Energy Research & Social Science 79 (2021) 102132

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

The great equalizer: Inequality in tribal energy access and policies to address it

Michaël Aklin [a,*], Brian Blankenship [b], Vagisha Nandan [c], Johannes Urpelainen [d]

[a] University of Pittsburgh, United States
[b] University of Miami, United States
[c] Initiative for Sustainable Energy Policy, United States
[d] Johns Hopkins SAIS, United States

ARTICLE INFO

Keywords:
Energy inequality
Energy poverty
Electricity access
Jharkhand
India
Saubhagya

ABSTRACT

Amidst a general increase in household electricity access across the world, some vulnerable communities stand at risk of being left behind. As a result, electricity inequality can be increasing even in countries in which access improves on average. We explore this question in the context of Jharkhand, India, which is characterized by its large tribal populations. Using new household survey data, we document two findings. First, tribal households are much more likely to suffer from poor electricity access. Electrification rates are about 11 percentage points lower than the general population (adjusting for a range of confounding factors) (95% CI: [-21, −1]). Likewise, tribal households own fewer appliances than their general population counterpart: the capacity of their appliances is 168 W smaller (95% CI: [-42, −295]) than that of the general population. Second, aggressive public policy can reduce electricity inequality. We show that tribal households were much more likely to be targeted by Saubhagya, a government electrification scheme, than the rest of the population, with estimates ranging from 11 (95% CI: [-2; 23]) to 22 percent (95% CI: [12; 32]). Public policy could thus, under favorable conditions and when designed appropriately, be an effective tool to combat energy inequality.

1. Introduction

Over the last several decades, countries around the world have made remarkable progress in electrification rates [1,2]. Despite this encouraging news, electricity access often remains unevenly distributed within countries. As a result, many are excluded from the benefits that it has to offer. Some of these benefits are direct: artificial lighting, cooling or heating, phone charging, and so on. Others are indirect, such as the possibility to run home-based businesses. Because of this, energy inequality may reinforce broader trends toward inequality in a society. Thus, understanding the sources of energy inequality deserves more attention because it has broad socioeconomic implications.

In this paper, we explore two related questions: what are the causes of inequality in electricity access? And can government policies reduce inequality? We focus on one particular set of causes of inequality: social cleavages. By social cleavages, we mean social and cultural divisions that characterize a society [3,4]. Social groups may be defined along religious or cultural lines, or, as in India, be shaped by caste and tribal status (among other existing cleavages) [5–7]. We build on research that shows how energy access in general varies considerably across different social groups [8,9]. In some cases, differences in energy access reflect broader welfare inequality. In other cases, energy inequality follows a political logic. Groups that are well represented politically tend to benefit from better access to electricity [10,11]. What we ask in this paper is whether social cleavages represent one of the causes of inequality in electricity access. This is our primary research question, which has drawn considerable interest but has mostly focused on industrialized countries [12,13].

MA wrote the paper, sketched the theory, and conducted the statistical analysis. BB and JU read the entire paper and provided feedback on all sections. BB, VN, and JU collected the data. All authors contributed to the design of the study. We are grateful to Morsel for fielding the survey. This study was made possible by the generous support from the Oak Foundation (grant number OCAY-18-683).
* Corresponding author.

https://doi.org/10.1016/j.erss.2021.102132
Received 5 January 2021; Received in revised form 18 April 2021; Accepted 24 May 2021
Available online 1 July 2021
2214-6296/

We ask this question in the context of Jharkhand, India. One of Jharkhand's key features is the presence of large tribal populations. According to recent census data, 8.6 out of Jharkhand's 32 million inhabitants belong to a tribal group (also referred to as Scheduled Tribes or STs) [14].[1] STs are important social actors in the state's politics [15: 281], but they are also known to suffer from high degrees of poverty [16: 40]. Our paper investigates whether ST households suffer from poor electricity access compared to the rest of the population. Lack of electricity access despite secular trends toward universal electrification would suggest the presence of electricity inequality.

In addition to documenting the existence of inequality, our paper also explores the ability of state interventions to reduce it. Over the last decades, the Indian government implemented several programs to improve access to electricity, especially among the poor. But the question remains open whether the most vulnerable segments of the population benefit from these policies. Here, we examine whether Saubhagya, the latest governmental push in this area, helped alleviate inequality in electricity access. Saubhagya made connections to power free for a wide range of disadvantaged social groups – including STs – and was designed in a way that could plausibly reduce inequality. This stands in contrast to earlier attempts to improve electrification rates, such as RGGVY, which had reinforced patterns of inequality [17].

To study these questions, we build on new survey data on energy access in rural Jharkhand. We interviewed a representative sample of 1,440 households across the state about their energy situation. Using this survey, we can explore the prevalence and determinants of electricity availability among tribal households and the broader population. We find that households that belong to tribes are systematically less likely to have an electric connection of any kind. In general, we find that a tribal household is about 10 to 11 percentage points less likely to have electricity compared to a generic household. For context, electrification rates in the general population of rural Jharkhand stands at about 87%. The differences are statistically insignificant when we focus on hours of electricity, consistent with the notion that discrimination is unlikely to happen in terms of quality of supply. We then examine consumption. We sum up the wattage of all electric appliances owned by each household. We find again that tribal respondents lag behind. On average, we show that their appliances sum up to 100 to 170 watts less than a general population household. Tribal households are less likely to own each application for which we have data, with the exception of the inefficient incandescent bulbs. The lack of LED is striking, given that more than 13 million LED light bulbs were handed out in Jharkhand under UJALA scheme.[2] In sum, tribal communities are at a disadvantage both at the extensive and the intensive margin compared to the broader population. We also show that geographical factors, such as distance to urban centers or village size, are unlikely to explain these patterns. This suggests that electricity inequality cannot be attributed to geographical location of ST populations.

Yet there exist encouraging signs. We find that tribal households were considerably more likely to have benefited from Saubhagya, India's flagship electrification program. The effect depends on specification, but it ranges between 10 and 22 percentage points. We interpret this result as an indication that government action was effective at reducing electricity poverty in a disadvantaged community. Thus, public policy can help reduce electricity inequality. At the same time, we note that the generalizability of our findings may depend on the context, a point we return to at the end of the paper. Furthermore, Saubhagya has not completely filled the gap between tribal and the broader population. We return to policy implications at the end of the paper, but we note here that a further push will be needed to address the remaining inequality.

2. Energy Inequality

We begin by briefly describing the concept of *energy inequality* in general before turning our attention to its prevalence in India.

2.1. The Concept of Energy Inequality

This paper investigates the existence and origins of energy inequality, with a focus on electricity. While there is considerable work on energy *poverty*, much less has been said on energy inequality. Here, we define energy inequality as the degree to which access to energy services is unequal within a society. It is distinct from energy access and energy poverty per se. Energy poverty is defined in this paper as the unavailability of affordable energy sources [1,9]. Lack of energy access represents a form of energy poverty. Energy access can improve in a manner that benefits the poorest segments of society, in which case energy poverty and inequality decrease at the same time. But energy access can improve in a way that leaves vulnerable populations behind by benefiting better-off groups. In this hypothetical case, energy access might improve on average but energy inequality increases.

The concept of energy inequality therefore helps distinguish the distributional consequences of energy policy. Two policies that improve the lots of, say, 10% of the population can have very different distributional impacts. This concept may also help think about various political priorities. For instance, a government may privilege an increase in electrification rates, while another may wish to improve the quality of supply. Both could improve energy access, but the latter might benefit primarily those who already have electricity and might be better off. The concept of energy inequality, thus, helps understand some of the normative nuances between competing energy policies.

Existing research that touches on the topic of energy inequality can be classified in two broad streams of literature. First, several studies document inequality across countries in terms of energy consumption. The question addressed by this literature is whether countries tend to converge (or not) toward similar levels of energy consumption. One of the earlier papers in this area is Jacmart et al. who conduct a cross-national comparison in per-capita energy consumption and find that inequality remained stable over the 1950–1975 period [18]. More recently, Meng et al. look at industrialized countries and likewise find that energy consumption tends to converge [19]. Focusing on electricity and expanding the sample worldwide, Maza and Villaverde identify a weak decline in inequality [20].

These studies shed light on broad macro patterns. But they tell us little about household-level inequality. They do not tell us whether inequality is increasing or decreasing *within* countries. There are relatively few studies in this area. One growing research program focuses on fuel inequality [13]. Fuel poverty is generally defined with respect to the cost of maintaining a healthy indoor air temperature [13: 477]. Fuel inequality then relates to the share of households that spend a substantial share of their income on energy [21,22]. This literature generally focuses on industrialized regions such as Europe [23].

In comparison, energy inequality in emerging and developing countries remains much less studied. Notable exceptions include Schiffer who conducts an ethnographic study on energy access in Gambia [24]. Pereira et al. study the change in electricity inequality in Brazil before and after an electrification program was implemented [25]. They find that this program considerably reduced inequality in electricity consumption.

Closer to our paper, several studies focus on the particular challenges faced by indigenous populations. Carpenter and Jampolsky note that

[1] This probably undercounts STs, because the census was fielded when many of them were away for work. See "Census 2011 undercounted tribal population in Jharkhand" *Business Standard*, February 26, 2016, available at https://www.business-standard.com/article/news-ians/census-2011-undercounted-tribal-population-in-jharkhand-116022600587_1.html (accessed on October 30, 2019).

[2] Data from the UJALA dashboard, available at http://www.ujala.gov.in/state-dashboard/jharkhand (accessed on April 28, 2020).

despite considerable variation in their condition, indigenous people generally are relatively poorer [26: 40]. Lack of access to modern energy prevents the development of profitable industries. Repeated displacements, for instance to satisfy the demands of commodity-extraction businesses, prevent from building lasting infrastructure [27]. Lack of political representation precludes the voices of these populations to be heard, and prevents them from reaping the benefits of new energy infrastructures [28]. Together, these forces trap these populations in a vicious cycle of poverty, joining the ranks of the "energy oppressed poor" [29: 202].

Most of these studies reviewed so far examine energy access at the extensive margin. Recent work has emphasized the need to study closely how energy is used. The benefits of electricity begin to materialize when households can acquire and use electric appliances [30–32]. For electricity, this means understanding the dynamics behind appliance ownership and usage [33]. It also means examining the existence of inequality within society and within households [34].

Overall, the literature suggests that inequality is declining at the cross-national level, but considerable inequality remains within countries. This literature, however, does not quite address two important questions: what are the origins of persistent energy inequality? And can corrective policies effectively address it? In what follows, we study the existence of electricity inequality in the Indian state of Jharkhand. We try to understand whether vulnerable populations are left behind in the otherwise remarkable improvement in electricity access across the country. Furthermore, we evaluate whether policies that should reduce electricity inequality meet their goal.

2.2. Energy Inequality in India

India represents an important case to study electricity inequality. Until recently, India suffered from low electrification rates. As late as of 2000, about 600 million people lacked access to power 41 [1]. Aggressive programs from successive governments, such as Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) and Saubhagya (which we return to below), rapidly reduced this number. While the exact number of unelectrified household remains uncertain, Prime Minister Modi announced that all villages were electrified as of 2018, with households to follow shortly after.[3] Latest numbers from authorities suggest that Saubhagya provided power to all interested households, though many households still lack access.[4]

Our first core question, then, is whether the progress made by India on average has been equally beneficial to all segments of the population, or whether some groups have lagged behind. We may have reasons to suspect that some groups stand at a disadvantage. Social cleavages have affected many facets of Indian politics [5–7]. Members of Scheduled Castes and Scheduled Tribes, in particular, have been in conflict with other social groups. We return to these in the next section.

We also investigate a second question: have the electrification programs implemented by the government been effective at reducing the gap between the energy poor and the rest? Studies suggest that energy policy can be designed to alleviate energy poverty, and, by extension, inequality [35–37]. There are reasons to believe that recent government action has been successful in doing so [38]. Providing electricity access to rural communities has long been a problem for Indian authorities [39]. Earlier government programs, such as RGGVY, helped expand the grid to previously unconnected communities. However, many households remained off the grid. To some degree, this state of affairs was caused by chronically underfunded distribution companies (DISCOMs). As a result, DISCOMs were often reluctant to provide connections to poor and remote households.

It is in this context that the Indian government under Prime Minister Narenda Modi launched a new electrification program in 2017: *Pradhan Mantri Sahaj Bijli Har Ghar Yojana*, better known as "Saubhagya." Saubhagya represents the government's solution to the problem caused by DISCOMs: it would subsidize the cost of last-mile connection from the grid to remaining unconnected households [40,41].[5] To fund the program, the government set aside about $2.3 billion.[6]

Under Saubhagya, the poorest households would obtain free connections, while others would pay 500 rupees (or about $7) [41].[7] Poor households were identified as such from the Socio-Economic and Caste Census (SECC) from 2011.[8] Households that report at least one type of "deprivation" in the SECC data were eligible for free connections. A household is considered to suffer from a deprivation if one of seven criteria is met, such as having no adults between 18 and 59, having no literate adult above 25, or – and most importantly for us – being a member of a Scheduled Caste or Tribe.[9] Thus, Saubhagya was deliberately designed to facilitate access to a wide range of social groups that have often found to be vulnerable. Whether it has been successful remains an open question. Studies looking at its aggregate effect generally see the program in a positive light [42]. At the same time, Jain et al. hint at the possibility that despite its ability to increase electrification rates, Saubhagya may have done so unevenly for various groups and regions [42: 25]. The question, then, is whether its inequality-reducing features were sufficient to reduce the gap between different social groups.

3. Tribal Communities in Jharkhand

Next, we investigate our two questions – the prevalence of electricity inequality and the ability of Saubhagya to curb it – in the context of Jharkhand.

Jharkhand, politically independent since 2000, is home to 32 million inhabitants. Compared to the rest of the country, it remains poor. According to the World Bank, Jharkhand ranks second to last among all Indian states in terms of poverty rates [43]. According to these data, 37% of the total population and 41% of the rural population lives in poverty. The World Bank describes the state as "low growth, low income," despite considerable reduction in poverty rates over the last decades.

The situation is worse for members of Scheduled Tribes (STs) [44]. STs represent about one-quarter of the state's population, making

[3] "Modi Announces '100% Village Electrification', But 31 Million Indian Homes Are Still In The Dark," *Forbes*, May 7, 2018.

[4] See Saubhagya's website (available at https://saubhagya.gov.in/, accessed on November 1, 2019). On remaining unelectrified households despite Saubhagya's data, see Johannes Urpelainen, "Universal Rural Electrification in India? Not So Fast," *Power for All*, February 6, 2019 (available at https://www.powerforall.org/countries/india/universal-rural-electrification-india-not-so-fast, accessed on November 1, 2019).

[5] See also "Can the Saubhagya scheme work?" Rahul Tongia, *Brookings*, October 31, 2017.

[6] "Government of India have launched the Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya) in September, 2017 with an outlay of Rs. 16,320" Government of India, Ministry of Power: Lok Sabha "Unstarred Question No. 1136" available at https://eparlib.nic.in/bitstream/123456789/766177/1/AU1136_13_16.pdf (accessed on October 30, 2019).

[7] Based on exchange rate prevalent on October 30, 2019. See also Saubhagya's website for details: https://saubhagya.gov.in/ (accessed on October 30, 2019).

[8] "Under Saubhagya scheme, the government will provide all willing households in rural areas and poor families in urban areas free electricity connections identified using Socio-Economic and Caste Census (SECC) data 2011 having at least one deprivation." Saubhagya, Frequently Asked Questions, available at https://saubhagya.gov.in/assets//download/Saubhagya%20FAQ.pdf (accessed on October 30, 2019).

[9] See "II. Deprivation Data" under: Government of India Ministry of Finance, "Provisional Data of Socio Economic and Caste Census (SECC) 2011 for Rural India Released " available at https://pib.gov.in/newsite/PrintRelease.aspx?relid = 122963 (accessed on October 30, 2019).

Jharkhand one of India's states with the largest tribal presence. Earlier data suggest that about 60% of STs live below the poverty line [45]. Even recent studies still place the share of STs living in poverty at about 50% [46]. Other indicators of poverty, such as infant mortality rates, similarly indicate that STs suffer from difficult conditions [47].

STs also suffer from poor access to important infrastructures. For instance, 86% use open defecation compared to 35% for the general population of Jharkhand and 21% for all of India [46]. Likewise, they struggle to get access to clean drinking water. Only 14% of the ST population reports having such access compared to 67% for the rest of the state.

There are many causes for the prevalent poverty of STs. Many STs do not get good access to formal education, which translates into high illiteracy rate (about 44% are illiterate against 22% for the general population) [46]. But beyond specific factors leading to poverty, a crucial problem has been public policy. Basu notes that since Jharkhand's independence, government policy has focused on industrial development and has paid little attention to providing support to vulnerable communities [48].

The status of STs in Jharkhand is intimately tied to tribal politics. Tribal communities were instrumental in the development of an autonomist movement that eventually gave birth to an independent state [49]. While urban tribal elites were able to capitalize on their advantageous position, large segments of tribal populations remained poor [49,50]. Tribal demands (e.g. with respect to land ownership) were often ignored by the government. The poverty of STs made them particularly vulnerable to predatory behavior by corporations (who seek resource-rich lands) [51]. In response, the government undertook several reforms to protect and promote ST communities. For instance, the state implemented a reservation system that guaranteed political jobs for people with ST background [49].

In sum, STs are an important and relatively large community. Because of systematic bias and inequality, there are reasons to suspect that STs may not have capitalized on the general growth in electricity access that has benefited many rural regions across India over the past two decades. As a result, the gap between those whose access improved and the rest may have widened. In other words, electricity inequality may have grown.

At the same time, STs ought to be automatically considered for electrification under Saubhagya. As noted above, being a member of an ST automatically places households in the category of having at least one 'deprivation' under the SECC classification system. The fact that Saubhagya uses it to decide whether to make electricity connections free should therefore help STs in particular, regardless of their immediate condition [52: 8]. Thus, the design of Saubhagya is such that it could plausibly be able to curb inequalities and minimize the gap between STs and the rest of the population.

Before turning to the analysis, we briefly discuss extant work that links social cleavages across dimensions such as race, ethnicity, or tribal status to energy poverty. We also contrast these studies to our own to clarify our contribution. In the Australian context, Churchill et al. use 12 waves of a longitudinal survey and find that ethnic diversity is associated with energy poverty [53]. They argue that ethnic diversity may undermine community trust, which in turn contributes to lower levels of economic development and thus makes household energy less affordable. In our study, we focus specifically on the status of tribal communities instead of diversity within communities.

Aklin et al. study village electrification in Uttar Pradesh and find that communities populated by Scheduled Caste households were less likely to be electrified under the Rajiv Gandhi Rural Electrification Scheme (RGGVY) [17]. Based on institutional analysis of the scheme implementation, they list caste-based bias and the over-representation of upper-caste individuals in government as possible drivers. Our study draws on a similar logic, though with a focus on tribal communities in Jharkhand. Below, we find that Saubhagya had different distributional implications than RGGVY, highlighting the importance of policy design.

Saxena and Bhattacharya find that both Scheduled Caste and Scheduled Tribe groups are disadvantaged in access to electricity and clean cooking fuel in India [54]. Using data from 2011–2012, their decomposition analysis suggests that a combination of social isolation and discrimination can explain why lower-caste groups fare worse in energy access.

Lastly, Pelz et al. use the 2015–2018 ACCESS panel survey from six North Indian states to analyze inequality in energy access [55]. They find that although caste-based inequalities have decreased for Scheduled Caste households, Scheduled Tribe households continue to lag behind other social groups. They argue that both low social status and clustering in remote households may explain these outcomes.

Thus, there are several reasons to expect inequality in electricity access. Broadly speaking, we identify two families of reasons. First, inequality in electricity access may be caused by other factors, such as differences in income across groups. Here, inequality is a byproduct of these other factors [53]. Second, inequality may be the result of forms of discrimination in the design and implementation of energy infrastructure programs [54,17]. Our data cannot disentangle between these different causal paths; to do so, we would need more information regarding the history of electrification for Scheduled Tribes. However, these causal channels jointly point to a same conjecture, namely that electricity access will be unequal.

4. Data and Methods

Having formulated two conjectures (STs may suffer from lower electricity access, but they may also have benefited disproportionately from Saubhagya), we next discuss our empirical strategy. We first present the data that we collected to test these conjectures. Then, we discuss each variable used in the econometric analysis.

4.1. Data

To explore electricity access in Jharkhand, we collected survey data from a representative sample of the rural population. Jharkhand is divided in 24 districts. Given the importance of coal for Jharkhand, we stratified villages in each district by their distance to coal mines. Dividing each district in three groups of equal size, we then randomly selected two villages per group. That is, we picked two villages from the group that was closest to mines, two from the group that was at medium distance, and two from those farthest away. Data on coal fields come from the US Geological Survey. This gives us a total of six villages per district, for a total of 144 villages. In each village, we randomly selected ten respondents. Each respondent was met face-to-face by a team of enumerators who visited each village and who were fluent in local languages. We held several training sessions to ensure that all questions were properly understood by respondents. Electronic records were later checked to confirm the quality of the data.

To ensure the representativeness of our findings, we weight respondents based on the population size of a given district. By construction, our sample is representative within a given district but not across districts. Sampling weights correct for this and allow to make inferences about the population in question. In total, we obtained the responses from 1,440 respondents. A map of Jharkhand and the location of selected villages is available in Fig. 1. The data were collected in July to August 2019.

4.2. Outcomes

Each respondent was asked a wide range of questions about their socioeconomic condition as well as their energy access (see Table 1 for summary statistics). The median respondent is a 35 year-old man. His household spends about 4,500 rupees (about $61) per month on household expenditures. More than half of the sample either had no formal schooling (40%) or up to 5th standard (29%). Overall, about 60%

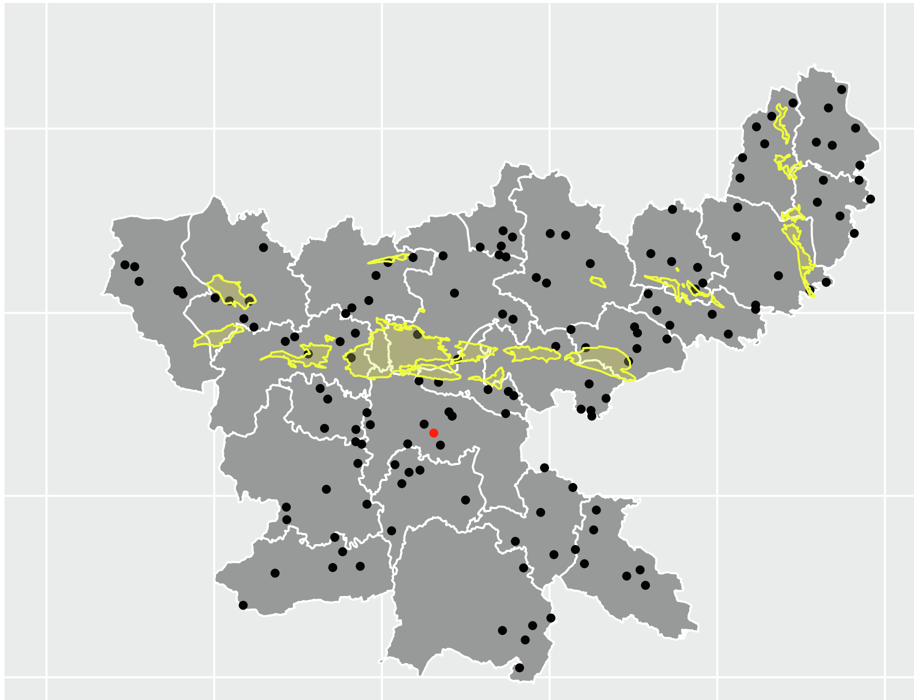

Fig. 1. Map of Jharkhand, with villages selected for the study (Ranchi, the capital, is identified in red, coal fields in yellow, and villages that were part of the study in black).

of the respondents could read and write in Hindi. This matches closely data from the 2011 census, which reported that literacy rates in rural Jharkhand were about 61% [56]. We also compared the share of STs in our sample compared to official data. After applying survey weights, our sample contains about 29% of people belonging to a tribe, whereas the census places this share at 26%. We are thus reasonably confident in the representativeness of our data.

Of particular interest to us are outcomes related to electricity access. To begin with, we examine whether a respondent has electricity – from any source, whether the grid or an off-grid technology. This variable takes value 1 if a household is connected. The raw sample mean suggests that 87% of the respondents have such a connection.[10]

We also examine electricity access at the intensive margin by modeling the number of hours of electricity per day that connected households benefit from [57]. This offers us a sense of the quality of electricity access: while a household may nominally be connected, it is often the case that in reality it benefits only from occasional access. Shares of appliance ownership are reported in Table 2.

Third, we explore whether respondents differ in terms of electricity consumption. Our questionnaire asked respondents if they owned a wide range of appliances.[11] Because we do not have data on how much each appliance is used, we cannot reconstruct an estimate of consumption. However, we can examine how much capacity respondents need to use their appliances. The assumption is that they will only buy appliances for which they have enough power. Thus, we first add up the capacity of all appliances listed by each household (measured in watts). To compute this, we rely on data on appliance wattage collected by Agrawal et al. [58], who estimated the typical wattage of appliances in several Indian states. We take the average estimate for each appliance and then apply it to our sample. This constitutes our main measure of consumption. Of course, it is unlikely that all appliances will be used simultaneously. Yet it is also unlikely that households will accumulate appliances beyond what they can properly power. In the appendix, we verify the reliability of these findings with an index of appliance ownership. The idea is to focus on the degree to which households own or not these appliances instead. We use factor analysis to generate an index (centered at zero and with standard deviation of 1); larger values mean that the household is ranked higher in terms of appliance ownership.

After examining *outcomes*, we study more attentively *outputs*. We focus on the role played by Saubhagya, India's most recent flagship program to increase electrification rates in rural areas. Respondents were asked if they were connected via this scheme. This allows us to examine whether Saubhagya indeed helped those populations that were in greatest need of public support.

4.3. Scheduled Tribes

Our key explanatory variable is the social status of a respondent. Specifically, we examine whether tribal members are indeed at a disadvantage in terms of their electricity access. To shed light on this question, we asked whether respondents belonged to a Scheduled Tribe, a Scheduled Class, Other Backward Classes, or the general population (see Table A1 for the distribution of respondents by group; see Table A12 for a breakdown by tribe). Furthermore, for those respondents who said that they were part of a tribe, we asked the name of the tribe. While the sample size for particular tribes tend to be quite small, we nevertheless wished to examine the prevalence of discrimination (or lack thereof) across tribes. The most common tribes in our dataset are Munda and Oraon (about 93 respondents each), followed by Santhali (67) and Ho (53). We grouped other tribes together to ensure a sufficiently large group (69). Overall, out of 1,440 respondents, 629 belong to the general population (44%), 375 belong to a Scheduled Tribe (26%), 250 to a Scheduled Caste (17%), and 186 are categorized as Other Backward

[10] We note here that we are focusing on access to electricity and do not make claims about people's satisfaction with their access. There might exist differences in expectations among the population regarding what good access represents. For studies on subjective satisfaction with electricity access, see for instance Aklin et al. [57].

[11] The appliances are: the number of incandescent bulbs, CFL bulbs, LED lights, tube lights, fans, electric irons, refrigerators, televisions, radios, cooler, washing machines, electric stoves, inverters, and electric water pumps.

Table 1
Descriptive statistics for the variables used in the main analysis.

	Mean	Median	S.D.	Min.	Max	Obs.
Scheduled Tribes						
Electricity (from any source)	0.82	1.0	0.4	0.0	1.0	375
Hours of electricity per day	9.88	8.0	5.6	0.0	24.0	308
Electricity capacity (watt)	302.26	194.0	466.1	0.0	5214.0	308
Appliances (index)	−0.32	−0.5	0.8	−3.4	4.3	308
Connection via Saubhagya	0.60	1.0	0.5	0.0	1.0	221
Expenditure (log)	8.11	8.2	0.6	6.2	9.9	375
Age	38.36	35.0	13.9	18.0	80.0	375
Female	0.14	0.0	0.3	0.0	1.0	375
Scheduled Castes						
Electricity (from any source)	0.83	1.0	0.4	0.0	1.0	250
Hours of electricity per day	10.13	10.0	5.3	0.0	22.0	206
Electricity capacity (watt)	427.48	217.0	686.1	0.0	5314.0	206
Appliances (index)	0.03	−0.4	1.1	−1.7	5.2	206
Connection via Saubhagya	0.37	0.0	0.5	0.0	1.0	156
Expenditure (log)	8.22	8.4	0.7	6.2	10.3	250
Age	38.52	35.0	14.1	18.0	80.0	250
Female	0.13	0.0	0.3	0.0	1.0	250
General population						
Electricity (from any source)	0.91	1.0	0.3	0.0	1.0	629
Hours of electricity per day	9.70	8.0	5.5	0.0	22.0	568
Electricity capacity (watt)	435.30	221.0	631.8	0.0	5147.0	572
Appliances (index)	0.08	−0.3	1.0	−1.1	6.2	572
Connection via Saubhagya	0.36	0.0	0.5	0.0	1.0	485
Expenditure (log)	8.24	8.4	0.7	6.6	10.1	629
Age	41.50	40.0	14.9	18.0	86.0	629
Female	0.15	0.0	0.4	0.0	1.0	629
Other Backward Class						
Electricity (from any source)	0.91	1.0	0.3	0.0	1.0	186
Hours of electricity per day	10.12	10.0	5.6	0.0	22.0	168
Electricity capacity (watt)	443.78	221.0	672.3	0.0	4333.0	168
Appliances (index)	0.14	−0.3	1.2	−2.0	7.2	168
Connection via Saubhagya	0.33	0.0	0.5	0.0	1.0	145
Expenditure (log)	8.24	8.3	0.7	6.9	10.1	186
Age	42.29	40.0	15.0	18.0	90.0	186
Female	0.19	0.0	0.4	0.0	1.0	186
Total						
Electricity (from any source)	0.87	1.0	0.3	0.0	1.0	1440
Hours of electricity per day	9.87	8.0	5.5	0.0	24.0	1250
Electricity capacity (watt)	398.55	205.0	608.0	0.0	5314.0	1254
Appliances (index)	−0.03	−0.4	1.0	−3.4	7.2	1254
Connection via Saubhagya	0.41	0.0	0.5	0.0	1.0	1007
Expenditure (log)	8.20	8.3	0.7	6.2	10.3	1440
Age	40.19	38.0	14.6	18.0	90.0	1440
Female	0.15	0.0	0.4	0.0	1.0	1440

Table 2
Appliance ownership: share of respondents who own at least one version of each appliance.

Share of appliance ownership	Mean	Obs.
Incandescent bulb	0.59	1254
CFL bulb	0.16	1254
LED light	0.52	1254
Tube light	0.01	1254
Any lighting	0.99	1254
Fan	0.62	1254
Electric iron	0.07	1254
Fridge	0.05	1254
TV	0.26	1254
Radio	0.02	1254
Cooler	0.02	1254
Washing machine	0.01	1254
Electric stove	0.00	1254
Inverter	0.02	1254
Electric water pump	0.07	1254

Classes (13%) (these totals are unweighted).

We note that respondents from Scheduled Tribes do not necessarily live separately from other groups. In Fig. 2, we show the distribution of population by tribal status. Very few villages are exclusively from a tribal background. Thus, tribal respondents often live with non-tribal households. Note also that about half the villages in our sample do not contain Tribal respondents.

4.4. Covariates and Model

Since we rely on observational data, we must ensure that any effect attributed to tribal status does not, in fact, stem from another variable. For instance, tribal respondents may be poorer for some other reason, and poverty may limit their ability to afford electricity. Thus, we adjust for several potential confounding factors. Besides income (which we proxy via log monthly expenditures), we adjust our estimates for age, gender, and education.

Note that our estimates are based on a reliable specification of our main models. Thus, we cannot rule out the risk of endogeneity affecting our results. Our primary strategy to address potential endogeneity is to rely on within-village variation by adding village fixed effects to our models. This helps us rule out a range of geographical, geological, and other related factors. For instance, one may wonder if villages closer to coal mines may be more likely to have electricity. As a result, our estimates derive from variation within villages. This ensures that our results are not driven by the geographic concentration of Scheduled Tribes. For instance, if they were located far from power plants, one may suspect that distance rather than tribal status would be to blame for inequality. It also ensures that geological factors, such as coal reserves and mines, are not driving our results. Using within-village variation reduces such concerns.

In the appendix, we examine whether ST households live at a greater distance from urban centers (Table A8), finding no evidence for any systematic difference across social groups. Another source of difference in infrastructure could be population size (Table A9). Here, there is some evidence that tribal households live in smaller villages, but that adjusting for population does not affect the main results (Table A10). As

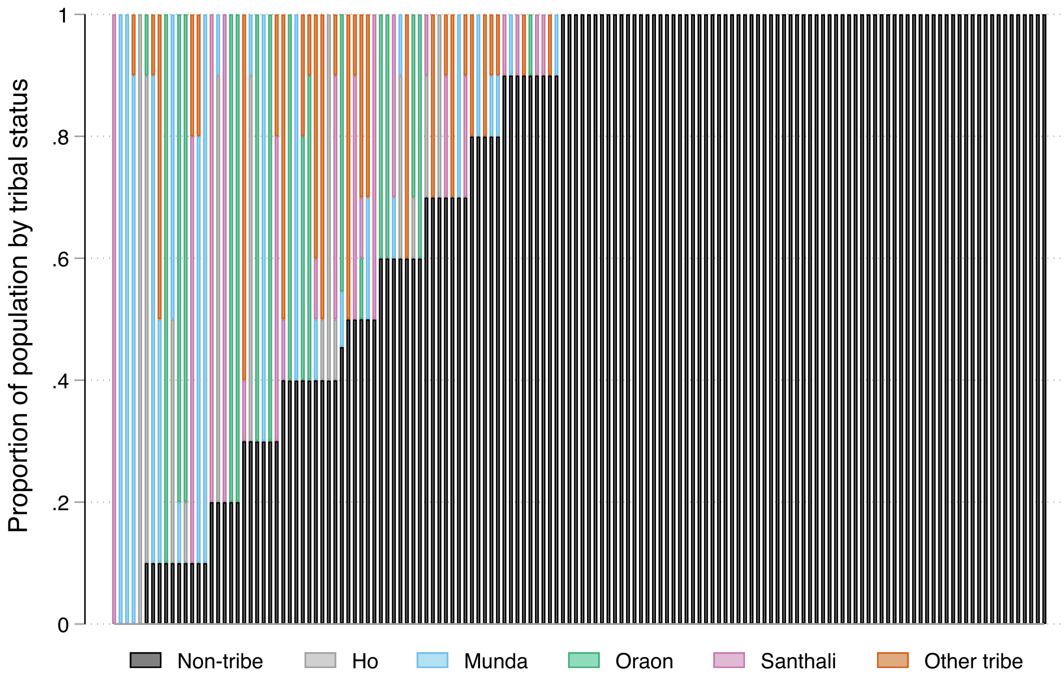

Fig. 2. Distribution of population by village based on tribal status.

an additional check, we implement the two-stage estimation approach suggested by Lewbel [59]. The results remain about the same (Table A15). For completeness, we replicate our results with district fixed effects as well.

To quantify inequality, we estimate linear models of the following kind:

$$Y_i = \beta \mathrm{ST}_i + \gamma \mathrm{SC}_i + \lambda \mathrm{OBC}_i + \mathbf{X}_i{}'\Gamma + \tau_j + \varepsilon_i,$$

where *ST* stands for Scheduled Tribe, *SC* for Scheduled Caste *OBC* for Other Backward Caste, **X** contains the confounders listed above, τ_j is a village or district fixed effect.

The primary outcome (Y) is a dichotomous indicator that takes value 1 for households that have some kind of electricity connection. Besides access, we also model the number of hours of electricity available per day (from 0 to 24), the total wattage of appliances owned by the household, and whether a household benefited from Saubhagya or not (1 if it is the case, zero otherwise).

Using the general population as the reference baseline category, our parameter of interest is β. This parameter tells us the difference in electricity access between a typical tribal respondent and a member of the general population. For completeness, we also estimate the effect of being part of a Scheduled Caste or Other Backward Classes. The models are estimated with ordinary least squares (our main results remain similar when estimated as conditional logit; see Table A13). Standard errors are clustered at the village level to account for correlations in unobserved shocks within villages.

5. Results

We begin our analysis by providing descriptive statistics for our sample. We start with Table 3 which indicates whether a household has access to electricity from any source. This could be from (and predominantly is) the grid, but in rarer cases could stem from solar home systems or other off-grid technology. We can see that Scheduled Tribes are considerably less likely to benefit from any electric connection than the general population. About 18% are unconnected among tribal respondents, against only 9% in the general population. The gap is about 9 percentage points. We note that Scheduled Caste members suffer from a similar situation.

Table 3
Cross-tab: socioeconomic groups and electricity access (in percentage). Weighted sample.

Does this household have electricity access?	SC	ST	General	Other Backward Class	Total
No	17.2	17.7	8.9	9.0	12.8
Yes	82.8	82.3	91.1	91.0	87.2
Total	100	100	100	100	100

We next examine whether these discrepancies remain observable when we account for village fixed effects and other potential confounding factors. The results of our analysis are reported in Table 4. See Tables A2 to A5 for the full results with all estimates. We begin with the first three columns, which model electricity access (where 1 means that a household has electricity). We find that our previous estimates of the gap between STs and the general population might have been understated. The adjusted results estimate that the gap stands at about 11 percentage points. The effect is statistically significant at conventional levels. The estimates remain stable whether we explain variation within villages or within districts.

We find little evidence that there is inequality in the quality of supply (measured by the number of daily hours of electricity), conditional on having electricity (see Table 4, Models (4) to (6), as well as Fig. 3). In other words, ST households that do have electricity are not at a disadvantage compared to the general population in terms of the quality of supply. This makes sense given that it would be difficult to discriminate against STs by improving or worsening supply on a household-by-household level. Furthermore, we show that it is not the case that ST households live at a greater distance from urban centers. Using data from the 2011 census, which includes a village's distance to the nearest town, we find no systematic difference between ST households and the general population (Table A8). On the other hand, we find some evidence that tribal households live in smaller villages (Table A9). However, if we reproduce our main results while holding village population

Table 4
Explaining various facets of electricity access. Omitted category: households belonging to the general population. See Tables A2 to A5 for full results. Standard errors clustered by village. Survey weights used to generate estimates. *: 0.1, **: 0.05, ***: 0.01.

Electricity access	Electricity {0,1}			Hours of electricity [0,24]			Appliances Wattage			Saubhagya {0,1}		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ST	−0.11**	−0.11**	−0.09***	−0.39	−0.40	0.02	−168.29***	−153.92**	−106.53**	0.11*	0.10	0.22***
	(0.05)	(0.05)	(0.04)	(0.58)	(0.56)	(0.66)	(63.89)	(62.93)	(50.66)	(0.06)	(0.07)	(0.05)
SC	−0.06	−0.06	−0.08**	0.73	0.74	0.36	−60.63	−43.27	−10.24	0.04	0.04	0.02
	(0.04)	(0.04)	(0.04)	(0.58)	(0.57)	(0.50)	(121.15)	(116.45)	(89.84)	(0.06)	(0.06)	(0.06)
Other Backward Class	−0.01	−0.01	−0.01	0.26	0.17	−0.05	−105.45*	−133.98**	−14.74	0.05	0.06	−0.03
	(0.03)	(0.03)	(0.03)	(0.42)	(0.41)	(0.52)	(62.32)	(60.59)	(62.28)	(0.06)	(0.05)	(0.05)
Expenditure (log)		✓	✓		✓	✓		✓	✓		✓	✓
Age		✓	✓		✓	✓		✓	✓		✓	✓
Gender		✓	✓		✓	✓		✓	✓		✓	✓
Education		✓	✓		✓	✓		✓	✓		✓	✓
Village FE	✓	✓		✓	✓		✓	✓		✓	✓	
District FE			✓			✓			✓			✓
Observations	1440	1440	1440	1250	1250	1250	1254	1254	1254	1007	1007	1007
# Villages	144	144	144	142	142	142	142	142	142	141	141	141
R^2	0.01	0.02	0.08	0.01	0.02	0.30	0.01	0.07	0.13	0.01	0.01	0.21
Mean of DV	0.87			9.94			403.33			0.40		
SD of DV	0.34			5.60			623.25			0.49		

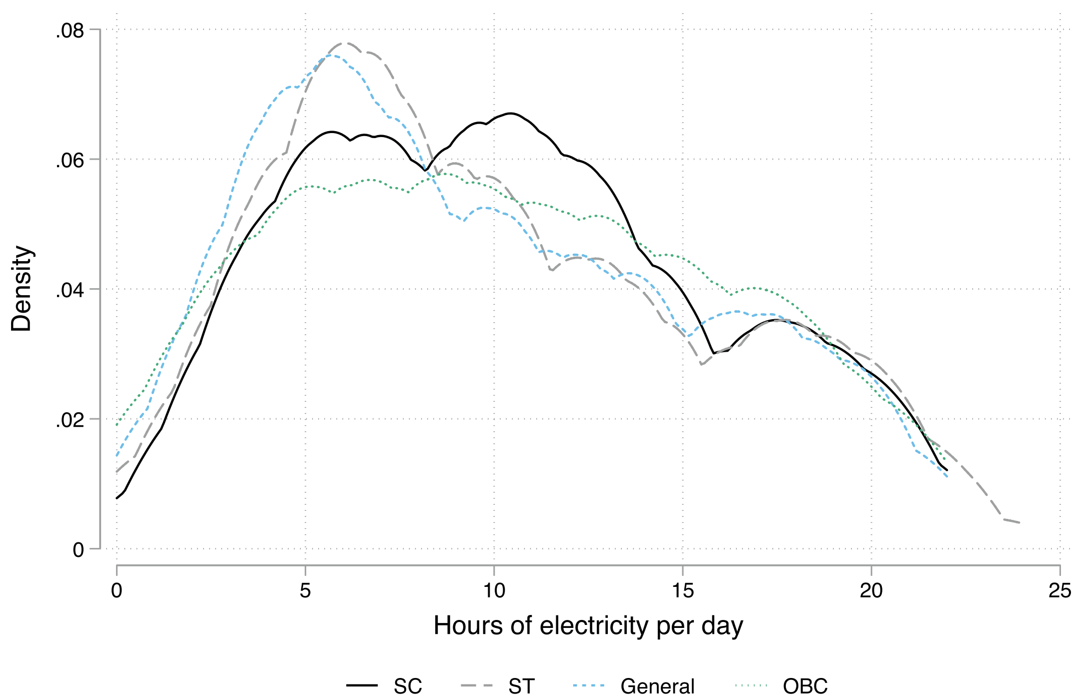

Fig. 3. Distribution of hours of electricity per day, by socioeconomic group (based on our survey data).

size constant, we find that the same patterns as those presented so far remain (Table A10).

Our third outcome models appliances capacity (models 7 to 9). Here, we find again evidence that STs are at a disadvantage. The sum total of appliances owned by an ST household is about 130 to 180 watts lower than a household belonging to the general population. ST households not only are in a worse situation at the extensive margin, but also at the intensive margin. These results are robust when we use alternative measures of capacity (an index of appliance ownership), as shown in Table A7.

We explore individual appliances in greater details in Fig. 4. This figure shows the relation probability of owning a given appliance for an ST household compared on one from the general population. As we can see, STs are less likely to own most appliances, with the exception of incandescent bulbs – the lighting source of poorest quality among those listed. The lower prevalence of LED lights is particularly striking, since more than 13 million LED bulbs were distributed in Jharkhand under the UJALA scheme.[12] There are several reasons that could explain this finding. Households requesting LEDs under UJALA need to have a metered connection to be eligible.[13] We find that only about half of ST

[12] Data from the UJALA dashboard, available at http://www.ujala.gov.in/state-dashboard/jharkhand (accessed on April 28, 2020).

[13] See UJALA's website for details about eligibility (http://www.ujala.gov.in/FAQ) (accessed on April 28, 2020).

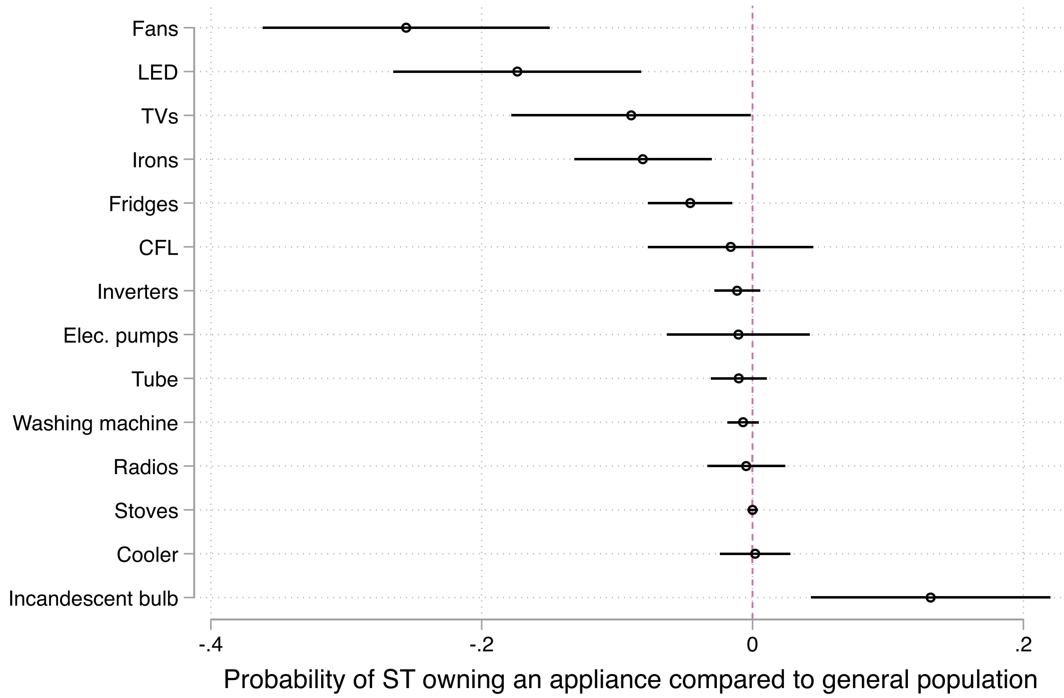

Fig. 4. Probability of owning various appliances for ST households compared to the general population. The point estimates are obtained from a model that includes all other categories (where the general population serves as the baseline; other coefficients not reported) and district fixed effects. Standard errors clustered by village. Survey weights included.

households have a meter. Furthermore, UJALA also requires a government ID and, in some cases, an electric bill. Possibly, ST households may be less likely to have these two items.

Overall, these findings confirm the existence of inequality not only at the extensive margin (in terms of connection rates) but also at the intensive margin (in terms of consumption). We can relate these results to our theoretical model. Electricity access, as we show here, matches social cleavages. Members of groups that are politically marginalized suffer from higher energy poverty than members from other groups. In this context, energy inequality across groups matches broader social inequality that characterizes parts of India [5–7].

Finally, we find some evidence that ST respondents were more likely to get connected under Saubhagya. The effect is about 11 percentage points in Model (10) and (11), though its precision varies. We find that the effect remains about the same once control variables and fixed effects are included, but the standard errors grow. One potential reason for this is that one may expect Saubhagya to benefit several households within hitherto unconnected villages at the same time. This would make within-village variation unlikely to detect differences in Saubhagya access. To check whether this intuition is corroborated by the data, we replicate Model (11) with district (instead of village) fixed effects (Model 12). And indeed, once we look at variation within districts, we find that ST respondents were considerably more likely to benefit from Saubhagya. The effect is estimated at about 23 percentage points.

This raises the question of whether ST households benefited from a form of positive discrimination. Were they purposefully targeted to reduce electricity inequality? We interviewed energy experts and a former DISCOM official from Jharkhand to understand whether STs might have benefited from positive discrimination. The general view was that ST households had not been targeted. Instead, they believed that the higher probability of STs to benefit from Saubhagya was a consequence of their higher degree of poverty and lower probability of having electricity in the first place. Thus, Saubhagya may have reduced inequality by design rather than because of biased implementation. As such, Saubhagya seems to differ from RGGVY [17].

In the appendix, we verify the robustness of our findings by replicating our main analysis using the ACCESS data [42]. We find similar patterns on electricity access across the six states considered in that survey (Table A11). The survey was conducted as Saubhagya was implemented, and thus data on electrification from this program was preliminary. However, we find evidence that ST and SC both benefited more from it in these states.

Next, we disaggregate tribes and examine whether they suffer to varying degrees from poor electricity access. This is done for completeness; we did not have specific expectations about variation across tribes. These results are exploratory and we did not formulate expectations about the relative inequality among tribes. Our interest in this question stems from the observation that Indian officials believe tribal communities to be "egalitarian and undifferentiated" 63 [49]. The results are reported in Table 5 and visualized in Fig. 5. Starting with electricity access (Models (1) and (2)), we find that all major tribes suffer from similar disadvantage compared to the general population. The effect ranges from about 5 percentage points (Munda) to 17 (members of other tribes). The effect is generally insignificant, which is not surprising given the small number of observations in each category.

Furthermore, we also find that for most part all tribes benefited similarly from Saubhagya, with the exception of the members of the Ho tribe. Fig. 6 shows that other tribes were substantially more likely to have received their connection from Saubhagya.

6. Conclusion

In this paper, we discussed and developed the concept of electricity inequality. Our motivation stemmed from the fact that even when electricity access improves on average, some vulnerable communities may still lag behind, increasing the gap between the "haves" and the "have nots." We hypothesized that this may be particularly the case in societies with deep social cleavages. Using original survey from Jharkhand, we show it to be the case in a state that has strong demarcation lines along tribal communities. Tribal households are considerably less likely to benefit from electric access. Furthermore, they own fewer appliances. The lack of LED bulbs is particularly noticeable, given that the

Table 5
Explaining various facets of electricity access. Omitted category: households belonging to the general population. See Table A6 for full results with all point estimates. Standard errors clustered by village. Survey weights used to generate estimates. *: 0.1, **: 0.05, ***: 0.01.

Electricity access: Inequality across tribes	Electricity {0,1}		Hours of electricity [0,24]		Appliances Wattage		Saubhagya {0,1}	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ho	−0.11	0.01	2.24	1.46	−180.41***	−85.66*	0.02	0.03
	(0.09)	(0.07)	(1.43)	(1.05)	(42.63)	(48.17)	(0.08)	(0.16)
Munda	−0.05	−0.07*	−1.42	−0.78	−193.67***	−105.00	0.27***	0.25***
	(0.04)	(0.04)	(1.06)	(0.76)	(68.31)	(70.46)	(0.09)	(0.07)
Oraon	−0.06	−0.07	0.62	0.63	−74.26	−144.49*	0.35***	0.20**
	(0.06)	(0.05)	(1.57)	(1.39)	(64.21)	(77.08)	(0.08)	(0.09)
Santhali	−0.10	−0.09	0.53	−0.16	−156.55***	−110.11	0.23***	0.28***
	(0.06)	(0.06)	(1.17)	(1.16)	(53.90)	(70.65)	(0.07)	(0.08)
Other tribes	−0.17*	−0.17*	0.76	−0.23	−88.03	−62.05	0.16**	0.25***
	(0.09)	(0.09)	(1.25)	(0.73)	(81.96)	(108.70)	(0.08)	(0.08)
Other Backward Class	−0.00	−0.01	0.41	−0.07	8.48	−14.17	−0.03	−0.03
	(0.03)	(0.03)	(0.67)	(0.52)	(62.49)	(62.53)	(0.06)	(0.05)
SC	−0.08**	−0.08**	0.43	0.34	−7.83	−10.21	0.02	0.02
	(0.04)	(0.04)	(0.66)	(0.50)	(85.36)	(89.81)	(0.06)	(0.06)
Expenditure (log)		✓		✓		✓		✓
Age		✓		✓		✓		✓
Gender		✓		✓		✓		✓
Education		✓		✓		✓		✓
District FE		✓		✓		✓		✓
Observations	1440	1440	1250	1250	1254	1254	1007	1007
# Villages	144	144	142	142	142	142	141	141
R^2	0.02	0.09	0.01	0.30	0.01	0.13	0.06	0.21
Mean of DV	0.87		9.94		403.33		0.40	

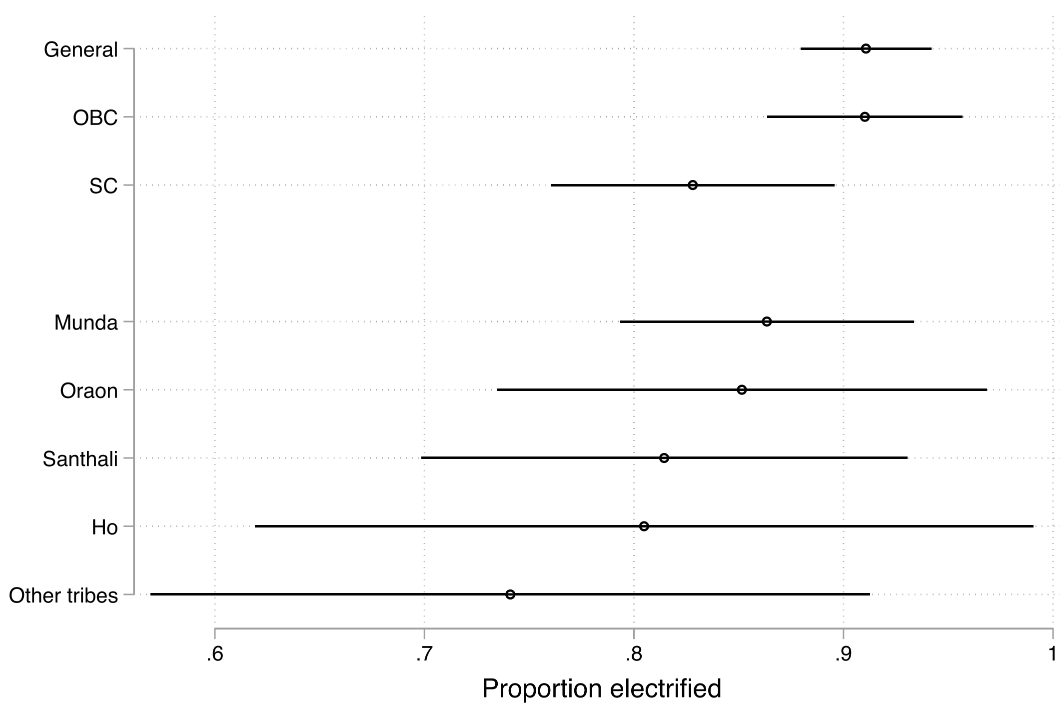

Fig. 5. Electrification rates by tribal group. Estimates from a regression of electrification {0, 1} on tribal status, without a constant included in the model. Survey weights used to generate estimates.

UJALA scheme was supposed to improve access to them. We find no evidence that geographic factors can explain differences between tribal households and the general population, suggesting that inequality has other sources. Yet we also found ground for optimism: Saubhagya, a program designed to improve electricity access (especially among the poor) disproportionately benefited tribal households. Thus, there is evidence that it helped reduce electricity inequality.

We must however stress that the generalizability of these findings may be limited. Policy remains endogenous to the political process. As such, whether other governments may use similar policy design will depend on the political cleavages that they face. Furthermore, even a well-designed policy may be rendered ineffective when governments fail to support it. What our paper shows is primarily that it seems possible, under ideal conditions, for a policy to cut inequality in electricity access.

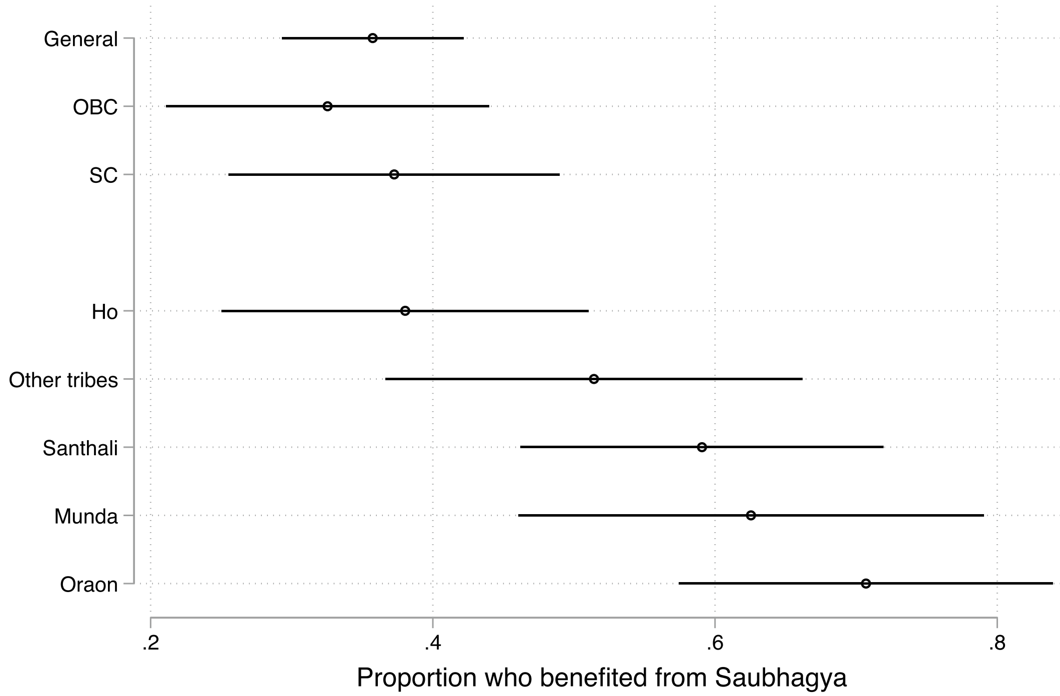

Fig. 6. Electrification rates by tribal group. Estimates from a regression of benefiting from Saubhagya $\{0,1\}$ on tribal status, without a constant included in the model. Survey weights used to generate estimates.

The implications of this study are twofold. First, we show that large scale policies, such as Saubhagya, can work. They can effectively provide electricity access to vulnerable communities. Using back-of-the-envelope calculations, we may estimate that the gap between tribal and non-tribal households might have been twice as large, were it not for Saubhagya. This is an encouraging sign that aggressive government action can reduce energy inequalities.

Yet the question remains open whether the lessons from Saubhagya can easily be translated in other contexts. In other words, are our findings about this particular policy valid elsewhere? We note here that some features of Saubhagya, such as its transparent eligibility criteria, would probably be valuable in other contexts. Public spending programs are often politicized and used to curry political favors, especially in countries with weak institutions and poor legal systems [60,61]. The same has been a problem for energy policies. Corruption and weak political capacity have historically hurt the development of energy infrastructures [9]. From a policy design standpoint, there is little to be said against reducing the risks of mismanagement. A government can always manipulate eligibility rules, but doing so is more difficult when the rules are transparent.

In Jharkhand and India, our findings point to the importance of interventions that specifically target Scheduled Tribe and other vulnerable communities [28]. While Saubhagya reduced inequality, it did not eliminate it entirely. With Scheduled Tribes often clustered in isolated communities, fully bridging the electricity access gap requires dedicated strategies. First, both the central and state governments should conduct a detailed mapping of the status of electricity access - household connections, quality of service, and affordability - among Scheduled Tribes. Such a study would enable government officials to focus on key districts and sub-districts. Second, in remote communities and difficult terrains, distributed power generation merits attention. Given the low power demand and appliance use in many Scheduled Tribe communities, distributed power generation can offer immediate electricity access at a low cost to communities where grid infrastructure is difficult to extend and maintain. Finally, to increase electricity use, policymakers can use public procurement programs to significantly reduce the cost of electric appliances and then make them available in marginalized communities. Government of India's mass procurement program for LED lights shows that mobilizing public resources to create demand for electric appliances can transform the market in terms of availability and affordability.

A push might also be needed to increase electricity consumption. The lack of appliance ownership must be addressed if these populations are to capitalize on the benefits of electricity access. Our study cannot provide the reasons for this particular inequality, but hypotheses include the cost of appliances, their availability at local markets, and other obstacles of that kind. Such barriers can be reduced via active public programs, such as subsidized cost. At the same time, if inequality in electricity consumption finds its origins in social biases, then another set of policies might be required. Future research on this topic would be particularly beneficial for these disadvantaged populations.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.erss.2021.102132. A replication package is available at: https://doi.org/10.7910/DVN/PYSTIM.

References

[1] IEA, Energy access outlook 2017: From poverty to prosperity, World Energy Outlook Special Report (2017).
[2] Michaël Aklin, S.P. Harish, Johannes Urpelainen, A global analysis of progress in household electrification, Energy Policy 122 (2018) 421–428.
[3] Seymour Martin Lipset, Stein Rokkan, Party systems and voter alignments: Cross-national perspectives, Free press, New York, 1967.
[4] Hanspeter Kriesi, The transformation of cleavage politics the 1997 stein rokkan lecture, Eur. J. Political Res. 33 (2) (1998) 165–185.
[5] Lloyd I Rudolph, Susanne Hoeber Rudolph, The political role of india's caste associations, Pacific Affairs 33 (1) (1960) 5–22.

[6] Lloyd I Rudolph, Susanne Hoeber Rudolph, The modernity of tradition: Political development in India, University of Chicago Press, Chicago, 1984.
[7] Pradeep K. Chhibber, Democracy without associations: Transformation of the party system and social cleavages in India, University of Michigan Press, Ann Arbor, 2001.
[8] John Briscoe, Energy use and social structure in a bangladesh village, Popul. Dev. Rev. (1979) 615–641.
[9] Michaël Aklin, Patrick Bayer, S.P. Harish, Johannes Urpelainen, Escaping the Energy Poverty Trap: When and How Governments Power the Lives of the Poor, MIT Press, Cambridge, MA, 2018.
[10] Benjamin K. Sovacool, The political economy of energy poverty: A review of key challenges, Energy for Sustainable Development 16 (3) (2012) 272–282.
[11] Brian Min, Miriam Golden, Electoral cycles in electricity losses in india, Energy Policy 65 (2014) 619–625.
[12] Vicent Alcantara, Juan Antonio Duro, Inequality of energy intensities across oecd countries: a note, Energy Policy 32 (11) (2004) 1257–1260.
[13] Kang Li, Bob Lloyd, Xiao-Jie Liang, Yi-Ming Wei, Energy poor or fuel poor: What are the differences? Energy Policy 68 (2014) 476–481.
[14] Government of India. 2011 census. Census database, 2011a.
[15] Kanchan Chandra, Why ethnic parties succeed: Patronage and ethnic head counts in India, Cambridge University Press, New York, 2007.
[16] Kevin Macdonald, Indigenous peoples, poverty, and development, Cambridge University Press, New York, 2012.
[17] Michaël Aklin, Chao-yo Cheng, Johannes Urpelainen, Inequality in policy implementation: Caste and electrification in rural india, J. Public Policy (2020).
[18] Marie Claude Jacmart, Maryse Arditi, Irène Arditi, The world distribution of commercial energy consumption, Energy Policy 7 (3) (1979) 199–207.
[19] Ming Meng, James E. Payne, Junsoo Lee, Convergence in per capita energy use among oecd countries, Energy Economics 36 (2013) 536–545.
[20] Adolfo Maza, José Villaverde, The world per capita electricity consumption distribution: Signs of convergence? Energy Policy 36 (11) (2008) 4255–4261.
[21] Brenda Boardman, Fuel poverty: from cold homes to affordable warmth, Pinter Pub Limited, London, 1991.
[22] Richard Moore, Definitions of fuel poverty: Implications for policy, Energy Policy 49 (2012) 19–26.
[23] Ute Dubois, Helena Meier, Energy affordability and energy inequality in europe: Implications for policymaking, Energy Res. Social Sci. 18 (2016) 21–35.
[24] Anne Schiffer, Empowered, excited, or disenfranchised? unveiling issues of energy access inequality and resource dependency in the gambia, Energy Res. Social Sci. 18 (2016) 50–61.
[25] Marcio Giannini Pereira, Marcos Aurélio Vasconcelos Freitas, and Neilton Fidelis da Silva. The challenge of energy poverty: Brazilian case study. Energy Policy, 39 (1): 167–175, 2011.
[26] Kristen A Carpenter, Jacquelyn Amour Jampolsky, Indigenous peoples: From energy poverty to energy empowerment, in: International Energy and Poverty, Routledge, London, 2015, pp. 63–76.
[27] James Anaya, Indigenous Peoples in International Law, Oxford University Press, USA, New York, 2004.
[28] Jacquelyn Amour Jampolsky, Activism is the new black-demonstrating the benefits of international celebrity activism through james cameron's campaign against the belo monte dam, Colorado J. Int. Environ. Law Policy 23 (2012) 227.
[29] Lakshman Guruswamy, Energy justice and sustainable development, Colorado J. Int. Environ. Law Policy 2 (2010) 231–276.
[30] Taryn Dinkelman, The effects of rural electrification on employment: New evidence from South Africa, Am. Econ. Rev. 101 (7) (2011) 3078–3108.
[31] Dominique Van de Walle, Martin Ravallion, Vibhuti Mendiratta, and Gayatri Koolwal. Long-term impacts of household electrification in rural india. World Bank Policy Research Working Paper 6527, 2013.
[32] Maximilian Auffhammer, Catherine D Wolfram, Powering up china: Income distributions and residential electricity consumption, Am. Econ. Rev. 104 (5) (2014) 575–580.
[33] Jennifer Richmond, Johannes Urpelainen, Electrification and appliance ownership over time: Evidence from rural india, Energy Policy 133 (2019), 110862.
[34] Meital Rosenberg, Daniel Armanios, Michaël Aklin, Paulina Jaramillo, Energy embeddedness: Distinguishing between electricity access and use through a mixed methods study of electricity consumption patterns amongst women in india, Working Paper (2018).
[35] Shahidur R Khandker, Douglas F Barnes, Hussain A Samad, Are the energy poor also income poor? evidence from india, Energy Policy 47 (2012) 1–12.
[36] Shahidur R Khandker, Hussain A Samad, Rubaba Ali, and Douglas F Barnes. Who benefits most from rural electrification? evidence in india. The Energy Journal, 35 (2), 2014.
[37] Meir Alkon, S.P. Harish, and Johannes Urpelainen. Household energy access and expenditure in developing countries: Evidence from india, 1987–2010. Energy for Sustainable Development, 35: 25–34, 2016.
[38] Sudeshna Ghosh Banerjee, Douglas Barnes, Bipul Singh, Kristy Mayer, and Hussain Samad. Power for all: Electricity access challenge in India. World Bank, Washington, DC, 2014.
[39] Sunila S. Kale, Electrifying India: Regional Political Economies of Development, Stanford University Press, Stanford, 2014.
[40] Karthik Ganesan, Kapardhi Bharadwaj, and Kanika Balani. Electricity consumers and compliance. Shakti and CEEW, February 2019.
[41] Anthony P. Heynen, Paul A. Lant, Simon Smart, Srinivas Sridharan, and Chris Greig. Off-grid opportunities and threats in the wake of india's electrification push. Energy, Sustainability and Society, 9 (1), 2019.
[42] Abhishek Jain, Saurabh Tripathi, Sunil Mani, Sasmita Patnaik, Tauseef Shahidi, and Karthik Ganesan. Access to clean cooking energy and electricity: Survey of states. Council on Energy, Environment, and Water report, November 2018, 2018.
[43] World Bank, Jharkhand: Poverty, growth and inequality. India State, Briefs (2016).
[44] Maitreyi Das, Gillette H. Hall, Soumya Kapoor, Denis Nikitin, Indigenous peoples, poverty, and development, Cambridge University Press, New York, 2012.
[45] K.M. Singh, M.S. Meena, R.K.P. Singh, Abhay Kumar, and Anjani Kumar. Rural poverty in jharkhand, india: An empirical study based on panel data. MPRA Paper 45258, March 2012.
[46] World Bank. Jharkhand: Social inclusion. India State Briefs, 2016b.
[47] Damodar Sahu, Saritha Nair, B.K. Lucky Singh, Gulati, and Arvind Pandey. Levels, trends & predictors of infant & child mortality among scheduled tribes in rural india, Indian J. Med. Res. 141 (5) (2015) 709–719.
[48] Ipshita Basu, The politics of recognition and redistribution: Development, tribal identity politics and distributive justice in india's jharkhand, Dev. Change 43 (6) (2012) 1291–1312.
[49] Stuart Corbridge, Competing inequalities: The scheduled tribes and the reservations system in india's jharkhand, J. Asian Studies 59 (1) (2000) 62–85.
[50] Stuart Corbridge, The continuing struggle for india's jharkhand: democracy, decentralisation and the politics of names and numbers, Commonwealth Comparative Politics 40 (3) (2002) 55–71.
[51] Kuntala Lahiri-Dutt, Radhika Krishnan, Nesar Ahmad, Land acquisition and dispossession: private coal companies in jharkhand, Economic Political Weekly 47 (6) (2012) 39–45.
[52] Bigsna Gill, Astha Gupta, and Debrajit Palit. Rural electrification: Impact on distribution companies in india. Shakti and TERI Report, 2019.
[53] Sefa Awaworyi Churchill, Russell Smyth, Ethnic diversity, energy poverty and the mediating role of trust: Evidence from household panel data for australia, Energy Economics 86 (2020), 104663.
[54] Vibhor Saxena, Prabir C. Bhattacharya, Inequalities in lpg and electricity consumption in india: The role of caste, tribe, and religion, Energy Sustainable Dev. 42 (2018) 44–53.
[55] Setu Pelz, Namrata Chindarkar, Johannes Urpelainen, Energy access for marginalized communities: Evidence from rural north india, 2015–2018, World Dev. 137 (2021), 105204.
[56] Government of India. Jharkhand profile. Census Info India 2011, 2011b.
[57] Michaël Aklin, Chao-yo Cheng, Johannes Urpelainen, Karthik Ganesan, Abhishek Jain, Factors affecting household satisfaction with electricity supply in rural india, Nature Energy 1 (2016) 1–6.
[58] Shalu Agrawal, Nidhi Bali, Johannes Urpelainen, Sidhartha Vermani, Rural electrification in india: Customer behaviour and demand, in: Smart Power India & Initiative for Sustainable Energy Policy, 2019.
[59] Arthur Lewbel, Using heteroscedasticity to identify and estimate mismeasured and endogenous regressor models, Journal of Business & Economic Statistics 30 (1) (2012) 67–80.
[60] Bruce Bueno de Mesquita, Alastair Smith, Randolph M. Siverson, and James D. Morrow. The Logic of Political Survival. MIT Press, Cambridge, 2003.
[61] Rafael La Porta, Florencio Lopez de Silanes, and Andrei Shleifer. The economic consequences of legal origins. Journal of Economic Literature, 46 (2): 285–332, June 2008.