

Empowering People - Enhancing Effectiveness of Rural Electrification Programmes



Disclaimer & Notice to reader

This Report has been prepared by KPMG in India ("KPMG") on the basis set out in KPMG's contract for 'Service Provider for Supporting Structural Reforms in the Indian Power Sector' with the Secretary of State for International Development at the Department for International Development ("the Client") dated 4 November 2016 (the "Services Contract"), and should be read in conjunction with the Services Contract. Nothing in this report constitutes a valuation or legal advice. KPMG has not verified the reliability or accuracy of any information obtained in the course of its work, other than in the limited circumstances set out in the Services Contract. This Report is for the benefit of the Client only and has not been designed to be of benefit to anyone except the Client. In preparing this Report KPMG has not taken into account the interests, needs or circumstances of anyone apart from the Client, even though KPMG may have been aware that others might read this Report. In particular, and without limiting the general statement above, this Report has not been prepared for the benefit of any other local authority / NHS Trust / etc. nor for any other person or organisation who might have an interest in the matters discussed in this Report. This Report is not suitable to be relied on by any party wishing to acquire rights against KPMG in India (other than the Client) for any purpose or in any context. Any party other than the Client that obtains access to this Report or a copy (under the Freedom of Information Act 2000, the Freedom of Information (Scotland) Act 2002, through the Client's Publication Scheme or otherwise) and chooses to rely on this Report (or any part of it) does so at its own risk. The information contained herein is of a general nature and is not intended to address the circumstances of any particular individual or entity. Although KPMG endeavours to provide accurate and timely information, there can be no guarantee that such information is accurate as of the date it is received or that it will continue to be accurate in the future. No one should act on such information without appropriate professional advice after a thorough examination of the particular situation. Views expressed in the paper are not the views of any government agency nor are not binding on any person, entity, authority or Court, and hence, no assurance is given that a position contrary to the opinions expressed herein will not be asserted by any person, entity, authority and/or sustained by an appellate authority or a court of law. This report has been prepared under the Technical Assistance titled "Supporting Structural Reforms in the Indian Power Sector" funded by UK aid from the UK government; however the views expressed do not necessarily reflect the UK government's official policies. To the fullest extent permitted by law, KPMG in India does not assume any responsibility and will not accept any liability in respect of this Report to any party other than the Client. KPMG thus disclaims all responsibility or liability for any costs, damages, losses, liabilities, expenses incurred by such third party arising out of or in connection with the report or any part thereof. By reading this Report, the reader of the Report shall be deemed to have accepted the terms mentioned hereinabove.



Acknowledgements

This report is the outcome of study on “**Empowering People – Enhancing Effectiveness of Rural Electrification Programmes**” that was funded by the Department for International Development (DFID), Government of United Kingdom. KPMG in association with Ashden India Renewable Energy Collective (AIREC) and Sambodhi Research and Communications has developed this report based on review of primary and secondary data/reports and discussions with key stakeholders.

The project team would like to thank the Ministry of Power (MoP) for their time and contribution to this research effort. Without their active support, this study would not have been possible. We greatly appreciate the support provided by the officials of Rural Electrification Corporation Limited, for carrying out this study.

The project team would also like to thank the officials of DISCOMs, Gram Panchayats and local healthcare centers in the four states — Bihar, Odisha, Rajasthan and Uttar Pradesh — for sharing their views, suggestions and helping us reach out to the various people across the villages and hamlets.

The team would also like to thank Mr. Nishant Bhardwaj, Energy Advisor, DFID for his insights and inputs during the course of the study.

Last but not least, we would also like to thank the respondents who shared their views, experiences and stories.

We hope that this report is informative for policy makers, governmental agencies, donor organizations and NGOs working in energy sector across India and the region.

Project Team:

KPMG, AIREC, Sambodhi Research & Communications and subject matter experts— Soma Dutta and Rekha Krishnan

List of Abbreviations

APL	Above Poverty Line
ASDP	Aajeevika Skill Development Programme
ASHA	Accredited Social Health Activists
BPL	Below Poverty Line
CFL	Compact Florescent Lamp
CSC	Common Service Centre
CSR	Corporate Social Responsibility
DC	Direct Current
DDUGJY	Deen Dayal Upadhyaya Gram Jyoti Yojana
DG	Diesel Generator
DISCOMs	Distribution Companies
DRE	Distributed Renewable Energy
EE	Energy Efficiency
EESL	Energy Efficiency Services Limited
ESCO	Energy Service Company
ESMAP	Energy Sector Management Assistance Programme
FGD	Focus Group Discussion
GoI	Government of India
GTF	Global Tracking Framework
Hh	Households
JSERC	Jharkhand State Electricity Regulatory Commission
KII	Key Informant Interview
LED	Light Emitting Diode
MeitY	Ministry of Electronics & Information Technology
MMR	Maternal Mortality Rate
MoP	Ministry of Power
MoSPI	Ministry of Statistics and Programme Implementation
MoU	Memorandum of Understanding
MSDE	Ministry of Skill Development and Entrepreneurship
NFHS	National Family and Health Survey
NGO	Non-government Organisation
PMJJBY	Pradhan Mantri Jeevan Jyoti Bima Yojana
PMMY	Pradhan Mantri Mudra Yojana
PMSBY	Pradhan Mantri Suraksha Bima Yojana
PRIs	Panchayati Raj Institutions

PWD	Persons with Disability
RE	Renewable Energy
REC	Rural Electrification Corporation
RGGVY	Rajiv Gandhi Grameen Vidyutikaran Yojana
Saubhagya	Pradhan Mantri Sahaj Bijli Har Ghar Yojana
SAVE	Serve as Volunteer for Energy Programme
SE4ALL	Sustainable Energy for All
SERC	State Electricity Regulatory Commission
SGD	Sustainable Development Goal
SLNP	Street Lighting National Programme
TPDDL	Tata Power Delhi Distribution Limited
TV	Television
UJALA	Unnat Jyoti by Affordable LEDs for All
UP	Uttar Pradesh
UT	Union Territory
VLE	Village Level Entrepreneurs

TABLE OF CONTENTS

LIST OF TABLES & FIGURES

Executive summary	10
1. Background and objective of the study	16
1.1 Background	17
1.2 Rationale	18
1.3 Objectives	18
2. Approach and methodology	19
2.1. Policy and programme review	21
2.2 Research design	21
2.3 Field surveys	23
2.4 Analysis	25
3. Survey findings	26
3.1 Access to electricity supply	28
3.2 Barriers to household electrification	28
3.3 Quality of life improvement/ Welfare benefits	31
3.4 User's experience	39
4. Conclusion and recommendations	46
4.1 Continuous focus on village and household electrification	47
4.2 Ensuring 24/7 reliable, good quality and affordable supply	52
4.3 Improving standard of living and wellbeing	56
Annexure 1: Sample size calculation for household surveys	61
Annexure 2: State's district covered	62
Annexure 3: State wise and district wise list of villages covered	63
References	64

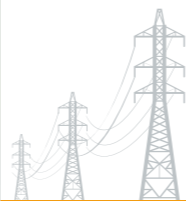
Tables

Table 1: Evolving definition of village electrification	17
Table 2: List of survey instruments	22
Table 3: Key statistics of selected states	25
Table 4: Number of respondents across different categories and FGDs	25
Table 5: Suggested areas for organizing awareness campaigns	48
Table 6: Proposed sample size	61

Figures

Figure 1: Approach for conducting the study	20
Figure 2: Research framework	21
Figure 3: Key findings	27
Figure 4: Demographic characteristics of sample households	28
Figure 5: Reasons for not availing electricity connection – stated by un-electrified households	29
Figure 6: Wealth category breakup of households stating high upfront cost	29
Figure 7: Percentage of households who paid for arranging last mile infrastructure	31
Figure 8: Consumers using electricity for different appliances , by state (%)	33
Figure 9: Consumers using electricity for different appliances, by wealth category (%)	33
Figure 10: Consumers' aspirations to purchase new appliances	34
Figure 11: Increase in children's study hours during evening (6 PM to 10 PM)	35
Figure 12: Reduction in health-related issues after availing electricity connection	36
Figure 13: Women's perception on improvement in quality of life (%)	37
Figure 14: Households that mentioned improvement in community services (%)	38
Figure 15: Benefits of electricity as reported by rural microenterprises	39
Figure 16: Metered and un-metered connections	40
Figure 17: Consumer's responses about frequency of receiving electricity bills	40
Figure 18: Consumer's response on frequency of bill payment	41
Figure 19: State-wise responses — whether consumers have faced bill accuracy related issues in the past	42
Figure 20: Consumer responses on key issues faced regarding supply quality	42
Figure 21: Average rural electricity supply hours per day	43
Figure 22: Percentage of consumers aware about whom to approach in case of a line fault	44
Figure 23: Interventions for enhancing effectiveness of rural electrification initiatives	47

EXECUTIVE SUMMARY



Executive summary

Background

Energy access is a prerequisite for poverty reduction and sustainable development. This has been universally accepted as part of the Sustainable Development Goal 7 (SDG 7) (UNDP 2016), which aims to ensure universal access to affordable, reliable, sustainable and modern energy by 2030. The Government of India (GoI) has taken a number of initiatives for providing electricity access to all households in the country. Under the Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY), extensive rural electrification work has been undertaken, leading to 100 percent village electrification achieved in May 2018 (MoP, Saubhagya Portal 2018). The GoI is now implementing Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya), which aims to achieve universal household electrification by December 2018 (MoP, Office Memorandum- Saubhagya 2017).

Improved access to electricity brings with it a number of advantages — better quality of life, advancements in social infrastructure, and economic and social development, among others. Keeping this in view, a study, 'Empowering People — Enhancing Effectiveness of Rural Electrification Programmes,' was conducted. The study provides useful insights on the effectiveness of rural electrification initiatives in India on key parameters — quality of life improvement/welfare benefits, user's experience related to electricity supply and services, and barriers to household electrification. Key objectives of this study were to:

- Assess the effectiveness of rural electrification initiatives from a gender and social inclusion perspective,
- Characterize who are presently excluded from the scheme or are unable to benefit to the fullest extent and identify factors responsible for the same and
- Identify measures required to enhance effectiveness of rural electrification initiatives.

Approach

A sample survey was conducted in 72 villages across four states — Bihar, Odisha, Uttar Pradesh and Rajasthan (during Nov 2017 to Jan 2018). This included:

- Survey of ~2,200 households (1,116 electrified and 1,085 un-electrified)
- Survey of ~250 micro-enterprises
- Focus group discussions (>30)

Interactions were also undertaken with key stakeholders such as officials of Rural Electrification Corporation (REC) and DISCOMs, representatives of local healthcare centres, Gram Panchayats and school teachers. Survey instruments (structured questionnaires, interview and FGD guidebook) for each respondent group were designed to capture information on key parameters of the four dimensions central to the objectives of this study: (i) Electricity access; (ii) Reasons for not availing electricity connections; (iii) Quality of life improvement/welfare benefits; and (iv) User's experience.

Based on the analysis of information collected from consumer surveys and stakeholder consultation, a set of interventions have been identified to enhance the effectiveness of rural electrification initiatives in India. These are summarized below.



Recommendations

Village and household electrification

Continued focus to increase household coverage — enhance effectiveness of the communication campaign under the Saubhagya scheme: Most common reasons for not availing electricity connections stated by un-electrified households were (i) consumers' perception that electricity is more expensive than traditional fuels, (ii) lack of knowledge about the benefits of using electricity and (iii) lack of awareness about the rural electrification initiatives. These issues can be resolved by organizing structured awareness campaigns to educate consumers about benefits of using electricity over traditional fuels. Local institutions such as Gram Panchayats, Common Service Centres, NGOs, public representatives, etc. may be involved to spread awareness not only about the scheme but also about benefits of using electricity.

Creating inter-scheme leverage: Multiple schemes focusing on rural development and welfare are being implemented. Creating inter-scheme leverage can reduce the transaction cost and also accelerate the pace of development. Gram Swaraj Abhiyaan is a welcoming initiative and may be organized at regular intervals to spread awareness about rural development programmes. Further, package of inter-linked services can also be provided to electricity consumers through network of Village Level Entrepreneurs created as part of Common Service Centres initiative, i.e. electricity connections with package of energy efficient appliances (LED lamps, fans, tube lights, etc.) and/or electricity connections (for micro enterprises) with access to low cost financing e.g. under Pradhan Mantri MUDRA Yojana (PMMY).

Encourage electricity led enterprises and skill development: Availability of reliable electricity, opens up multiple avenues for income generation and promoting entrepreneurship among rural people. About 46 percent of micro enterprises stated that they started operations after electrification. However, attractiveness and viability of income generating opportunities for rural people need to be made apparent. Skill development and training programmes organized under Aajeevika Skill Development Programme (ASDP) should focus on imparting skills for creating electricity led micro enterprises. Further, Discoms/ implementing agencies of Saubhagya scheme/ rural electricity franchisees can train/engage local youth as champions/ambassadors for carrying out various functions such as metering, billing, compliant redressal, minor repair & maintenance activities, spread awareness about energy efficiency & conservation, etc.

Focus on scaling up energy efficiency: As people climb up the energy ladder, penetration of electric appliances is also expected to increase. About 24 percent of the electrified households stated that they are planning to purchase new appliances. This provides opportunity to embed energy efficiency into the foundation of emerging energy market and ensure that consumption efficiency is a focus right from the beginning. EESL or similar institutions should be encouraged to collaborate with Discoms (as they operate at the grass-root level) for distribution of energy efficient appliances in rural areas. Innovative models such as 'insurance backed equipment leasing model', 'Pay-as-you-go' or 'service based contracts', in which consumers do not have to bear the upfront cost for energy efficient appliances may also be considered. Micro Finance Institutions operating in rural areas may also be involved for financing.

24x7 Reliable, good quality and affordable supply

Focus on quality and reliability improvement — continuous monitoring: Quality and reliability of supply plays an enabling role in allowing consumers to fully benefit from electricity. About 76 percent of respondents stated that they have faced one or more issues related to the quality of supply. An efficient monitoring system is needed to provide evidence-based feedback for improving the quality of supply and service to all stakeholders i.e. DISCOMs, regulatory commissions and policy makers, consumer groups, etc. Data/information on basic measures of supply and service quality (outages, distribution transformer failure, interruption duration, time taken for issuing new connections, number of consumer complaints resolved, etc.) should be regularly updated and made available in the public domain.

Robust metering, billing and collection processes- franchising and outsourcing: About 22 percent of consumers reported that they do not receive regular electricity bills. Further, consumers mentioned that this generates a fear among un-electrified households and hence they do not avail connections. Robust metering, billing and collection processes are not only required to ensure 100 percent recovery, but will also help in building consumer confidence and improve relationships between DISCOMs and consumers. When done in house, it is important to maintain regularity of billing and collection. Alternately, DISCOMs may also consider appointing rural electricity distribution franchisees, primarily as an instrument to help with metering, billing and collection aspects. An operational framework to outsource such functions should be developed. Local youth and women SHGs should be encouraged to work as franchisee.

Pre-paid/smart meters and scaling up digital payments: As per the 'Resolution for Future Roadmap to Reform Power Sector and ensure 24x7 Power for All' adopted by all states during the 'Conference of Power and New & Renewable Energy Ministers of States and UTs,' promotion of digital payments has been adopted as one of the key resolutions. The survey shows that only 1 percent of rural consumers used digital modes of payment for electricity bills, though 98 percent uses mobile phones and have bank account. This can be leveraged to promote digital modes of payment for electricity bills. DISCOMs should prioritize the digitization of receivables, initially as a means of improving collections efficiency. Further, to unlock the full benefits of digital payments, deployment of pre-paid/smart meters can be considered.

Co-opt existing DRE/off-grid systems with central grid: Multiple studies indicated that servicing rural household in remote areas through grid based/centralised systems is often more expensive compared to decentralised generation. The Draft Energy Policy, 2017 (NITI Aayog), also identifies DRE-based infrastructure as an opportunity for developing the future power sector. Decentralised generation systems (e.g. solar/biomass based generation systems) set up close to the demand centres can be leveraged to serve rural consumers. State-level policies and regulations need to be developed for survival and coexistence of these installation with the central grid.

Standard of living and wellbeing

Monitor parameters related to improved quality of living and wellbeing: Access to electricity services contributes to the greater welfare and increasingly higher levels of economic well-being. About 58 percent of respondents mentioned that the overall mobility of women has increased, 34 percent of them stated that the number of coaching classes and evening schools in the village has increased and 29 percent stated that the hours of operations of health facilities have increased. It is imperative to track the progress of such development — e.g. improvement in community services, productive end uses, education etc. on a periodic basis.

Street lighting programme for rural areas: Absence of street lights in villages has been identified as a major areas of concern by the consumers. About 6 percent of the consumers mentioned presence of street lights in the villages. Since electricity infrastructure has been developed in all the villages, implementation of a street lighting programme for rural areas deserves consideration. State-level programmes for installation of street lights in rural areas can be designed. The role of private sector entities or Energy Service Companies (ESCOs) may also be explored.

Aiding people with disability: People with disabilities often have a special need for electricity services as they spend a substantial amount of time indoors and are dependent on assistive appliances. The conducive ecosystem to support learning and development for such people can only start with access to electricity. Under the Saubhagya scheme, free electricity connection is provided to households with disabled members, which is a welcome initiative. Further, additional support is required to ensure that people with disability can access the full potential benefits of electricity services with ease. Special provisions can be made for households with disabled members such as: (i) Extending the bill payment time; (ii) Provision for printing of bills in larger fonts, braille and audio version; and (iii) Sensitizing the billing and collection agents by way of trainings/workshops.



Empowering people – Enhancing effectiveness of rural electrification programmes

Recommendations

- Continued focus to increase household coverage
- Creating inter scheme leverage: (Saubhagya with UJALA, Mission Indradhanush, Bima Yojana (PMJJBY), Suraksha Yojana (PMSBY), etc.)
- Encourage electricity-led enterprises for increasing economic activities and job creation
- Scaling up EE, e.g., star-rated appliances offered through service contracts, promote D.C appliances
- Robust metering, billing and collection processes — franchising/outsourcing
- Prepaid/smart metering and other digital initiatives to reduce cost to serve
- Focus on quality & reliability and continued improvement of service standards (commence with monitoring fewer parameters to enhance experience)
- Continuous awareness campaign
- Co-opt existing DRE systems that harmonize grid and off-grid systems
- Monitoring parameters related to quality of life & wellbeing
- Street lighting programme for rural areas
- Aiding people with disability
- Continued focus on:
 - Skill development
 - New business models to enhance viability
 - Overall economic development
 - Quality and reliability
 - Digital initiatives



Survey findings

- 56 percent un-electrified households are planning to avail electricity connections.
- Top barriers to hh electrification : (i) high connection charges; (ii) cumbersome process (iii) perception of electricity being more expensive than traditional fuels.
- People in rural areas use DG sets (5 percent) as backup sources and in some cases RE micro grids.
- 22 percent respondents do not receive regular electricity bills.
- Electricity usage was the highest for lighting, followed by mobile charging, fans and TVs.
- 24 percent households are planning to buy new appliances.
- Of the ones that are looking to buy new appliances, lighting, fans and mobile phones are top priorities.
- 98 percent rural households uses mobile phones — indicates familiarity with “pre-paid” concept.
- 72 percent of the microenterprises reported an increase in hours of operations after electrification.
- 90 percent microenterprises (those operational even before electrification) stated that their net-income has increased after electrification. These include rice & flour mills, general stores, mobile shop/photocopy/photo-studio, tailoring shops, poultry, parlor/saloon and hardware shops.
- Major quality-related issues faced by consumers are voltage fluctuations & supply shortage.
- Provision of electricity services has increased children’s study hours (in evening) by 30 minutes; 29 percent stated that hrs of operations of local healthcare facilities have increased after electrification.
- 65 percent electrified households stated that women now have more time for socializing & leisure activities.
- 43 percent electrified households stated that incidence of injuries due to darkness have reduced after electrification.
- 80 percent of rural households use traditional fuels (e.g., wood, dung cake) for cooking. Though electricity has not replaced cooking fuel, it has made it easier to cook during evening hours.
- 98 percent of rural households have bank accounts — indicating high penetration of Jan Dhan Yojana.

Social dimensions should also be monitored and evaluated

Indicators – Social dimension

Indicative list

- Percentage of electrified households
- Hours of supply
- Per capita income
- Appliance ownership
- No. of women owned enterprises
- No. of operational street lights
- Student enrollment and truancy rate
- Hours spent on productive activities
- Productive end use

1 BACKGROUND AND OBJECTIVE OF THE STUDY



Background and Objective of the Study

1

1.1 Background

Energy access has been universally accepted as part of Sustainable Development Goal 7 (SDG 7) — which aims to ensure universal access to affordable, reliable, sustainable and modern energy by 2030 (UNDP 2016) — and is essential for poverty reduction and sustainable development. Ensuring electrification of the vast rural swathes of the country is a critical part of the ‘Power for All’ mission and has become central to various Gol plans and programmes. Under the Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY), extensive rural electrification work has been undertaken and as a result, 100% of the villages have now been electrified.

Table 1 Evolving definition of village electrification¹

Time period	Definition of village electrification
Prior to October 1997	A village was considered electrified if electricity was being used within its revenue area for any purpose whatsoever.
After October 1997	A village was considered electrified if electricity was being used in the inhabited locality, within the revenue boundary of the village, for any purpose whatsoever.
From 2005 onwards	A village is considered as electrified if: <ul style="list-style-type: none">• Basic infrastructure, such as distribution transformer and distribution lines, are provided in the inhabited locality as well as the Dalit Basti hamlet where it exists,• Electricity connections are provided to public places such as schools, panchayat office and healthcare centres, and• At least 10 percent of the households in the village are electrified.

The Gol is now implementing Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya), which aims to achieve universal household electrification by December, 2018 (MoP 2017). The following are the scheme’s key features:

- Free electricity connections are provided to the beneficiary households, which will be identified using the 2011 Socio-Economic and Caste Census (SECC) data. This includes SC/ST households, female-headed households, households having member(s) with disability and landless households, among others.
- Households that are not eligible for free electricity connections will be provided connections at the rate of INR500 per household, which will be recovered by the respective DISCOMs in 10 instalments along with their electricity bills.
- DISCOMs have been directed to organise special camps for releasing new service connections.
- Solar power systems of 200–300 Wp capacity (with battery bank) will be provided to households that cannot be connected with electricity grid. With the advent of energy-efficient appliances, a 300 Wp panel can be used not only for lighting, but also for other applications such as fans, televisions and/or other communication devices.

¹ http://www.ddugjy.gov.in/mis/portal/definition_electrified_village.jsp, last accessed on 30th April, 2018



1.2 Rationale

Improved electricity access brings better quality of life, advancements in social infrastructure, and economic and social development, among others. However, access to electricity is not a binary measure but consists of a broad spectrum of characteristics which work in tandem to define effective energy access. Physical electrification infrastructure is only the first step in enabling access to electricity: studies show that while electricity services may seem to be equally available to everyone, certain sections of the society may be hindered in their use, mostly due to unequal access to finance, information, and training or education or prevailing socio cultural hierarchies (CEEW 2017). For instance, women, especially in developing countries often live under discriminating conditions including unequal decision making structures, which gives rise to questions on how investments in energy access programmes empower women and affect/promote gender equality (Winther, et al. 2017). Similarly, energy services may also overlook social aspects that either support or restrict access of people from marginalized groups—such as the disabled; particular caste, linguistic or religious groups; immigrants; people living in far flung areas, etc. to energy services.

The government has undertaken various rural electrification initiatives, however, the above considerations make it imperative to understand the effectiveness of such initiatives from a social inclusion perspective. Keeping this in view, a study, “Empowering People — Enhancing Effectiveness of Rural Electrification Programmes,” was undertaken from a social inclusion perspective. The study provides useful insights on the effectiveness of rural electrification initiatives in India on key parameters — quality of life improvement/welfare benefits, user's experience related to electricity supply and services, and barriers to household electrification. It provides directional inputs for identifying policy interventions and other improvement measures to enhance effectiveness of rural electrification initiatives from a gender and social inclusion perspective

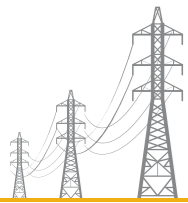
1.3 Objectives

The key objectives of the study were to:

- Assess the effectiveness of rural electrification initiatives from a gender and social inclusion perspective,
- Characterize who are presently excluded from the scheme or are unable to benefit to the fullest extent and identify factors responsible for the same and
- Identify measures required to enhance effectiveness of rural electrification initiatives.

2 APPROACH AND METHODOLOGY



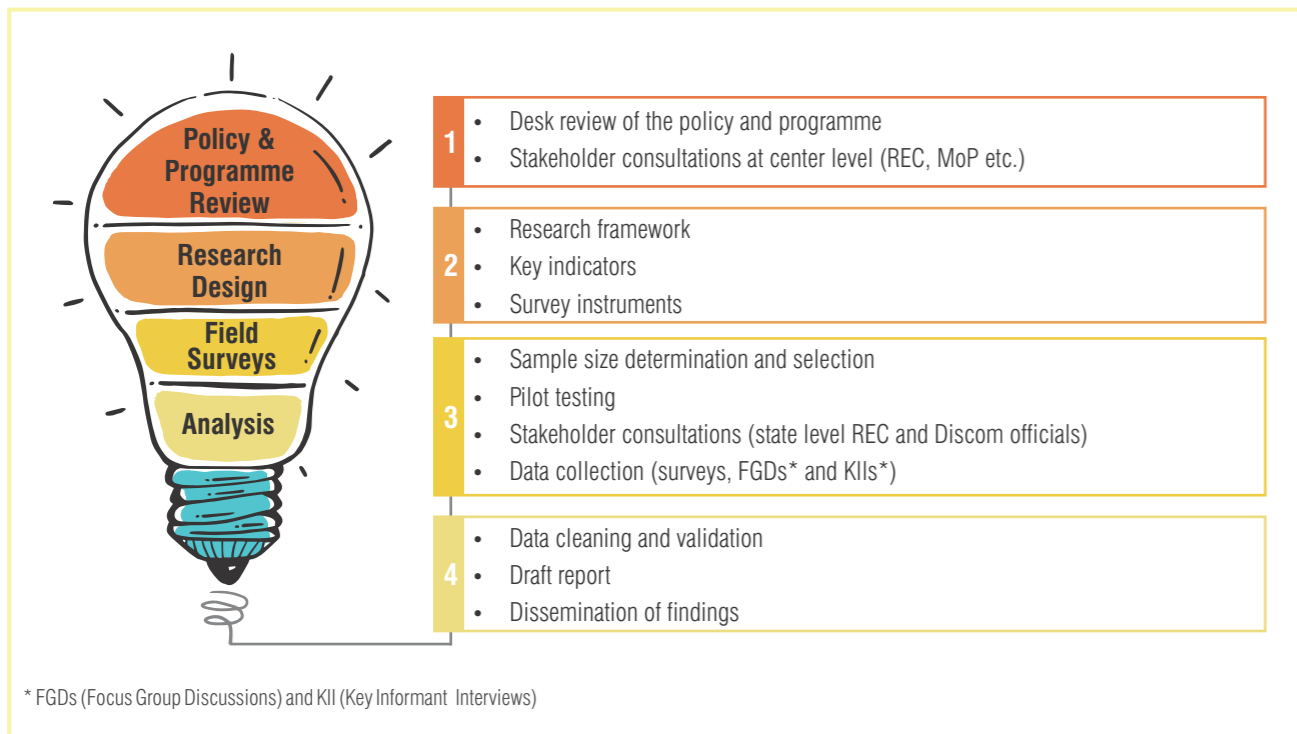


Historically, access to electricity has been measured in binary terms — ‘whether a household has an electricity connection or not’. However, factors such as quality and reliability of electricity supply, consumers’ experience with respect to electricity services (including metering, billing and collection services), improvement in social and community services are also equally important. A new approach for monitoring these aspects was developed as part of the Global Tracking Framework (GTF) (World Bank 2017) under Sustainable Energy for All (SE4ALL) initiative (Sustainable Energy for All 2011). It envisaged the use of binary metrics over the immediate term in view of paucity of data, however it also emphasized on using a Multi-Tier Framework (MTF) over medium and longer term.

The MTF has been designed to monitor and evaluate energy access by following a multidimensional approach. Key dimensions or locales defined in the MTF are energy access for (i) households (including access to electricity and cooking fuel); (ii) productive engagements/enterprises and (iii) community services (e.g. street lighting, education facilities, healthcare facilities, etc.). For each of these dimensions, a range of attributes have been defined and progress is measured using a multi-tiered-spectrum which ranges from Tier 0 (no access) to Tier 5 (the highest level of access). These attributes includes - capacity (measured in terms of watt or watt-hours), duration, reliability, quality, legality, health, safety, etc.

Considering the objectives of present study, a research framework was developed to assess the effectiveness of rural ‘electrification’ initiatives. Some of the key attributes covered under the MTF, such as duration, quality and reliability of electricity supply, were also captured in this research framework. In addition, the assessment links electricity access to parameters such as standard of living, caste and gender, which may influence its adoption and use. The overall approach followed for the study is presented in Figure 1.

Figure 1 Approach for conducting the study



The following sections briefly talk about each of the above-mentioned steps.



2.1 Policy and programme review

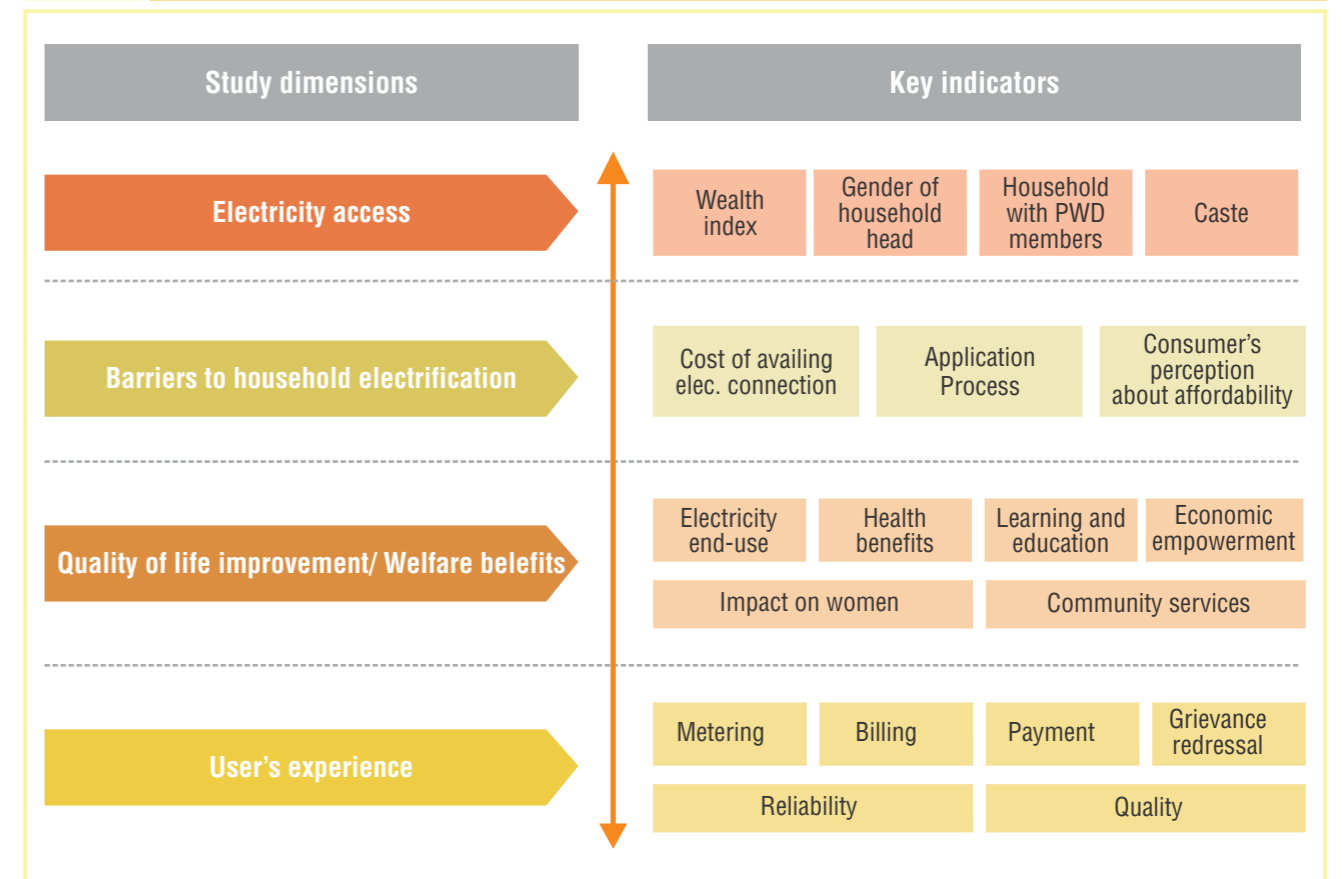
This includes review of Gol’s various rural electrification initiatives (including RGGVY and DDUGJY) to understand key challenges faced during implementation and strategies adopted to overcome those challenges. It provided inputs for identification of key issues for further assessment, including gender and social inclusion aspects. The key steps followed at this stage were:

- Detailed review of the documents related to the rural electrification schemes to understand the intent, objectives and implementation modalities
- Consultations with key stakeholders, including the Ministry of Power (MoP) and Rural Electrification Corporation (REC), to identify study states and understand the key issues faced during implementation
- Meetings with the government and non-governmental agencies involved in the states to gather perspectives, identify areas/groups that are likely to be marginalised, related concerns, methods/practices being adopted for improved delivery and suggestions to enhance consumer experience

2.2 Research design

A snapshot of the multi-dimensional research framework developed for conducting this study is presented in Figure 2. Consumer responses with respect to the key indicators of each of the four dimensions mentioned below were captured.

Figure 2 Research framework



- **Differential electricity access:** Different groups have different capacities to access electricity services, depending on a number of factors. A comparative assessment of the income group, caste and gender profile of the household heads among the electrified and un-electrified households was carried out to understand who has been able to access electricity services.
- **Reasons for not availing electricity connections:** A survey of un-electrified households was conducted to understand the reasons behind households not availing electricity connections.
- **Quality of life improvement/welfare benefits for men and women:** Consumers' perception of benefits of electricity access on key parameters was captured. This included:
 - o Electricity end-use: Appliances used and future aspirations of electrified households
 - o Health benefits: Reduction in incidences of fire, coughing and itching in eyes due to reduction in indoor air pollution caused by kerosene lamps
 - o Learning and education: Increase in children's study hours during evening, increase in the number of evening schools/coaching centres post electrification of villages
 - o Economic empowerment: Increase in the hours of operations and income of micro enterprises, number of women led micro enterprises
 - o Women's quality of life: Increase in the time available for social interactions, leisure and learning activities; perceptions on increase in mobility, safety and ease of performing domestic work
 - o Community services: Increase in the hours of operations and number of local healthcare facilities, availability of street lights
- **User experience:** The quality of service and supply of electricity has a significant impact on the consumers' ability to avail the full benefits of electricity access and on their perception about comparative benefits of electricity vis-à-vis traditional fuels. Consumer experience on the following key parameters was captured:
 - o Quality of services — metering, billing and bill payment: Number of metered and un-metered connection, frequency of bill distribution and consumers' experience w.r.t. complaint redressal
 - o Quality of supply: Issues faced by consumers related to daily hours of supply, voltage fluctuations, etc.

The respondent group included electrified households, un-electrified households, rural micro enterprises (productive end uses) and community institutions (schools, Gram Panchayats and local healthcare centres). The list of survey instruments used to collect information from these respondents groups are provided in Table 2.

Table 2 List of survey instruments

Instruments	Target group
Structured questionnaires	Electrified and un-electrified households, and rural micro enterprises <ul style="list-style-type: none"> • Primary respondent: The primary respondent was preferably the head of the household (male or female). If not available, then an available adult was interviewed. • Secondary respondent: The household questionnaire included a section specifically directed at women, in case the primary respondent is a man.

Instruments	Target Group
Interviews guidebook	<ul style="list-style-type: none"> • School teachers, healthcare services/primary healthcare centres and Gram Panchayats
FGD guidebook	<ul style="list-style-type: none"> • Men and women from user communities

2.3 Field surveys

Selection of states

The study focused on assessing the effectiveness of rural electrification initiatives in four states — Bihar, Odisha, Rajasthan and Uttar Pradesh. These were selected on the basis of consultation with key stakeholders — the MoP and REC.



Interview with ASHA worker, Dhauri Village, Bhojpur District, Bihar



Table 3 Key statistics of selected states

States	Un-electrified rural household (%)	BPL population (%)	Female-headed households (%)	SC/ST households (%)
Bihar	23	34	7	12
Odisha	33	33	10	37
Uttar Pradesh	37	29	8	19
Rajasthan	15	15	7	28
All India	17	12	10	25

Source: Saubhagya dashboard (last accessed on 14 May 2018) and census of India, 2011

Sample size and sample distribution

The sample size for the household survey was estimated with an acceptable error of +/- 5 percent in the sample design (details provided in Annexure 1). The total sample size of at least 270 electrified households and the same number of un-electrified households was considered for each state. The number of respondents across different categories and FGDs conducted in the 4 states are provided in Table 4.

Table 4 Number of respondents across different categories and FGDs

States	Sample Size						
	No. of Districts	No. of Villages	Electrified	Un-electrified	Total	Micro enterprises	FGDs and interviews
Bihar	3	18	287	262	549	51	8
UP	3	18	271	270	541	77	8
Rajasthan	3	18	269	268	537	64	8
Odisha	3	18	289	285	574	59	8
Total	12	72	1,116	1,085	2,201	251	32

Interactions were also undertaken with key stakeholders such as officials of REC and DISCOMs, school teachers, representatives of local healthcare centres and Gram Panchayats.

Districts and villages were selected on the basis of social maps drawn in consultation with local representatives of DISCOMs/REC/Gram Panchayats, keeping in mind parameters such as percentage of electrified and un-electrified households, number of electrified villages, percentage of BPL population and remoteness of district/village, among others.

2.4 Analysis

The data analysis process included four stages — (i) preliminary assessment; (ii) verification and validation; (iii) data cleaning and (iv) analysis of information on key parameters of the four dimensions identified in research framework. Based on these, actions required for enhancing the effectiveness of rural electrification initiatives were identified.

The key findings and insights emerging from the field studies are presented in the subsequent sections of this report.



3 SURVEY FINDINGS



Survey findings

3

This chapter provides the key findings of the household survey. The first section presents the demographic profile of electrified and un-electrified households and attempts to explore if there are any socio-economic factors influencing access to electric supply. The second section provides analysis of responses from un-electrified households on reasons for not availing electricity connections. The third section provides users' perception of the quality of life improvement/welfare benefits from electrification, again linked to exclusion parameters. The last section deals with their experience regarding electricity services and supply quality. Key findings are portrayed in the graphic below (Figure 3).

Figure 3 Key findings

Access to electricity supply



- Proportion of low wealth category households is lower among electrified as compared to the un-electrified households.
- No differential was observed in terms of access across other indicators such as caste, gender etc.

Barriers to household electrification



- Major barriers to household electrification from the consumers' perspective are high connection charges, cumbersome process and perception of electricity being expensive than traditional fuels.
- 56% un-electrified households were planning to avail electricity connection.

Quality of life improvement/ welfare benefits



- Electricity usage was the highest for lighting, followed by mobile charging, fans and TV.
- 24% of households are also planning to purchase new electric appliances- lighting, fan and mobile phones are top priorities.
- Among the households electrified in past 3 years, average hours of study for children during evening have increased by around 30 minutes.
- 43% electrified households stated that incidence of injuries due to darkness have reduced after electrification.
- 65% households stated that women have more time for socializing & leisure activities after electrification.
- 34% of respondents stated that number of evening schools/coaching classes have increased in their villages.
- 90% of micro-enterprises reported increase in net income has increased after electrification. 72% also reported increase in evening hours of operation.
- 14% micro-enterprises were owned by women.

User experience



- While majority of electrified households in Odisha and Rajasthan were metered, 59% of households in UP and 16% in Bihar were unmetered.
- Around 22% consumers reported that they do not receive regular electricity bills.
- Majority of consumers pay electricity bills every month while 14–29% mentioned that they paid it once in the last six months.
- Major quality-related issues faced by consumers are voltage fluctuations & supply shortage.

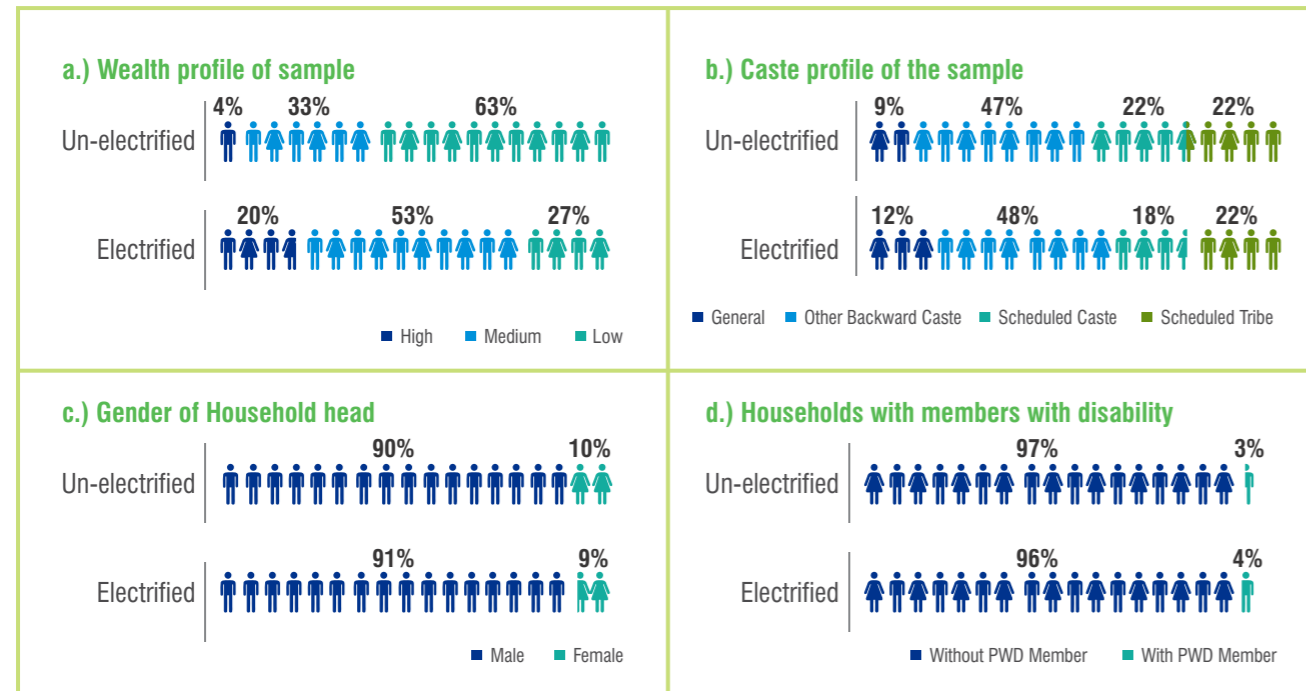


3.1 Access to electricity supply

The demographic profile of electrified and un-electrified households on the basis of key parameters — (i) Wealth category² (ii) caste and other social characteristics (iii) gender of the household head and (iv) household with and without members with disability — is showcased in Figure 4.

There was a significant difference in electricity access with respect to wealth profile: the proportion of low wealth category households is lower among electrified as compared to un-electrified households. However, no significant differential was observed on other indicators among electrified and un-electrified households.

Figure 4 Demographic characteristics of sample households



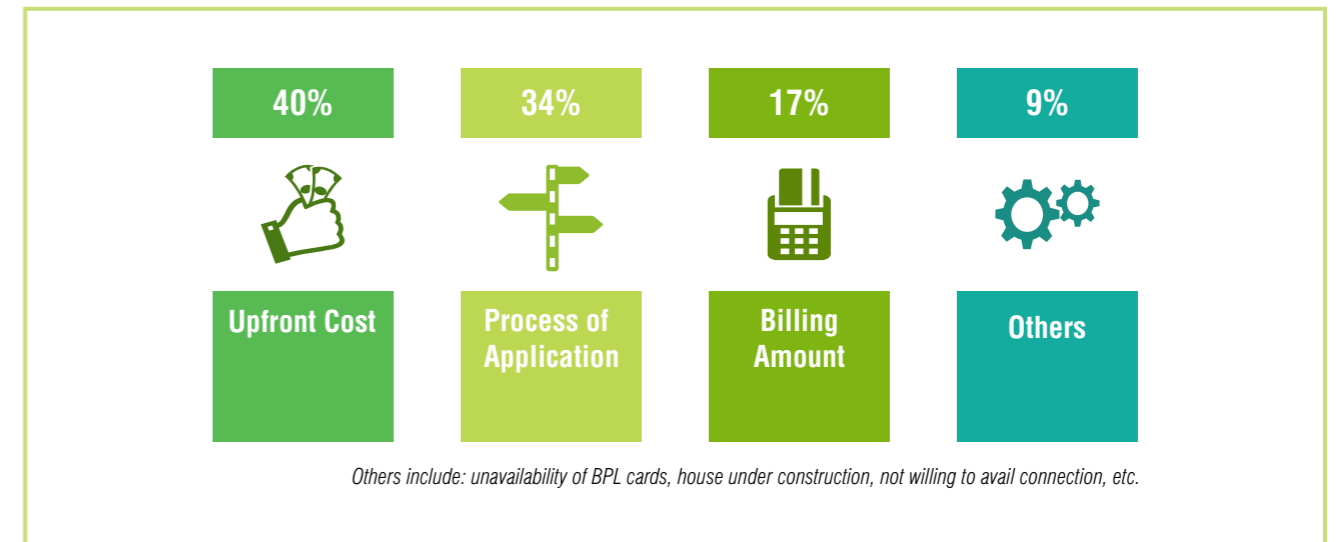
*PWD – People with disability

3.2 Barriers to household electrification

As mentioned in section-2, a survey of un-electrified households was also conducted to understand the reasons for not availing electricity connections. Major reasons mentioned by un-electrified households were (i) high upfront cost of electricity connection, (ii) cumbersome process of application and (iii) consumers' perception that cost of electricity consumption is higher than that of traditional fuels, among others. (Figure 5)

² Wealth Category (Index) has been defined by using the same approach as adopted by National Family Health Survey (NFHS). Information on 27 household assets and housing characteristics, such as ownership of consumer items, type of dwelling, source of water, etc. was collected and combined into a single index, using weights assigned to individual components by NFHS. (International Institute for Population Sciences, 2017).

Figure 5 Reasons for not availing electricity connection – stated by un-electrified households



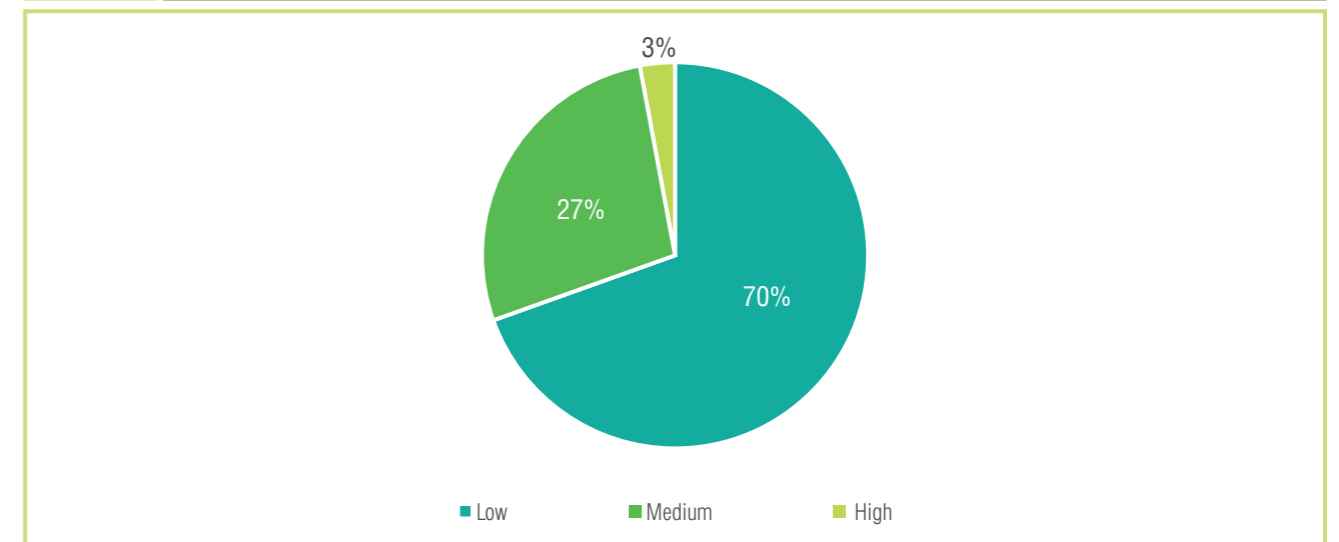
Each of these reasons are further analyzed in the following sections.

3.2.1 Upfront cost

One of the major reason for not availing electricity connection as stated by un-electrified households was high upfront cost. The connection charges vary from state to state and include cost of electricity connection, determined by state electricity regulatory commissions and cost of developing infrastructure for last mile connectivity. The latter is applicable, if a household is located far from the nearest electricity pole/charge point (limit varies from state to state). Additionally, a consumer has to incur the cost of internal wiring and electrical appliances.

High connection charges are a frequent barrier to connecting the poor.
- Villagers during FGDs

Figure 6 Wealth category wise breakup of hhs stating high upfront cost as major barrier



About 70% respondents who stated high upfront cost as a major reason for not availing electricity connection were from low wealth category. Discussion during the surveys suggest that part of the problem is linked to low awareness about availability of free electricity connections for BPL households (under DDUGJY) and process of availing electricity connection.

This issue of high upfront cost of availing electricity connection is addressed under the Saubhagya scheme, wherein free electricity connections are provided to the beneficiary households. Further, those which are not eligible for free electricity connections, are eligible to avail electricity connections at a nominal rate of Rs. 500/-, which can be paid in 10 monthly installments. It is imperative to ensure that all un-electrified households are aware of this scheme so that they can take informed decisions for availing electricity connection.

3.2.2 Process of availing electricity connection

For availing a new electricity connection, consumers have to submit an application form along with the supporting documents such as lease agreement or records to prove that land/premises is owned by the applicant, identity proof etc.

Further, as mentioned above, prior to implementation of the Saubhagya scheme, consumers had to pay additional charges for arranging last mile infrastructure, if their house was located far from the nearest pole³ (Figure 7).

However, under the Saubhagya scheme, infrastructure for last mile connectivity is being provided by the government and consumers do not have to pay additional charges for the same. Hence, it is expected that all consumers, even those who live in sparsely populated hamlets and periphery of villages, will be able to benefit from this scheme.



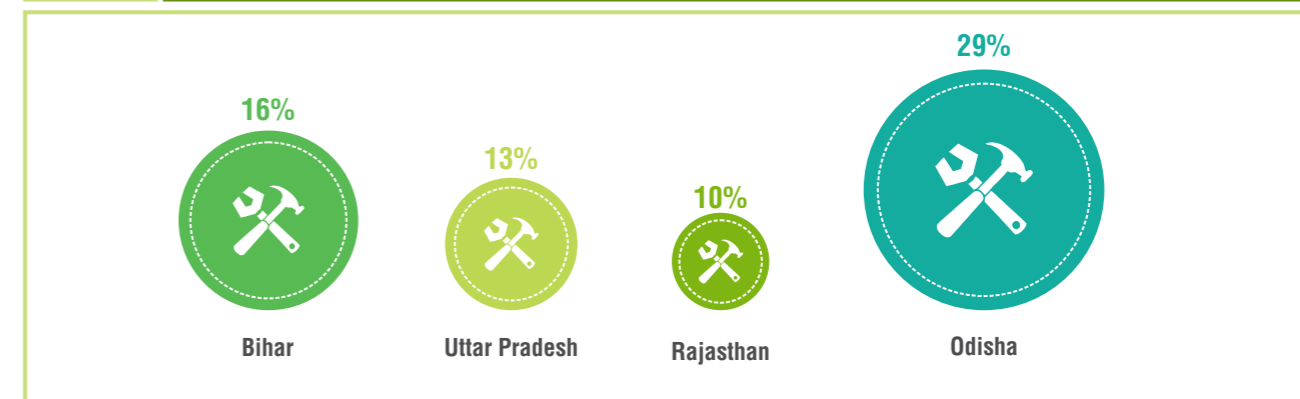
³ As per the guidelines issued by various state electricity regulatory commissions, consumers have to pay for additional infrastructure (such as cables and poles) if the distance between their house and nearest electricity pole/charge point is more than certain limit (varies from state to state).

3.2.3 Higher electricity bills and other major reasons

Other major reason for not availing electricity connection was (i) people’s perception that electricity is expensive than traditional fuels and (ii) fear of receiving higher electricity bills (accrued over a period). It is imperative to note that people in rural areas mostly rely on the experiences of neighboring households. Even a single case of abnormal billing in the village has a significant impact on people’s perception and this can restrict them from availing electricity connection. Apart from this, some of the other reasons mentioned by un-electrified households were:

- Households with fire-prone roofs are apprehensive of availing electricity connection owing to fear of fire. People living in such houses do not allow electricity wires to pass near their houses due to fear of fire.
- Some respondents stated that since they were not present in the village (were away from home due to personal/professional work) when electricity camps were organised, they were not able to avail electricity connection.
- Some of the respondents stated that they prefer ‘older ways of life’ and they do not want to avail electricity connection.

Figure 7 Percentage of households who paid for arranging last mile infrastructure



About 56% un-electrified households reported that they are willing to get an electricity connection. This number is expected to increase as the issues related to connection charges and process of availing electricity connections are addressed under the Saubhagya scheme.

3.3 Quality of life improvement/Welfare benefits

Access to electricity services provides multiple benefits related to quality of life improvement and consumer welfare. The extent of benefits can vary both among the households and the members of the households (World Bank, 2012). The following section provides analysis of consumers’ responses on various parameters related to quality of life improvement and welfare benefits of rural electrification initiatives.



3.3.1 Electricity end-use

This section examines the appliances used by electrified households and their future aspirations of purchasing new electrical appliances. It can be seen as a proxy indicator of the level of adoption of electricity and provide insights on how to maximize the benefits.

3.3.1.1 End-use appliances

It was observed that electricity is predominantly being used for lights, fans and charging mobile phones in all the four states. About half of the respondents in UP, Rajasthan and Odisha also use electricity to watch television. Other appliances used, though in very small numbers were air conditioners and air coolers (mostly in Rajasthan), washing machines, sewing machines, etc. (Figure 8). The key observations are:

- About 98 percent of households have one or more mobile phones, which are charged using electricity. The villagers stated, that charging of mobile phones was accorded high priority and considered as 'necessary' for connectivity and entertainment, especially by the youth.
- Vis-à-vis other surveyed states, Rajasthan reported a higher penetration of refrigerators and space conditioning appliances (e.g., coolers and/or air-conditioners). About 11 percent and 17 percent of households in Rajasthan were using electricity for air-conditioning systems and refrigerators, respectively. Further analysis of responses from households electrified in last three years revealed that the penetration of such appliances was much lower (4 percent and 1 percent, respectively). This highlights that gradually people move up in the energy ladder, with rural consumers increasingly likely to purchase such energy-intensive appliances to meet their needs and aspirations.
- Electricity is rarely used for cooking in rural areas, despite interest demonstrated by many women respondents.
- A comparison of appliance ownership among wealth categories shows a higher penetration of energy-intensive appliances among those from high-wealth categories (Figure 9).



Figure 8 Consumers using electricity for different appliances , by state (%)

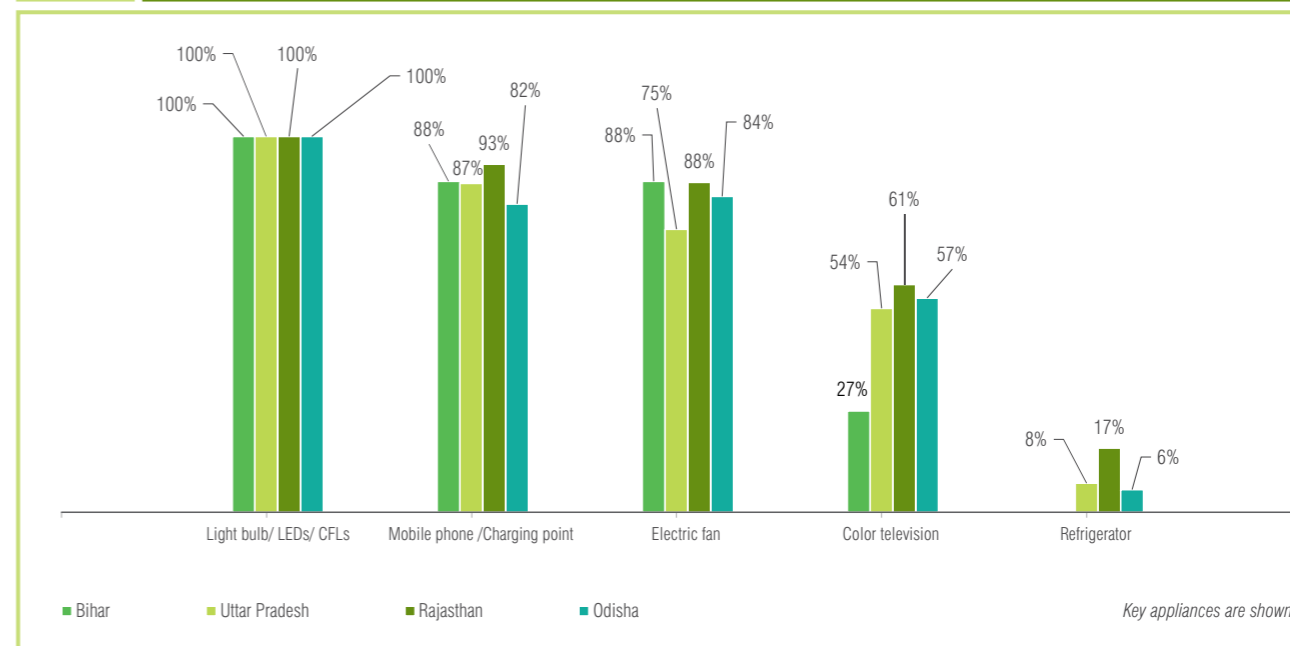
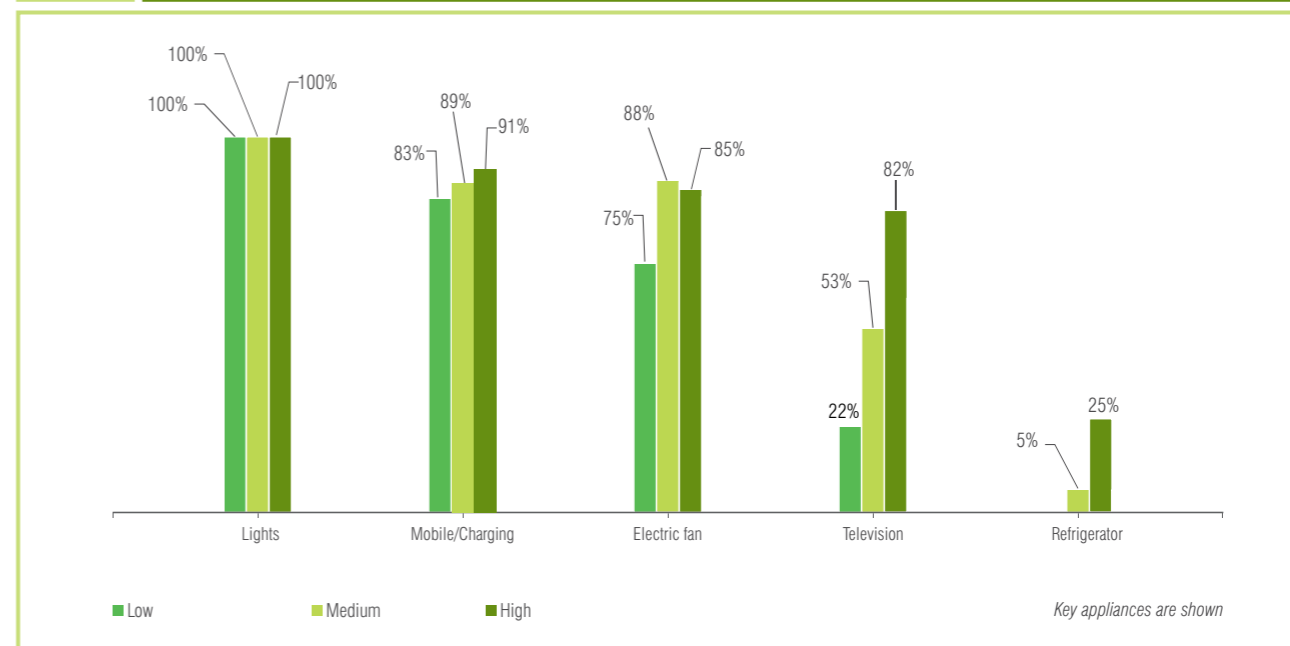


Figure 9 Consumers using electricity for different appliances, by wealth category (%)



“Before electrification “we used to charge mobile phones at the neighbour’s house and it was inconvenient especially for my wife. Hence, we decided to avail electricity connection.”

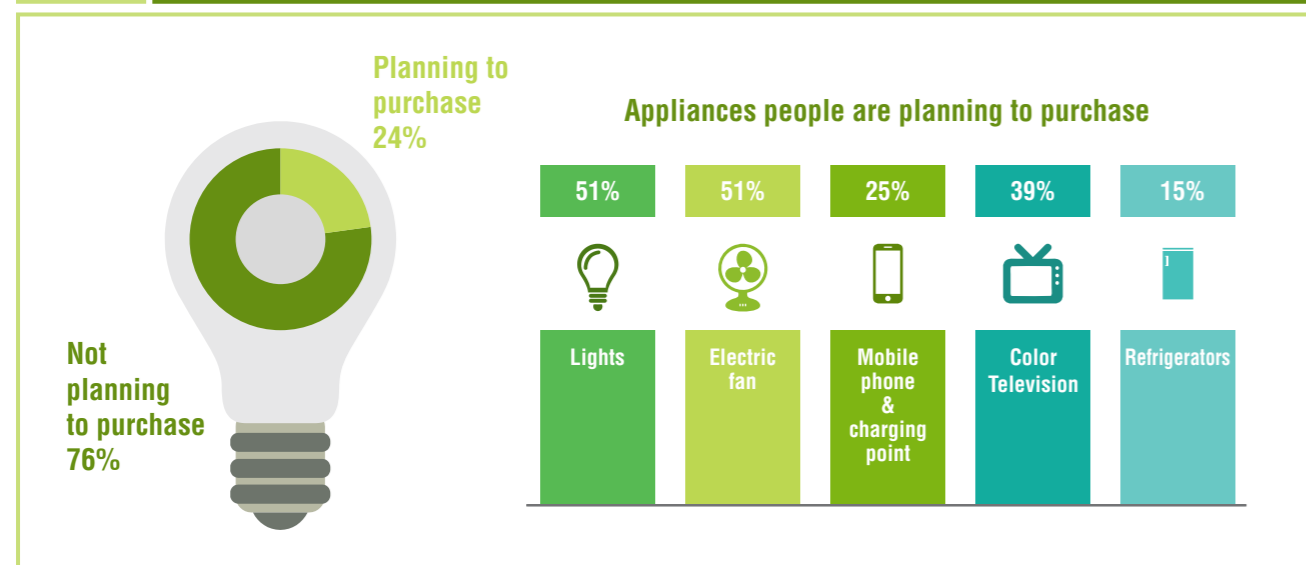
– Consumer in Balua Village, Bhojpur District, Bihar



3.3.1.2 Consumers' aspirations for purchasing new appliances

With the advent of electricity, consumers' aspiration to purchase new electrical appliances has increased. About 24 percent of respondents mentioned that they were planning to purchase new electric appliances, mainly lighting (bulbs/CFLs/LED), fans and mobile phones. More than half of them mentioned that they are planning to purchase television sets. Around 9% of these households also mentioned about their willingness to purchase electricity intensive appliances like: ACs, washing machines and refrigerators (Figure 10). All of these suggest that though slowly, consumers are moving towards and aspiring for more energy-consuming appliances, indicating certainty of increase in the number of appliances and electricity demand with increase in electricity access in the villages.

Figure 10 Consumers' aspirations to purchase new appliances



3.3.2 Learning and education

The primary ways in which electrification affects education are (i) increase in availability of schools/coaching centres during evening hours and (ii) increase in time allocation at home for studying. Some of the related benefits rural people mentioned were:

- Average hours of study for children in evening (between 6 PM and 10 PM) have increased by about 30 minutes, in all the four states (Figure 11)⁴.
- About 34 percent of the households⁵ stated that the number of evening schools/coaching classes has increased in their villages after electrification.
- Many villagers mentioned (during FGDs) that women and girls have more free time during the day, as they can now undertake household tasks such as cooking and water pumping in evening/night.
- Further, it was observed that educating children has been considered as one of the key driving forces by consumers to avail electricity connections. Among un-electrified households, about 80 percent of those with school-going children mentioned that they were planning to apply for electricity connection.

⁴ Mentioned by recently electrified households (in last 3 years)

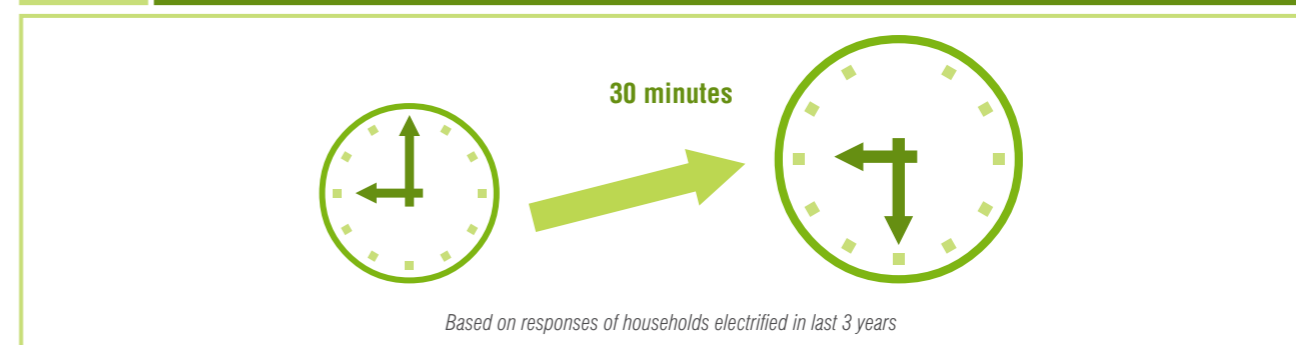
⁵ This includes both electrified and un-electrified households



Aanganwadi Centre, Nilo Rukunpur Village, Vaishali District, Bihar

Increase in study hours due to access to electricity can be linked with positive gains in educational performance, thereby increased motivation and reductions in truancy. - (UNDESA 2014)

Figure 11 Increase in children's study hours during evening (6 PM to 10 PM)



3.2.3 Health benefits

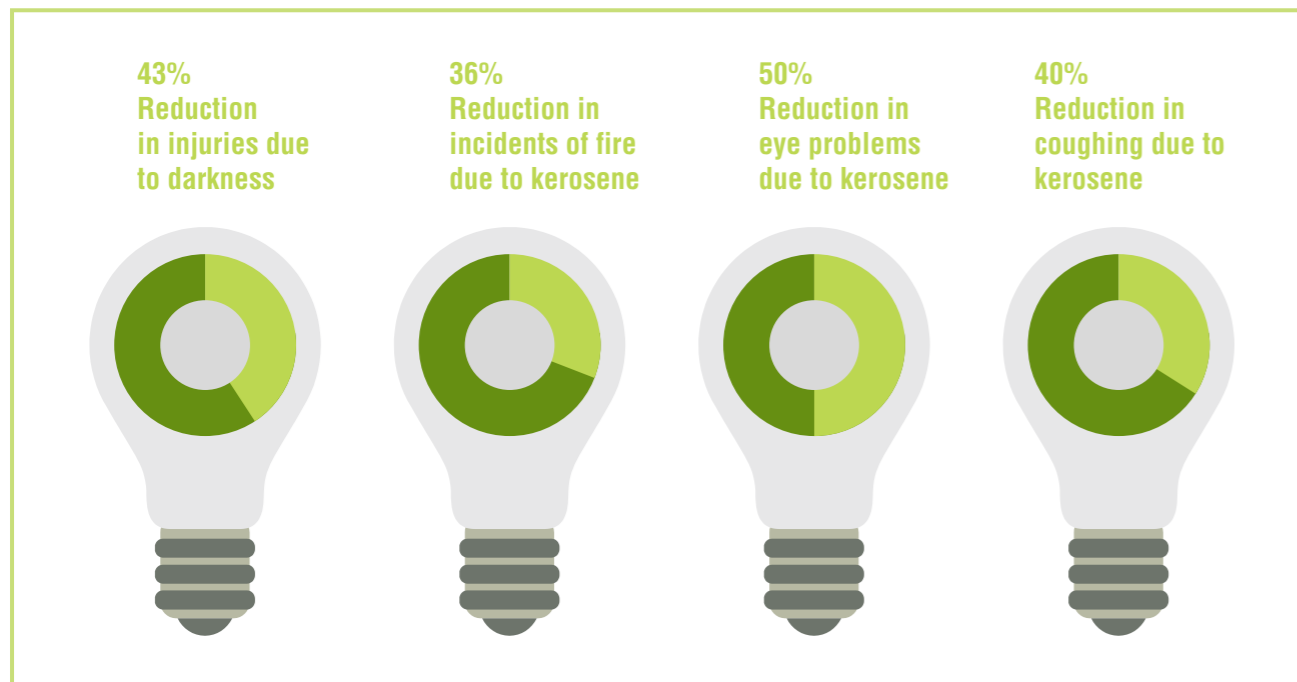
The health benefits of electrification can be attributed to two major factors (i) improved healthcare facilities in the villages due to increased hours of operations and enabling adequate capacity to store medicines and vaccinations and (ii) reduced indoor air pollution caused by kerosene lamps. Some of the key health-related benefits reported by households during the survey were:

- Reduction in eye problems, injuries in the dark, cough and fire incidence (Figure 12)
- Reduction in incidences of animal attacks
- Increased hours of operations for healthcare centres, with about 29 percent consumers mentioning this; Further, discussions with ASHA⁶ revealed that the ability of local healthcare centres to preserve medicines and vaccinations have also improved after electrification.

⁶ ASHA- Accredited social health activists



Figure 12 Reduction in health-related issues after availing electricity connection



3.2.4 Improved quality of life for women

Improved electricity access has significant impact on various quality of life parameters for women (ESMAP, 2004). Women respondents value the convenience that electricity access offers in terms of (i) ease of performing domestic chores; (ii) flexibility to carry out household tasks in evening hours, which provides more time for other activities such as socializing and leisure activities and (iii) improved sense of security and enhanced mobility, especially during evening hours (Figure 12).

On average more than 50% of the women perceived that they have experienced a positive change with the advent of electricity. (Figure 21). It was also mentioned during FGDs that the provision of electricity has made it easier for women to cook during evening hours.

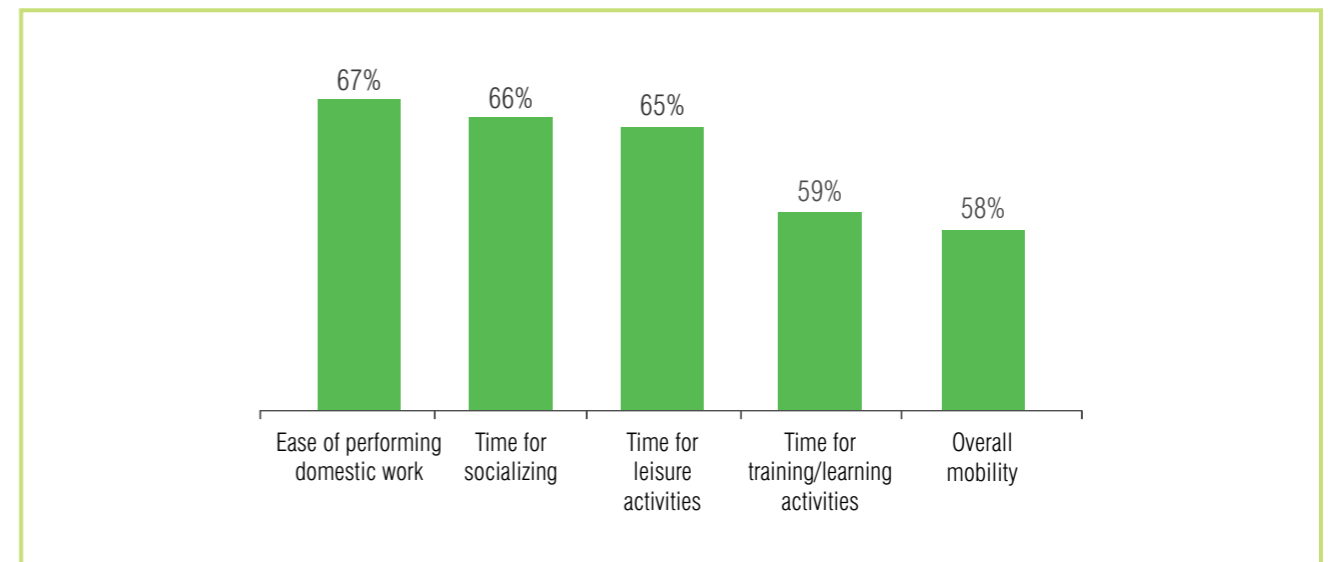


FGD in Baman Para Village, Banaswara District, Rajasthan

Prior to availing electricity connection, we had to stay awake until late night to manually grind the wheat, but now we use grinding machines during daytime.

-Women respondent from Bagas village, Sikar district, Rajasthan

Figure 13 Women's perception on improvement in quality of life (%)



The impact of electricity on women's employment and income generation capacity was also examined. About 92% percent of the consumers mentioned that women were neither involved in any income-generating activity, nor were they planning to start. This indicates that in most rural households, women primarily play the part of homemakers and carry out vital tasks to keep the household running, while men go out to earn. This further substantiates the fact that energy needs and priorities vary for men and women, e.g., unemployed or non-working women who spend most of their time in the house, require continuous energy supply even during the day, whereas working men are not present in the house during daytime and hence may not put much emphasis on uninterruptable energy supply during the day.



Before electrification we had to finish cooking early during day light hours. However, post electrification we have the freedom to cook during night hours and we look forward to watching television during dinner time with the family.

- Women respondents in FGD, Chapta Village, Vaishali District, Bihar

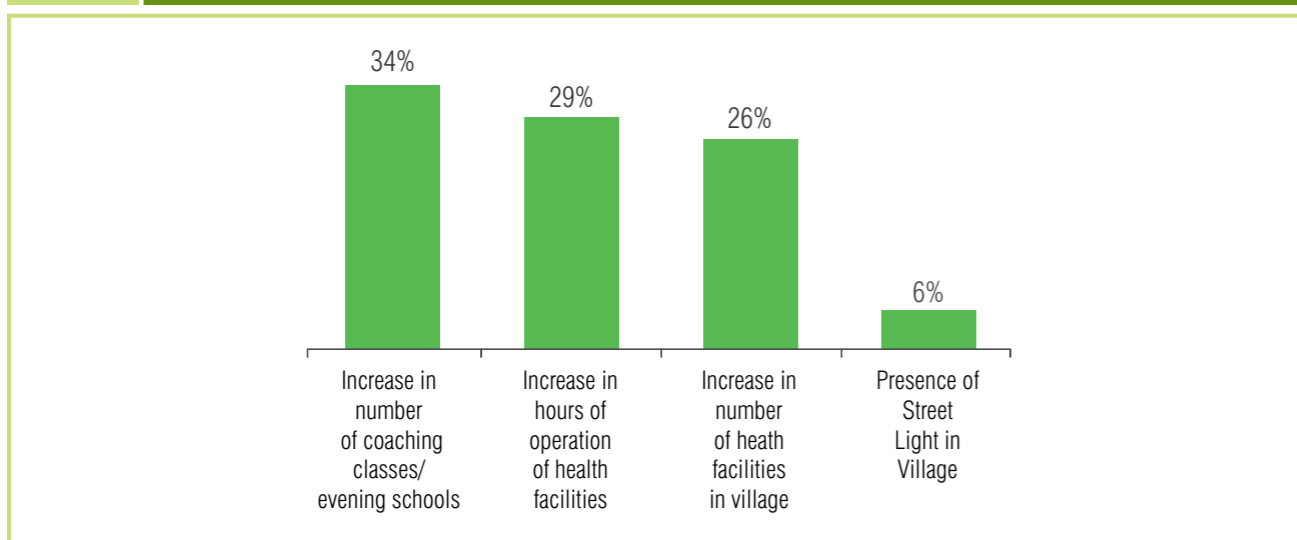
3.3.5 Improvement in community services

Community services or social infrastructure (including schools, community centres and healthcare facilities) is an essential feature of community development and contributes to the overall community well-being. It provides services and facilities that meet the needs of residents, promotes social interaction and enhances the overall quality of life within a community. Figure 14 provides the percentage of households that mentioned improvement on account of key parameters related to community services.

After electrification, local healthcare facilities have installed refrigerators/cold storages, which improves their ability to store medicines and vaccinations for longer durations

– ‘Accredited Social Health Activist (ASHA)’ in Bihar

Figure 14 Households that mentioned improvement in community services (%)



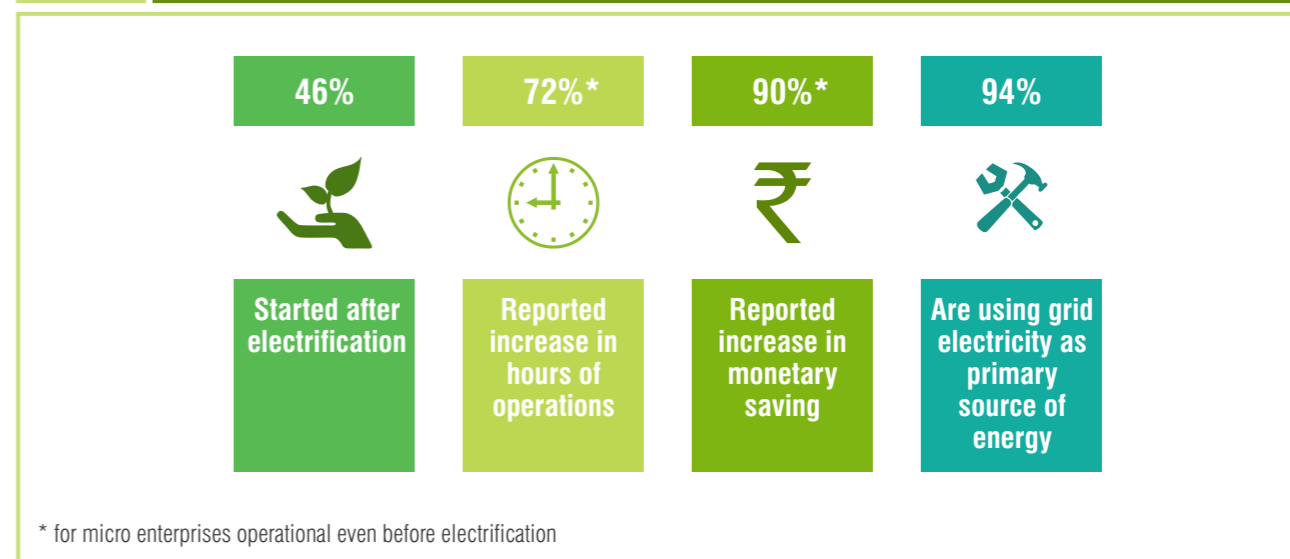
Some of the key observations were:

- About one-third of the respondents stated that the provision of lighting in the evening has resulted in increase in the number of evening schools/coaching classes in the villages. Further, nearly half of these respondents were those who were electrified in the last 3–4 years.
- One of the major areas of concern in villages was absence of street lights. Only 6 percent of the respondents mentioned about presence of street lights in village after electrification. Women were particularly concerned about this issue.
- It was mentioned during FGDs that with the advent of electricity, people now prefer to get medical treatment in local healthcare facilities rather than going to nearby cities/towns.

3.3.6 Economic empowerment and livelihood generation

Rural electrification has a distinctive productive role since electricity-powered machinery and tools can replace inefficient manual ones, resulting in more revenue and profit for commercial enterprises (ESMAP 2002) (Barkat, et al. 2002). Benefits of electrification also include extended hours of operations, improved work environment and better access to knowledge. As mentioned in section-2, a survey of 251 rural microenterprises (including thirty five women led microenterprises) was carried out across the four study states. Key insights from the survey are presented below (Figure 15).

Figure 15 Benefits of electricity as reported by rural microenterprises



- Microenterprises in villages, mainly include saloons, grocery shops, mobile repair shops, rice hullers, flour mills and tailoring shops.
- Uses of electricity in these micro enterprises vary depending on the nature of the business. While enterprises such as saloons and poultry farms uses electricity primarily for lighting/space conditioning (fans), other enterprises such as rice hullers and flour mills use it for running their motors and machines.
- Some of the microenterprises (6 percent) reported that they still use traditional fuel, e.g., diesel/kerosene as the primary source of energy. This can be primarily attributed to lack of finance as replacing old machines that run on traditional fuels with new electric machines require high capital investment.
- Most of the respondents mentioned that the hours of operations in evening have increased after electrification. This can be attributed to improved mobility of people due to lighting.
- Nearly 90 percent of the microenterprises that were operating before electrification stated that their net monthly savings (in monetary terms) have increased after electrification. This can be attributed to multiple factors, such as increase in hours of operations, savings in cost of energy and increase in disposable incomes leading to increase in demand for goods and services in villages.

3.4 User's experience

In addition to the provision of electricity connections, aspects related to quality of service and supply are equally important to achieve the desired economic and social development (ESMAP, 2015). The following sections present the analysis of consumer responses regarding their experiences on key parameters related to quality of service and supply.

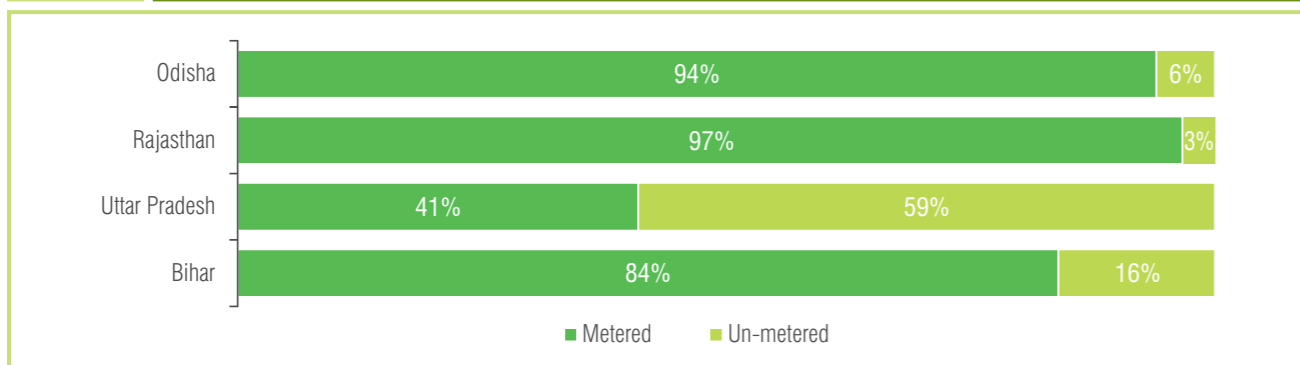


3.4.1 Quality of service

3.4.1.1 Metering

Majority of electrified households in Odisha and Rajasthan were metered, however, 59 percent and 16 percent of electrified households in UP and Bihar were unmetered⁷ (Figure 16). Lack of appropriate metering is one of the major challenges faced by DISCOMs. Unmetered consumers pay a lump-sum charge, determined by the respective regulatory commissions. This charge does not depend upon the amount of electricity consumed and is fixed for a duration (monthly or bi-monthly). Hence, at times DISCOMs are not able to recover the full cost of supply.

Figure 16 Metered and un-metered connections

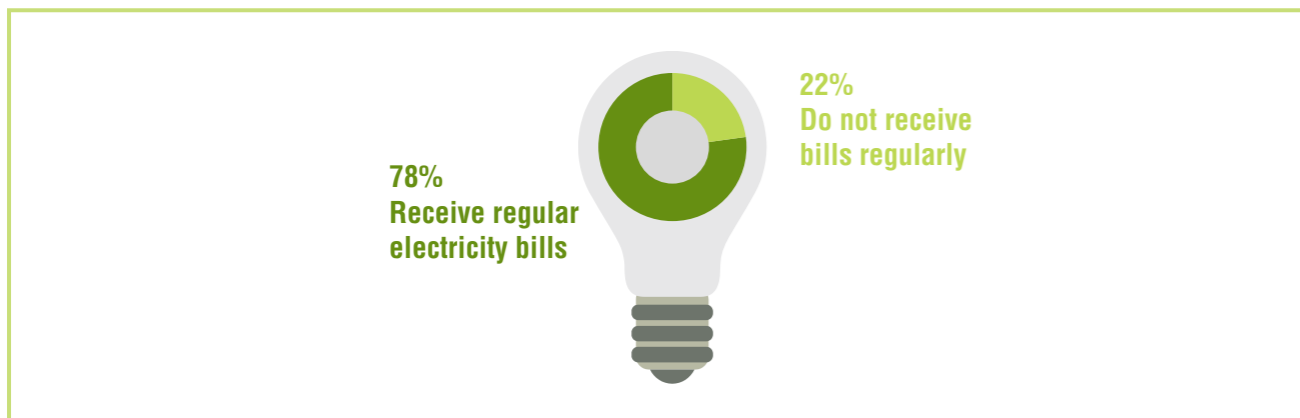


3.4.1.2 Billing

Consumer billing is one of the major touch points through which the DISCOMs interact with consumers. Regular and accurate billing is important for improving the level of consumer satisfaction. While the majority (78 percent) of consumers mentioned that they receive regular electricity bills, about 22 percent of them stated that they do not receive regular electricity bills. (Figure 17).

During FGDs, it was mentioned that delay in receiving electricity bills is one of the major reasons for consumers voluntarily surrendering their electricity connection. It also develops a fear of receiving higher electricity bills accumulated over a period of time, thereby restricting some consumers to use electricity only for lighting.

Figure 17 Consumer's responses about frequency of receiving electricity bills

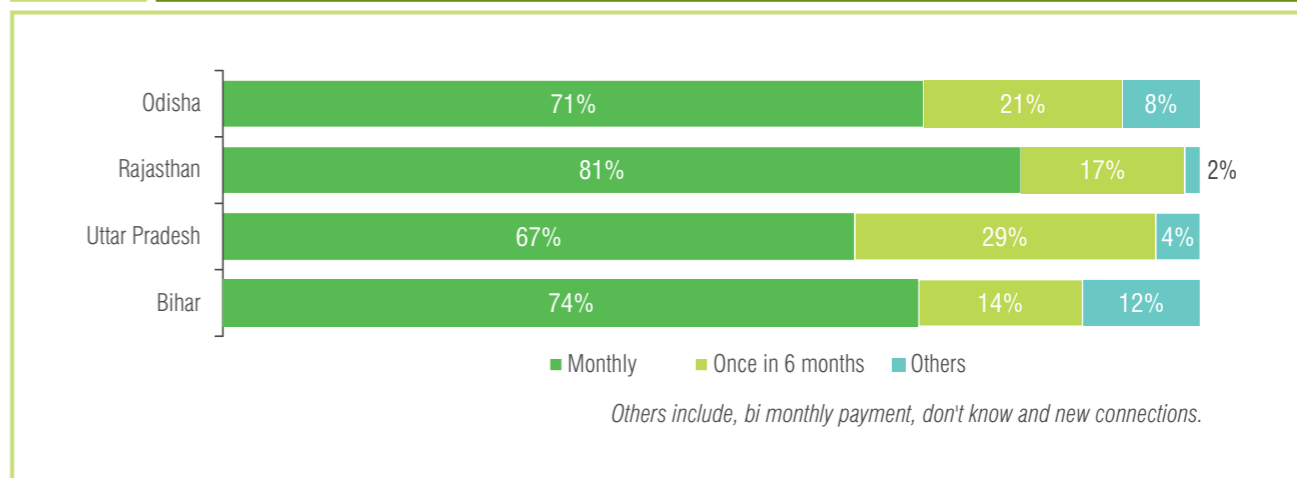


⁷ The 24x7 power for all report for Uttar Pradesh, also highlights the issue of unmetered connection in UP. Around 40 percent (i.e., 0.68 crore) of the total 1.70 crore registered domestic households were unmetered in FY17 (Gol, Govt. of UP 2017)

3.4.1.3 Payment

About 14–29 percent consumers mentioned that they have paid electricity bill only once in the last six months. This is mainly due to delay in receiving electricity bills and in some cases the inability of some consumers who do not have a regular source of income (such as farmers who prefer to clear their dues when farm outputs are sold in the market) (Figure 18).

Figure 18 Consumer's response on frequency of bill payment



Other major observations with respect to bill payments are:

- Most of the payments are made in cash. Only one percent of the consumers mentioned that they use digital modes of payments for electricity bills.
- Most of the consumers understand that they need to pay for using electricity services. Even in rural areas, the perception that electricity is a privilege and should be free, no longer holds.

Pre-paid meters may help in reducing the fear of high bills, as the consumers will be in-charge of their expenses and consumption.

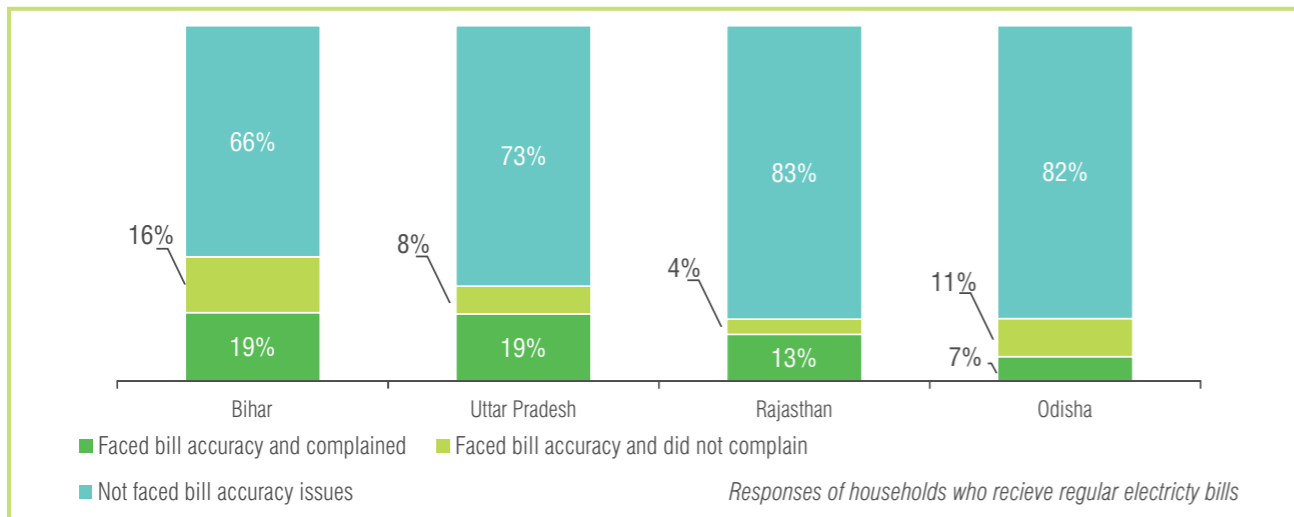
- Villagers during FGDs

3.4.1.4 Complaint redressal — electricity billing

Timely redressal of consumer complaints regarding inaccurate billing is one of the important aspects of consumer satisfaction. About 18–35 percent claimed to have faced such issues in the past. (Refer Figure 19).



Figure 19 State-wise responses — whether consumers have faced bill accuracy related issues in the past



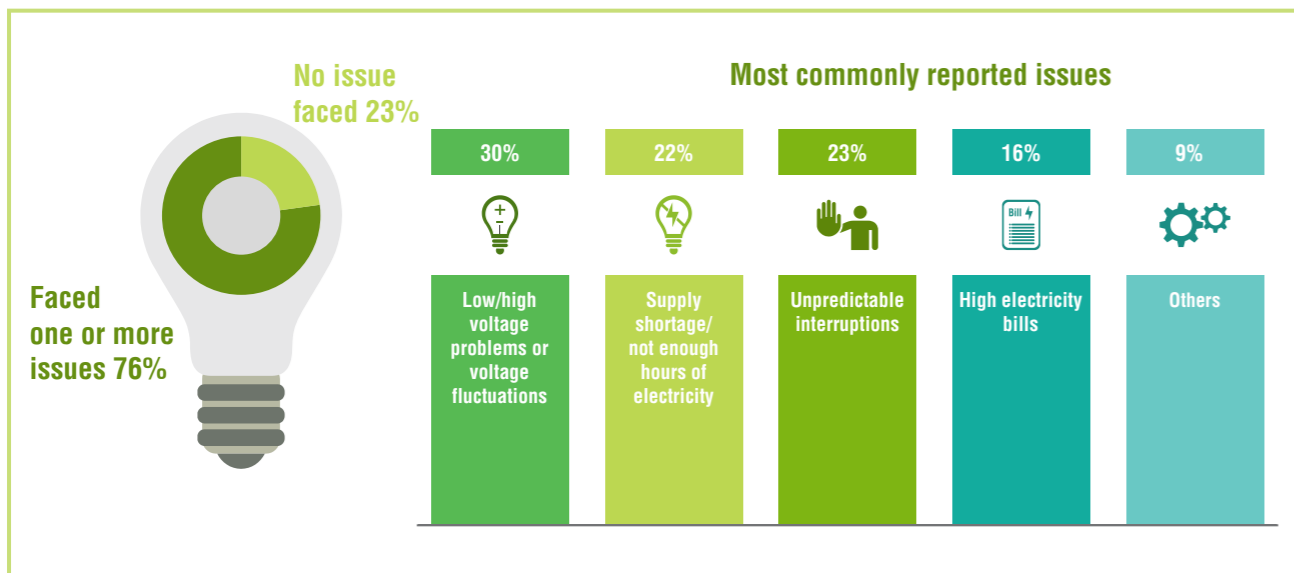
Analysis of consumers' response on time taken for complaint resolution shows that most of the complaints were resolved within the limit specified in the 'Standard of Performance' regulations notified by the respective SERCs.

3.4.2 Quality of supply

Quality of electricity supply has significant influence on: (i) consumer satisfaction (ii) socio-economic development and (iii) sustainability of electricity supply operations. Poor quality of supply results in increased expense on backup sources, thereby making the proposition of availing electricity connection less attractive for consumers.

Quality of supply aspects include voltage fluctuations, supply interruption, time taken for resolution of complaints related to line faults, etc. Figure 20 shows analysis of consumers' responses on key issues faced regarding electricity supply quality. About 76 percent of electrified households mentioned facing one or more such issues. The subsequent sections provide further insights on some of these issues.

Figure 20 Consumer responses on key issues faced regarding supply quality



3.4.2.1 Voltage fluctuations

Voltage fluctuations were one of the major concerns, because not only is the consumers' ability to use electricity is affected but safety is also significantly impacted. Issues such as flickering lights, lights glowing brighter or dimmer, premature blowing of bulbs, failure of electronic equipment, interference of radio or TV reception have been faced. Most of the voltage fluctuation cases were observed during the evening hours when the demand for electricity is at its peak.

With more households getting connected and moving up the energy ladder, the demand for electricity is expected to increase and continuous upgrade and maintenance of distribution infrastructure is essential to sustain the progress.

Approximately 75 percent of those who mentioned voltage fluctuation as one of the major issues, also stated that they face it mostly during evening and late night hours.

3.4.2.2 Availability

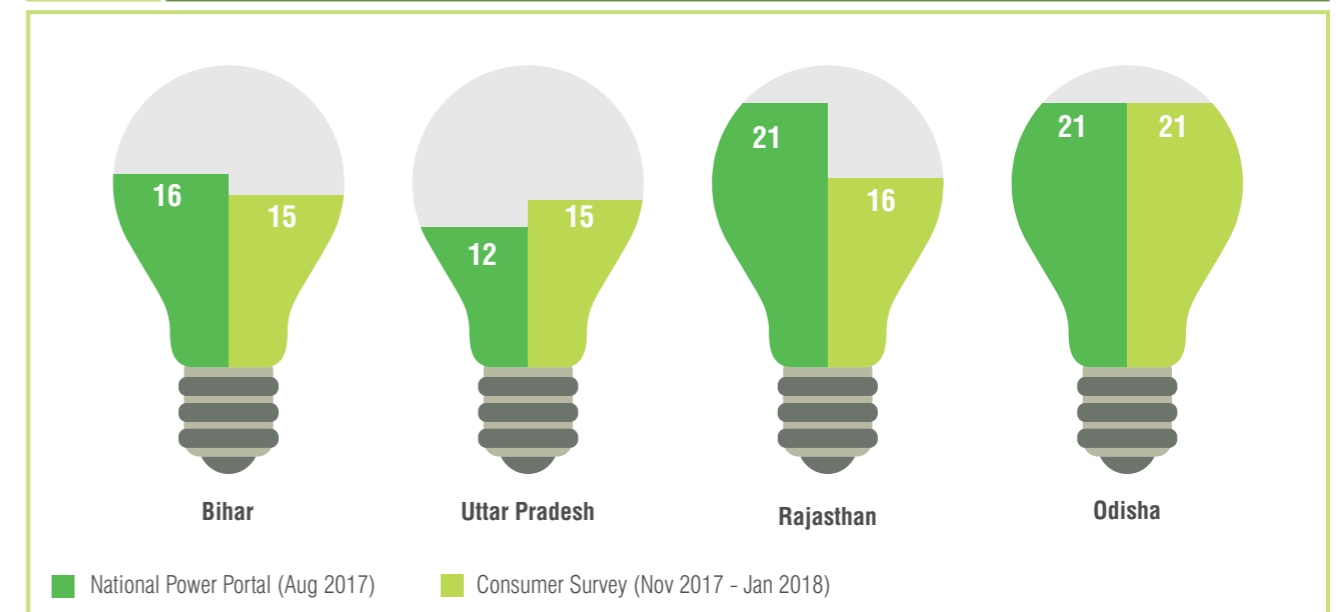
Load shedding restricts the consumers' ability to harness the full-potential benefits of electricity access. Figure 21 compares the average supply hours as stated by consumers during the survey and those available at the National Power Portal. Extended load shedding was reported in all states except for Odisha where no household reported load shedding of more than 10 hours.

Inadequate supply hours result in additional expenditure for consumers on backup sources of energy.

The most common back-up source of energy was kerosene lamps followed by batteries/storage devices, solar lanterns/home systems, candles, generators (used only by high wealth category households), micro-grids, etc.

6 percent of rural consumers stated that they are using RE micro-grids/DG sets as backup sources.

Figure 21 Average rural electricity supply hours per day⁸



⁸ Primary data collected through consumer surveys and secondary data collected from following: <<https://npp.gov.in/dashBoard/rd-map-dashboard>>, last accessed on 5th May, 2018 (CEA, MoP, 2018)

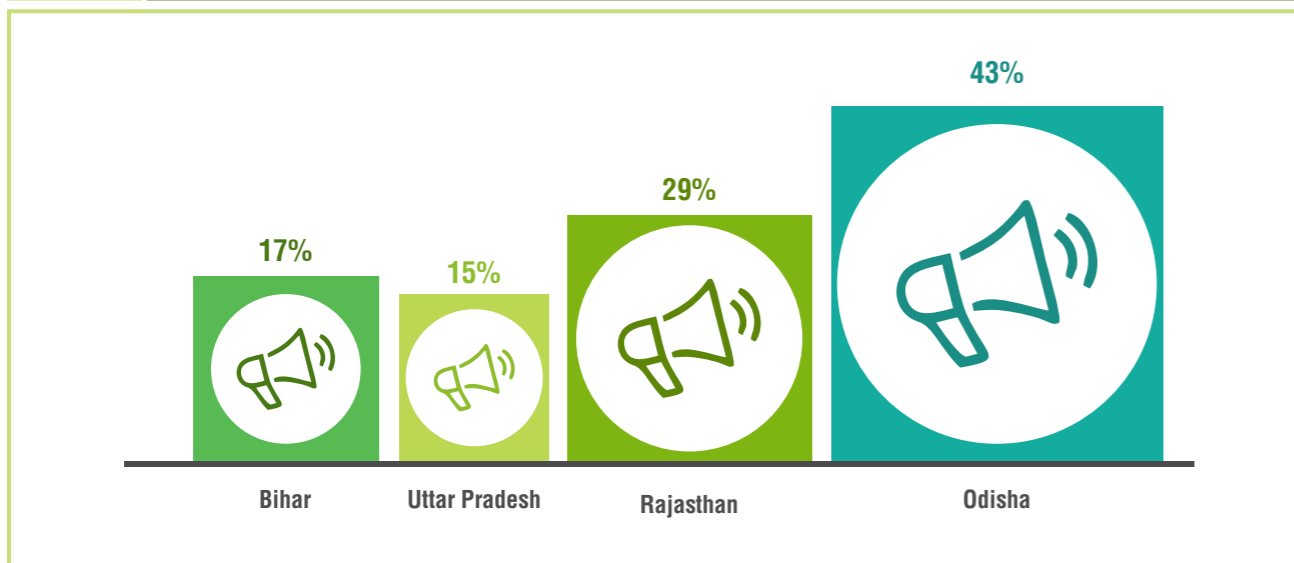


3.4.2.3 Resolution of complaints related to unpredictable interruptions

Another important issue faced by electrified households was unpredictable interruptions due to a fault in distribution systems or unfavorable weather conditions. The issue of line faults usually impacts the whole community rather than particular households and hence has larger implications.

It was observed that the majority of consumers were not aware of whom to complain to in case of line faults (refer Figure 22). This can be attributed to the fact that in most of the rural areas, common problems that impact the whole community are usually resolved by community leaders and hence all consumers may not feel the need to identify DISCOM officials for raising complaints about line faults.

Figure 22 Percentage of consumers aware about whom to approach in case of a line fault



4 CONCLUSION AND RECOMMENDATIONS






Conclusion and recommendations

4

Based on the analysis of information collected from consumer surveys and stakeholder consultation, a set of interventions has been identified. These have been categorized into three sections: The first section (i) ‘village and household electrification’ provides key interventions required to enhance coverage of rural electrification initiatives and improve end-use efficiency as demand expands. The second section (ii) ‘24x7 reliable, good quality and affordable supply’ focuses on interventions required to improve consumers’ experience with respect to electricity supply services. The last section (iii) ‘standard of living and well-being’ dwells on the interventions required to improve the overall consumers’ satisfaction and meet the aspirational needs of customers, facilitating improved standard of living (Figure 23).

Figure 23 Interventions for enhancing effectiveness of rural electrification initiatives

		
Village & household electrification	24x7 Reliable, good quality and affordable supply	Standard of living and well being
<p>Focus on reaching out to non-census villages/hamlets; improve end use EE and generate livelihood opportunities</p> <ul style="list-style-type: none"> Continued focus to increase household coverage Creating inter-scheme leverage Encourage electricity led enterprises and skill development Focus on scaling up EE – EE appliances offered through service contracts 	<p>Improve consumer services & enhance viability of rural electricity supply business</p> <ul style="list-style-type: none"> Focus on quality and reliability improvement – continuous monitoring Robust metering, billing and collection processes- franchising and outsourcing Pre-paid/smart meters and scaling up digital payments Co-opt existing DRE/off-grid systems with central grid 	<p>Better customer satisfaction can be achieved through improved standard of living and wellbeing</p> <ul style="list-style-type: none"> Monitoring parameters related to quality of life & well being Street lighting programme for rural areas Aiding people with disability

The following sections briefly expand upon each of the above mentioned interventions.

4.1 Village and household electrification

4.1.1 Continued focus to increase household coverage — enhance effectiveness of the communication campaign under the Saubhagya scheme

Among others, common reasons for not availing electricity connections were (i) consumers’ perception that electricity is more expensive than traditional fuels and their fear of receiving higher electricity bills, (ii) lack of knowledge about the benefits of using electricity and (iii) lack of awareness. These issues can be resolved by educating consumers through structured awareness campaigns.



Potential interventions: Under the Saubhagya scheme, there are provisions for organising awareness campaigns. It is imperative to ensure that these awareness campaign reach out to all un-electrified households so that they can take an informed decision about availing electricity connection. The following information can be included in such campaigns:

- Information about operational cost, e.g. monthly electricity bill and its comparison with traditional sources of energy; tailored messages and campaigns that are easily comprehensible in local languages and dialect; those benefitting from electrification could be engaged to spread the word. It is imperative to ensure that information is provided to all households including those living in remote location.
- Health benefits of using electricity for lighting — e.g. reduction in indoor air pollution
- Measures required to be undertaken by consumers to ensure safety
- Information about complaint resolution mechanism and DISCOM's point of contact for registering complaints related to bill accuracy, line faults, interruptions in supply, etc.

Action

- Local institutions such as Gram Panchayats, Common Service Centres, NGOs, public representatives, etc. may be involved to spread awareness about the scheme to rural swathes of the country and ensure continuity of initiatives beyond initial campaigns.
- Awareness campaigns should include information about benefits of availing electricity connection.

For a community or individual to realize that they are/is not excluded, they need to understand their rights and the quality of service/electricity that they should expect as also the mechanisms for complaint redressal. Once people are aware, they are likely to feel empowered to raise complaints and take action. Some suggested areas for organizing consumer awareness campaigns are provided in table below:

Table 5 Suggested areas for organizing awareness campaigns

Area	Action
<ul style="list-style-type: none"> • On safety (e.g. safety of wire from being fire proof) 	<ul style="list-style-type: none"> • DISCOMs to organize awareness campaigns publicizing the safety standards through display on notice boards and electricity bills.
<ul style="list-style-type: none"> • On bills and charges for connection 	<ul style="list-style-type: none"> • DISCOMs may engage local community people/groups like SHGs, women entrepreneurs or Gram Vidyut Pratinidhis to spread awareness about electricity charges applicable for different consumer categories.
<ul style="list-style-type: none"> • On the documentation required at the time of connection 	<ul style="list-style-type: none"> • This information should be communicated (in local language) through local media and communication channels. • It should include details on documents required as proof of residence, connection charges applicable for new connections applicable for different consumer segments, etc.

Focused efforts for providing electricity access

Tata Power Delhi Distribution Limited (TPDDL) (electricity distribution utility in Delhi, India) took over the operations of electricity distribution from state owned electricity board in 2002. One of the major issues faced by the utility, was high number of electricity theft cases and unmetered connections, especially in slum colonies (hutment dwellers). The utility launched various schemes to regularize the unauthorized electricity connections and conducted raids to curb electricity theft. At the inception stage, it was observed that some of these consumers are not able to afford penalties for electricity theft and hence, voluntary disclosure/amnesty schemes and special settlement schemes were implemented. Under these schemes, the utility invited residents to seek metered connections without penalty of theft. Such schemes were launched at regular intervals and have been immensely successful in promoting settlements (TPDDL 2012).

Government of Rajasthan launched Mukhya Mantri Sabke Liye Vidyut Yojana for providing group electricity connections in rural areas. Under this scheme, electricity connections were provided to group of 4-10 households sharing similar socio economic characteristics. Such connections not only reduced the cost of connection per family but also addressed the issue of self-arranged incremental infra, resulting in enhanced affordability for the households.

Best practices for reaching out to remote villages and hamlets

Several measures have been adopted in Bihar by DISCOMs and other agencies to ensure inclusion. Few of them are highlighted below (DDUGJY Best Practices 2015):

- *Non-conventional modes such as boats, rafts made of banana stem, etc. were used to transport poles to flood affected areas.*
- *Special campaigns were organized to spread awareness about rural electrification initiatives in remote areas. This included meetings with community members, sign boards across villages which included details like cost, beneficiary details, contact details of concerned officials etc., setting up stalls on national holidays and discussions during meetings of Gram Sabhas and farmer clubs.*
- *Provision of incentives (VAT exemption, easier payment or loan terms etc.) to set up local pole making units.*

4.1.2 Creating inter-scheme leverage

The GoI has been implementing a number of programmes/schemes for rural development, which include schemes for electrification of households, distribution of LED bulbs, opening of bank accounts, provision of life and medical insurance, etc. Significant progress has also been made — 92 percent rural households⁹ have been electrified, 98 percent (electrified and un-electrified) reported that they have a bank account; 307 million LED lamps¹⁰ have been distributed across the country and so on. Dovetailing of these initiatives provides immense opportunities for creating inter-scheme linkages.

⁹ (As on 1st Oct 2018)

¹⁰ (As on 24th August 2018)



Potential interventions: As part of 'Gram Swaraj Abhiyaan,' the GoI organised a massive campaign to spread awareness about rural development schemes across the country. About 3.3 million elected representatives of Panchayati Raj Institutions (PRIs), 50 million women self-help groups and many public leaders were engaged in the programme. Such campaigns should be organised at regular intervals to spread awareness about all rural development schemes.

A package of inter-linked services can also be provided to electricity consumers, i.e. electricity connections with package of energy efficient appliances (LED bulbs, fans, tube lights, etc.) and/or electricity connections (for commercial consumers) with access to low cost financing e.g. under Pradhan Mantri MUDRA Yojana (PMMY). It will not only help in reducing the transaction cost of providing services to consumers, but would also help in accelerating the pace of development.

As far as the channeling of these services is concerned, the GoI has set-up Common Service Centres (CSCs), as access points for delivering essential public utility services, social welfare schemes, healthcare, financial, education and agriculture services. These CSCs are actively working in all the villages through a network of 0.2 million Village Level Entrepreneurs (VLEs) (MeitY 2018). These VLEs can be engaged to provide a package of interlinked services.

Action

- Gram Swaraj Abhiyaan is a welcome initiative and may be organised at regular intervals to spread awareness about rural development programmes.
- The network of VLEs developed as part of a CSC initiative should be leveraged to provide a package of inter-linked services to rural consumers, e.g. electricity connection along with efficient appliances, electricity connection (especially for rural micro enterprises) along with access to low cost financing under government programmes/schemes.

Examples of such interlinked initiatives include (i) ; Serve as a Volunteer for Energy programme (SAVE) of Energy Management Centre, Kerala was implemented in collaboration with the Kerala State Electricity Board for spreading awareness about energy efficiency at the grassroots level; (ii) direct benefit transfers of electricity subsidy to eligible rural consumers can be done through the Jan Dhan account.

4.1.3 Encourage electricity led enterprises and skill development

Availability of reliable electricity opens up multiple avenues for income generation and promoting entrepreneurship among rural people. About 46 percent of micro enterprises stated that they started operations after electrification. However, attractiveness and viability of income generating opportunities for rural people need to be made apparent.

Under the Aajeevika Skill Development Programme (ASDP), training and placement schemes are being implemented in partnership with public, private, non-government and community organizations. Further, the MoP and Ministry of Skill Development & Entrepreneurship (MSDE) have partnered to train about 47,000 people to support implementation of the Saubhagya scheme. This provides immense opportunity for generating employment and developing entrepreneurial opportunities for the rural youth.

Potential interventions: Highlighting the productive end use of electricity will not only increase rural electricity demand but will also help increase the consumers' paying capacity through job creation and generation of livelihood opportunities. Training programme to promote electricity led microenterprises may be organized under ASDP.

Further, people trained as part of the MoU between MoP and MSDE can act as champions/ambassadors to spread awareness about government schemes, support in the implementation of other infrastructure augmentation programs. They can also assist DISCOMs or franchisees (as applicable) in carrying out various functions such as metering, billing, compliant redressal and minor repair and maintenance activities.

Action

- Project Implementation Agencies of ASDP may organize skill development programmes to encourage rural people to set-up electricity led microenterprises.
- Local financing institutions such as banks and micro-financing institutions may also be encouraged to participate in such programs to support the financing requirements of micro-enterprise, if any.
- Local people trained for implementation of the Saubhagya scheme may be encouraged to act as champions/ambassadors to spread awareness about government schemes, support in implementation of capex and other infrastructure augmentation programs.

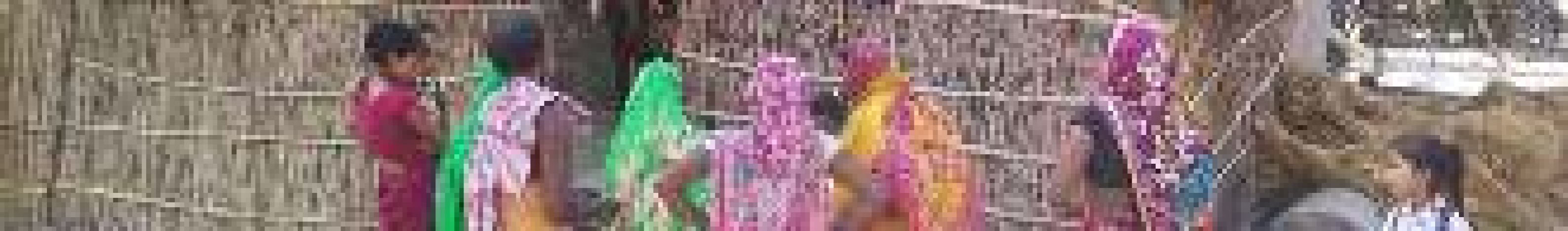
TPDDL launched an initiative for electrification and regularization of electricity connections in slum areas. As part of this initiative, TPDDL organised campaigns to highlight productive end-uses of electricity i.e. tailoring, convenience stores, food processing, etc. that benefit the community and generate livelihood opportunities. Local leaders, NGOs and youth were also engaged in spreading the awareness. The utility successfully provided electricity to 175,000 households covering 217 slums areas. (Sunita 2015)

4.1.4 Focus on scaling up energy efficiency

As people climb up the energy ladder, penetration of electric appliances is also expected to increase. About 24 percent of the electrified households stated that they are planning to purchase new appliances. It is expected to increase further in the future as the households, after getting electrified, gradually move up the energy ladder and aspire for more energy intensive appliances. This provides opportunity to embed energy efficiency into the foundation of the emerging energy market and ensure that consumption efficiency is a focus right from the beginning.

Potential interventions: Large-scale promotion of efficient end-use appliances could result in better consumer service, higher satisfaction and lower energy bills, which can help in improving the consumers' willingness and ability to pay for services. It is imperative to ensure that energy efficient appliances are available at an affordable cost in the rural areas. EESL has been implementing the UJALA programme for the promotion of energy efficient appliances (LED bulbs, tube lights and fans). The UJALA programme can be expanded rapidly in rural areas and more appliances can be offered under the same.





Action

- EESL or similar institutions should be encouraged to collaborate with DISCOMs (as they operate at the grass-root level) for distribution of energy efficient appliances in rural areas. These appliances can also be provided to households being electrified under the Saubhagya scheme.
- Innovative models in which consumers do not have to bear the upfront cost for energy efficient appliances may also be considered. This includes
 - ✓ Insurance backed equipment leasing model — consumers do not pay upfront cost of the appliances, instead they pay a rent on a periodic basis. The appliances are owned by a service provider (i.e. ESCO) and its risk is covered through insurance.
 - ✓ Pay-as-you-go or service based contracts — the consumers pay as per the usage of appliance or service.
- Micro Finance Institutions operating in rural areas may also be involved for financing.

4.2 Ensuring 24/7 reliable, good quality and affordable supply

4.2.1 Focus on quality and reliability improvement — continuous monitoring

Quality and reliability of supply plays an enabling role in allowing consumers to fully benefit from electricity. 76 percent of respondents stated that they have faced one or more issues related to the quality of supply. This includes issues such as voltage fluctuations and unpredictable interruptions. Draft amendment of National Tariff Policy (30th May 2018) also emphasises on supply of adequate and uninterrupted power to all categories of consumers.

An efficient monitoring system is needed to provide evidence-based feedback for the quality of supply and service to all stakeholders i.e. DISCOMs, regulatory commissions and policy makers, consumer groups, etc. A reliable data on key parameters related to quality of supply and quality of service, will help in increasing the accountability of DISCOMs and monitoring the compliance of standard of performance regulations.

Potential interventions: Data/information on basic measures of supply and service quality (outages, distribution transformer failure, interruption duration, time taken for new connections, number of consumer complaints, etc.) should be regularly updated and made available in the public domain. In addition to this, penalties imposed on DISCOMs and the reasons for the imposition should also be provided.

Further, performance of various DISCOMs on operational indicators, service quality and so on should be compared. This can help states learn from each other, showcase success stories and share experiences. The MoP may consider establishing a virtual platform, wherein data related to the standard of performance parameters for all the DISCOMs, related analytics and key success stories are updated regularly.

Action

- As a starting point, DISCOMs should commence periodic monitoring of parameters related to quality and reliability of supply. Data on key parameters should be made available on an online portal to ensure accountability and transparency.
- Focus on improving the quality of supply, and service; and also reducing the cost of transactions (due to dispersed set of customer base) through technological options should be explored.
- An online portal for monitoring and reporting performance of DISCOMs on key parameters related to quality of service and supply may be developed.

4.2.2 Robust metering, billing and collection processes- franchising and outsourcing

About 22 percent of consumers reported that they do not receive regular electricity bills and more than half of the rural consumers in U.P were un-metered. Further, consumers mentioned that fear of receiving higher bills (accumulated over a period of time) restricts the usage of electricity for lighting. It also generates a fear among un-electrified households and hence they do not avail connections.

Inefficient collection leads to accumulated arrears and also adversely impact DISCOM's financial health. Hence, it is imperative to put in place a robust metering, billing and collection system to ensure sustainability of rural electricity supply business.

Potential intervention: Robust metering, billing and collection processes are not only required to ensure 100 percent recovery, but will also help in building consumer confidence and improve relationships between DISCOMs and consumers. Frequent billing enables consumers to pay smaller amounts, which is easier for low income groups as compared to paying higher amounts accumulated over a period of time. The improvement process also provides opportunities for involving local youth or intermediaries as partners in metering, billing and collection as well as in operation and maintenance activities.

Women's groups as franchisees

About 37,000 rural franchisees are operating in India covering more than 216,000 villages across 18 states (World Bank, 2014). Most of these are collection based, where the franchisee either takes a part of the revenue or earns an incentive up to a pre-determined collection-efficiency target, depending on the contract. Women self-help groups have also been engaged as distribution franchisees in many states. Discussions with women respondents indicates that the task of bill payment becomes easier (especially an issue with single women and women headed households) if bills are collected at the doorstep. Some examples of engaging women SHGs are:



- *Engaging women SHGs for meter reading, billing, bill distribution, revenue collection, etc. was piloted in Nayagarh district of Odisha in 2010-11. Significant improvements were observed- in Feb-March 2011, these SHGs collected Rs. 189.95 lakh against the target of Rs. 97.61 lakh. (Orissa Electricity Regulatory Commission 2011, Government of Odisha, 2011).*
- *Women's SHGs in West Bengal and Uttaranchal are actively engaged in more than 1,169 and 5,321 villages, respectively.*

Action

- When done in-house, it is important to maintain regularity of billing and collection, especially with rural consumers. Avoidance of accumulation of arrears is absolutely critical through regular billing and collection, as such households, due to their low paying capacity, find it extremely difficult to pay the lump sum/accumulated dues. Special awareness campaigns can be undertaken to enable transition towards digital modes of payment (since mobile penetration has been found to be high).
- When franchising is considered, DISCOMs should develop an operational framework to outsource metering, billing and collection functions. Local youth and women self-help groups should be encouraged to work as rural electricity distribution franchisees.

4.2.3 Pre-paid/smart meters and scaling up digital payments

The Gol is focusing on promoting digital payments with an aim to move towards a less-cash society. Several initiatives are being implemented to promote digital payments — a target of INR 2,500 crore (~\$400 Million) worth of digital payment transactions in FY17-18 was also set by the Gol.

Further, as per the 'Resolution for Future Roadmap to Reform Power Sector and ensure 24x7 Power for All' adopted by all states during the 'Conference of Power and New & Renewable Energy Ministers of States and Uts,' promotion of digital payments has been adopted as one of the key resolutions. Specifically, the states resolved to 'promote digital payments through various measures such as cash incentives, waiving convenience fee, consumer friendly online payments and promotion of digital payments through various media⁹.'

The consumer survey shows that only 1 percent of rural consumers used digital modes of payment for electricity bills. Further, it was observed that 98 percent of rural households use mobile phones and have a bank account. This can be leveraged to promote digital modes of payment for electricity bills. Basic IT infrastructure is already in place in most of the DISCOMs. There is need to sensitize and train people in rural areas to use digital modes of payment. Additionally, promotion of prepaid/smart meters may also be considered as a step for moving towards automation. The government has already set targets to deploy 35 million by 2019 with an overall aim of 250 million.

⁹ <http://pib.nic.in/newsite/PrintRelease.aspx?relid=174185>



Potential intervention: DISCOMs should prioritize the digitization of receivables, initially as a means of improving collections efficiency. Further, to unlock the full benefits of digital payments, deployment of pre-paid/smart meters can be considered. Such technology-based interventions can have advantages for both the consumers as well as DISCOMs. While consumers benefit from ease of transaction and improved convenience, DISCOMs can benefit from reduced administrative costs and improved collection efficiencies.

Some people at grassroots level may be intimidated by use of such technologies and hence may feel excluded. Training programmes in local language and handholding support for technology adoption will help to ensure acceptability.

Action

- Wide-scale awareness to support transition to the digital mode during initial periods will be useful. CSCs may be engaged to sensitize and promote digital modes of payments and spread awareness among consumers.
- A strategic roadmap for deployment of pre-paid/smart meters should also be developed. This should include analysis of existing infrastructure, consumer behavior pattern, best practices and a phase-wise implementation plan for moving towards automation.

In 1995, EdM, the public electricity utility in Mozambique, implemented a slum electrification project in Matola, where 70 percent of the population lived in informal settlements with limited or no access to modern energy services. The project aimed at regularizing electricity consumers in informal settlements. The project started by installing 500 pre-paid meters in low income households in Matola, which increased to 5,000 more informal settlement households in just one year. The project subsequently expanded to include other Mozambican cities and had positive outcomes for the beneficiaries as well as for utility. The utility's revenue collection rate improved from 75 percent in 1995 to 94 percent in 2005. Similarly, the average household electricity consumption dropped from 148 to 124 kWh per month and total distribution losses decreased from 43 percent to 18 percent (UN-Habitat 2017).

4.2.4 Co-opt existing DRE/off-grid systems with central grid

Cost-economics of electricity supply for rural consumer is apparently less favorable than urban consumers due to various reasons such as sparsely populated habitations, long-distance network resulting in high losses, lower tariffs etc. Multiple studies indicated that servicing rural household in remote areas through grid based/centralised systems is often more expensive compared to decentralised generation. The Draft Energy Policy, 2017 (NITI Aayog), also identifies DRE-based infrastructures as an opportunity for developing the future power sector.

Decentralised generation systems (e.g. solar/biomass based generation systems) set up close to the demand centres can be leveraged to serve rural consumers. About 6 percent of the respondent mentioned they are using local micro grids and diesel generators sets during power cuts. Further, it was mentioned during FGDs that people in many areas are using community-based generators as a backup source of energy.

Potential intervention: As we move ahead with household electrification and electricity grids get extended to the remotest areas, the following considerations will be important.



- Coexistence of DRE systems along with the central grid: Decentralised generation systems (solar/ biomass-based generation) are much better placed to serve rural consumers and utilise the developed infrastructure. Hence, DRE systems will need to co-exist within the larger grid to improve reliability, affordability as well as financial viability for DISCOMs. There is need to develop a mechanism that will enable survival and coexistence of these installations with the central grid.
- Viable business models and innovative financing: With the advantages of DRE systems in view, innovative business models will need to be developed to enable reliable and affordable power supply. While designing such models, private participation must also be considered.

Action

- State-level policies and regulations need to be developed for survival and coexistence of these installation with the central grid. This should include suitable payment mechanism, technical specifications for grid integration, guidelines for operations and maintenance etc.
- Innovative business models and financing instruments need to be designed to encourage private sector participation.
- Institutional capacity for energy planning needs to be created at the state level to look at the whole systems approach as one and plan the expansion accordingly.

The Pay-As-You-Go model has been implemented in various geographies in east Africa, especially Kenya. The business model leverages the telecom/IT revolution in order to deliver off grid electricity. Under this modes , users make payments for the electricity consumers on a daily basis through their mobile phones thereby reducing capital and working capital risk. (UNCDF, 2017)

4.3 Improving the standard of living and wellbeing

4.3.1 Monitor parameters related to improved quality of living and wellbeing

Access to electricity services contributes to the greater welfare and increasingly higher levels of economic well-being, which is evident from the consumers' responses. 58 percent of respondents mentioned that the overall mobility of women has increased, 34 percent of them stated that the number of coaching classes and evening schools in the village has increased and 29 percent stated that the hours of operations of health facilities have increased. It is imperative to track the progress of such development — e.g. improvement in community services, productive end uses, education etc. on a periodic basis.

Potential intervention: Gol has implemented a centralised monitoring mechanism for 42 of its flagship schemes, allowing cross scheme monitoring (DISHA Dashboard). Key indicators related to improvement in quality of life and wellbeing should also be monitored at regular intervals. This will provide useful information and insight into programmes for socio-economic development of rural areas. Monitoring of such indicators can lead to measuring electricity access in line with the approach proposed under the multi-tier framework as proposed under the Global Tracking Framework.

Action

- Considering that such schemes significantly influence the social life and well-being of the individuals, it is important that such parameters are tracked for changes and impact the assessment overtime. The Ministry of Statistics and Programme Implementation (MOSPI) or appropriate state agencies should initiate monitoring of parameters related to social well-being and quality of life.
- With such data being collected, we can gradually move to a more comprehensive definition of energy access in line with the MTF (Multi-tier framework) as defined under GTF (Global Tracking Framework).

List of indicator for monitoring progress on social dimension

- | | |
|-------------------------------------|---|
| ✓ Appliance ownership | ✓ Time spent on non-productive activities |
| ✓ Number of women-owned enterprises | ✓ Productive end use of electricity. |
| ✓ Student enrolment/truancy rate | ✓ Number of operational street lights |

4.3.2 Street lighting programme for rural areas

Absence of street lights in villages has been identified as a major areas of concern by the consumers. About 6 percent of the consumers mentioned presence of street lights in the villages and the infrastructure for this was observed in 21 of 72 villages surveyed by the enumerators. Absence of street lights not only restricts the mobility of people during the evening, but is also a grave threat to security, especially for women and children.

Potential intervention: Since electricity infrastructure has been developed in all the villages, implementation of a street lighting programme for rural areas deserves consideration. State-level programmes for installation of street lights in rural areas can be designed. It should include details of the implementation mechanism, investment requirements, payment mechanism, technical specifications and timelines. The role of private sector entities or Energy Service Companies (ESCOs) may also be explored.

Action

- Under the Street Lighting National Programme (SLNP), EESL is replacing the existing street lights in urban and semi-urban areas with LED street lights. State governments, through appropriate agencies, should consider a similar mechanism to implement street lighting programmes in rural areas in association with such ESCOs or other public and private sector entities.
- This will not only help in cost reduction through economies of scale, but will also help in leveraging programme management experience of such entities for fast-track implementation.

4.3.3 Aiding people with disability

People with disabilities often have a special need for energy services as they spend a substantial amount of time indoors and are dependent on assistive appliances. The conducive ecosystem to support learning and development for such people can only start with access to electricity.



Potential intervention: Under the Saubhagya scheme, free electricity connection is provided to households with disabled members and no able bodied adult member, which is a welcome initiative. Further, additional support is required to ensure that people with disability can access the full potential benefits of electricity services with ease. Special provisions can be made for households with disabled members such as:

- Extend the bill payment time
- Provision for printing of bills in larger fonts, braille and audio version through mobile phones if needed
- Sensitize the billing and collection agents by way of trainings/workshops to proactively seek out households with members with PWD and provide addition support such as reading out the bills and help in making payments

Action

- States should encourage DISCOMs and other nodal agencies/authorities to enable systems/mechanisms that aid consumers with disability to effectively utilise provision of electricity and other services.

The implementation of these interventions are expected help enhance the effectiveness of rural electrification initiatives in India.



Consumer survey (pilot) in Bayapur Village, Patna District, Bihar





Annexure 1: Sample size calculation for household surveys

The sample size was determined with an acceptable error of +/- 5 percent in the sample design and based on the two-sample formula:

$$n = \frac{[D[Z_{1-\alpha} \sqrt{2P(1-P)} + Z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)}]^2]}{(P_2 - P_1)^2}$$

Where

Design effect, $D = 1.1$

Estimated proportion at first time period, $P_1 = 0.5$

Estimated proportion expected, $P_2 = 0.625$ (The proportion of electrified households expected is 62.5 i.e. an increase of 12.5 percent)

Z-score corresponding to 95 percent level of significance, $Z_{1-\alpha} = 1.96$

Z-score corresponding to 80 percent power, $Z_{1-\beta} = 0.84$

The z-score is the number of standard deviations a given value is away from the mean in a standard normal curve.

Total rural households for a state has been considered as the population, and in line with the above approach, estimated sample size was 270 for each state for the electrified households. Similar number of un-electrified household were also considered to understand their reasons for not availing electricity connections.

The sample size estimated using the above approach and actual sample (number of households) covered during the study is given in the table below:

Table 6 Sample size

States	Proposed		Actual	
	Electrified Hhs	Unelectrified Hhs	Electrified Hhs	Unelectrified Hhs
Bihar	270	270	287	262
Uttar Pradesh	270	270	271	270
Rajasthan	270	270	269	268
Odisha	270	270	289	285
All India	1080	1,080	1,116	1,085



Annexure 2: State's district covered

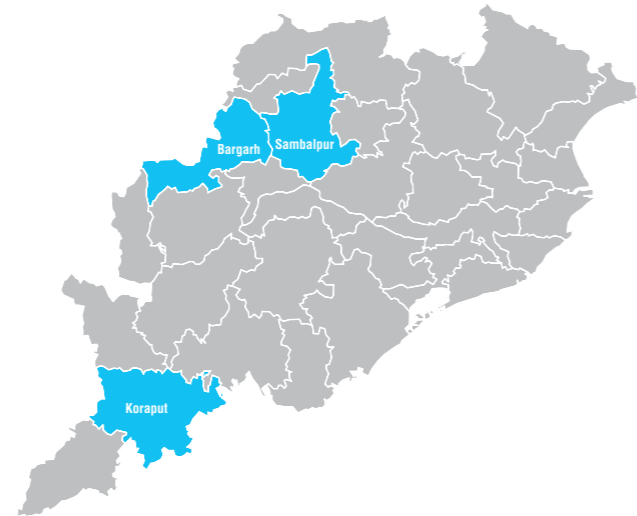
Bihar

Araria, Vaishali, Bhojpur



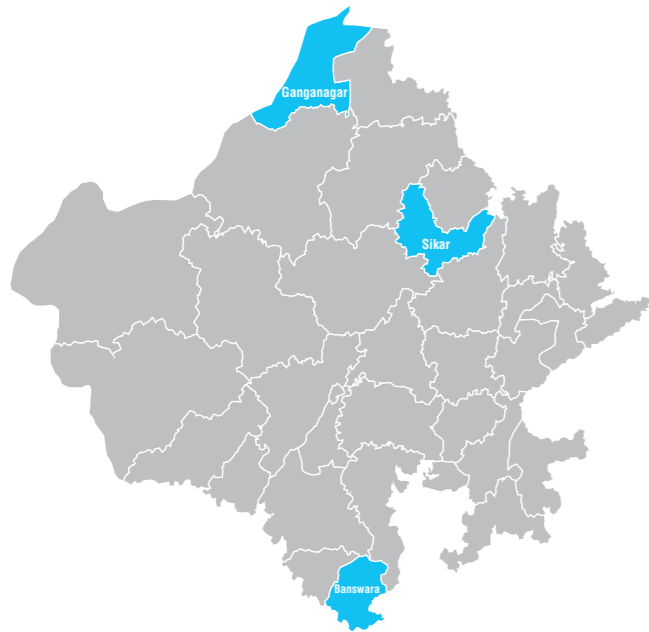
Odisha

Bargarh, Koraput, Sambalpur



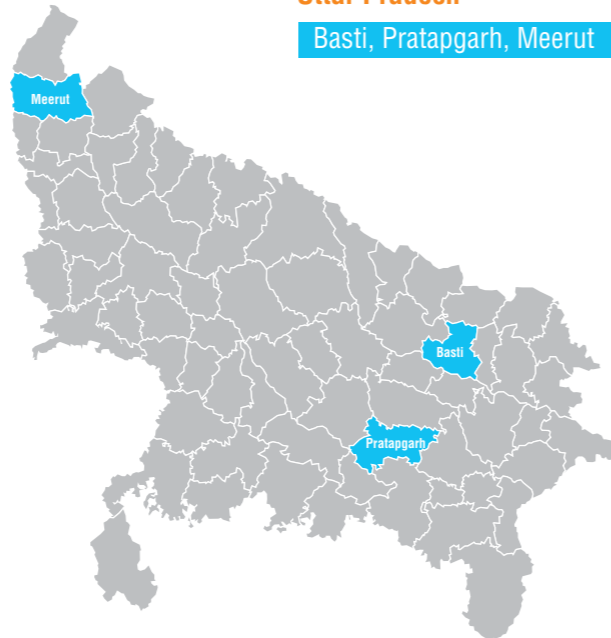
Rajasthan

Ganganagar, Sikar, Banswara



Uttar Pradesh

Basti, Pratapgarh, Meerut



Annexure 3: State wise and district wise list of villages covered

Bihar	Odisha	Rajasthan	Uttar Pradesh
Araria	Bargarh	Banswara	Basti
Anchraand Hanuman Nagar	Bandhenbahal	Baman Para	Amouli
Basmatiya	Dekulba	Bodigama	Babhan Ganwa
Bela	Dungipali	Jhalon Ka Gara	Banwariya
Binodpur	Jhimbahal	Juna Padariya	Gayajitpur
Eidgah	Kudopali	Shivpura	Kanethu Bujurg
Kamladorha	Purena	Tamtiya	Kungi Khurd
Bhojpur	Koraput	Ganganagar	Meerut
Balua	Atigam	1 e	Dudhli Khadar
Basauna	Chilisanka	1 Rm	Jalalabad Urf Jalalpur
Dhuri	Chintagura	4 Bnw (Banwala)	Mubarikpur
Dumaria	Gotiput	8 Shpd	Nagla Shekhu
Manikpur	Khilua	8 Y	Shahpur Zadid
Salempur	Podagada	Suratgarh (Rural)	Sisoli
Vaishali	Sambalpur	Sikar	Pratapgarh
Bhadwas	Baijamunda	Amarpura	Pendra
Chapta	Gargadbahal	Bagas	Pure Hudha
Kaddutanr	Lapanga	Bagdoda	Purey Gulal
Lohani Patti	Larasara	Bhagwan Pura	Purviya Patti
Nilo Rukunpur	Palsamal	Dookiya	Ruer
Sarwan Amar	Thapapali	Roopnagar	Udideeh



References

Barkat et al, 2002: 'Economic and Social Impact Evaluation Study of the Rural Electrification Programme in Bangladesh', Human Development

CEA, MoP2018 *National Power Portal* <https://npp.gov.in/dashBoard/rd-map-dashboard> (last accessed July, 8, 2018)

CEEW 2017 Access to Clean Cooking Energy in India- Beyond connections, towards sustained use <http://thecleannetwork.org/downloads/124-1507813090.pdf> (last accessed on July, 9, 2018)

Department of Administrative Reforms and Public Grievances 2015 DDUGJY Best Practices <https://darpg.gov.in/sites/default/files/DDUGJY%20-%20Best%20Practices.pdf> (last accessed on July, 8, 2018)

EESL *Ujala Portal* <http://ujala.gov.in/> (last accessed July 4, 2018)

ESMAP 2002 Rural Electrification and Development in the Philippines: Measuring the Social and Economic Benefits Report No. 255/02 Washington DC

ESMAP 2002 India Household Energy, Indoor Air Pollution and Health https://esmap.org/sites/default/files/esmap-files/Rpt_26102_India_Household_Energy_Indoor_Air_Pollution_Health.pdf (last accessed on July, 8, 2018)

ESMAP 2004 The impact of energy on women's lives in rural India <http://documents.worldbank.org/curated/en/600391468771661997/The-impact-of-energy-on-womens-lives-in-rural-India> (last accessed on July, 6, 2018)

ESMAP 2015 Beyond Connections- Energy access redefined <http://www.worldbank.org/en/topic/energy/publication/energy-access-redefined> (last accessed on July, 6, 2018)

Government of India, Government of UP 2017, 24x7 power for all https://powermin.nic.in/sites/default/files/uploads/PFA_14.04.2017_Signed_CRISIL_Final_Ver00.pdf (last accessed on July, 8, 2018)

International Institute for Population Sciences 2017 National Family Health Survey (NFHS-4)

MoEIT 2018 *Common Service Centres Scheme* <https://csc.gov.in/vle> (last accessed July, 5, 2018)

MoP 2017 Office Memorandum- Saubhagya [http://saubhagya.gov.in/assets//download/OM-SAUBHAGYA%20\(SIGNED%20COPY\).pdf](http://saubhagya.gov.in/assets//download/OM-SAUBHAGYA%20(SIGNED%20COPY).pdf) (last accessed on July, 6, 2018)

2017 *Pradhan Mantri Sahaj Bijli Har Ghar Yojana Saubhagya* <http://pib.nic.in/newsite/PrintRelease.aspx?relid=171101> (last accessed July, 7, 2018)

Saubhagya Dashboard <http://saubhagya.gov.in/> (last accessed July, 8, 2018)

Sustainable Energy for All <https://www.seforall.org/> (last accessed July, 5, 2018)

UNCDF 2017 The Fight for Light: Improving Energy Access through Digital Payments https://www.seforall.org/sites/default/files/Highlights_-_Energy_case_study.pdf (last accessed on July, 8, 2018)

UNDP 2016 *Sustainable Development Goals* <http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-7-affordable-and-clean-energy.html> (last accessed on July, 6, 2018)

UNDESA 2014 Electricity and education: The benefits, barriers, and recommendations for achieving the electrification of primary and secondary schools <https://sustainabledevelopment.un.org/content/documents/1608Electricity%20and%20Education.pdf> (last accessed on July, 6, 2018)

UN-Habitat 2011 Enhanced Energy Access for Urban Poor

USAID 2002 Economic and Social Impact Evaluation Study of the Rural Electrification Program in Bangladesh. Report to the National Rural Electric Cooperative

WEF 2015 *Lessons from India on Electrifying Urban Slums* <https://www.weforum.org/agenda/2015/09/lessons-from-india-on-electrifying-urban-slums/> (last accessed on July, 6, 2018)

Winther, Tanja, Margaret N. Matinga, Kirsten Ulsrud, and Karina Standal. 2017. "Women's empowerment through electricity access: scoping study and proposal for a framework of analysis." *Journal of Development Effectiveness*.

World Bank 2014 More Power to India: *The Challenge of Electricity Distribution*. The World Bank Washington, DC: World Bank Directions in Development.

http://www.avsi-usa.org/uploads/6/7/4/2/67429199/avsi___coelba3.pdf (last accessed on July, 13, 2018)

World Bank 2017 *Global Tracking framework* <http://www.worldbank.org/en/topic/energy/publication/global-tracking-framework-2017> (last accessed July, 4, 2018) World Bank 2012 Who benefits most from rural electrification- Evidence in India <https://openknowledge.worldbank.org/handle/10986/9328> (last accessed on July, 7, 2018)

World Bank 2014 More Power to India- The Challenge of Electricity Distribution <https://openknowledge.worldbank.org/bitstream/handle/10986/18726/889060PUB0978100Box385252B00PUBLIC0.pdf?sequence=1&isAllowed=y> (last accessed on July, 7, 2018)

World Bank 2015 Power for All Electricity Access Challenge in India

<http://documents.worldbank.org/curated/en/562191468041399641/pdf/922230PUB0978100Box385358B00PUBLIC0.pdf> (last accessed on July, 8, 2018)



Contact Details

Nishant Bhardwaj

Energy Advisor
Department of International Development
n-bhardwaj@dfid.gov.uk

Anish De

Programme Director - Power Sector Reforms Programme
KPMG India
anishde@kpmg.com



For more information visit



<https://www.psrindia.com>



https://twitter.com/psr_india



www.facebook.com/PSR-India-122338261759998/