

24x7 Power for All in Uttar Pradesh

Strategies for on-ground action based on ACCESS 2015

BY SAURABH TRIPATHI AND ABHISHEK JAIN



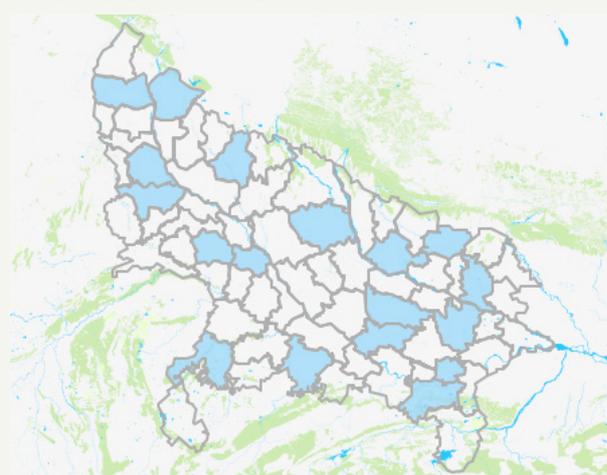
Image Credit: CEEW

Data from the Ministry of Power shows that all villages of Uttar Pradesh, except two, are electrified. However, around 50 per cent of rural households in the state are still unelectrified. The recent transition from village electrification targets to household electrification, reinforced by the *Saubhagya* scheme, is a necessary one given that the end-user of the electricity is the household. Yet even that is not 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 ensure adequate, sufficient and affordable supply for all in the state.

To support planning for on-ground electricity access improvement in the state of Uttar Pradesh, 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 was conducted in 18 districts of Uttar Pradesh, each from one administrative division of the state. The choice of district was random with probability proportional to the population of the district. We surveyed 168 households in each district, amounting to 3,023 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 already electrified households.

ACCESS 2015 covered 18 districts in Uttar Pradesh



Aligarh	Gonda	Muzaffarnagar
Azamgarh	Gorakhpur	Pratapgarh
Banda	Jhansi	Siddharthnagar
Bareilly	Kannauj	Sitapur
Bijnour	Mainpuri	Sultanpur
Bulandshahar	Mirzapur	Varanasi

1. Key insights and recommendations

- Seventy-one per cent of unelectrified rural households in Uttar Pradesh live in habitations with grid electricity. For them the main barriers to adopting connections were the steep upfront cost, high recurring payments and unreliable supply of electricity.
- Over 53 per cent of the households were unable to use appliances that they would like to use, only because of limited supply or poor quality of electricity.
- One-fifth of the electrified households were not receiving any electricity supply between sunset and midnight on a typical day.
- Less than 15 per cent of electrified households had a meter installed, and at least 20 per cent of electrified households were not paying for the electricity they were consuming.

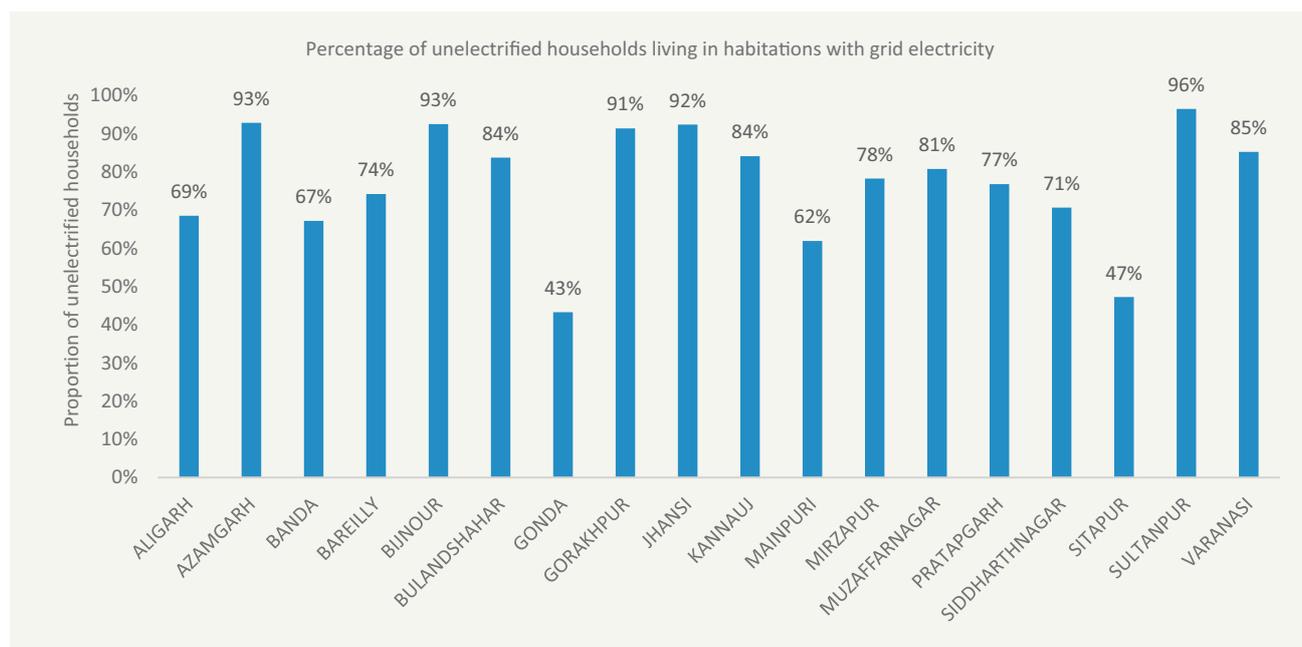
A few recommendations to ensure 24x7 power for all households:

- Awareness camps in unelectrified habitations of Banda, Bulandshahar and Kannauj, to educate households of the prevailing tariff of grid electricity, given that people perceive the recurring cost of electricity to be too high, even when they spend more on kerosene for lighting.
- Increase the hours of supply in Bareilly and Sitapur, where the level of satisfaction with grid electricity is also very low.
- There is much scope to improve the penetration of meters and improve the efficiency of bill generation and collections across all districts. Regular and correct bills would help in reducing the public perception around high recurring bills. The possibility of distribution franchisees could be explored to improve the billing and collection efficiency and to reduce the losses of the state distribution companies.

2. Reaching out to unelectrified households in rural Uttar Pradesh

According to ACCESS, 71 per cent of unelectrified rural households in Uttar Pradesh live in habitations that are 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. In at least five districts of the state – Azamgarh, Bijnour, Gorakhpur, Jhansi and Sultanpur – over 90 per cent of unelectrified households reside in electrified habitations. This implies that the basic infrastructure required to electrify habitations is already present, but that effort is required to intensively electrify households.

Figure 1: In half of the districts, over 80 per cent of unelectrified households reside in electrified habitations

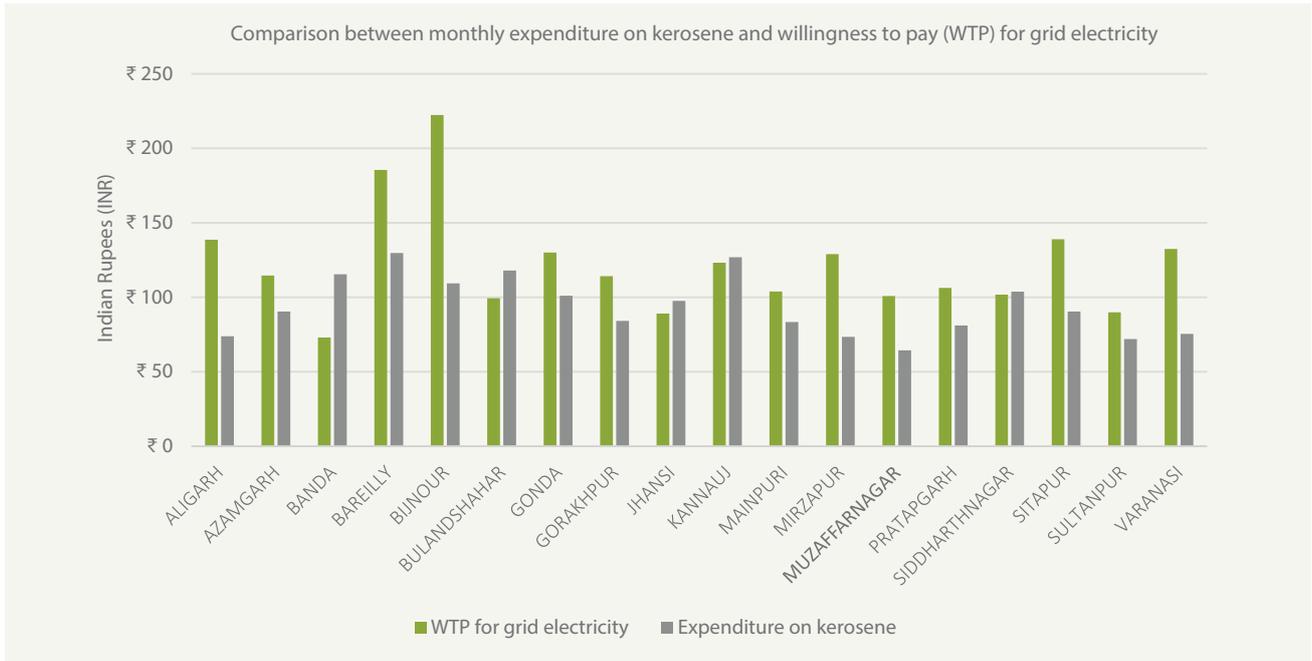


Source: CEEW

The main barriers to adoption of electricity for unelectrified households in grid-electrified habitations, are steep upfront costs (90 per cent), high recurring expenses (86 per cent) and unreliable supply (79 per cent). Awareness of how to get the connection and who to approach also emerges as a barrier for a majority of households in Kannauj and Sultanpur. To improve the perception of the grid amongst unelectrified households, there is a need to focus on improving the duration of supply (especially during evening hours) while reducing the number of 24-hour black-out days. The latter could be achieved by improving maintenance services, which in turn would enhance the utility derived by the consumer.

Eighty-nine per cent of BPL households in the state found the upfront connection cost too high, despite being provided highly subsidised connections. This indicates the need for improved awareness under the *Deen Dayal Upadhyaya Gram Jyoti Yojana*. A similar proportion of APL households also find upfront costs too high. This could be addressed by the newly launched *Saubhagya* scheme, which is aimed at improving upfront affordability for APL households across the country. In a few districts across the state, the perception among most unelectrified households about grid electricity was that it is too expensive for daily use, even though they spent as much, if not more, on kerosene as their primary source of lighting.

Figure 2: Most households in Uttar Pradesh were willing to pay more for grid electricity than their monthly expenditure on kerosene



Source: CEEW

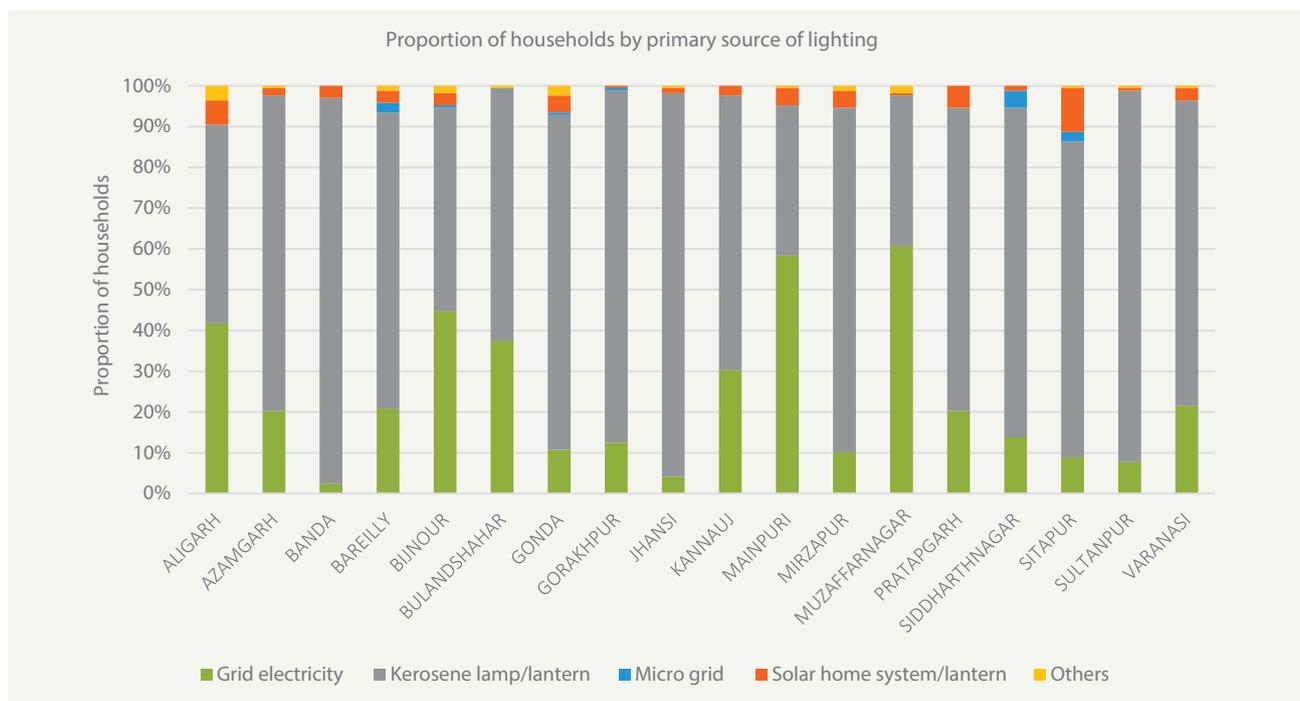
Unlike the situation in neighbouring states, many unelectrified households in Uttar Pradesh were willing to pay more for grid electricity than their existing expenditure on kerosene. This shows that they valued electricity highly and would be willing to transition from kerosene were the grid made available to them, and the supply situation more adequate and reliable. In districts where households spend more on kerosene than they are willing to spend on electricity – Banda, Bulandshahar and Kannauj – there is a need to generate awareness about the prevailing tariff of grid electricity.

3. Improving electricity access for electrified households

According to ACCESS, 57 per cent of rural households in Uttar Pradesh were connected to the grid, and even then, nearly three-quarters used kerosene lamps or lanterns as their primary source of lighting. The penetration of decentralised energy alternatives such as micro-grids and solar home systems or lanterns is low across the districts, with highest penetration of solar products being in Aligarh and Sitapur, where grid electricity supply is also rather poor.



Figure 3: Seventy-two per cent of households in Uttar Pradesh use kerosene for their primary lighting needs



Source: CEEW

Twenty-three per cent of the rural households in Uttar Pradesh use grid electricity as their primary source of lighting, while 57 per cent are connected to the grid. This difference is starkest in Sultanpur, where only eight per cent of households use the grid as their primary source of lighting even though 66 per cent of households have a grid connection. A similar situation is prevalent across the state. In Gorakhpur and Azamgarh, where despite two-thirds of households being electrified, the proportion of primary users is much lower at 13 and 20 per cent, respectively. In such districts, the vast majority of households rely on kerosene due to the poor electricity supply situation. Muzaffarnagar and Mainpuri stood out as the best performers across districts, with the around 60 per cent of households using grid electricity as their primary source of lighting.

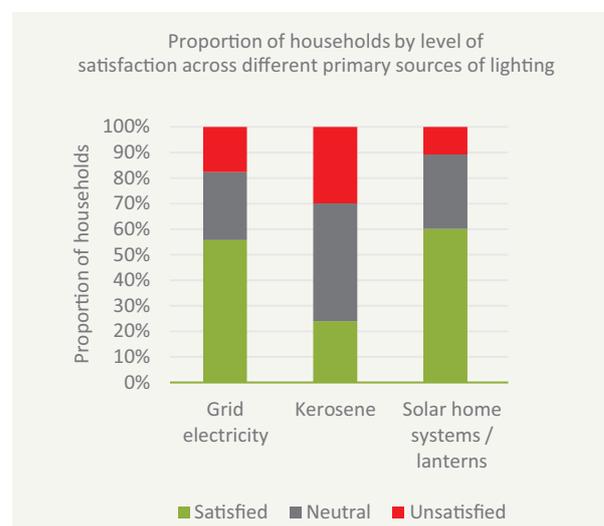
3.1. Improving the satisfaction of households with electrification

When we asked households about their satisfaction with their primary source of lighting, we found that users of solar home systems and lanterns were more satisfied than users of any other source of lighting, including the grid. Such a high degree of satisfaction with solar products might be the result of a more reliable performance of these products, especially in the hours when they need electricity the most.

Unsurprisingly, primary users of kerosene were the least satisfied. Solar products have the least proportion of unsatisfied primary users (10 per cent) – even lesser than that of grid electricity. Consumers of solar systems then are less likely to be actively looking for a better source of lighting, as compared to others.

Assessing households’ satisfaction is critical because voters are likely to form policy preferences based on their experiences with various technologies and solutions. When asked which source of lighting they would most like to see supported by the government, most households in rural Uttar Pradesh chose the grid. Solar-based

Figure 4: Primary users of solar-based solutions were the most satisfied

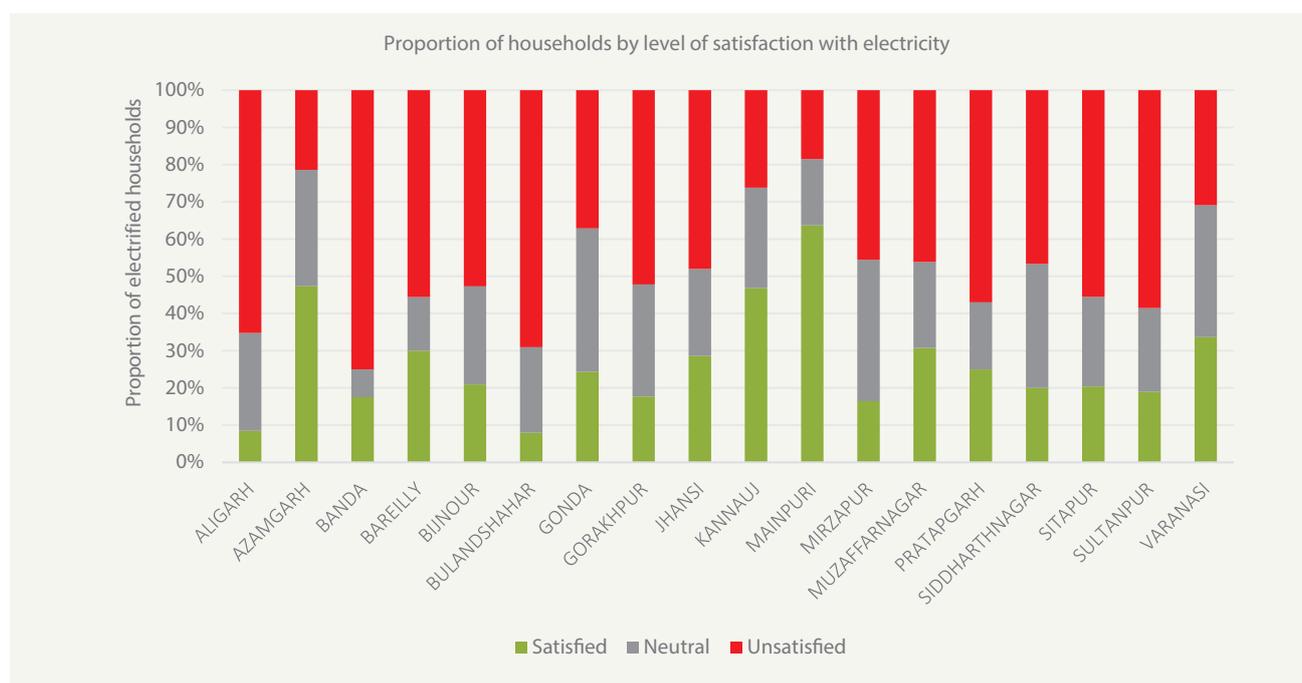


Source: CEEW

solutions were the second-best alternative, ahead of kerosene, with over 13 per cent of households indicating a preference in favour of government support for them. Unelectrified households were generally more reluctant to see support for the grid and hoped for more support for kerosene, probably due to their current perception around electricity access and unfamiliarity with decentralised solutions. Despite the poor supply situation in many districts, households were still hopeful of being connected to the grid and receiving reliable supply.

Generally, only a quarter of electrified households were satisfied with their electricity situation. In the districts of Aligarh, Banda and Bulandshahar, over 65 per cent of respondents were dissatisfied with the electricity they were receiving. It is necessary to evaluate the factors that result in such a high level of dissatisfaction, and devise strategies to improve specific elements of grid electricity supply in order to provide more utility to users.

Figure 5: Almost 50 per cent of households in Uttar Pradesh were dissatisfied with their electricity situation



Source: CEEW

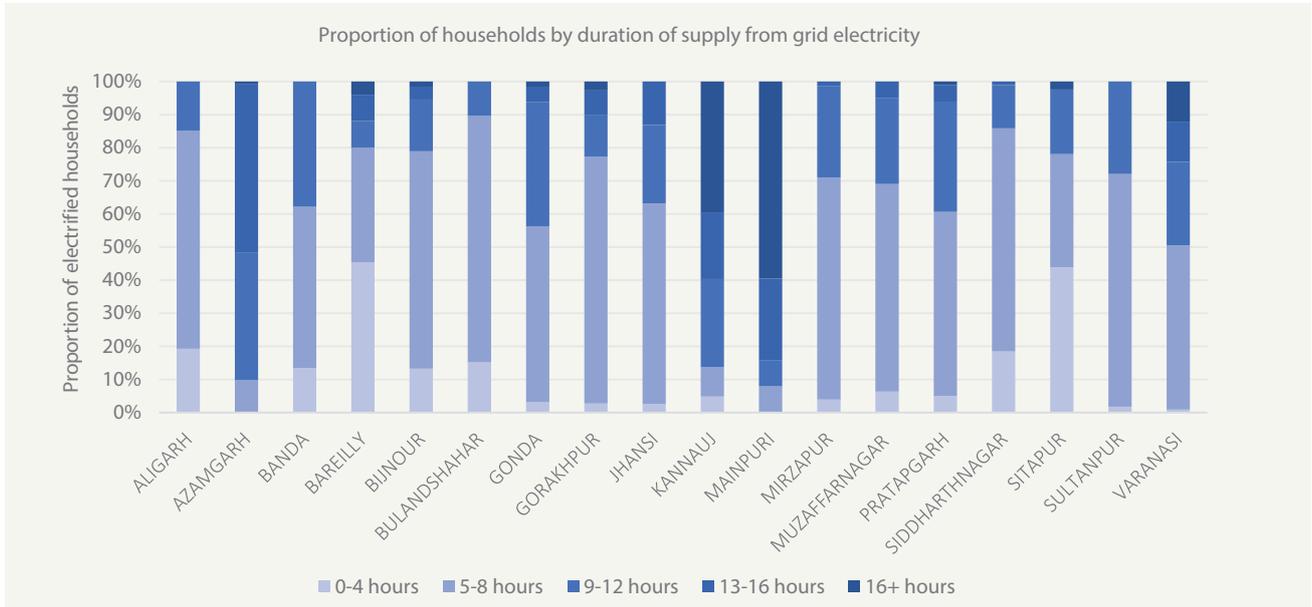
Of those households who were dissatisfied with their electricity situation, almost all stated that they were not receiving electricity when they needed it the most. Further, about 85 per cent of them were dissatisfied because of the frequent voltage fluctuations, that led either to sub-optimal use of appliances or their damage. A smaller but still significant proportion of households reported finding the recurring monthly expense of electricity to be too high, and maintenance and repair services to be poor. While some issues are more important to households in some districts, it is other issues elsewhere. Distribution companies need to appreciate and solve these issues at a decentralised, district- or village-level.

Over half of the electrified households in the state were unable to use appliances that they would like to use, only because of limited supply or poor quality of electricity. The most commonly mentioned appliances in this regard were televisions, ceiling fans and refrigerators. **Household satisfaction around electricity is likely to sway considerably based on the kind of appliances it enables them to use and the lifestyle changes such appliances introduce.** It is therefore important to view electricity access from the viewpoint of the opportunities and experiences it allows households to realise.

Duration of supply

Households in Uttar Pradesh receive a median supply of just eight hours of electricity per day. The worst performing districts are Bareilly and Sitapur, where over 40 per cent of the households receive four or less hours of supply per day. The situation was much better in Kannauj and Mainpuri, where the proportion of households receiving 16 hours or more of electricity was 40 and 60 per cent, respectively.

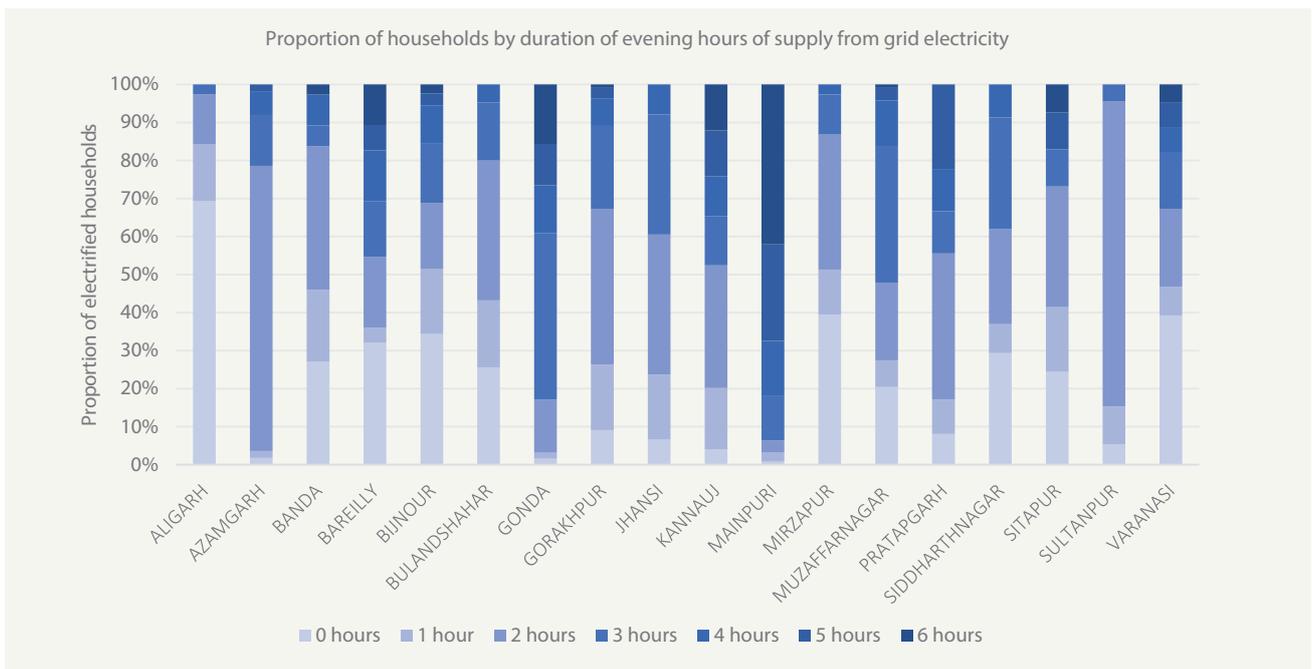
Figure 6: In half of the districts, over 70 per cent of households receive eight or less hours of electricity supply in a typical day



Source: CEEW

A critical component in transitioning from electricity connections for all to 24x7 power for all, is to enable households to use electricity during hours when they need it the most. **In Uttar Pradesh, supply of electricity during evening hours is inadequate across most districts, with just two hours of supply between sunset and midnight for most households.** The situation is particularly poor in Aligarh, Bijnour and Mirzapur, where the majority of electrified households receive one hour or less of supply during the evening.

Figure 7: One-fifth of households were not receiving any supply in the evening

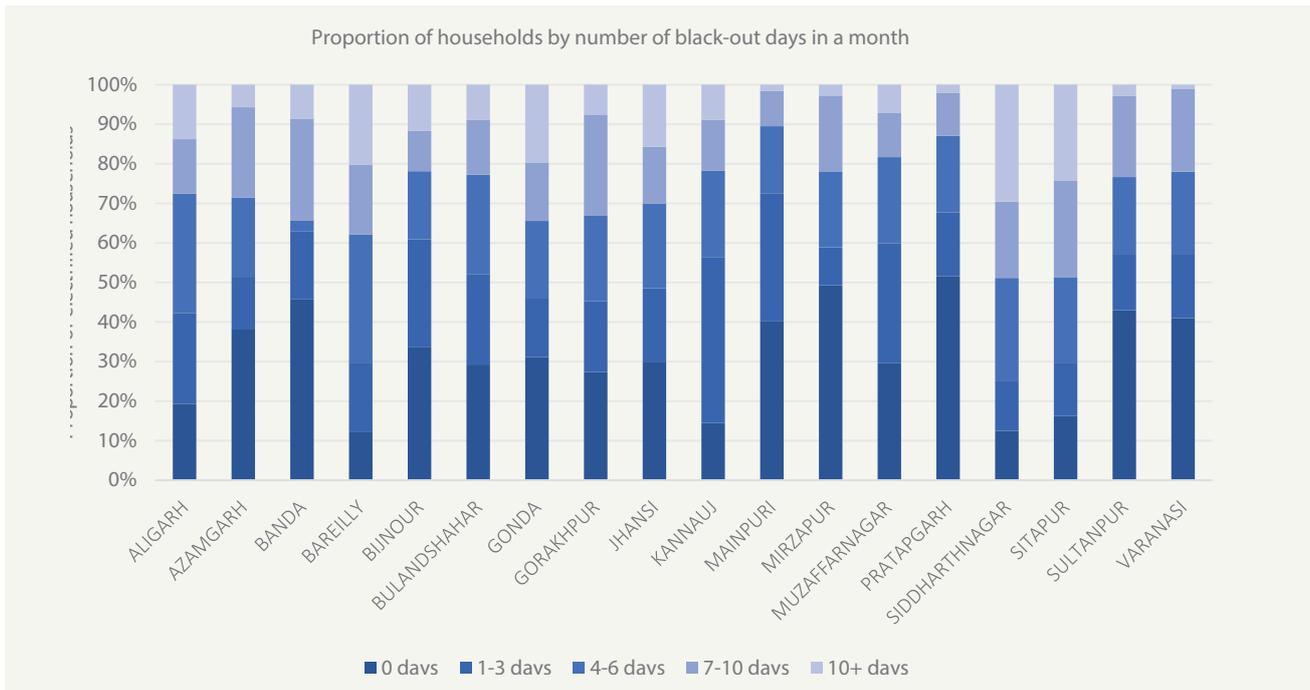


Source: CEEW

Extended black-outs

The typical rural household in Uttar Pradesh experiences three 24-hour long black-out days in a month, i.e. days with no electricity for 24 hours continuously. **Districts in the north of the state were particularly worse performing, with nearly half of the households in Siddharthnagar and Sitapur reporting at least seven days of black-outs in a typical month.** Mainpuri and Pratapgarh were the least affected, possibly due to better availability of maintenance services. Distribution companies are unlikely to be employing 24-hour long intentional load-shedding at such high frequencies to manage their supply and demand, across all areas. Long duration outages are more indicative of poor maintenance services and delay in efforts to restore outages arising from technical issues.

Figure 8: More than seven days of black-outs are common across all districts surveyed

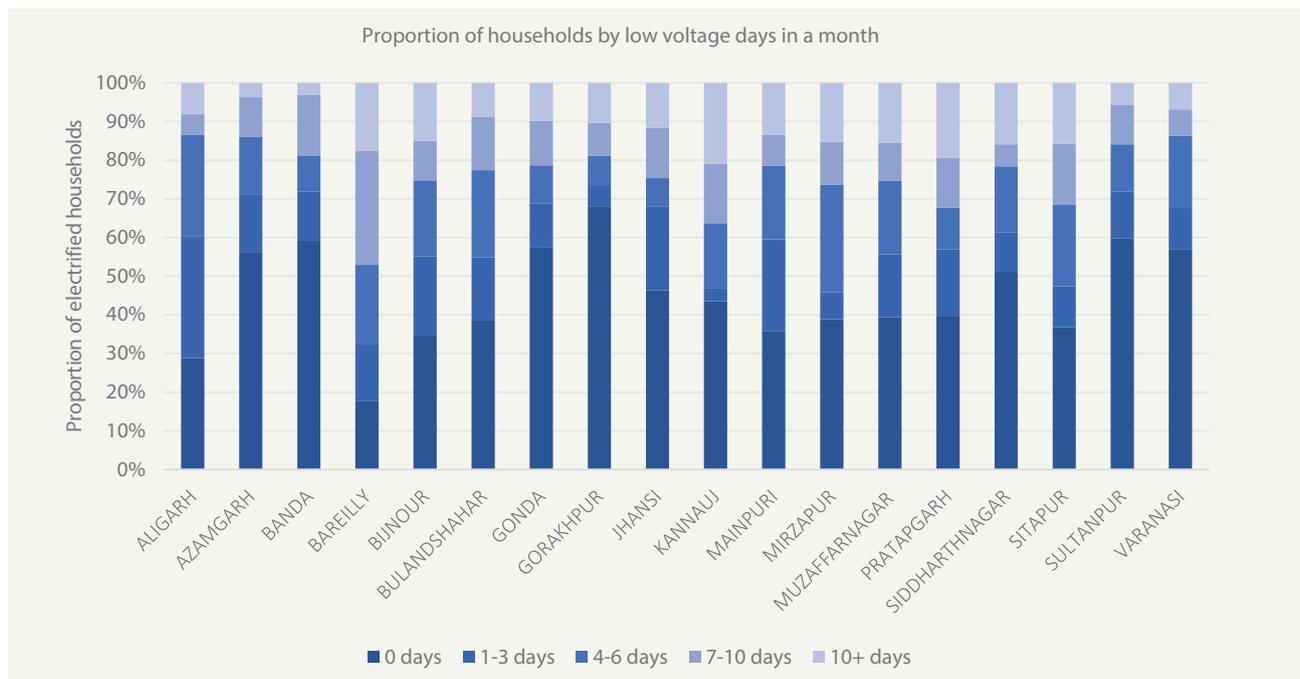


Source: CEEW

Quality of supply

Low voltage supply also surfaces as a problem across districts, albeit to a lesser extent than supply duration and black-outs. Households typically report experiencing two days of low voltage supply in a month. It is important to tackle this, because it is likely to impact households' satisfaction given that it reduces the utility they derive from appliances they have already invested in. Around 20 per cent of respondents in Bareilly, Kannauj and Pratapgarh report receiving low-voltage supply for ten or more days in a typical month.

Figure 9: A quarter of the households in Uttar Pradesh experience seven or more days of low-voltage supply in a month



Source: CEEW

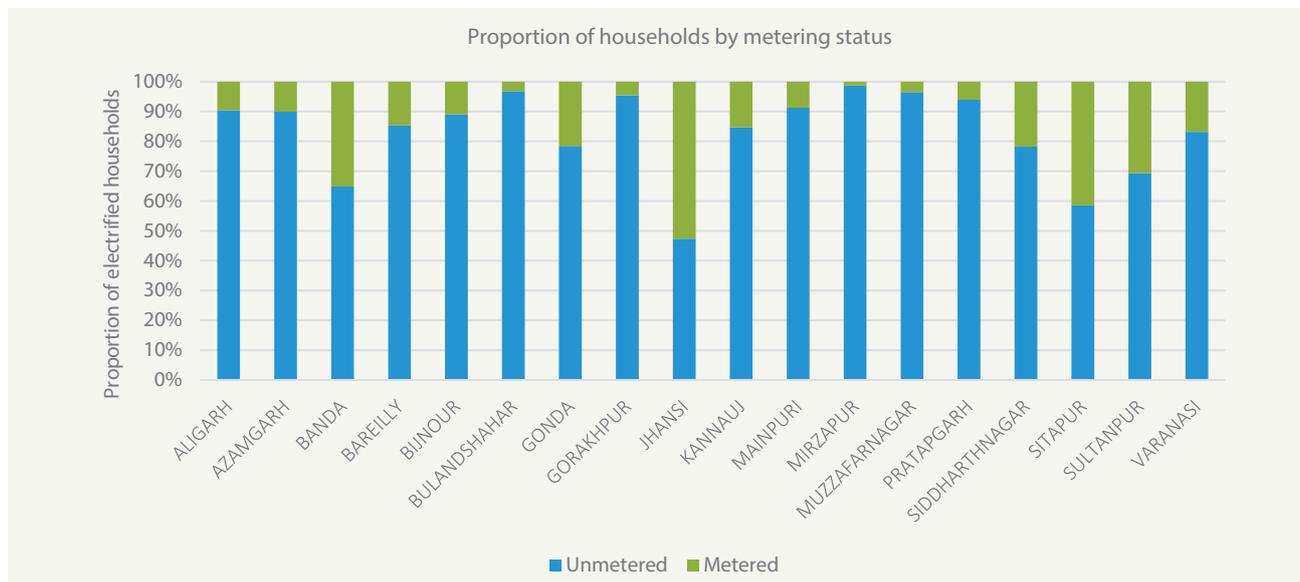
Such low voltage issues could be due to the rural feeders receiving less power vis-à-vis their actual requirements. The state distribution companies should take corrective action through better demand forecasting and proactive management of their power procurement. Reduction in illegal connections would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

3.2. Scope for efficiency improvements in grid electrification

Rate of metering

The penetration of meters in rural areas across Uttar Pradesh was found to be very low, with under 15 per cent of grid electrified households having a meter installed. The problem afflicts all districts surveyed, although much less prevalent in Banda, Jhansi and Sitapur. The lack of meters in districts with good supply of electricity is a wasted opportunity for adequate revenue collection, given households’ higher level of satisfaction.

Figure 10: Only one in every seven households had a metered connection



Source: CEEW

Billing and collection efficiency

Across the districts, we find that a quarter of the electrified households do not pay for their electricity, including those with both metered and unmetered connections. Moreover, a quarter of the metered households report receiving fixed bills, as opposed to variable bills based on their electricity consumption. This could be because the meters are not in working condition or are not being read by distribution companies regularly.

The issue of non-payment was significantly worse in Kannauj, Aligarh and Mainpuri, where the proportion of households who did not pay anything for electricity stood at 58, 40 and 39 per cent respectively. In Jhansi, Siddharthnagar and Sultanpur, about a fifth of electrified households reported not knowing where or whom to pay for grid electricity.

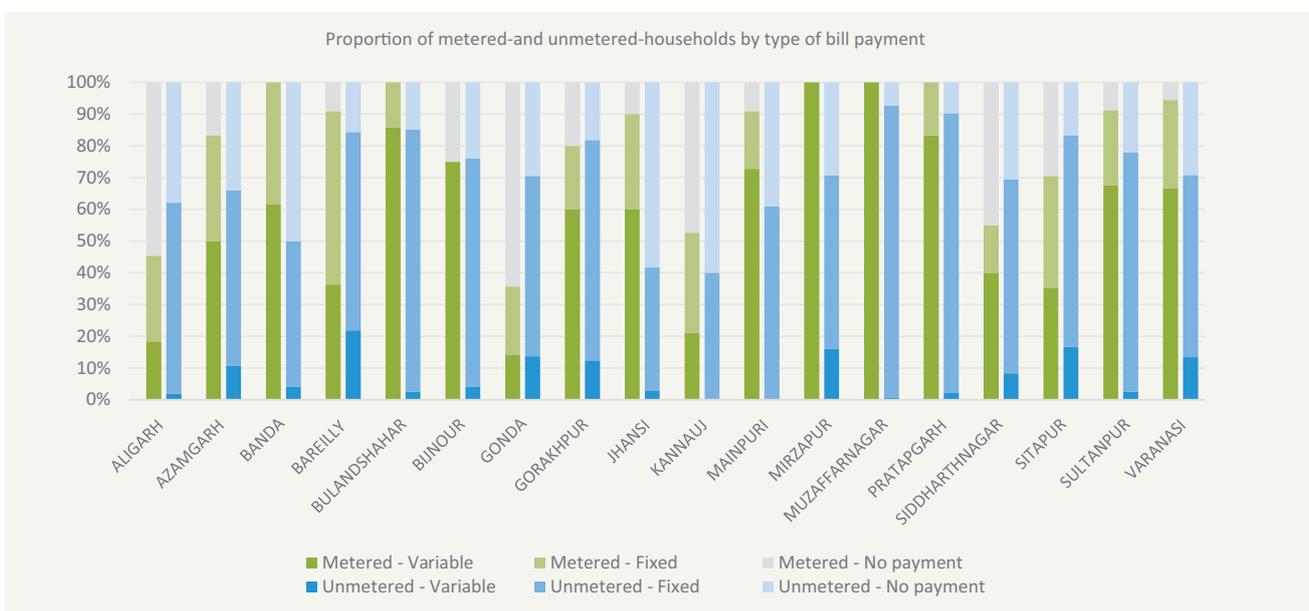
When asked about electricity theft, 46 per cent of households reported it was prevalent in their village, and 94 per cent of respondents were aware that it is illegal.

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) **hire 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.

The challenge of defaults and electricity theft could be addressed 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.

Figure 11: A quarter of households do not pay for the electricity they consume

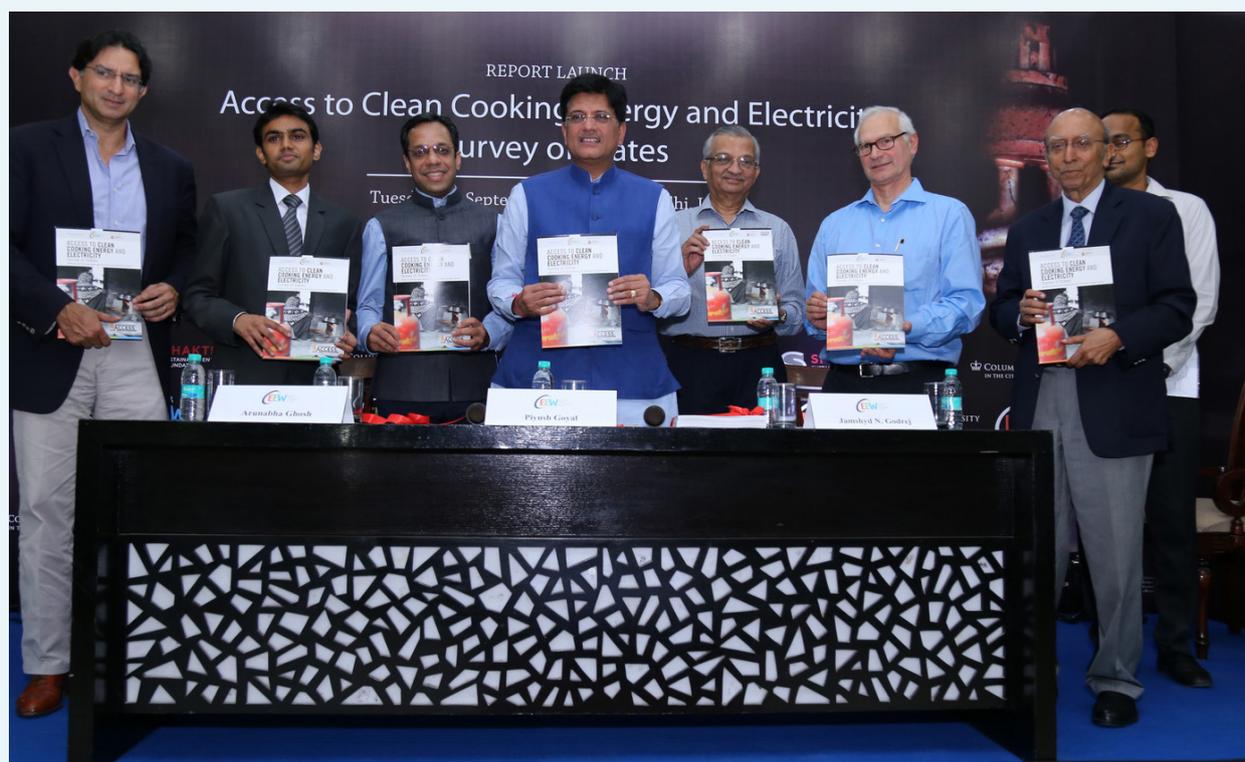


Source: CEEW

4. Conclusion

Grid electrification in Uttar Pradesh needs significant improvement to provide higher duration, better quality, and more reliable supply to rural areas. Even as the number of electrified households steadily increases, 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 majority of unelectrified households live 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 of households with electricity was because they were not receiving electricity when they needed it the most, and due to unpredictable voltage fluctuations. Focus on improving the duration and quality of supply can improve peoples' perception of the grid as a service. In some districts, there is a need for awareness camps to sensitise households on the need to pay for electricity, and to communicate 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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About CEEW

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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A policy brief on '24x7 Power for All in Uttar Pradesh: Strategies for on-ground action based on ACCESS 2015'.

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