

24x7 Power for All in Bihar

Strategies for on-ground action based on ACCESS 2015

BY SAURABH TRIPATHI AND ABHISHEK JAIN



Data from the Ministry of Power shows that despite making progress towards achieving 100 per cent village electrification, Bihar lags considerably in household electrification, with 52 per cent of households still un-electrified. The gap between the rate of village and household electrification is sizeable across several districts in Bihar, notably in Purba Champaran and Gaya, where despite 100 per cent village electrification, the corresponding rate of household electrification is much lower at 32 and 38 per cent, respectively. While the state government's *Har Ghar Bijli Yojana* is ambitious and encouraging, focusing only on household electrification may not be enough, as merely being connected to the grid does not guarantee access to electricity. To ensure 24x7 power for all, the government must go beyond providing electricity connections to attest adequate, sufficient and affordable supply in the state.

To support planning towards improved electricity access in the state of Bihar, the Council on Energy, Environment and Water (CEEW) presents the following findings and recommendations based on a household survey on energy access (referred to as ACCESS) conducted in collaboration with Columbia University in 2015. The survey spanned six states, including Bihar where it was conducted in nine districts of the state, each from one administrative division to represent the geography of the state. The choice of district was random with probability proportional to the population of the district. We surveyed 168 households in Bhagalpur, Khagaria, Kishanganj, Nawada, Patna, Purba Champaran, Samastipur, Siwan and Supaul, amounting to 1511 households across the state. Given the sampling strategy adopted, the survey results are representative of the situation at the district and state levels.

Section 1 of this brief summarises key insights and recommendations from ACCESS. Section 2 focuses on unelectrified households and improving the household electrification rate. Section 3 looks at improving the satisfaction derived from electricity for households.

1. Key insights and recommendations

- Over 50 per cent of unelectrified rural households in Bihar live in habitations with grid electricity. For them, steep upfront cost and recurring monthly cost were the biggest barriers to get an electricity connection.
- Sixty-two per cent of unelectrified households found the monthly cost of grid electricity to be a barrier to electrification, and yet most such households spent much more on kerosene for lighting than they were willing to pay for grid electricity, highlighting a gap in valuing the utility from electricity (notwithstanding its unreliability and limited supply) and the perception that recurring expenditure of electricity is too high to afford. Such gaps in perception need to be bridged by improving supply situation and awareness generation.
- Only seven per cent of electrified households were satisfied with grid supply. Unreliable supply and voltage fluctuations were the main reasons for the dissatisfaction of households. Poor supply situation is also reflected in the fact that while 41 per cent of households were connected to the grid, only 21 per cent used it as their primary source of lighting.
- Supply duration in Purba Champaran and Siwan was much worse than other districts, with around 90 per cent of households receiving supply for eight hours or less in a day.
- Fifty-four per cent of electrified households reported experiencing four or more days of 24-hour black-outs in a typical month.

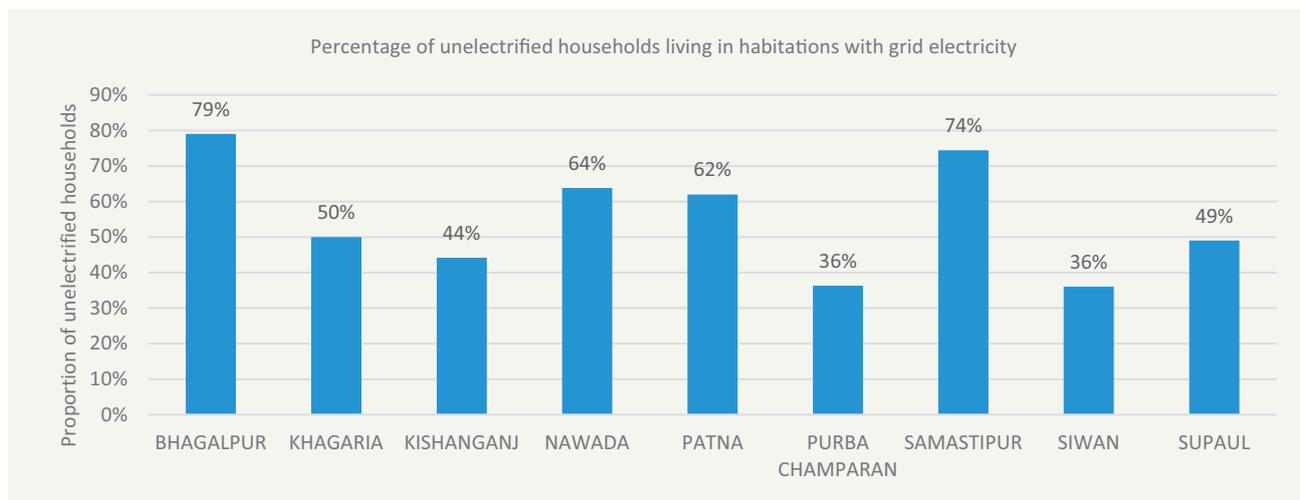
Key recommendations to ensure 24x7 power for all households:

- Organise awareness camps in unelectrified habitations to educate households of the prevailing tariff of grid electricity, as an attempt to amend the general perception of people about the high recurring cost, even when they spend as much if not more on kerosene for lighting.
- Improve maintenance services to reduce occurrence of 24-hour black-out days, and particularly increase the hours of supply (generally, and in the evening) to Siwan and Purba Champaran, where satisfaction with grid electricity was reported very low.
- Improve billing and collection efficiency, particularly in Nawada, Patna and Samastipur, where a large proportion of households with meters were either not paying anything for the grid, or paying a fixed amount instead of receiving variable bills.

2. Reaching out to unelectrified households in rural Bihar

According to ACCESS, in 2015, over half of the unelectrified rural households in Bihar resided in habitations that were already connected to the grid. The electrification of such households could be prioritised to rapidly increase the rate of household electrification, because this is likely to require limited deployment of heavy on-ground infrastructure. As Bhagalpur and Samastipur were the districts with the highest proportion of such households, these could be targeted to rapidly increase the household electrification rate in a short period of time.

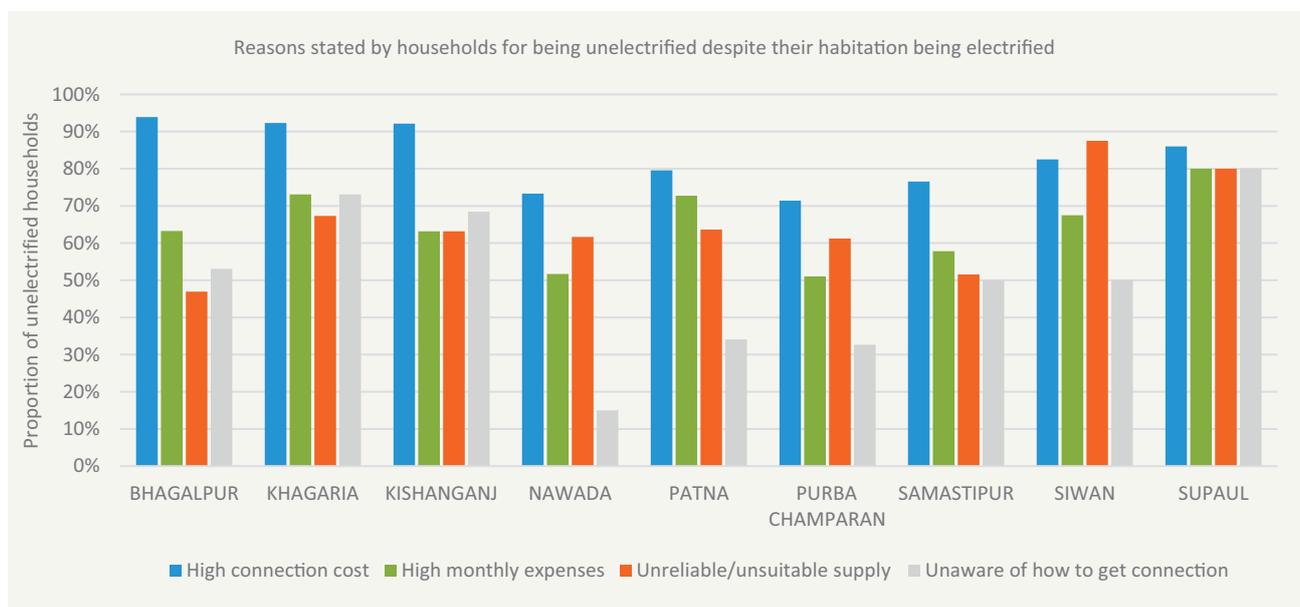
Figure 1: Households in districts like Bhagalpur and Samastipur could be prioritised to rapidly increase the rate of electrification



Source: ACCESS 2015

While this is an immediate opportunity, it is also essential to understand the reason behind so many unelectrified households living in habitations with grid electricity. As reported above, the most important barriers to the adoption of electricity for such households were steep upfront costs, high monthly recurring expenses and unreliable electricity supply.

Figure 2: Steep upfront cost is the most significant barrier to 100 per cent household electrification

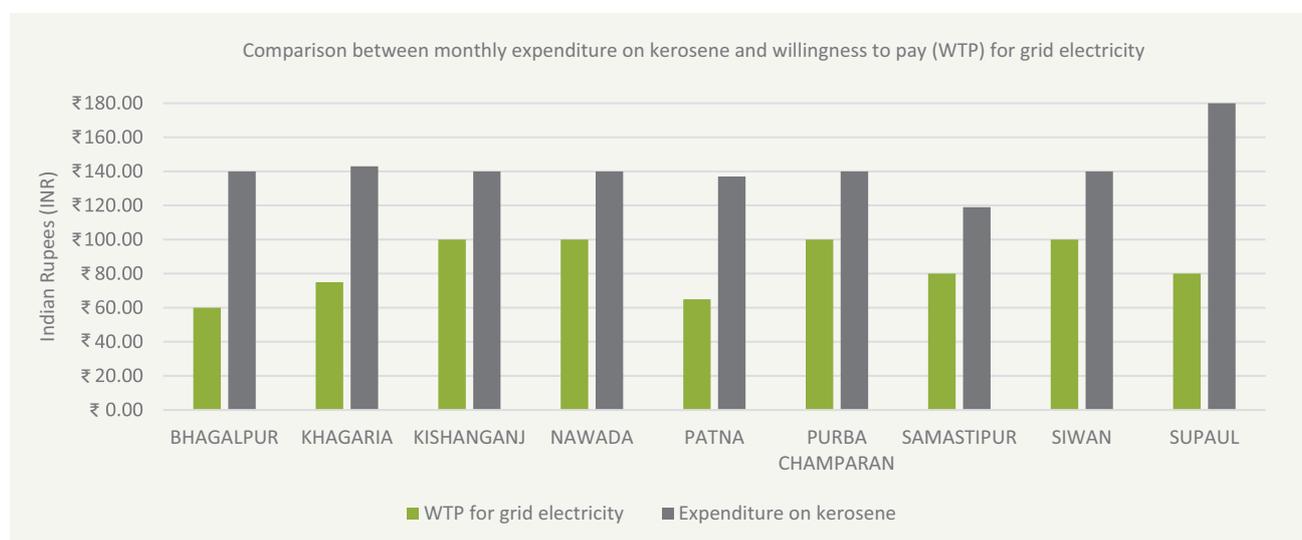


Source: ACCESS 2015

Nearly 85 per cent of BPL households in the state found the cost of connection to be too high, despite being provided highly subsidised connections by the government. This indicates gaps in implementation or awareness, which must be addressed, as 57 per cent of the households who reported upfront cost as a barrier were BPL households. About 72 per cent of APL households also found upfront costs to be too high. This has been addressed to an extent by the *Har Ghar Bijli Yojana*, which started in 2016 and promised free connections to many APL households in rural Bihar. The recently launched *Saubhagya* scheme would further address this challenge.

One final challenge in reaching out to unelectrified households is that of the high perceived expenditure associated with being connected to the grid. While a majority of households stated high recurring monthly expenditure as a barrier to adoption, many of these households spent as much or more on kerosene as their primary source of lighting.

Figure 3: Most households in Bihar were willing to pay less for grid electricity than their existing monthly expenditure on kerosene



Source: ACCESS 2015

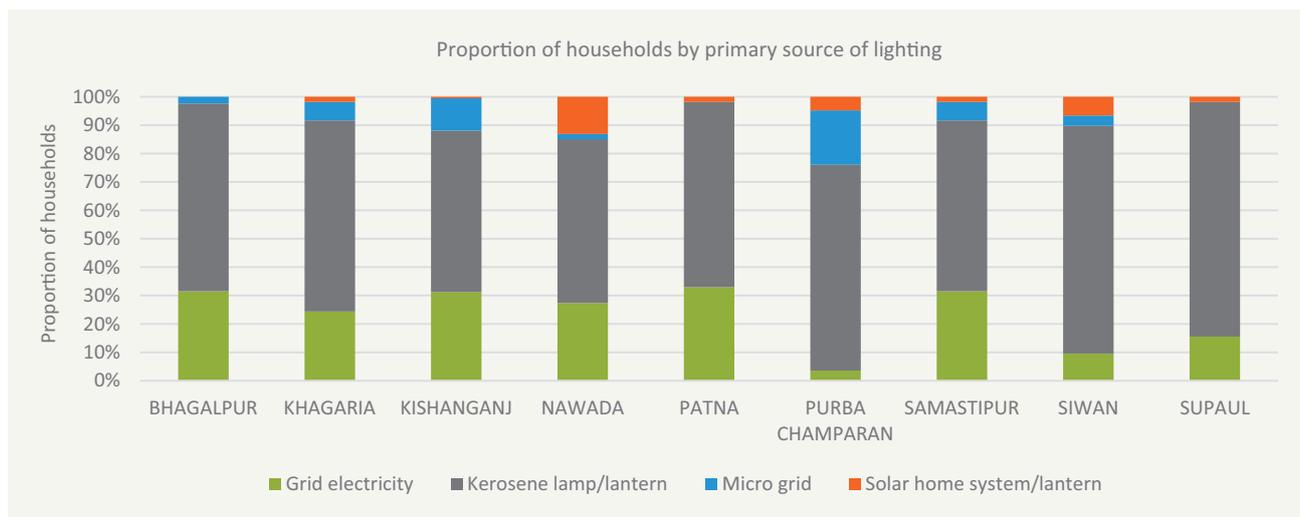
We found that across all districts surveyed, most households were willing to pay a much lesser amount for electricity than their existing expenditure on kerosene. This shows that households in Bihar valued grid electricity lesser than kerosene; possibly a reflection of limited utility being derived from electricity due to its limited, unreliable, and poor-quality supply. This is corroborated with the difference between the number of households with grid connections and the number of households able to use grid electricity as their primary source of lighting in rural areas of Bihar. APL households in Purba Champaran were the only group to value grid electricity higher than kerosene, despite the significantly worse situation of electricity supply in their district vis-à-vis others.

Furthermore, the fact that such households also perceived the recurring cost of grid electricity to be too high, underlines the need for targeted campaigns that increase awareness of the prevailing tariff of grid electricity and how it compares with households' existing expenditure on kerosene. Such interventions must leverage peoples' knowledge of the ill-health effects of using kerosene, which 86 per cent of households in Bihar were cognizant of. Moreover, improving supply in rural areas would help households to value electricity more adequately.

3. Improving electricity access for electrified households

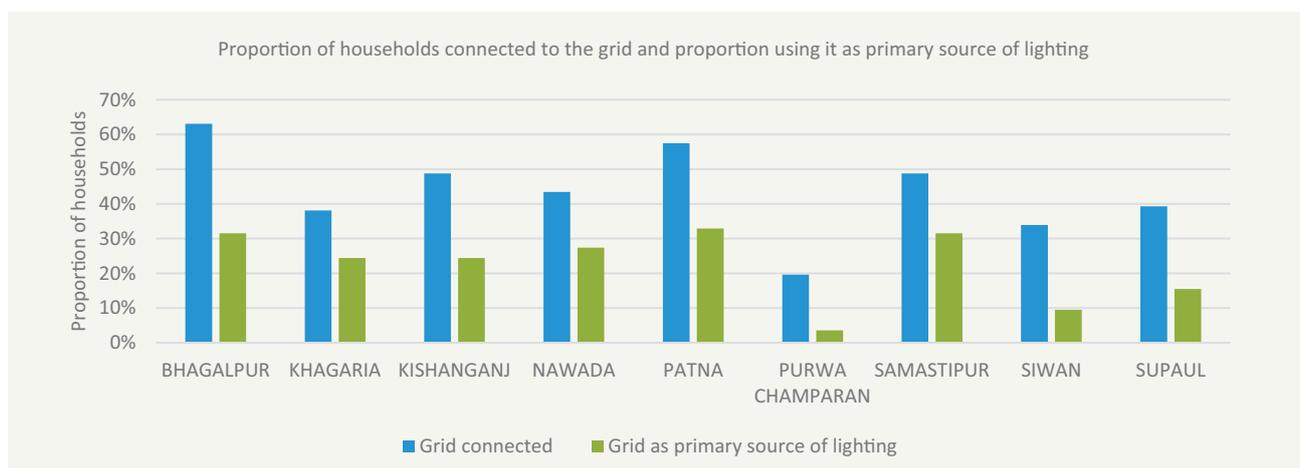
According to ACCESS, despite the fact that 41 per cent of households in Bihar were connected to the grid, nearly two-thirds continued to rely on kerosene lamps or lanterns as their primary source of lighting. The situation was worse in Purba Champaran, Siwan and Supaul, where 72 - 82 per cent of households rely on kerosene. The penetration of micro-grids and solar home systems or lanterns was rather low across the districts, but higher in those that have poor availability of grid electricity.

Figure 4: Over two-thirds of households in Bihar continue to rely on kerosene as their primary source of lighting



Source: ACCESS 2015

Figure 5: Being connected to the grid does not guarantee access to grid electricity



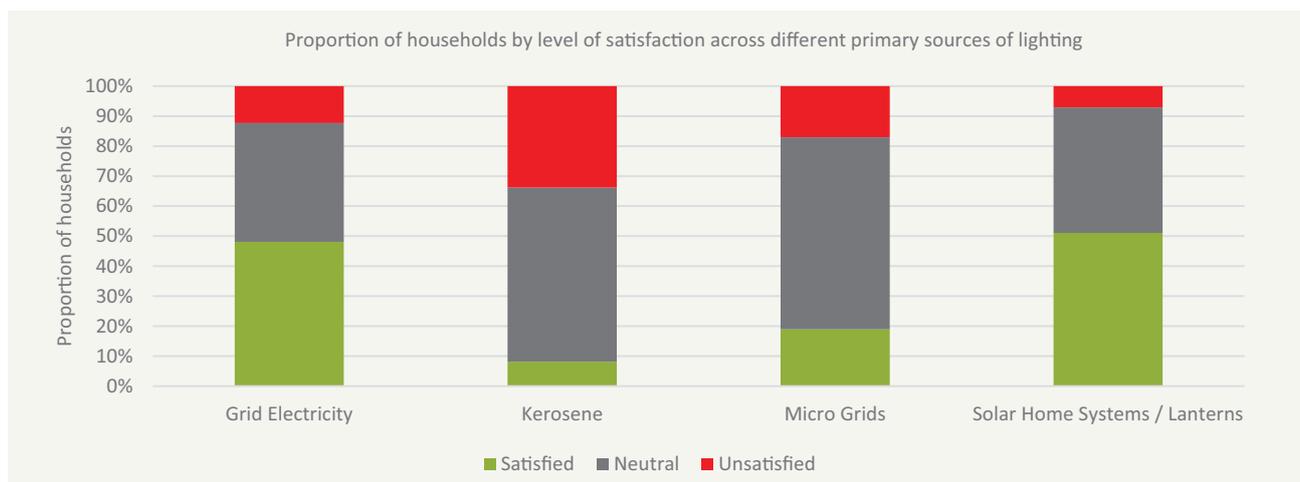
Source: ACCESS 2015

This is well illustrated by the fact that while 41 per cent of the rural households in Bihar were connected to the grid, only 21 per cent used it for their daily lighting needs. In an attempt to bridge this gap, progress must be made to improve the subjective satisfaction that households derive from electrification, and the management of grid electricity as a service. This section explores several critical issues that impact household satisfaction, and the penetration and efficiency of metering.

3.1. Improving the satisfaction of households with electrification

When we analysed satisfaction levels of households with their primary source of lighting, we found that users of solar homes systems and lanterns were more satisfied than users of any other source of lighting, including the grid. This could be because of more reliable performance of these products, or perhaps a higher propensity for tailoring solar solutions to match local needs, given the decentralised nature of such energy systems.

Figure 6: Users of solar-based solutions were more satisfied than other users

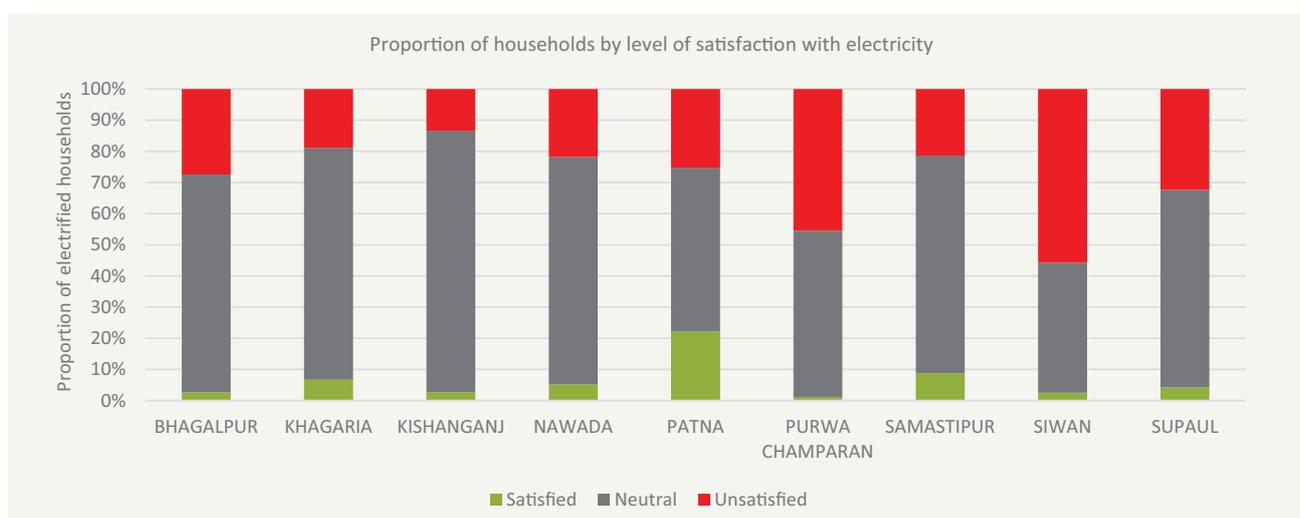


Source: ACCESS 2015

Assessing households’ satisfaction is critical because voters are likely to form policy preferences based on their experiences with various technologies and solutions. Most households in rural Bihar chose the grid, when asked about the preference of the source of lighting. Unelectrified households were generally less interested to see support for the grid and hoped for more support for kerosene, which might be the only lighting option they feel they can rely on, considering their lack of familiarity with decentralised solutions and current perceptions around the reliability of grid electricity. Interestingly in Nawada, despite a small proportion of households using micro-grids for primary lighting needs, well over 20 per cent of electrified and unelectrified households chose government support for micro-grids above all else. Similar patterns emerged in government support for solar home systems and lanterns in Patna and Samastipur. Households were still hopeful of receiving reliable supply from the grid, especially in Purba Champaran, where despite low penetration and poor supply, an over-whelming majority of unelectrified households sought government support for the grid over anything else.

It is, therefore, important to understand where and how grid electricity supply could be improved to provide increased utility to its users. An analysis of the households that have access to electricity showed that less than seven per cent of them were satisfied with their electricity situation. While most respondents were indifferent, in Purba Champaran and Siwan, over 40 per cent were dissatisfied, likely due the combination of various factors, explored below.

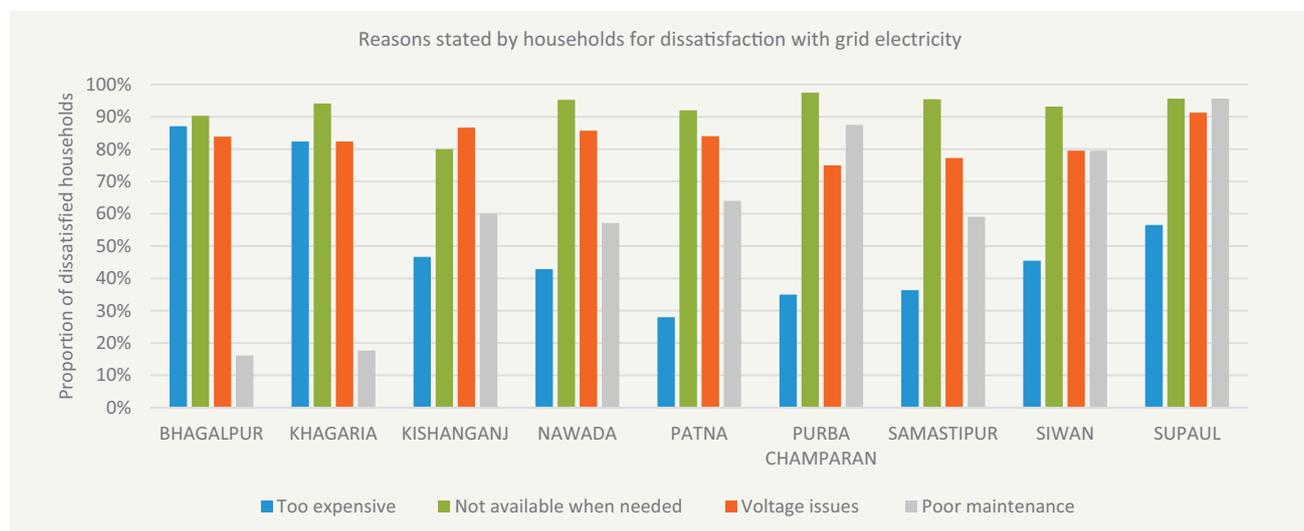
Figure 7: Households in Siwan and Purba Champaran were most dissatisfied with their electricity situation



Source: ACCESS 2015

Poor availability of electricity in the hours of need and voltage fluctuations associated with supply were the biggest reasons for dissatisfaction among electrified households. While most households in Bhagalpur and Khagaria reported finding grid electricity too expensive, those in other districts did not find cost to be material to their dissatisfaction. Identifying these various issues and their relevance in specific districts is important – and the distribution companies must appreciate and resolve these issues through localised strategies at district and village level.

Figure 8: Unreliable supply and voltage fluctuations were the major reasons for dissatisfaction with grid electricity



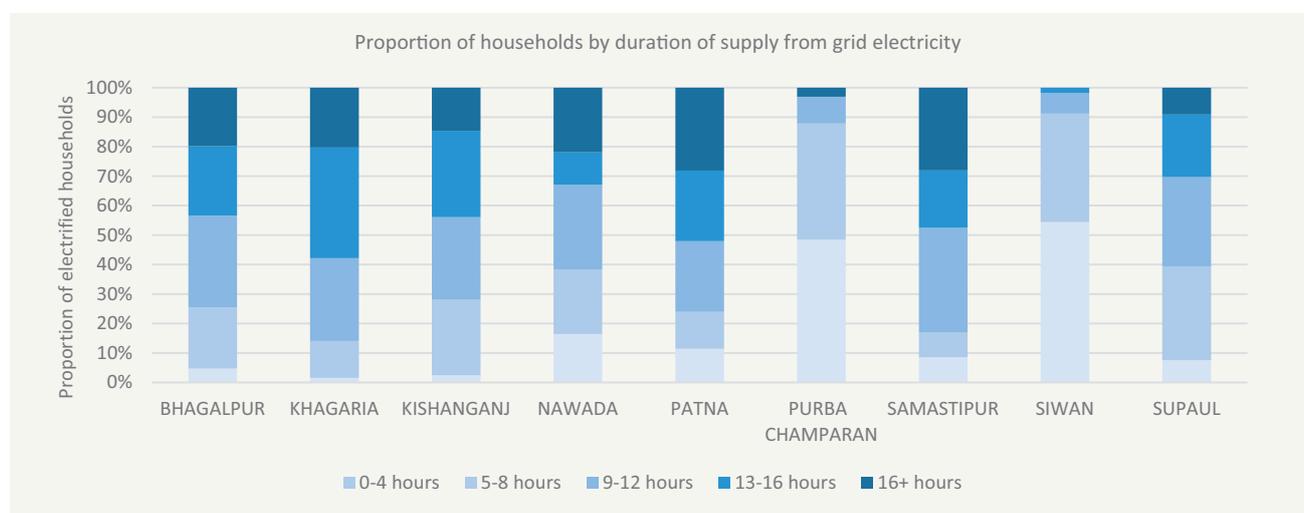
Source: ACCESS 2015

To better understand how the status quo can be improved, we present our findings on the duration, quality and reliability of electricity supply in rural Bihar.

Duration of supply

Households in Bihar received a median supply of just 12 hours of electricity per day. The worst performing districts were Purba Champaran and Siwan, where around 50 per cent of households got four or less hours of electricity per day, and 90 per cent got eight or less hours of supply. Households in Patna and Samastipur were better off, with 30 per cent receiving more than 16 hours of electricity per day.

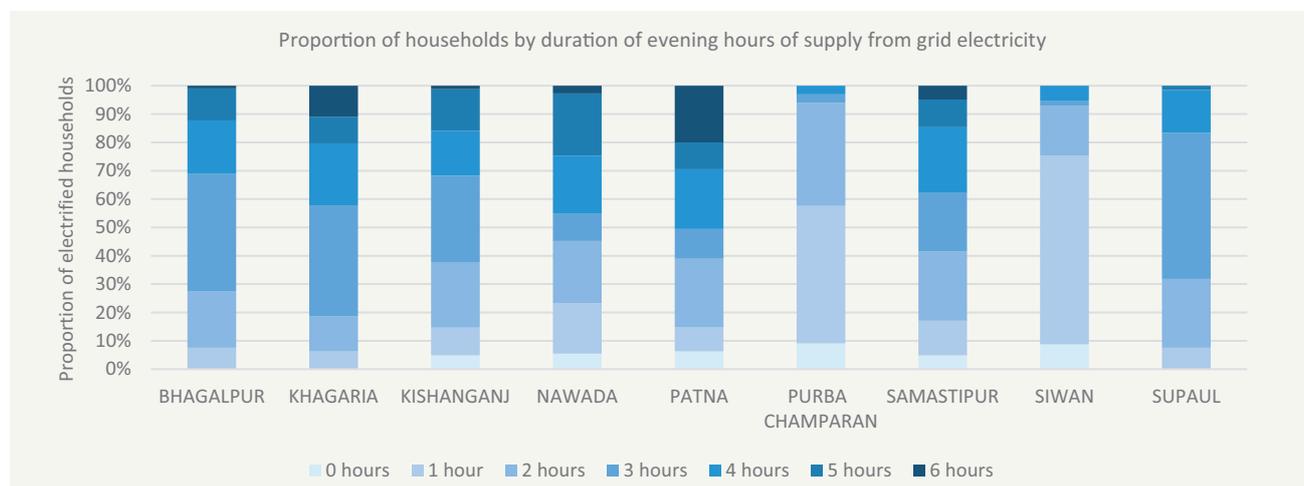
Figure 9: Duration of electricity supply is worst in Purba Champaran and Siwan



Source: ACCESS 2015

Literature suggests that duration of supply (particularly during evening hours) has a strong influence on households' satisfaction from electricity. Households in Bihar experienced around three hours of supply between sunset and midnight, pushing many to use kerosene for lighting at night. Supply during evening hours was particularly poor in Purba Champaran and Siwan, with Bhagalpur and Khagaria doing much better. Households in Patna experienced highly unequal supply during evening hours, with 20 per cent receiving six hours and nearly 40 per cent receiving two hours or less.

Figure 10: Except Khagaria and Patna, over 90 per cent of households in other districts did not receive sufficient power in the evening



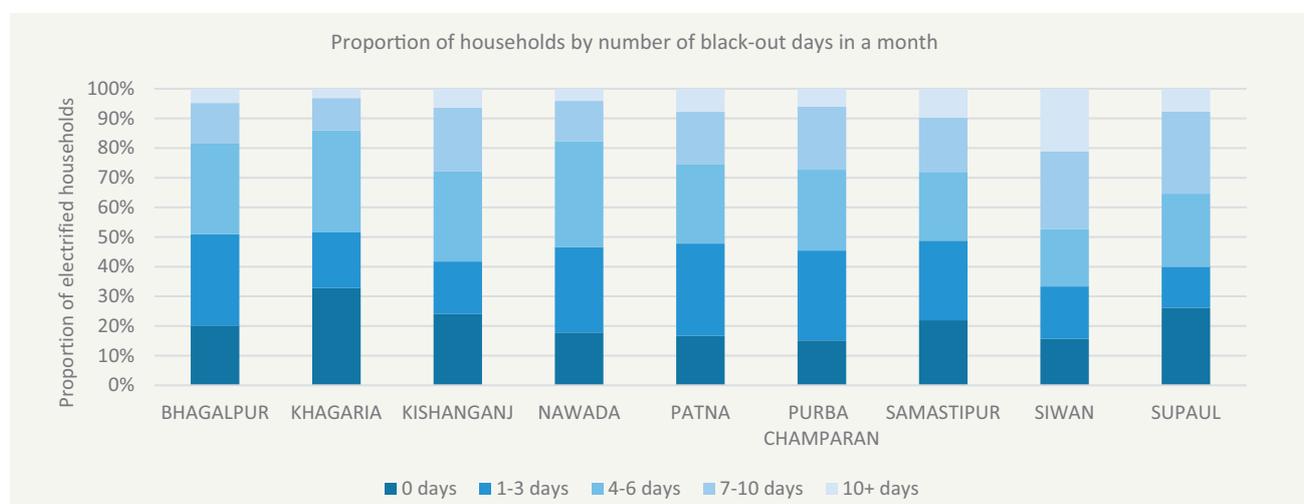
Source: ACCESS 2015

The state must focus on increasing the duration of supply for its electrified households, to improve the utility they derive from electricity and the perception of the grid supply amongst unelectrified households.

Reliability of supply

The typical rural household in Bihar experienced four black-out days in a month, i.e. days with no electricity for 24 hours continuously. Seemingly, this issue afflicted all districts equally. However, specific attention to improvement in maintenance services was required in Siwan, where almost 50 per cent households reported having seven or more black-out days in a month.

Figure 11: About 60 per cent of households in Siwan, Supaul and Kishanganj experienced four or more black-out days in a month



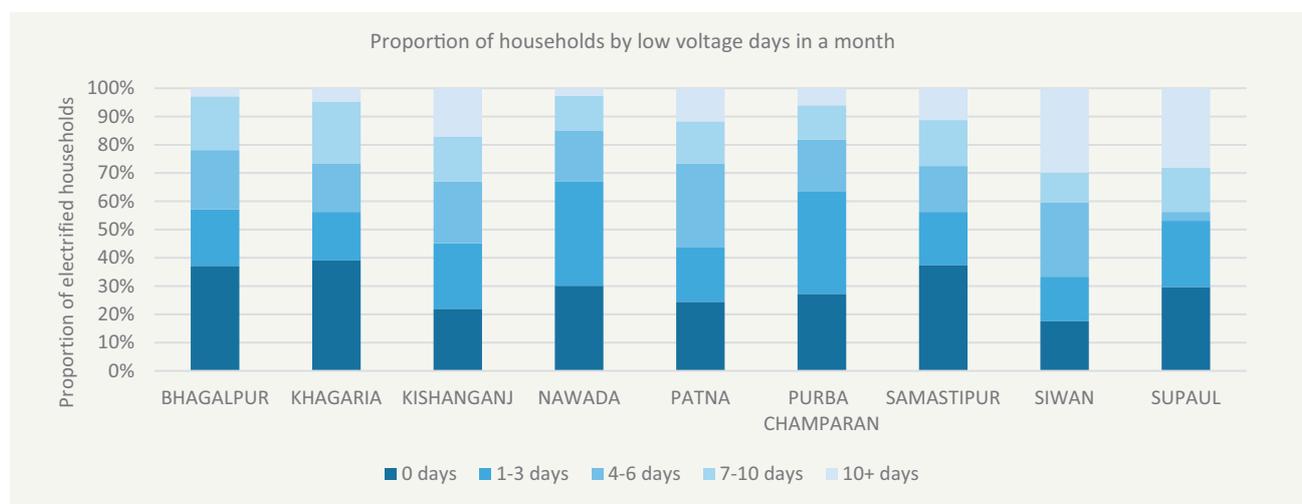
Source: ACCESS 2015

It is unlikely that distribution companies are employing 24-hours' long intentional load-shedding at such high frequency across all areas. Long duration outages are more indicative of inadequate maintenance services and delay in restoring outages arising from technical issues. Since overwhelming majorities in Purba Champaran, Siwan and Supaul identified poor maintenance and repair as a reason for dissatisfaction with the grid, it would be worthwhile to understand the specific maintenance related issues of households in these districts.

Quality of supply

Across the state, 50 per cent of the electrified households reported experiencing four or more days with low voltage supply in a month. Siwan and Supaul had the least reliable electricity supply, with 30 per cent of households recounting 10 or more such days in a typical month.

Figure 12: In most districts, one-fifth of households reported seven or more days with low voltage supply in a month



Source: ACCESS 2015

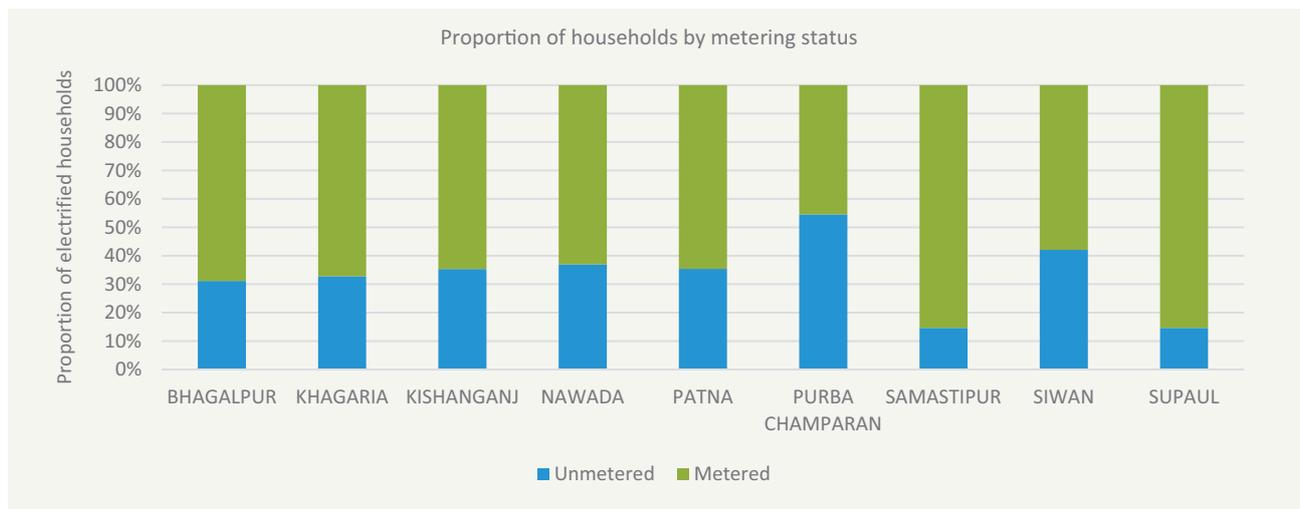
Such low voltage issues could be due to the rural feeders receiving less power vis-à-vis their requirements. The state distribution companies must take corrective action through better demand forecasting and proactive management of their power purchases. Reduction in illegal connections would also help in better estimation of demand and allay voltage issues.

3.2. Scope for efficiency improvements in grid electrification

Rate of metering

While the penetration of meters in Bihar is much better than the neighbouring states, there remains a significant room for improvement. Our data shows that about a third of electrified households in rural Bihar did not have a metered connection. Lack of metering appeared to be a common problem across all the surveyed districts, with Purba Champaran and Siwan being home to the most unmetered connections, many of whom may be illegal connections.

Figure 13: One in three households in rural Bihar did not have a metered connection



Source: ACCESS 2015

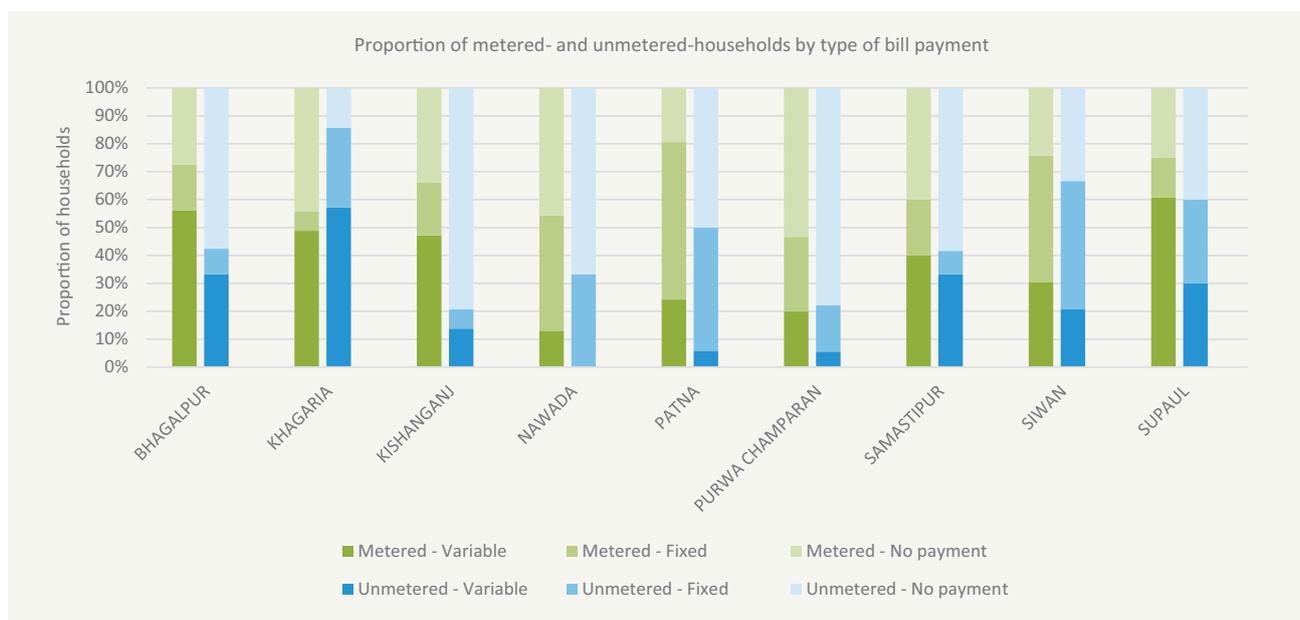
Billing and collection mechanisms

We found that over 40 per cent of metered and unmetered households did not pay for their electricity. The problem was particularly acute in Nawada and Purba Champaran, where as many as 60 per cent of electrified households did not pay or thought they were not required to pay for electricity.

About 30 per cent of metered households reported receiving fixed electricity bills, as opposed to variable bills based on their monthly consumption. The situation was particularly worse in Nawada, Patna and Siwan, where a significant proportion of households with meters were receiving fixed bills. This might be because the meters were not in working condition or were not being read by distribution companies on a regular basis.

While it is encouraging to note that over half of the households did not think there was any electricity theft in their village, almost 40 per cent did not know if there was any theft. Over 90 per cent of respondents were aware that electricity theft is illegal.

Figure 14: Over 40 per cent of electrified households in Bihar did not pay anything for the electricity they were receiving



Source: ACCESS 2015

Collectively, three challenges on billing and collection need to be addressed: (i) regular (meter reading and) bill generation; (ii) regular revenue collection; (iii) reducing defaults and electricity theft. Accordingly, two possible ways to improve the billing and collection efficiency in the state could be to: (i) install smart meters that enable mobile payments and avoid human intervention for regular bill generation and collection; (ii) engage village level entrepreneurs under micro-franchisee arrangements to manage bill generation and revenue collection for a commission. Likewise, spot billing as well as voluntary consumer declarations with periodic verification visits could also reduce billing and collection cost for distribution companies.

It might also be possible to achieve better management in rural areas through input-based distribution franchisees. These franchisees could be provided with targets that are linked to reduction in AT&C losses. However, to enforce contracts that are fair to all parties, the supply from state distribution companies to the franchisees should be set at a minimum guarantee, which would help franchisees in distributing reliable power supply. Such a model might help in ensuring adequate supply and maintenance services and high billing and collection efficiency in rural areas.

Defaults and electricity theft could be further reduced by sensitising households on the need to pay for electricity, while devising incentive structures wherein clusters of households are provided with better quality supply based on their collective bill-payment record from feeder-level meter readings. The added social pressure of group payments and the linked incentives are likely to improve revenue of distribution companies.

4. Conclusion

Grid electrification in Bihar needs significant improvement towards higher duration, better quality, and more reliable supply to rural areas. There are a few key areas for intervention that could help cover more households rapidly and improve reliability and quality of power. ACCESS shows that over half of the unelectrified households lived in electrified habitations, and this presents a unique opportunity to pace up the rate of electrification. The insights presented here drive the need to view energy access from a multi-dimensional perspective, and for going beyond connections. Such an approach enables stakeholders to identify gaps and areas for targeted interventions to improve households' access to electricity. The low satisfaction levels of households with electricity were due to not receiving electricity when needed the most and due to voltage fluctuations in their supply. There is a need to focus on improving the duration and quality of supply, which can improve peoples' perception of the grid as a service. The current awareness camps in rural areas need to target households' perception of high recurring expenses of grid electricity by communicating the prevailing tariff, which also emerges as a barrier to realising 24x7 power for all. As the state expands and strengthens the electricity grid network, it should complement its efforts with better maintenance, higher energy procurement, and integration with decentralised energy solutions to provide reliable and high-quality electricity access to all.

About the ACCESS study

The Access to Clean Cooking Energy and Electricity – Survey of States (ACCESS) is India's largest energy access survey, covering more than 8500 households, 714 villages and 51 districts, across Bihar, Jharkhand, Madhya Pradesh, Odisha, Uttar Pradesh and West Bengal. The ACCESS study was published in collaboration with Columbia University in September 2015. Shri Piyush Goyal, former Minister for Power, Coal and Renewable Energy, released the study. The ACCESS study found that despite 96 per cent of villages being electrified, only two-thirds of rural households had a connection and only half of them received more than twelve hours of power a day.



Meet the authors



Abhishek Jain is a Senior Programme Lead at the Council on Energy, Environment & Water (CEEW) and leads the council's research and work on 'energy access'. His research focuses on energy provision and use for households, community, and productive applications, fossil fuel subsidies reform, and circular economy. With close to seven years of professional experience, Abhishek has worked on multiple issues at the confluence of energy, economics, and environment. He holds an MPhil from University of Cambridge and an engineering degree from IIT Roorkee.

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The Council on Energy, Environment and Water (<http://ceew.in/>) is one of South Asia's leading not-for-profit policy research institutions. CEEW uses data, integrated analysis, and outreach to explain – and change – the use, reuse, and misuse of resources. It prides itself on the independence of its high quality research, develops partnerships with public and private institutions, and engages with wider public.

In 2017, CEEW has once again been featured extensively across nine categories in the '2016 Global Go To Think Tank Index Report', including being ranked as South Asia's top think tank (14th globally) with an annual operating budget of less than US\$5 Million for the fourth year running. In 2016, CEEW was also ranked 2nd in India, 4th outside Europe and North America, and 20th globally out of 240 think tanks as per the ICCG Climate Think Tank's standardised rankings. In 2013 and 2014, CEEW was rated as India's top climate change think-tank as per the ICCG standardised rankings.

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