuri Santhali, Mundari, or Khortha are also spoken among tribes. Our analysis suggests that though Hindi is widely spoken, only 60% of the rural population could actually read and write in it.

According to data from the National Sample Survey (NSS) and India Human Development Survey (IHDS), in 2011 40.8% of Jharkhand's rural population lived below the poverty line (748 INR/month), and rural median per capita income was 9,716 INR (Reserve Bank of India 2019; Desai et al. 2012). As is often the case, poverty is much more prevalent in rural areas. More than 60% of the Scheduled Tribe and Schedule Caste population live below the poverty line (Singh et al. 2012, 2). Our survey suggests that about 44% of the rural households were Below Poverty Line (BPL) card holders, while an additional 9% possessed Antyodaya cards, which are provided to the poorest households. Further, as per 2011 census data, the average literacy rate in rural areas of Jharkhand was estimated at 61% (73% for men and 27% for women). Our survey confirms low levels of formal education, with only 5% of respondents being graduates. Moreover, despite the state's resource abundance and industrial production, about 49% of the rural population continue to practice agriculture as their main source of income. Another 34% earn their livelihoods through daily labor available locally or in the nearest town. The size of land holdings is also small among those involved in cultivation. Our survey shows that about 85% of the households owned land and every such household had small land holding (<1 hectare, ha).

Further, the rural households in Jharkhand typically comprise medium sized families with five to nine members (Census 2011, 4). According to our survey data, about 56% of households reported being medium-sized while the other 32% were small families with four or less members. About 59% of them lived in Kaccha houses (made of material such as wood or dry grass), while the rest either live in mixed or pucca houses (made of firmer material such as brick or cement). Our analysis also revealed that only 60% of the rural households had toilets and 5% had a tapped water supply.

Having provided a general picture of rural Jharkhand, we next turn to the analysis of electricity access. To this end, we rely on survey data collected from 144 villages selected randomly from all 24 districts (6 villages randomly per district, with larger villages more likely to be selected). Figure 1 maps both the selected villages (black dots), coal mines (blue dots), and Ranchi, Jharkhand's capital (red dot).

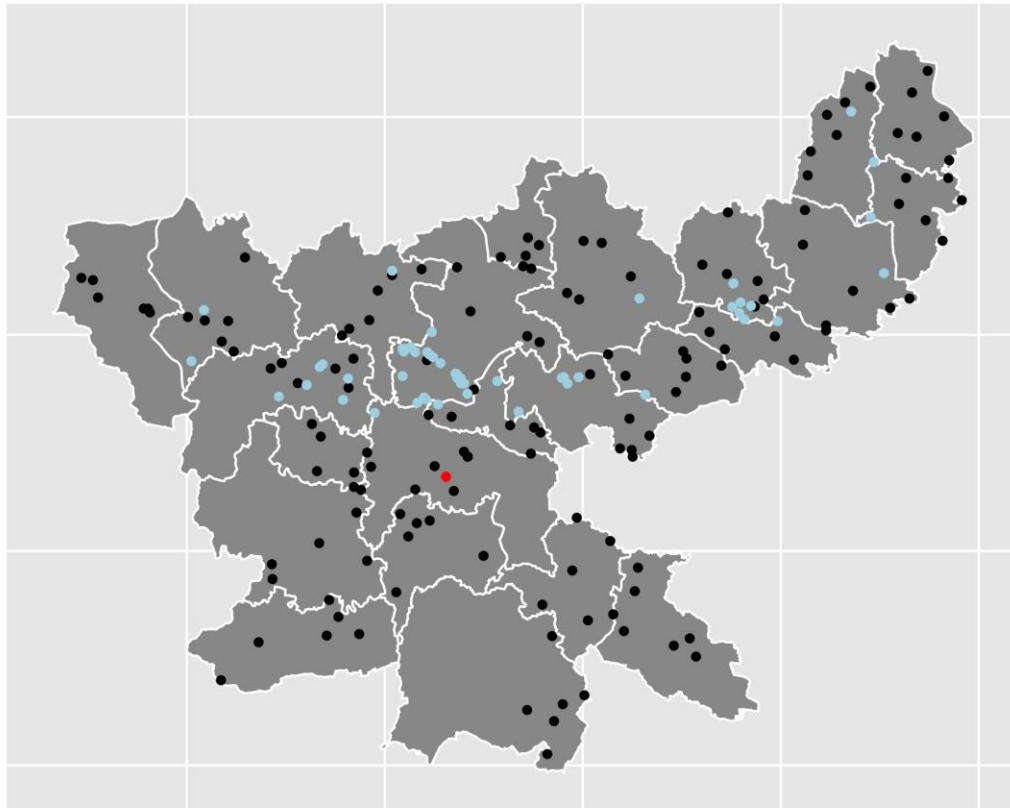


Figure 1: Map of Jharkhand. Black dots: villages that were randomly selected for the survey. Blue dots: coal mines across the state. Red dot: Ranchi.

3. ELECTRICITY ACCESS AND USE

Introduction

Access to clean and affordable electricity is important for economic development (Dinkelman 2011; Khandker et al. 2012). While Jharkhand has long struggled to increase electricity consumption rates, according to 2001 census data, only 10% of its rural population had electricity (Government of India 2011). This number jumped to 32% in 2011. Aside from access, consumption – the amount of electricity consumers actually used – also lagged that same year, however, as the government estimated that Jharkhand ranked 17th among all Indian states in terms of per-capita electricity consumption at 880.43 kWh per person.¹ Over the past few years the state has witnessed an increase in the number of households with access to grid electricity, with 83% of rural households connected as of 2018 (Jain 2018, 25).

Our survey of all 24 districts in the state suggests that about 87% of rural households have access to electricity whether from grid, micro-grid or solar home systems. But not every household with access used electricity as their primary source of lighting. Twenty four percent of households still relied on kerosene lamps as their main lighting source, for example. Furthermore, about 64% of respondents were not satisfied with grid electricity because of unreliability and poor-quality supply; the median rural household had access to about 10 hours of service per day. The analysis revealed that districts with the fewest hours of electricity supply also had the highest share of households that used kerosene as their primary fuel. In addition, most houses without access also reported high connection costs and unaffordable monthly electricity bills as the reasons why they did not have access. The survey results also shed light on the Discoms' capacity limitations since only 51% of rural households in the state were metered and 54% received a bill for their electricity consumption. In effect, only 9% of households are metered, receive a bill, and pay it in a timely manner.

This section of the report discusses findings from our state-level survey of electricity access among the rural households of Jharkhand. The subsections discuss the overall state of access, satisfaction with grid electricity, and metering and billing of electricity consumers.

Access to electricity

According to official statistics, Jharkhand is among the many states in India that have achieved 100% electrification (Government of India, 2019b), but our results indicate that there are still some households without access. Specifically, our survey found that about 87% of rural households were electrified. Out of these, 97% have access to the grid while the other 3% use sources like micro-grid or solar home systems as a source of electricity. A district-wise look at electrification status reveals that Deoghar, Giridih and

¹ Source: <https://pib.gov.in/newsite/PrintRelease.aspx?relid=74497> (accessed on November 1, 2019)

Hazaribagh are the most electrified with 98% electrification whereas Dumka is the least electrified with just 65% of its households having access (Figure 2).

Interestingly, households without access are not limited to BPL (below poverty line) families and a significant number of APL (above poverty line) families also do not have grid connection. For example, in Dumka, which, as per our survey is the least electrified district, 48% of APL families do not have connection in comparison to 39% of BPL families. Overall, 78% of APL households use grid electricity as their primary lighting source against 67% for BPL households. The average household without a grid connection was willing to pay about 170 rupees for a grid connection.

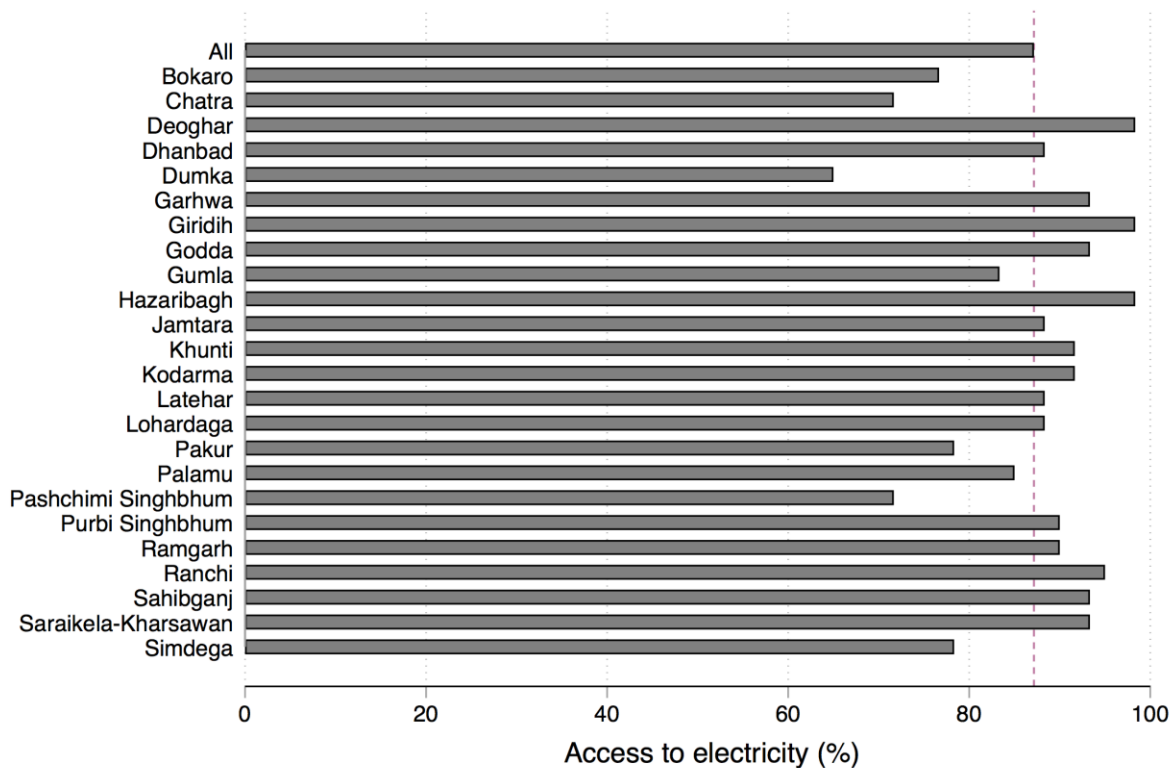


Figure 2: Access to electricity by district. Weighted responses.

Even among households that have access to electricity, a considerable proportion of them do not use it as their primary source of lighting. Out of all the households with electricity access, 84% used it as their primary source while 13% still relied on kerosene primarily. When examined across districts, grid electricity was most prominently used as the primary source of lighting in Giridih district (97%), as shown in Figure 3.

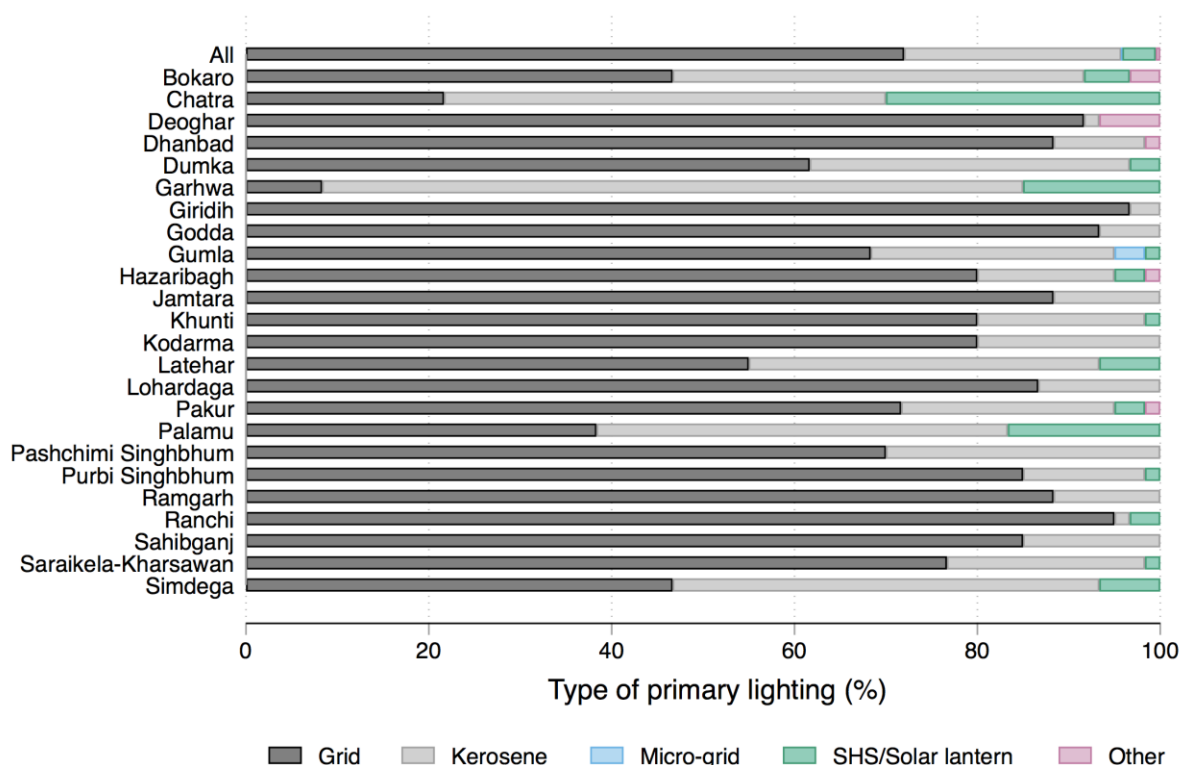


Figure 3: Primary source of lighting by district. Weighted responses.

Kerosene continues to remain a major lighting source for 24% of the state population. Interestingly, of all the houses that used kerosene as their primary source, 50% have access to electricity. Again, the evidence suggests that even electrified households may not be willing or able to use electricity for lighting. Our data reveals that about 77% of the surveyed population in Garhwa district used kerosene primarily, including about 73% of households that have a grid connection. Its use is also high in Palamu, Simdega, Bokaro, and Chatra where more than 45% of the households rely on kerosene. Meanwhile 4% of the respondents also used solar home systems or solar lanterns as a primary lighting source. Solar use is highest in Chatra district with 30% of the population reporting solar home systems or solar lanterns as their main source. Other sources used for lighting are candles and emergency lights (less than 1% of respondents).

It is important to note here that about 26% of the un-electrified households had previously been connected but eventually lost their connection due to reasons like non-payment of electricity bills or breaking down of supply or voluntarily terminating their connection. This suggests that just expanding electricity connections will not necessarily result in long-term gains in electrification unless paying monthly bills is affordable and the quality of supply is high enough to keep households interested in maintaining a grid connection.

In addition, about 82% of tribal households in the state have access to electricity (whether from the grid, micro-grid or solar home systems). Out of all the grid-connected tribal households in the state, 42% reported having been connected under the Saubhagya scheme. Again, however, not all electrified households use it as their primary source of lighting. 87% of tribal households reported using grid electricity as their primary source while 11% relied on kerosene. Further, of all the households that used kerosene lamps as their primary lighting source, 32% belonged to the schedule tribe community. In total, 38% of all the un-electrified households belonged to the schedule tribe category.

Consumer satisfaction

Consumer satisfaction with electricity depends on multiple factors including the availability, affordability, quality of supply and reliability of electricity (CEEW, 2015). Our survey of the state suggests that consumers are highly dissatisfied with the electricity they use, with only 36% reporting that they were satisfied with the electricity they consume (including grid, micro-grids and solar home systems). The proportion of dissatisfied households remained the same when limited to grid-connected households only.

The primary reasons for dissatisfaction among electricity users were found to be unreliable supply and poor quality of electricity. About 84% of the households said electricity was not available when needed while 71% reported voltage fluctuations and poor-quality supply issues (Figure 4). Fifty five percent of households reported dissatisfaction because of high monthly expenses of electricity bills and 47% reported poor repair and maintenance services.

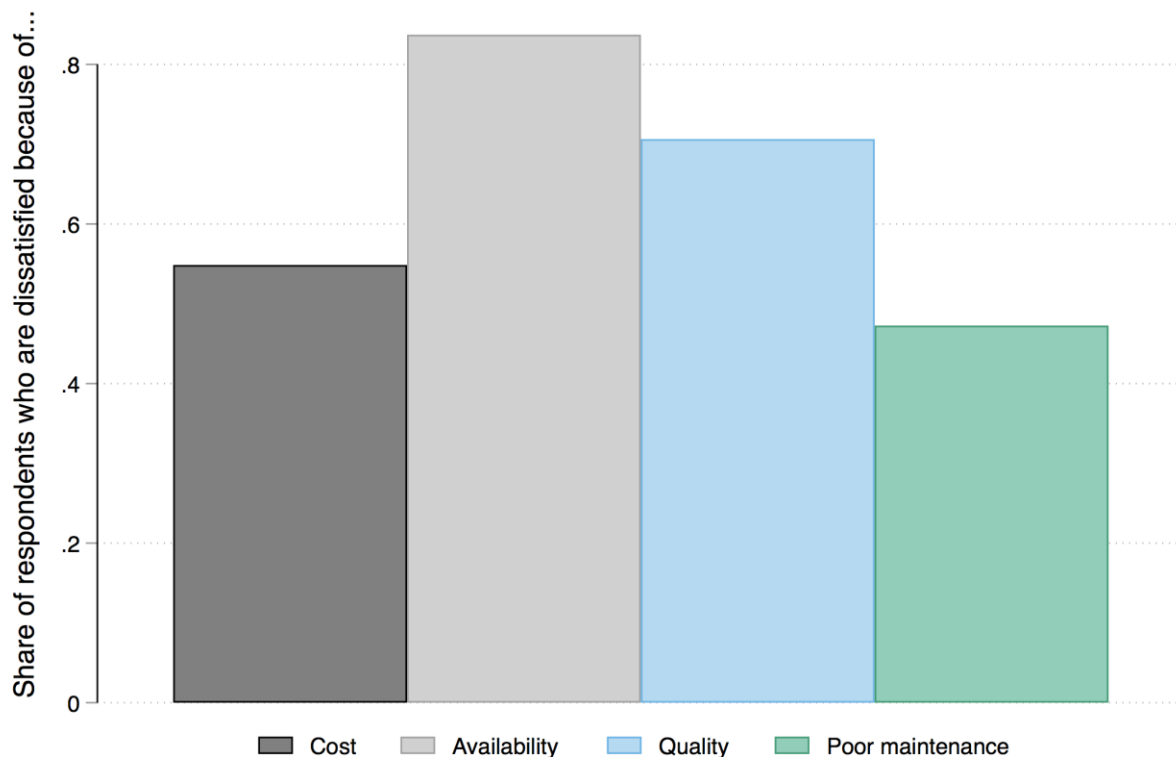


Figure 4: Share of respondents who are dissatisfied with electricity because of its cost, its availability, its quality or because of poor maintenance. Weighted responses.

Households using electricity for lighting received a median of nine hours of supply in a day. (All references to number of hours refer to the median household unless stated otherwise.) This was even lower for solar home systems that received four hours of supply a day. Households also reported receiving electricity for only three hours from evening to midnight. When examined across districts, the hours of electricity available per day shows massive variation as shown in Figure 5. Ranchi, the state capital, received 16 hours of electricity supply per day – the highest in the state. Four hours of supply was the lowest value, recorded in the Garhwa district. This might explain why 77% of rural households in Garhwa used kerosene as their primary source of lighting.

Overall, households receive extremely few hours of supply each day. Only a bare majority of 13 districts (out of 24) had more than ten hours of household electricity access. None of them came even close to offering 24 hours of supply, and only Ranchi and Ramgarh district offered more than 15 hours per day. Unsurprisingly, then, about 85% of the households in the state reported using kerosene lamps for lighting along with electricity.

High electricity bills were another reason for using kerosene in addition to electricity. As mentioned earlier, more than half of consumers found electricity expensive and our analysis show that about 98% of these consumers used kerosene lamps as their primary lighting source.

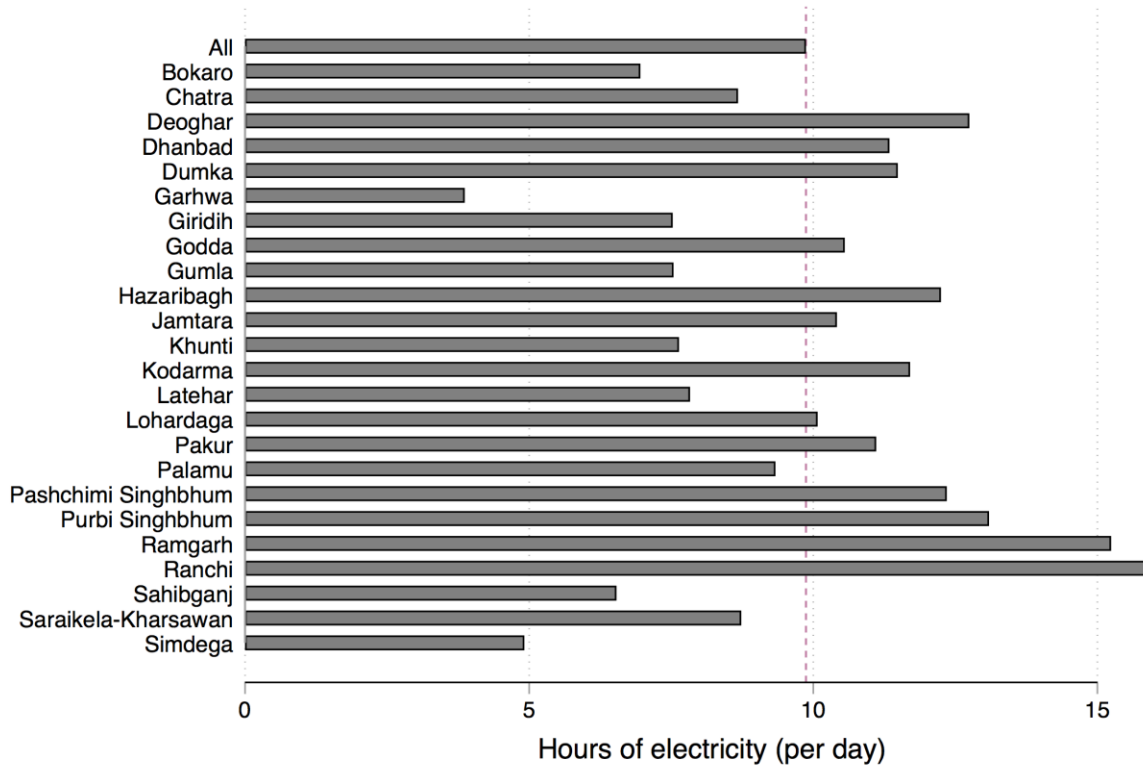


Figure 5: Hours of electricity supply for grid households (median value) by district. Weighted responses.

Of the households *without* access to grid connections, 66% of them reside in habitations that are electrified. The primary reasons they cited for not having access were high connection cost and the high monthly expenditure for maintaining a connection. About 50% of non-electrified houses said that connection costs were too high, while 44% said they could not afford the monthly expenditure for the electricity bill (Figure 6).

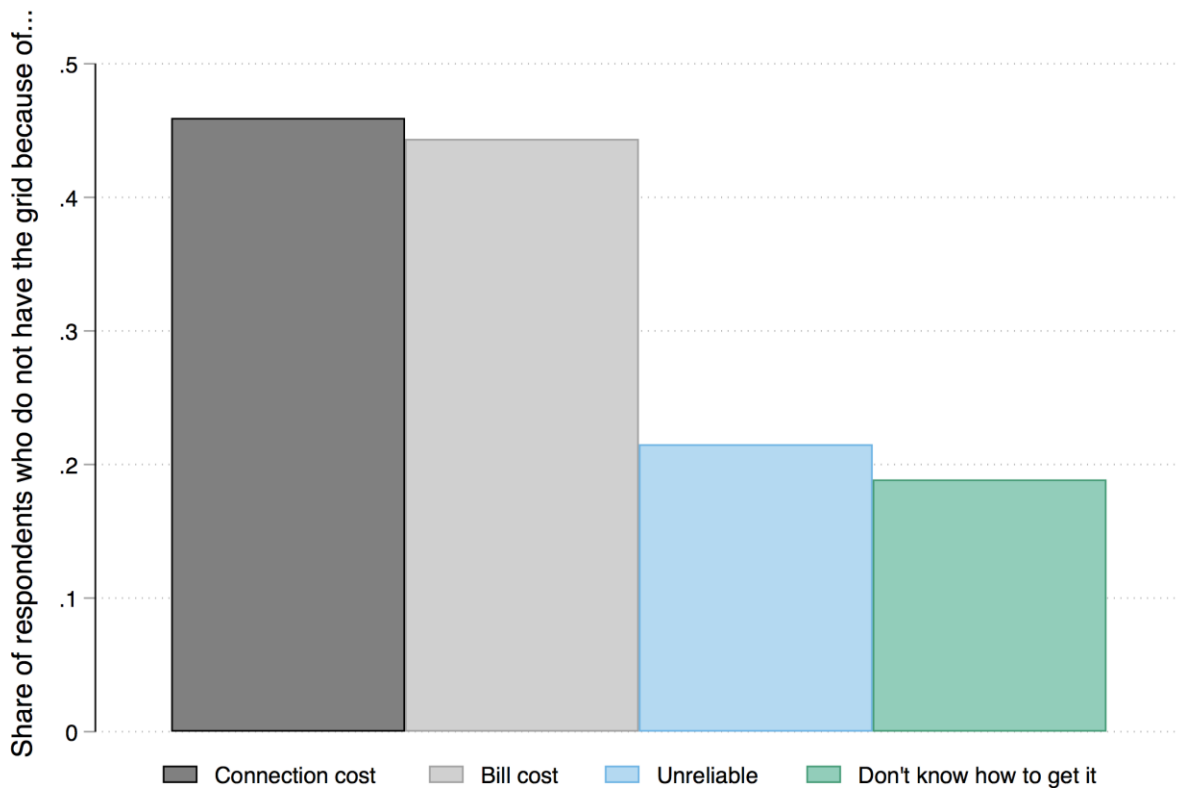


Figure 6: Household's reasons for not getting connected to grid electricity, despite it being available. Weighted responses.

Government Policies

Connections under Saubhagya: Our survey finding reports that out of all the electrified households in the state, 33% were connected under the ambitious Saubhagya scheme. Launched in 2017, the scheme aimed to provide grid electricity connections to all rural households by offering poor households connections at little to no cost. Households with an Above Poverty Line (APL) ration card could apply for a connection at the reduced cost of 500 rupees, and households with a Below Poverty Line (BPL) card could apply for a connection free of charge. APL and BPL households received a meter to measure consumption, while BPL households also received 40 meters of cable, one LED light bulb, and one electricity board. As part of the scheme's implementation, the Discoms set up connection camps in each state where households could go and register for a connection (Government of India, 2017). About 65% of the electrified households in Lohardaga were connected under Saubhagya which is the highest for any district in the state.

Proper metering and billing of consumers are crucial to maintain the financial health of Discoms. Our survey helped us understand the status of metering and billing in the state. Our survey found that only 51% of the electrified households in the state have metered connections. This was partly because metering work

is still going on in some districts, as revealed during household interviews. Metering varies across districts, as shown in Figure 7. Deoghar, Palamu and Pashchim Singhbhum were identified as states where less than 25% of the connections were metered. 64% of meters were pre-paid while the rest were post-paid.

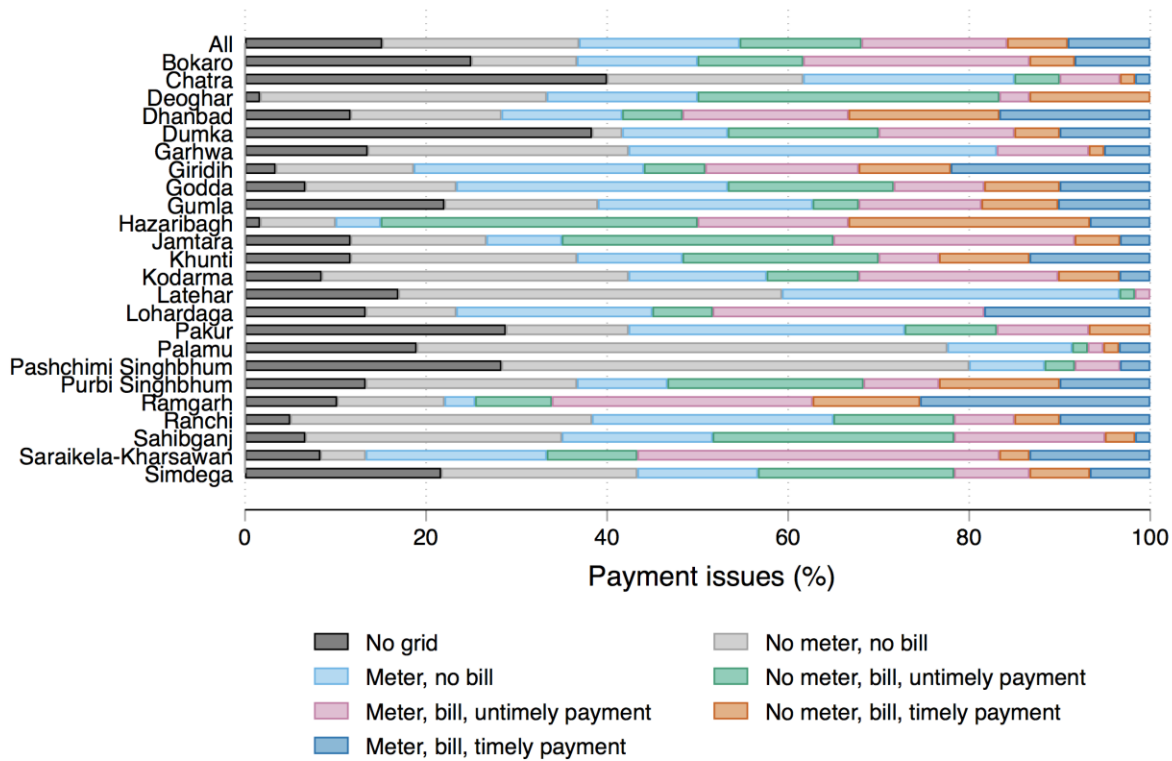


Figure 7: Household metering and timely payment of electricity bills, by district. Weighted responses.

Our data also allow us to study the billing and payment efficiency in the state. Only 54% of rural households in the state received electricity bills, while among metered households this number was slightly higher at about 59%. Overall, only 9% of households that have the grid were metered, received a bill, and paid it on time, suggesting that non-payment of bills, poor billing practices, and late payments exerts a substantial negative effect on Discom revenue. Of all the metered households in the state, it was found that 34% paid only fixed charges while 23% also paid variable charges for consumption. Further, about 41% of unmetered households claimed paying fixed charges while another 10% said their monthly bill tended to fluctuate from month to month.

Electricity connections under Saubhagya include the provision of pre-paid and post-paid energy meters (Government of India, 2017). Our survey reveals that 73% of households connected under Saubhagya have meters, of which 70% have pre-paid meters while the rest have post-paid meters. Nevertheless, despite the

prevalence of meeting among Saubhagya households, we found that 55% do not *receive* any electricity bill, while a slightly higher proportion (59%) of households do not *pay* any bill. 23% pay a fixed amount monthly and 18% pay variable charges.

Further, only 46% of the households reported getting bills every month while 22% said they received bills less often than every three months (Figure 8). But of all the households who received bills every month, only 16% paid it within ten days of due date. The data reveals that 52% of the households who always paid bills within ten days received electricity bills more than once a month. Further, 38% of the households who never paid bills on time were the ones who received bills less often than every 3 months.

Thus, what is most striking is the small number of households who pay their bills on time. In no district did more than 40% of households pay timely bills, and in 18 of 24 districts, fewer than 20% of households did. In Sahibganj district, for example, more than 90% of households had a grid connection but less than 10% of households paid their bills on time. This places an enormous strain on the financial health of the Discom, which in turn creates less incentive and less capacity to improve service.

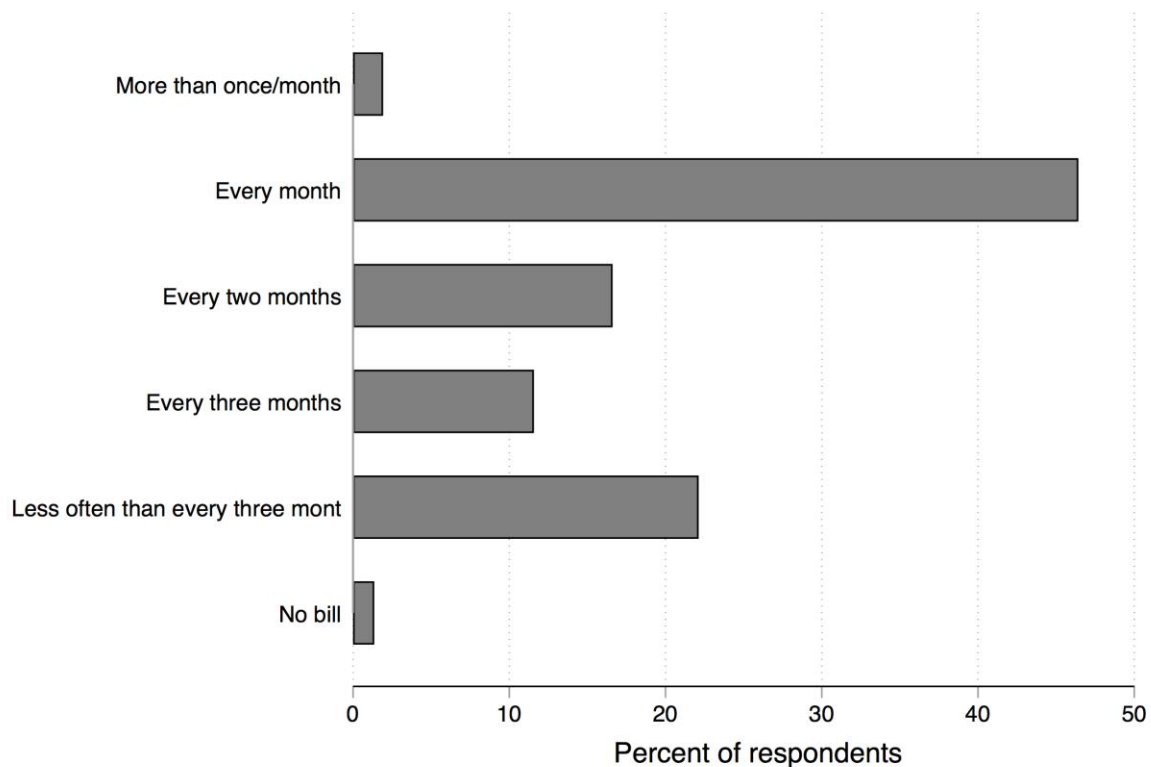


Figure 8: Billing frequency among households. Weighted responses.

Section Summary

Our survey of the state of electricity access in the Jharkhand shows about 87% of the households have access to electricity. However, not all the household with access used it as their primary source of lighting. About 24% of the residents still relied on kerosene. The complete eradication of kerosene as a lighting source experiences limitations mainly due to widespread dissatisfaction with grid electricity. About 64% of the households expressed dissatisfaction with electricity supply. The main reasons were unreliable supply and voltage fluctuations leading to poor quality of supply. Of all the households who still do not have access to grid electricity, the primary reason was unaffordability. Most of the households claimed high connection costs and unaffordable monthly electricity bills were the reasons why they have not yet been connected.

Further analysis of metering and billing efficiency of Discoms in the state revealed that only 51% of the households are metered and only 54% received bills for the electricity they consume. Our survey of the state reveals that though electricity has reached a significant proportion of the state population, its popularity as a primary source would largely depend on its reliability and affordability with a greater emphasis on infrastructure development to curb financial losses. Similarly, people's dissatisfaction with their electricity largely stems from the poor quality and reliability of service.

Several implications follow from these findings. First, household electricity connections are still an issue to be addressed through future connectivity drives. Despite some progress under Saubhagya – especially among the tribal communities – more work remains to be done. Second, aside from access, improving the quality of electricity service is crucial. The median grid-connected household in Jharkhand enjoys fewer than ten hours of electricity per day, and most households cited poor service quality due to voltage fluctuations and limited hours of supply as the key reason for being dissatisfied with their electricity connection. Third, increasing rates of household bill payments and metering is essential for increasing Discom revenues, which can in turn be used to improve service quality.

4. CLEAN COOKING FUELS

Introduction

Expanding access to clean cooking fuel is important for promoting better health outcomes, reducing indoor air pollution, combating climate change, and increasing the affordability of home cooking. About 4.3 million deaths take place annually due to indoor air pollution caused by use of unclean fuel such as biomass for indoor cooking (World Health Organization, 2018, 2).

Jharkhand relies heavily on firewood as one of its main cooking fuels (CEEW, 2018). Our survey confirms that about 83% of the rural population in Jharkhand relies mainly on biomass – such as firewood and dung cakes – for cooking their daily meals. The same share of the households also reported indoor cooking. Furthermore, about 95% used traditional biomass cook-stoves putting them at a greater threat of diseases caused by air pollution.

Access to liquefied petroleum gas (LPG) as a clean cooking fuel has expanded over the last three years under the Pradhan Mantri Ujjwala Yojana (PMUY) scheme. However, only 53% of rural households in our survey reported having LPG connections, though 76% of these were connected under the PMUY scheme. Moreover, many LPG users find purchasing new cylinders expensive. About 64% of the households without LPG access said it was too expensive to get connection while 61% found monthly expenses for refills too high. Thus, 46% of LPG households do not use it for all their cooking needs and 83% reported stacking fuel – that is, using multiple sources of fuel – such as firewood, cow-dung cakes, or coal as supplements. About 77% of the households were satisfied with LPG use. Of households dissatisfied with LPG, 90% said it was too expensive and 45% reported difficulty in procurement. Furthermore, current evidence regarding the barriers to clean cooking access also suggests that unaffordability and lack of awareness about government schemes were two crucial reasons for non-adoption of LPG in the first place.

In this section, we analyze the adoption of LPG in the rural areas of Jharkhand. The section further identifies crucial bottlenecks to LPG access and the causes of dissatisfaction with LPG.

Access to clean cooking fuel

The rural population in Jharkhand relies on a number of different cooking fuels. Depending upon the ease of availability and cost, most households use either biomass or coal to prepare their meals. Our survey reveals that 53% of the rural population in Jharkhand has access to LPG. When observed across districts, it was found that LPG penetration is high in Garhwa, Palamu, Hazaribagh, Ranchi and Lohardaga where 75% or more households have access to LPG. On the other hand, it is the lowest in Deoghar, Jamtara, Saraikela Kharsawan and Pashchim Singbhum districts where at most 30% of households use LPG for cooking (Figure 9).

Our survey suggests that LPG is the second most widely used fuel in the state, as 17% of households mentioned using it as their primary fuel (Figure 10). However, this is far below firewood and wood chips with 71% of households using them as their primary fuel. Other fuels used include dung cakes and coal. None of the households currently used biogas, which alongside LPG is a cleaner cooking fuel, but 3% mentioned using it in the past.

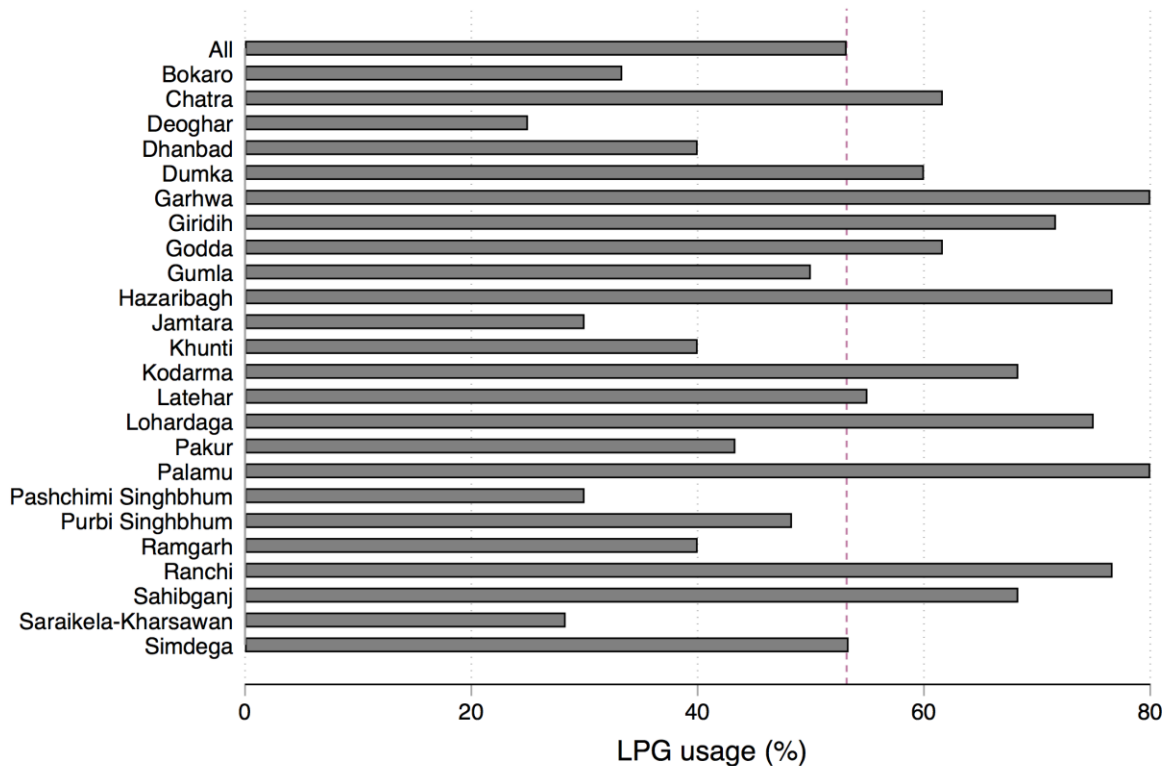


Figure 9: Access to LPG, by district. Red dotted line represents the average for the full sample. Weighted responses.

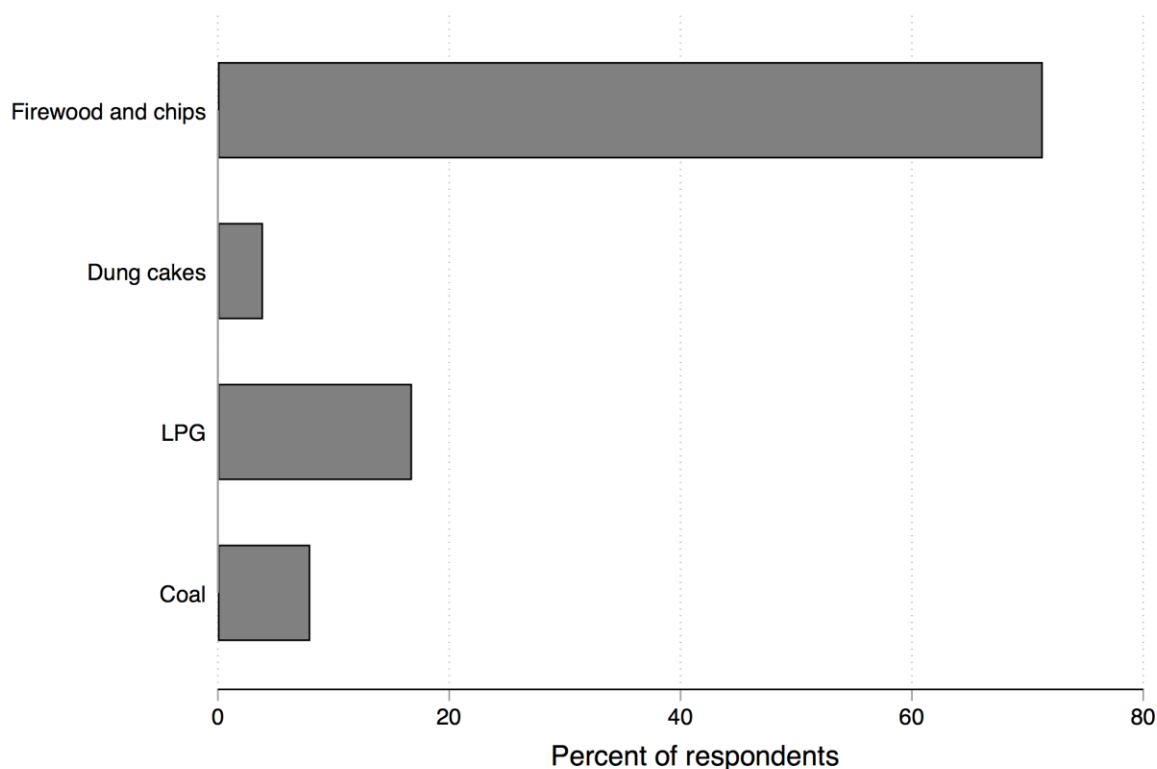


Figure 10: Household's primary cooking fuel. Weighted responses.

There is clearly a significant difference between the number of households that have access to LPG and those using it as a primary fuel. Out of all the households that have access, only 31% used it as their primary cooking fuel. More than 50% of households in all districts of the state used firewood as their main fuel except for Hazaribagh, Dhanbad and Godda, where the proportion is slightly lower.

Amongst tribal households, the survey data show that 40% used LPG for cooking, but of these, only a quarter used it as their main cooking fuel. The tribal population in the state was largely dependent on firewood, as about 89% reported using it as their primary fuel. In Khunti, where a majority of our tribal respondents lived, 100% used firewood as their primary cooking fuel (Figure 11).

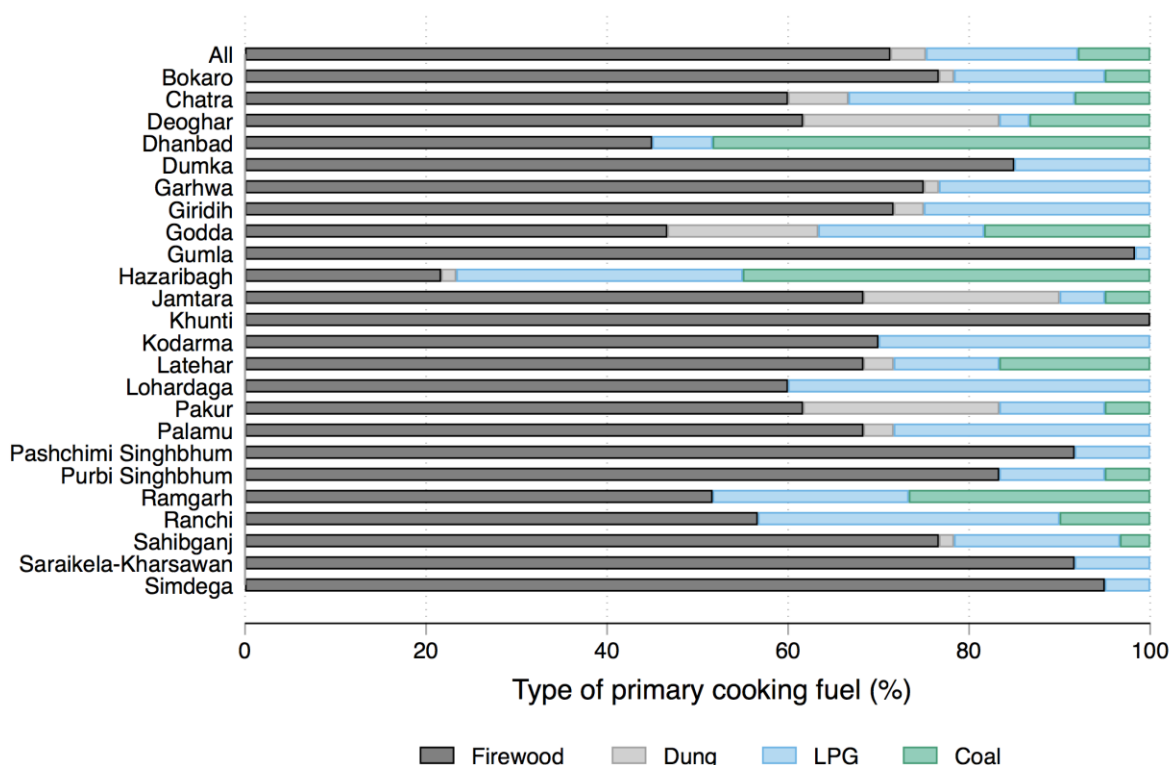


Figure 11: Primary cooking fuel, by district. Weighted responses.

Women's participation in decision making related to LPG remains low as 72% of the households reported that LPG refills are ordered by the (usually male) household head. About 8% reported it being done by women and 22% said it was done jointly by men and women. Similar results were found when examining who procured the refilled cylinders, if this was done away from home. About 67% said the men in the household were responsible, whereas 26% reported it was done by both men and women.

Status of PMUY in the state

Pradhan Mantri Ujjwala Yojana was initiated by the central government in 2016 to provide subsidized LPG connections to poor households (Government of India, 2019c, 1). Since then, the number of households with LPG connections has increased in the state (CEEW, 2018). In our survey we found that out of all the households with LPG in Jharkhand, 76% were connected under PMUY. The scheme has clearly played an important role in increasing access, even though its impact varies across districts (Figure 12). More than 80% of all LPG connections in seven districts of the state occurred under PMUY. In fact, while all LPG households in Khunti district received connections under the PMUY scheme, our early analysis reveals that none use it as their primary cooking fuel.

The overall effect of PMUY has been to help reduce inequality between scheduled tribes and non-tribal households in the state. When access to LPG is broken down by caste, the data show that 88% of the scheduled tribe households using LPG received their connection under the PMUY scheme, compared to 73% for non-ST households.

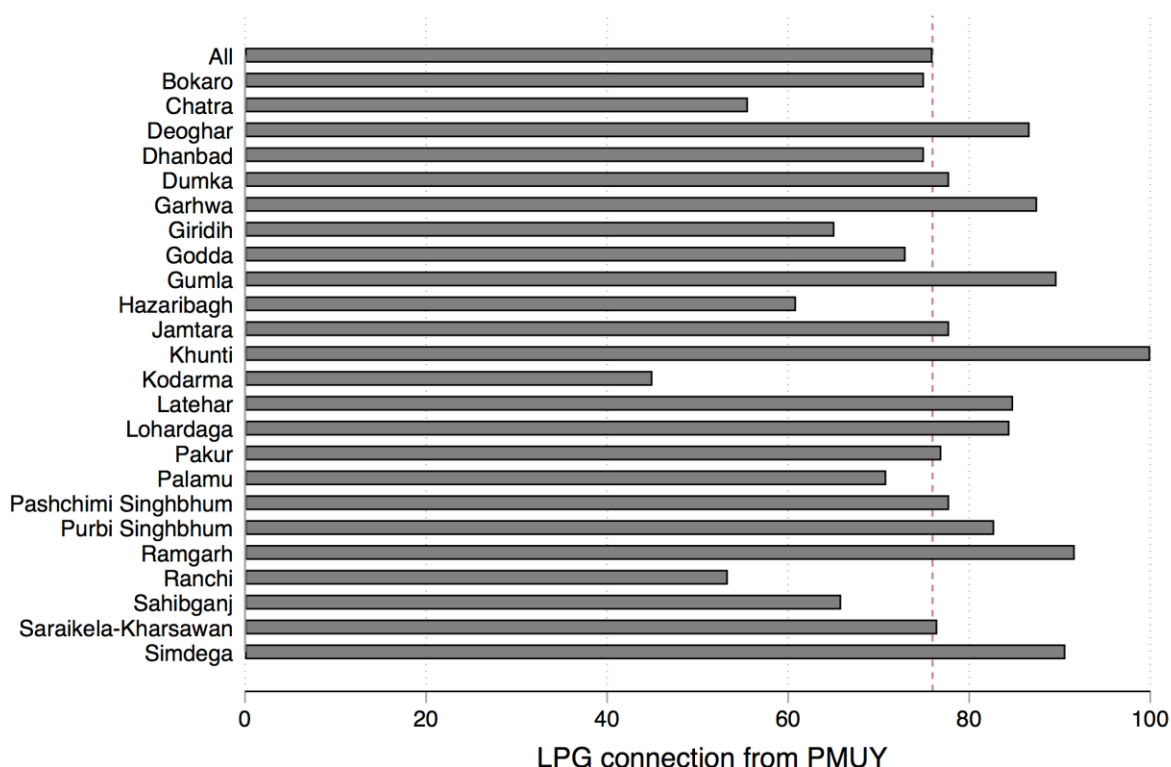


Figure 12: Proportion of households that received their LPG connection under the PMUY scheme. Red dotted line represents the overall average. Weighted responses.

However, use of LPG as a primary fuel was more common among non-PMUY households. Just a quarter of PMUY households used LPG as their primary fuel in comparison to about 53% of the non-PMUY households. Moreover, their annual consumption of LPG was also lower. Our data suggests that non-PMUY households consumed six large cylinders annually whereas PMUY households consumed just three.

Satisfaction with LPG

Based on our data, about 77% of LPG households expressed satisfaction about LPG as a cooking fuel. Satisfaction with LPG was slightly higher among non-PMUY households where 81% of the population expressed satisfaction in comparison to 76% of the PMUY households.

About 90% of households that expressed dissatisfaction cited cost, specifically the high monthly expenses of using LPG (Figure 13). This number was virtually identical for both households connected under PMUY and those that were not. Other reasons were availability constraints and maintenance issues, which also inhibit the sustained use of LPG. About 45% of the households said that it was too far to procure. Procurement of refilled cylinders remains a challenge as 75% of the LPG households reported that they did not receive doorstep delivery of cylinders. They had to travel a minimum of 5 km (median value) each way to procure one cylinder. Such limitations encourage the use of more than one fuel for cooking. Nevertheless, 89% of the households reported that it takes two or less days to get a refill.

Therefore, both high monthly expenses and difficulty in procurement explain why stacking of cooking fuel is common in the state. About 83% of households that use LPG stack fuel such as firewood, dung cakes, coal, and sometimes agro-residue for cooking. This proportion is even higher for PMUY households where 89% of the population stacked fuel.

High monthly expenses on refills and easy availability of biomass were the prime reasons why people did not use LPG as their primary cooking fuel. Only 54% of the household used LPG for all their cooking needs. A high proportion among these, about 93%, said it was because LPG was too expensive to use. Another 37% cited easy availability of biomass as one reason. Other reasons were difficulty in procurement and cooking preferences for certain food items.

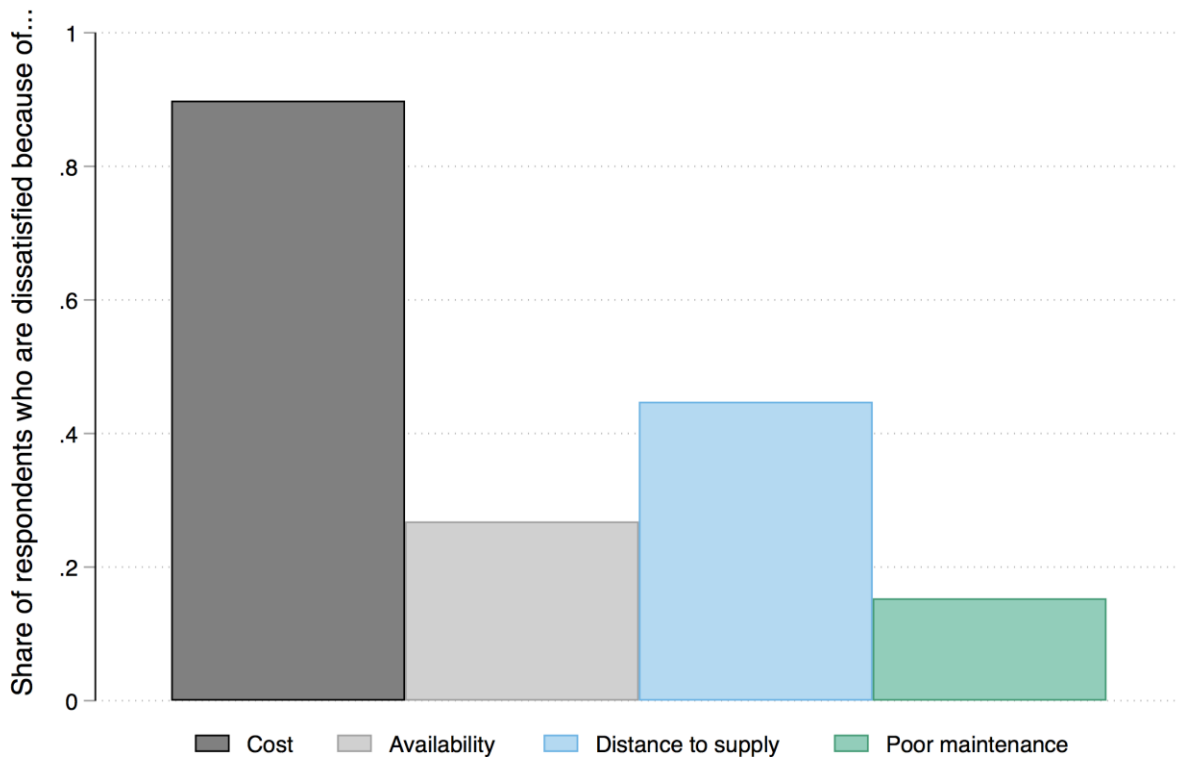


Figure 13: Reasons for dissatisfaction with LPG. Weighted responses.

Bottlenecks to adoption of clean cooking fuel

Our study also helped explain the bottlenecks to LPG adoption. The biggest constraint mentioned was high connection charges. About 64% of the households said that it was too expensive to get an LPG connection. This comes despite the government's ambitious PMUY scheme to connect poor households at subsidized rates. Another 61% of the households said that the current monthly expense of LPG was too costly. Procurement issues and lack of awareness about how to get an LPG connection were some other reasons cited (Figure 14).

By and large, however, non-adoption of LPG was not due to lack of interest. About 72% of the households expressed their desire to secure LPG connections. These households were willing to spend INR 400 monthly to get their cylinders refilled. The existence of these bottlenecks thus limits a significant proportion of the rural population's ability to access clean cooking fuel.

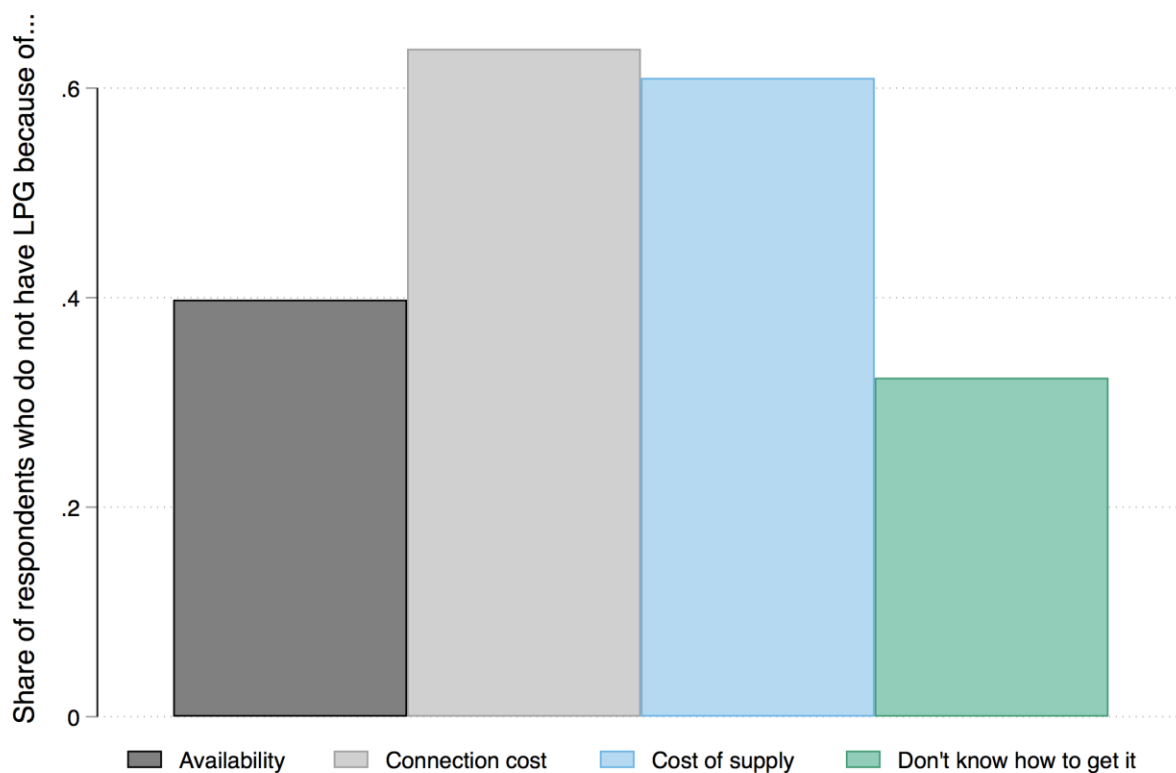


Figure 14: Bottlenecks to access. Weighted responses.

Section summary

At present, Jharkhand is a state whose rural population is largely dependent on biomass as their main cooking fuel, and only 53% of rural households have access to LPG. Expanding the use of LPG as a clean cooking fuel can go a long way towards both mitigating adverse health effects due to indoor air pollution and increasing households' access to affordable cooking. Though PMUY has successfully increased access to LPG in the state, there is still scope to increase adoption since only 31% of households reported using it as their primary fuel.

Factors such as high monthly expenses, easily available biomass, and procurement issues were found to be crucial limitations to the widespread use of LPG. Unawareness about the subsidized connection scheme

under PMUY further limited LPG penetration. Thus, in order to bridge the energy access gap and make universal access to clean cooking a reality, it is important to make it not only easily available but also feasible financially.

In terms of policy implications, the analysis suggests a continued need to pursue two related goals. The first of these is increasing access to LPG, and the second is to support sustained use of LPG. Despite the PMUY scheme, and despite widespread interest in LPG, adoption of it remains low at 53% of households. Moreover, only 31% of connected households actually used LPG as their primary cooking fuel. By far, the most common reasons given for household dissatisfaction with LPG was the cost and difficult of procuring it, as the median household had to travel 5km for a refill. Moreover, most households without LPG cited cost as a reason, while yet others cited a lack of awareness of how to obtain a connection. Moving forward, increasing awareness of the PMUY scheme and of the procedure for obtaining an LPG connection, making the cost of LPG refills more affordable, and making procurement of LPG easier will be key in moving closer to universal LPG usage.

5. COAL MINING AND LIVELIHOODS

Introduction

Jharkhand is home to the largest coal reserve in India, estimated to be more than 83,000 million tons (Indian Minerals Yearbook 2018, 5). Its share in the total provisional production in the year 2017-18 was 18%, making it the third largest coal producing state in the country. More than 96% of India's coking coal and about 13% of non-coking coal production comes from the state (Indian Minerals Yearbook 2018, 8). This makes Jharkhand strategically important for India's energy security, and at the same time puts it at a greater risk from a transition to clean energy.

Coal mining is confined to certain specific districts of the state and indirectly affects local communities and their livelihoods (Mishra, 2009). Coal India Limited (CIL) and its subsidiaries are the largest employers in the region, followed by other private producers. Furthermore, small scale and unauthorized mining also employs a significant number of people (Lahiri-Dutt, 2003). Our survey findings suggest that the coal mines in Jharkhand, spread across 14 districts provide direct employment to just 1% of the rural population. Their roles are limited to mining, coal transportation, selling of coal or other maintenance activities. Note that Jharkhand's dependence on coal cannot solely be measured by the size of its rural workforce. Some mines are located in urban areas.

A closer look at people's perception suggests that coal, otherwise a promising industry, is not considered attractive for employment among the rural population in the state. People's perception about coal jobs does not vary much across the coal and non-coal districts. Almost everyone who had an opinion about it considered it to be dangerous and physically demanding. The most attractive aspect was the wage, as coal workers seemed to be highly satisfied with their salaries unlike non-coal workers. Despite high wages, a significant proportion of the population considers it to be an unattractive employment option.

Communities that are dependent on formal or informal coal jobs consider it important for their socio-economic growth. Eventual decline in coal demand would decrease direct employment in the sector leaving unskilled coal workers in rural areas with very few alternatives. Our current analysis depicts that due to the lack of job opportunities and dearth of cultivable land these workers find it extremely challenging to get similar paying jobs locally. Furthermore, the rural employment scheme run by the government pays less than half of their average daily salary as a coal miner, making it financially unattractive.

This section of the report presents our survey findings about employment in the coal sector of Jharkhand. It further explores the costs and benefits of being a coal-worker in the state and alternatives to coal jobs for the workers whose livelihoods are dependent on it.

Employment in the Coal Sector

Coal is often said to represent an important source of jobs in Jharkhand. Yet the industry has been undergoing a rapid transformation over the last decade. Central Coalfields Limited (CCL), a Jharkhand-based subsidiary of Coal India (CIL), reported employing about 40,000 people as of 2018 (Central Coalfields Limited 2018, 25). In 2013, it was still counting 48,000 individuals on its payroll. Thus, coal employment at CCL decreased by 16% over five years – a drastic change in what long used to be a stable industry. While this number does not include those who are indirectly or informally involved in the coal business, it indicates the declining and limited role played by this industry in terms of employment.

Our survey confirms these general statistics. Out of the 1,440 households we interviewed, only 20 worked in the coal sector. Adjusting for sampling weights, this represents 1% of the respondents. This number does not significantly change if we examine whether respondents knew family members who work in coal. However it is calculated, the share of people who earn a living from coal remains small. When examined for tribal divide, it was found that 4% of the tribal population was part of the coal workforce.

Let us take a closer look at respondents who reported working in the coal industry. They were split in about equal proportions between coal miners, coal transporters, and coal sellers. This covers the most typical types of coal jobs available in rural areas (managerial positions tend to be located in urban regions). Half of the respondents worked for CIL or one of its subcontractors, confirming the central role played by these large state-owned enterprises. This was particularly true for mining and transportation jobs.

Yet the informal and indirect employment also appears to matter. About one-quarter of the respondents were self-employed or worked in the informal sector, highlighting the wider community of coal-related jobs outside of CIL and its subsidiaries. While the number of individuals directly employed by CCL may have been declining, we do not know if the same applies to informal and indirect jobs. While we emphasize the need for prudence given the small sample size at our disposal, our survey suggests that possibly one-quarter of all rural coal workers belong to the informal sector. Another 15% are employed by private firms that are outside of CIL's immediate control. This implies that focusing solely on CIL and CCL employment would considerably undercount of the number of people making a living from coal. Thus, while we observe that coal's role in terms of employment opportunities appears to have been declining overall, it could plausibly remain an important source of jobs for certain communities.

The Benefits and Costs of Coal Jobs

Looking forward, the question is: how appealing are coal jobs? Coal workers generally seem to appreciate the wages that are paid in their line of work (69% indicated being satisfied with their salaries). At the same

time, they also expressed concern over their working conditions. About 90% found their work physically demanding, and a similar share perceived it to be dangerous.

Are these views shared by the broader rural population? There is widespread belief that coal is beneficial for Jharkhand's economy (Figure 15). Among people who have an opinion on this topic, about 70% see coal as beneficial for Jharkhand's economy. We note however, that the modal respondent expressed no view on this question.

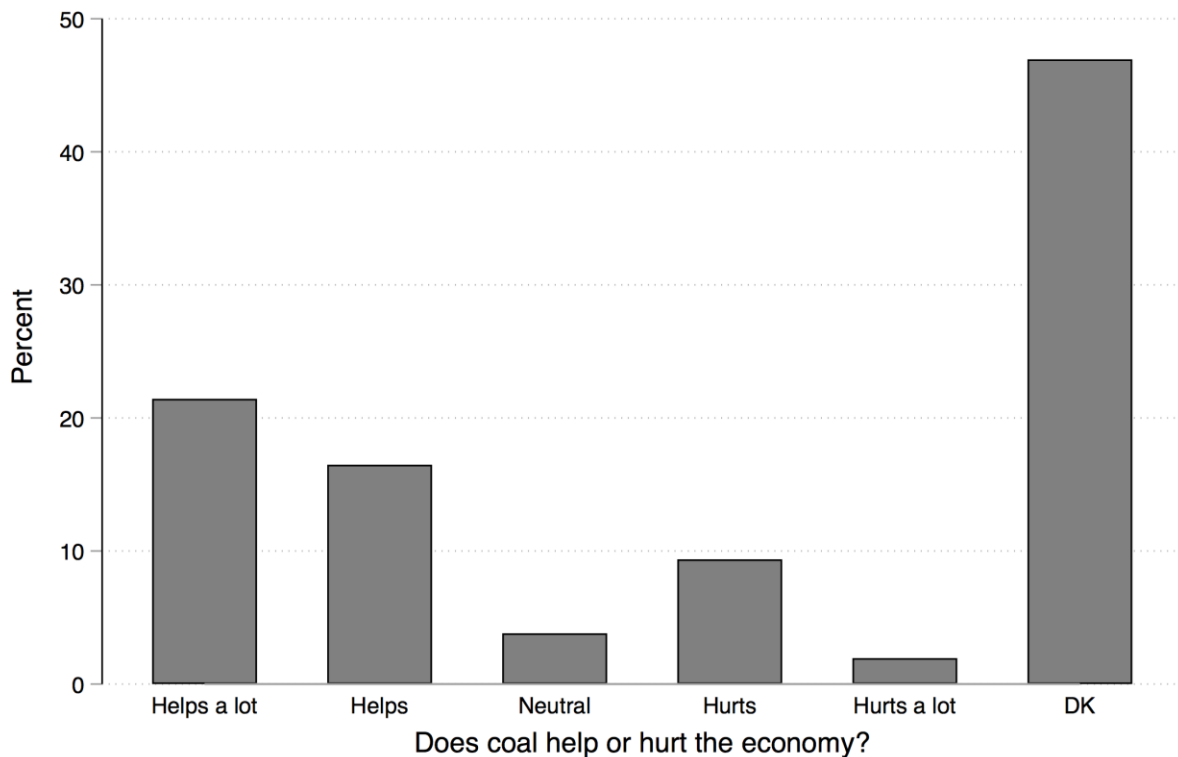


Figure 15: Does coal help or hurt Jharkhand's economy? Weighted responses.

At the same time, most non-coal respondents do not find coal jobs particularly attractive. Almost half the respondents find a job at CIL to be unappealing or even very unappealing (Figure 16). The primary reasons for this lack of interest seem to be the danger inherent to these jobs, the physical burden that these jobs entail, and the distance to their potential workplace. In fact, the only appealing factor appears to be wages: about half of the respondents believe wages in the coal sector to be high. Overall, 75% of the respondents who had an opinion believed that the wage they could earn as a coal miner would be much higher than the one they were earning from their non-coal job at the time.

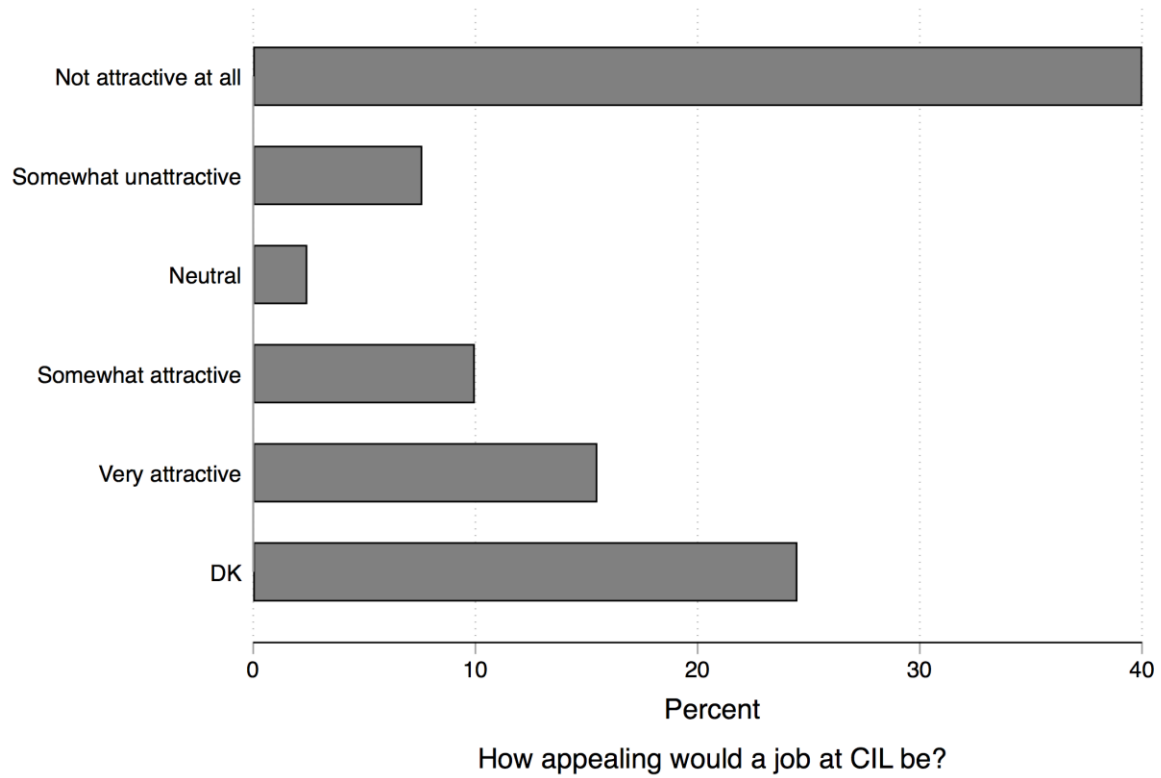


Figure 16: How appealing is a job at CIL? Weighted responses.

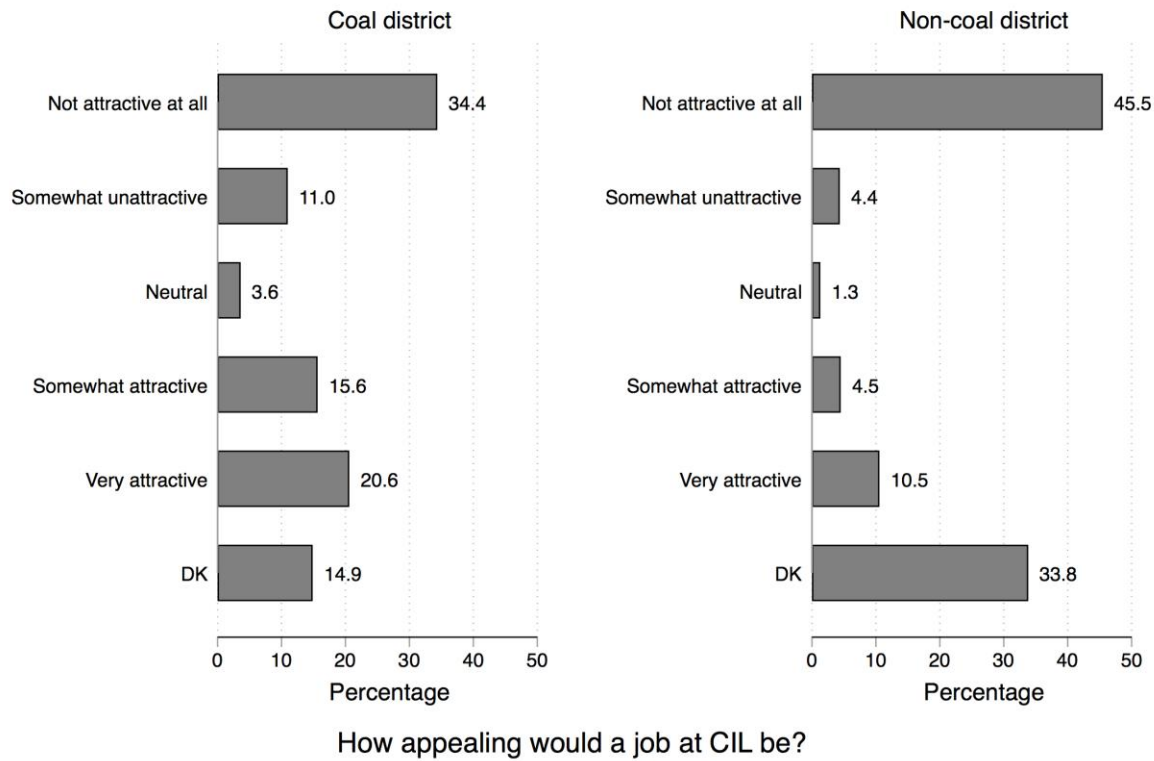


Figure 17: How appealing is a job at CIL? Comparison between coal and non-coal producing districts. Weighted responses.

Table 1: Perceived coal miners' wages. Distribution of responses to the question: "how much money do you think coal miners make compared to you?" The last row removes respondents who said that they did not know. All values rounded up. Weighted responses.

How much money do you think coal miners make compared to you?					
Much less	Somewhat less	The same	Somewhat more	Much more	Don't know
<1%	2%	1%	8%	35%	53%
Among those who expressed an opinion					
1%	3%	2%	18%	75%	-

However, perceptions vary across districts. We examined for coal and non-coal districts separately and found that about 36% in the rural population in coal districts perceived that coal workers get higher wages. This perception was lower (15%) in the non-coal districts. Similarly, attractiveness for coal jobs also varies with variation in proximity to coal mines. Respondents in the coal district find CIL jobs slightly less unattractive than respondents from non-coal district (Figure 17).

Alternatives to Coal Jobs

A decrease in coal demand will take a toll on jobs in the region and will have socio-economic implications for the dependent workers. Our survey examined what alternatives to coal jobs are available for workers in the community.

More than 86% of the coal workforce said it would be difficult for them to find jobs with comparable wages in the same geographical area. The majority of their land, which was earlier used for agriculture, is now owned by the mining companies², leaving them without the alternative to switch back to agriculture. The rural employment scheme run by the government pays far less than when they currently earn. Our survey reported that an informal worker involved in mining and selling coal earns an average wage of INR 370 per day. On the other hand, a daily wage laborer in MNREGA, India's national work program, is entitled to get just INR 171 per day in Jharkhand (Government of India 2019a, 2). Moreover, less than a quarter of coal workers hold the requisite degrees needed to secure high-skilled jobs.

Poverty and lack of alternate sources of income often force people to venture towards illegal mining activities.³ Many abandoned mines in the state continue to experience mining by the locals, which is both illegal and dangerous. Despite the potential risk, it acts as a reliable source of income for the dependent masses.

The coal sector workforce might require re-skilling and re-training to succeed in labor markets that require a different skill set. Limited opportunities in the same geographical area would compel them to migrate to cities for work. Thus, despite its significance as an important livelihood source for certain communities, we find that coal jobs, especially in the informal sector, are more avenues of employment out of destitution than out of opportunity.

² Mining in Jharkhand threatens locals in their own land. DownToEarth. April 2019. Available at <https://www.downtoearth.org.in/blog/mining/mining-in-jharkhand-threatens-locals-in-their-own-land-63920>

³ Lack of jobs in Jharkhand's Giridih leads to proliferation of illegal coal mines; for villager, polls only means more police raids. Firstpost. October 2019. Available at <https://www.firstpost.com/politics/lack-of-jobs-in-jharkhands-giridih-leads-to-proliferation-of-illegal-coal-mines-for-villagers-polls-only-mean-more-police-raids-6500301.html>

Section Summary

The coal industry in Jharkhand employs a very small proportion of the rural population – close to 1%. These are low skilled workers who are employed as miners, sellers or transporters of coal for formal and informal industries. The only aspect of their work that appeals to them is the high wages. Otherwise, the physically demanding nature of work and danger to life, make coal jobs a very unattractive employment option across all the districts of the state.

While finding another job with similar wages is considered difficult among workforce in the state, the people employed in the coal sector are specifically vulnerable to such changes. Limited skill sets, low rates of education among coal workers and the limited possession of cultivable land leave them with very few alternatives. While implications of the transition to a low carbon economy are many, these workers whose livelihoods are dependent on coal may be the worst affected. It is important that people are kept at the center of important policy decisions to enable a smooth transition away from coal.

6. POLICY IMPLICATIONS

Power sector

- **Provide electricity connections to all households.** Despite electrification rates increasing under the impulse of the Saubhagya scheme, about 15% of respondents still do not use the grid for lighting. This would mean that about 3.75 million people across rural Jharkhand lack access. The primary reason that respondents cited for not having a grid connection was the cost of both the initial connection and the monthly bills. Another round of programs designed to increase connectivity by offering poorer households assistance in obtaining and paying for a connection – and, crucially, raising awareness about such programs – is therefore necessary to achieve universal grid electrification.
- **Ensure households receive reliable and high-quality electricity supply.** Among respondents who use the grid, about 34% reported being “unsatisfied” with their electricity situation. Quality of supply appears to be a primary cause of dissatisfaction: 84% of respondents reported that supply was unreliable and 71% said that poor quality of electricity from voltage fluctuation – was a reason for dissatisfaction. Voltage fluctuations, which on average happened about 5 days per month, affected their ability to use appliances. Thus, investments in infrastructures to improve the reliability of supply is necessary to meet consumers’ expectations.
- **Strengthen metering, billing, and collection.** Poor funding affects Discoms’ ability to invest in improving grid services. Among households that have access to the grid, only 11% have a meter, receive a bill and make timely payments. Another 19% do pay their bills, but do so late. This means that about 70% of the respondents either do not have a meter or have one but do not receive a bill. In fact, we find that 26% neither have a meter nor receive a bill, and yet use the grid. This represents a substantial share of users that do not pay for the electricity they consume. Addressing payment issues – and understanding why they happen – should therefore be a priority.

Clean cooking

- **Increase access to LPG.** LPG usage remains low. While 53% of our respondents indicated they use LPG, it represents the primary cooking fuel for only 17%. Thus, despite PMUY’s success in increasing nominal access, usage continues to lag. Our survey identified several potential reasons: lack of awareness, perceived cost (64% of households that have access to LPG believed that connection costs were too high), and implementation issues more generally. We therefore encourage the use of public information campaigns that emphasize the benefits of schemes like PMUY and clarify their cost-reduction features.

- **Support sustained use of LPG.** The high cost of refills surfaced as a major limitation to the sustained use of LPG gas cylinders in our study. Of all the LPG households dissatisfied with access, 90% believed the monthly costs of refill were too high for them. Unaffordable usage despite subsidized rates is indicative of the poor economic status of a significant proportion of the population. Targeted policies that aim to advance the socio-economic status of rural folk and create livelihoods that strengthen their financial status need to be prioritized.

Coal communities

- **Limited alternatives for coal workers.** Our study found that working in the coal industry was perceived as unattractive among rural households. Instead, being employed in the coal industry seemed to be driven by a lack of competitive alternatives. Policies that accelerate the decline in coal demand should therefore be accompanied by programs to develop rural job opportunities. Such programs could include the promotion of new industries (e.g. the renewable energy sector) or general training camps that facilitate people's move to faster growing areas. This would help diversify Jharkhand's economy and make it more robust to shocks that threaten the coal sector.

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The Initiative for Sustainable Energy Policy (ISEP) is an interdisciplinary research program that uses cutting-edge social and behavioral science to design, test, and implement better energy policies in emerging economies.

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