



Distribution Utilities Forum



RURAL ELECTRIFICATION: IMPACT ON DISTRIBUTION COMPANIES IN INDIA

A study to highlight the real and perceived implications on power distribution companies due to the large-scale intensification of rural electrification in India.

Bigсна Gill | Astha Gupta | Debajit Palit



RURAL ELECTRIFICATION IMPACT ON DISTRIBUTION COMPANIES IN INDIA

A study to highlight the real and perceived implications on power distribution companies due to the large-scale intensification of rural electrification in India.

Authors

Bigсна Gill | Astha Gupta | Debajit Palit

This publication may be reproduced in whole or in part and in any form for academic and nonprofit purposes without special permission from the copyright holder, provided it is acknowledged. TERI would appreciate receiving notifications or a copy of any publication that uses this publication as a reference.

No part of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from TERI.

Disclaimer

The views/analysis expressed in this report/document do not necessarily reflect the views of Shakti Sustainable Energy Foundation. The Foundation also does not guarantee the accuracy of any data included in this publication nor does it accept any responsibility for the consequences of its use.

Published by

TERI Press
The Energy and Resources Institute
Darbari Seth Block,
IHC Complex, Lodhi Road
New Delhi - 110003

Tel.: 24682100, 41504900
Fax: 24682144, 24682145
India +91 • Delhi (0) 11
Email: teripress@teri.res.in
Web: www.teriin.org

CONTENTS

MESSAGE BY AJAY MATHUR	V
MESSAGE BY KRISHAN DHAWAN	VII
FOREWORD BY GIREESH B PRADHAN	IX
ACKNOWLEDGEMENTS	XI
1 EXECUTIVE SUMMARY	1
2 INTRODUCTION	3
3 OBJECTIVES OF THE STUDY	6
4 APPROACH AND METHODOLOGY	7
5 FINDINGS	8
5.1 Saubhagya Scheme	8
5.2 Implementation Challenges	9
5.2.1 Technical	9
5.2.2 Financial	9
5.2.3 Institutional	10
5.3 Anticipated Post-Implementation Challenges	11
5.3.1 Technical	11
5.3.2 Financial	12
5.3.3 Institutional and Operational	12
5.4 Technology and Process Enablers	14
5.4.1 IT-Based Energy and Revenue Management	14
5.4.2 Augmented Revenue-Collection Methods	15
5.4.3 Intensive Governance and Monitoring	15
5.4.4 Training and Capacity Building	16
5.4.5 Concentrated Implementation Approach	16
6 LEARNING AND THE WAY FORWARD	17
7 SUMMARY AND CONCLUSION	19
8 ANNEX 1	21
9 ANNEX 2	22
10 ANNEX 3	22
11 ANNEX 4	23



Message

AJAY MATHUR

Director General, TERI

The Energy & Resources Institute (TERI) and Shakti Sustainable Energy Foundation (SSEF) have launched the Distribution Utilities Forum (DUF), with a view to enhance and accelerate sharing and learning amongst distribution utilities from each other's experiences. The DUF is a Forum for Discoms to come together to discuss issues of importance to the distribution sector, and deliberate on ways to achieve their common goals.

In the inaugural meeting of the Forum it was decided that there was a need to address the issues in respect of rural electrification from a Discom's perspective and there is a lot that can be learnt from each-other's experiences. Accordingly, 'Rural Electrification: Impact on Distribution Companies in India' was taken as the theme for discussion at the second meeting of DUF. A discussion paper on the theme was prepared by TERI based on literature review and consultations with Discoms officials. TERI presented its findings from the study in the Forum meeting held on 31 October, 2018. The participating Discoms shared their challenges and best practices in implementing the rural electrification program as well as post-implementation challenges.

This analysis and experience has been captured in this report, which provides an updated understanding of best practices and of ways and means to address the challenges of rural electrification.

A handwritten signature in blue ink that reads "Ajay Mathur". The signature is fluid and cursive, with a horizontal line underneath the name.

Dr. Ajay Mathur



Message

KRISHAN DHAWAN

CEO, Shakti Sustainable Energy Foundation

Shakti Sustainable Energy Foundation and The Energy and Resources Institute launched the Distribution Utilities Forum this year to provide Indian power distribution companies with an independent platform where they can meet with their peers and share perspectives on operational issues and challenges that confront the sector and discuss potential solutions to these problems.

The Forum also provides a platform where utilities can look collectively at the big picture changes that they must face-up to in the context of evolving technology and growing consumer expectations.

I am pleased to note that the initiative has been received well by the Discoms that attended the two meetings that have been held to date. In the inaugural meeting the Discoms came forward with their views on the most immediate challenges that need to be addressed. The discussions provided a ground level view of the challenges faced by India's power distribution companies.

The second meeting focussed on the challenges that Discoms have faced in implementing various rural electrification schemes, notably the recent Saubhagya scheme. At this meeting, the utilities spoke about operational concerns and potential solutions such as managing human resources and how they have used technology to resolve some of these issues.

This report flows out of our initial findings and the discussions at the DUF meeting on rural electrification.

I trust you will find the report of interest.

A handwritten signature in black ink, appearing to be 'Krishan Dhawan', written in a cursive style.

Krishan Dhawan



Foreword from Chairman

GIREESH B PRADHAN

Honorary Chairman, DUF

Government of India has set out several important goals: ensuring financial sustainability of the distribution sector, providing 24*7 affordable power supply, realizing a greater share of cleaner resources and achieving universal household electrification by March 2019. Distribution utilities have been making concerted efforts to implement these schemes, but their effectiveness varies from state to state depending on the base line, various socio-economic imperatives as well as the financial and systemic constraints.

In the process, many success stories in the distribution sector have not been captured or replicated widely and nor have they been able to contribute to the current narrative on the sector. Most distribution companies remain busy with day-to-day operations and opportunities for cross learning and strategic discussions are few and far between.

The Distribution Utilities Forum is a welcome initiative by Shakti Sustainable Energy Foundation and The Energy and Resources Institute and seeks to build synergies between distribution utilities across states. The Forum facilitates interaction among distribution utilities to facilitate an exchange of ideas, sharing of knowledge and best practices that can benefit the distribution sector.

The two meetings of the Forum held till now saw enthusiastic participation from a dozen Discoms who spoke about the variety of day-to-day challenges they face in operationalising the different mandates given to them.

I look forward to fruitful interactions with many more Discoms in the forthcoming meetings of the Forum.

I trust you will find the report of interest.

A handwritten signature in black ink that reads "Gireesh Pradhan". The signature is written in a cursive style and is positioned above a horizontal line.

Gireesh B Pradhan

ACKNOWLEDGEMENTS

This paper would not have been possible without the cooperation and support received from the following state distribution companies: West Bengal State Electricity Distribution Company, Grid Corporation of Odisha, Madhyanchal Vidyut Vitaran Nigam Ltd., Purvanchal Vidhyut Vitaran Nigam Ltd., Maharashtra State Electricity Distribution Company Limited, Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Ltd., Jaipur Vidyut Vitran Nigam Ltd., Jodhpur Vidyut Vitran Nigam Ltd., North Bihar Power Distribution Company Ltd., and South Bihar Power Distribution Company Ltd. We are extremely grateful to all the officials who took time out to talk to us and shared their perceptions, experiences, and best practices on rural electrification and the implementation of SAUBHAGYA.

We thank Shakti Sustainable Energy Foundation (SSEF) for supporting this initiative, and Mr Deepak Gupta, Sr. Programme Manager (Power), and Ms Gayatri Ramanathan, Programme Associate (Renewable Energy), for their inputs during the course of this research.

We are also grateful to Mr A K Saxena, Senior Fellow & Director, Electricity and Fuels Division, TERI, for his continued guidance and support in making this paper pertinent to the purpose of the study. Ms Rashmi Singh, Research Associate, Electricity and Fuels Division is also gratefully acknowledged for her assistance in coordinating the publication of this paper.

ABOUT THE AUTHORS

This paper has been authored by **Bigсна Gill**, Fellow and Area Convener, Centre for Impact Evaluation & Energy Access, TERI, **Astha Gupta**, Associate Fellow, Centre for Impact Evaluation & Energy Access, TERI and **Debajit Palit**, Senior Fellow & Director, Rural Energy and Livelihoods Division, TERI.

EXECUTIVE SUMMARY

As 2018 drew to a close, the pressure on Discoms to reach their electrification milestones, under the central government's Saubhagya scheme by 31 December 2018, also intensified. Though India has been undergoing a gradual process of rural electrification for nearly two decades, through various village- and household-electrification schemes, the Saubhagya scheme introduced a granular and targeted approach towards achieving universal electrification. The world's largest rural -electrification programme of its kind, Saubhagya's scope of interventions expanded beyond village-level infrastructure development and BPL households, to include all un-electrified households—both urban and rural—in the country. The scheme was notified on October 17, 2017 with a target of covering approximately 30 million un-electrified households.

As of 10 December 2018,¹ over 72% of this target had been achieved with 21+ million households having been connected to the grid or provided off-grid electricity alternatives (Annex 1). 80% of villages under the purview of the scheme are reported to have been fully electrified. Less than a third (approximately 8.2 million) of the total un-electrified households remained, with the majority falling in the northeastern states of Arunachal Pradesh, Meghalaya, Nagaland and Assam, and in Uttar Pradesh. Together these states held nearly 80% of the total remaining un-electrified household base, with state-level electrification rates around 85%. On the contrary, several states that had significant ground to cover, with 15–25% of un-electrified households, had already fulfilled their electrification targets well before the deadline. Notable among these are Bihar (23% un-electrified HHs), Madhya Pradesh (16%), and Jammu & Kashmir (15%). Other states that have made good progress in significantly reducing their share of un-electrified households include Odisha, Jharkhand, Manipur, and Tripura (see Annex 1).

¹ See <http://saubhagya.gov.in> (last accessed on 10 December 2018).

Discoms are experiencing several technical, financial and institutional challenges during the course of implementations under the Saubhagya scheme, and also anticipate forthcoming challenges related to maintaining revenue sustainability, theft and keeping AT&C losses within the prescribed regulatory range.

Given the stiff targets for advancing household electrification in India, Discoms have faced immense pressure to meet the 100% household-electrification target regardless of their current on-ground capabilities. In addition to the implementation challenges of providing connections to far-flung settlements within the given timeline, Discoms have simultaneously begun grappling with post-implementation challenges of monitoring and servicing these new connections. With Saubhagya and the resulting intensification of rural-electricity access, fulfilling the conditions under the Ujwal Discom Assurance Yojana (UDAY) scheme is expected to become more challenging for many Discoms, with implications for the Discoms' performance and financial viability in the immediate future, as well as long-term cost implications for the overall power system.

In this context, the study was undertaken to present the Discoms' perspective of the key challenges they face in implementing the Saubhagya scheme, as well as its impending implications for their overall operational and financial performance. Discoms at different stages of electrification under Saubhagya and from different geographies were identified—those that had already made a significant progress in rolling out the scheme as well as those that were yet to meet the majority of

their electrification target. The study also highlights several technologies and process enablers that some Discoms have successfully operationalized, and which have enabled them to manage their electrification and performance targets well. Detailed discussions with 29 mid-to-senior-level officials in 10 Discoms, ² in charge of commercial, technical, revenue, and project-implementation functions, revealed that Discoms are experiencing several technical, financial, and institutional challenges in the implementation of the Saubhagya scheme, and also anticipate challenges related to maintaining revenue sustainability, theft, and keeping the aggregate technical and commercial (AT&C) losses within the prescribed regulatory range.

Discoms expressed concern regarding the scheme's ambition to cover all un-electrified households within the limited time frame and institutional scope and stressed that the ground realities must be considered. The **lack of adequate time to conduct physical surveys** in implementation areas led to inconsistencies in the beneficiary survey data, which in turn impacted planning and human-resource deployment. The **need for creating distribution infrastructure** in areas where the grid had not yet reached and traversing through demanding terrain (flood-prone and hilly areas, islands) to reach remote households made implementing Saubhagya a resource-intensive activity.

Additionally, there were frequent **chokes in material supply** that delayed implementation activities. Even though equipment manufacturers were operating at peak-productions levels, there were lags in meeting the demand. This was further impaired by factors that were beyond the control of Discoms like transportation delays due to strikes or shortage of human resources during festival time. Mobilizing, managing, and controlling **outsourced human resource** at the required scale was a demanding task. Several Discoms also pointed out the need for a well-designed IT management system that could help them manage their monitoring, billing, and demand-management processes better.

The post-implementation implications foreseen by Discoms will ultimately impact and define their AT&C losses, and many Discoms are anticipating that keeping AT&C losses low will be a key challenge in

the coming months, especially in the context of the requirements of the UDAY scheme. The key concerns expressed by Discoms included maintenance of the significantly expanded network, keeping theft in check, and building capacities of human resource to manage the network more efficiently to **keep technical losses to the minimum** as much as possible. Maintaining **revenue sustainability** was another major concern, as the cost to serve these new connections is higher than the revenue generated. Consumer awareness and affordability are also seen as deterrents to revenue sustainability; Discoms are now focusing on streamlining the billing and collection processes to combat this.

Despite these common hurdles across all Discoms, some Discoms have been successful in building resilience by developing technology and process enablers. This has allowed them to meet their Saubhagya targets while keeping their overall performance in check, with positive outcomes.

IT-based energy and revenue-management systems have aided Discoms to manage electricity-supply services better, improve consumer interface and revenue collections, and minimize AT&C losses. The use of **mobile-based applications** has brought about a consumer-centric approach to services and has also helped Discom employees to manage day-to-day processes like feeder and load management, meter reading, processing new connections, and so on better. **Expedited DT replacement** services have also greatly improved the quality of services provided by Discoms on the ground.

Innovative revenue-collection methods, in addition to the existing collection processes, have also lent impetus to the overall collection-efficiency standards, especially in rural areas. Incentive-based models seem to work well for some Discoms that have engaged village-level collection agents, while others have designated their own staff at the division level to enhance consumer convenience as well as improve billing and collection rates. Training and **capacity building** of new human resource being engaged for the expanded network, as well as **intensive governance and monitoring**, has enabled Discoms to keep their implementation progress steady and relatively smooth.

² Consultations were conducted in July 2018 for a total of 32 hours; the duration of interviews ranged from 40 minutes to 2 hours.

INTRODUCTION

The Electricity Act, 2003, inter alia, provided a governance framework for expanding electricity access in the country, both via grid extension and standalone systems. Section 6³ of the act obligates the central and state governments to extend electricity access to all areas, including villages and hamlets, through rural electricity-infrastructure development and connections to households.

Post the introduction of this landmark legislation, the Government of India launched the Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) in April 2005, with the objective of extending electricity to all un-

electrified villages in the country (numbering more than 100,000 at the time), and the intensification of electricity infrastructure in the electrified villages. The key features of the programme included the provision of the Village Electrification Infrastructure (VEI) with distribution transformers (DTs) of appropriate capacity in all villages and free connections to all the Below Poverty Line (BPL) households in the villages. Under this scheme, state governments received a 90% grant from the central government and the remaining 10% as a loan from the Rural Electrification Corporation (REC). This was a paradigm shift from the earlier financing model wherein the central government used to provide soft loans to state governments for rural electrification. With strong support from the central government for rural electrification, the VEI was extended to around 110,000 villages during the period 2005–2013. Further, the central government also engaged central PSUs,

³ Section 6: Joint responsibility of state government and central government in rural electrification—the concerned state government and the central government shall jointly endeavour to provide access to electricity to all areas, including villages and hamlets, through rural electricity infrastructure and electrification of households.
See <http://www.cercind.gov.in/Act-with-amendment.pdf> (last accessed on 31 January 2019).



NTPC, NHPC, Power Grid, and DVC⁴ to implement the VEI in some states, in order to improve implementation efficiencies in partnership with the state government, rural-electrification agencies and Discoms.

In 2015, the Government of India launched the Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) which subsumed the RGGVY and brought in an additional component of agricultural feeder separation. The 18,500 villages in extremely remote locations that remained un-electrified under the RGGVY were taken up for electrification under this scheme, and on April 28, 2018, the milestone of electrifying all villages was achieved. The DDUGJY has also been crucial in providing support for strengthening sub-transmission and distribution networks in rural areas, particularly focusing on the metering of distribution transformers, feeders and consumers in rural areas.

Acknowledging that the grid alone may not be able to provide access to all households, or may take a long time to reach all un-electrified households in inaccessible areas, the central government also made several complementary efforts to support these programmes through standalone mini-grids or solar home systems, such as RVE,⁵ the VESP,⁶ and DDG⁷ under the DDUGJY. The state governments also contributed through various off-grid energy-access schemes and mini-grid policies to promote DRE⁸ solutions. All these supplemental efforts were crucial in achieving universal energy access, especially in inaccessible areas where grid extension was difficult. Further, other distribution reform schemes and programmes such as UJALA⁹, to promote efficient energy-use practices to better manage and reduce load demand, and UDAY in 2015, to enable a financial turnaround¹⁰ and operational improvement of Discoms (by mandating state governments to take over 75% of the Discoms' debt, and pay back lenders by selling bonds, and by directing Discoms to issue bonds for the remaining 25%). The key conditions of the UDAY scheme were that Discoms would significantly improve their operational efficiency,

bring AT&C losses down to 15%, and reduce the gap between the ACS¹¹ and the ARR¹² to zero. (For details of progress made under the scheme thus far, refer to Annex 2).

Even though village electricity expansion was achieved by way of the RGGVY and the DDUGJY, the rate of household electrification continued to be slow. While both schemes included provisions for free electricity connections to all BPL households, evaluations of RGGVY by TERI¹³ and other research institutes indicated that a majority of the 'Above Poverty Line' (APL) households did not take up electricity connections under the scheme due to various reasons,¹⁴ such as high upfront connection costs, already having 'unauthorized connections', poor quality of supply, poor maintenance services, and so on.

Some states also initiated their own electricity-access programmes to accelerate the rate of hamlet and household connections that were otherwise not covered under the central government schemes, such as the West Bengal Rural Electrification Programme, the Har Ghar Bijli scheme in Bihar, and the Bijuli Bati mobile-based app to enable last-mile connectivity and household connections in Odisha.

To address this, the central government launched the Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya) in September 2017, with the ambitious target of providing electricity connections to all un-electrified households by March 2019¹⁵—a total of 30 million un-electrified households (25 million rural and 5 million urban). The programme has been progressing steadily, and as of December 10, 2018, more than 21 million connections (approximately 70% of the target) had been provided across the country since its launch in September 2017 (Annex 1).

Amidst the large-scale implementation of rural-electrification schemes in India, the financial condition

⁴ Damodar Valley Corporation

⁵ Remote Village Electrification

⁶ Village Energy Security Programme

⁷ Decentralized Distributed Generation

⁸ Distributed Renewable Energy

⁹ Unnat Jyoti by Affordable LEDs

¹⁰ At the time of the announcement of the UDAY scheme, the accumulated losses of discoms amounted to Rs 4.3 lakh crore with annual incremental losses of Rs 60,000 crore.

¹¹ Average cost of supply

¹² Average revenue realized

¹³ See http://www.recindia.nic.in/download/TERI_Combined_Executive_Summary.pdf (last accessed on 31 January 2019).

¹⁴ See http://planningcommission.nic.in/reports/peoreport/peo/peo_rggvy3107.pdf; <http://irade.org/2.IRADe-%20Integrated%20Executive%20Summary%20cum%20combined%20report%20of%20RGGVY%20evaluation%20of%20Rajasthan,%20Assam,%20Gujarat,%20Himachal%20Pradesh%20and%20Uttar%20Pradesh%20-Rajiv.pdf> (last accessed on 31 January 2019).

¹⁵ Though the scheme document mentions 31 March 2019 as the deadline for 100% electrification, it also states that an additional grant will be awarded to states that complete their targets by 31 December 2018, owing to which most discoms are aiming to achieve the latter deadline.



of many Discoms in the country had weakened, due to high AT&C losses and high-interest outgo on loans and other operational challenges.

With Saubhagya and the resultant intensification of rural electricity expansion, fulfilling the conditions under UDAY is envisaged to become an even more

challenging task,¹⁶ with associated implications for Discom performance, its viability in the immediate future, as well as long-term cost implications for the overall power system, which may be heavily overbuilt.

¹⁶ For example, in the case of a discom covered under this study, the number of connections will more than double in a very short time, though its human resource capacities to manage the new scale are not increasing proportionally.

OBJECTIVES OF THE STUDY

Based on the aforementioned backdrop and the discussions held at the first meeting of the Distribution Utility Forum on May 4, 2018, the main objectives of this study are:

- To present an overview of Discoms' perspective on the technical, operational, institutional, and financial implications of the Saubhagya scheme.
- To underline the key challenges Discoms faced in implementing the Saubhagya scheme, and after-effects of the scheme on their performance.
- To highlight the leading operational and institutional best practices that have enabled Discoms to manage their electrification and performance targets well.

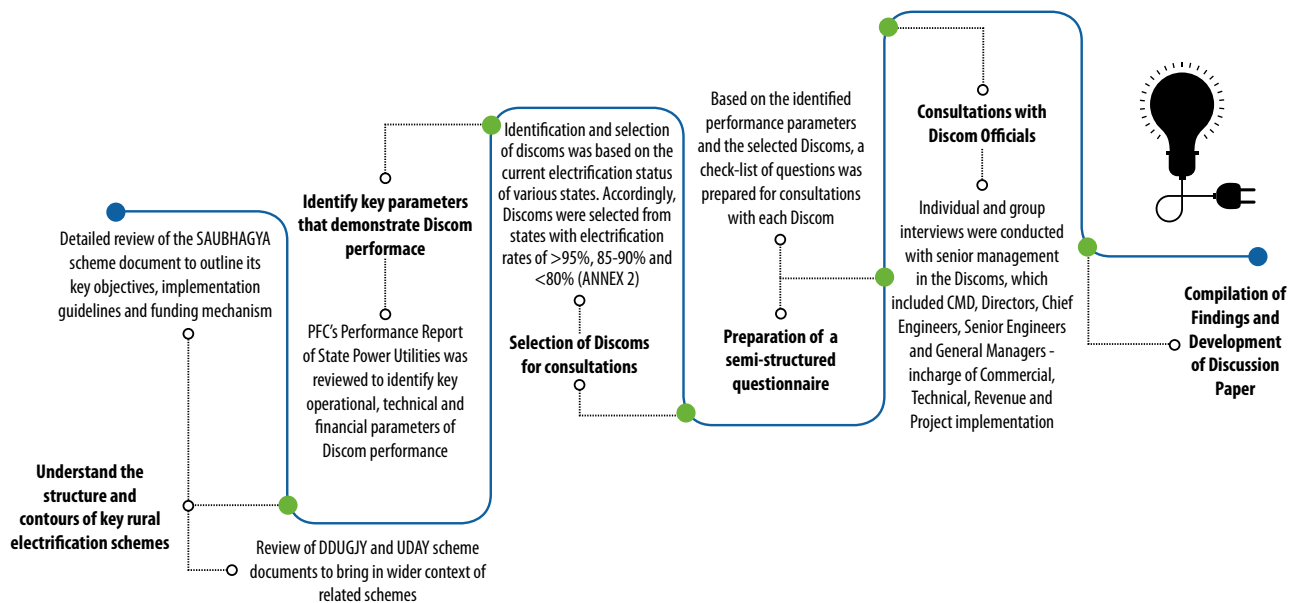


APPROACH AND METHODOLOGY

The approach adopted to achieve the objectives of this study included a combination of literature review (of rural-electrification schemes) and stakeholder consultations with Discom officials. A total of 10 Discoms (Annex 3) across seven states—Uttar Pradesh, Rajasthan, Odisha, West Bengal, Maharashtra, Madhya Pradesh, and Bihar—were selected for consultation. The selection was done with a view to include Discoms from states that are at different stages of electrification, such as those where electrification rates are very high and those who still have large numbers to cover by March 2019.

The team met a cross-section of mid-to-senior-level Discom officials which included directors, chief engineers, general managers, and superintendent engineers in charge of commercial, technical, revenue, and project-implementation (Saubhagya, RGGVY, and DDUGJY) functions. The CMDs of a few Discoms were also interviewed. Semi-structured, face-to-face group and individual interviews were conducted with 29 Discom officials, for a total of 32 hours, in July 2018. The duration of interviews ranged from 40 minutes to 2 hours. The checklist of questions is provided in Annex 4.

A detailed methodology is presented below.



FINDINGS

This section presents key findings from consultations held with Discom officials and is organized into four subsections. The first subsection provides a brief overview of the Saubhagya scheme, followed by two subsections that cover the most critical challenges Discoms faced during implementations under the scheme, as well as those they anticipate will arise in the near future due to the large-scale electrification undertaken. The final subsection highlights the key technology and process enablers that Discoms have put into action, which, despite the pressure to expand scale, has led to a more efficient performance and effective service delivery.

5.1 The Scheme

The Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya) was launched to ensure last-mile connectivity and electricity connections to all the remaining un-electrified rural and urban households in India (approximately 30 million at the time of announcement)¹⁷ by March 2019. It is the world's largest rural-electrification programme of its kind, expanding its scope beyond village-level infrastructure development and connections to BPL households to include all un-electrified households in the country—both urban and rural. The overarching scope and objective of the scheme is to:

- Provide last-mile connectivity and electricity connections to all the remaining un-electrified households in rural areas
- Provide solar PV-based electricity connections where it is not feasible to supply power through the grid

¹⁷ Recently, the Ministry of Power clarified that the initial estimate of 40 million unelectrified households was based on Census figures and as reported by the states. However, when the electrification teams went to the villages, the actual number of un-electrified houses in most villages were found to be lower due to two main reasons: (i) many census households living together now and availing electricity services together through a single connection, and (ii) many households having already availed connections under the ongoing DDUGJY scheme and other States' schemes. See: Ministry of Power, PIB Delhi, 25 Jan 2019. <http://www.pib.nic.in/PressReleasframePage.aspx?PRID=1561456>



- Provide last-mile connectivity and electricity connections to all poor un-electrified households in urban areas

Though the government declared in April 2018 that 100% village electrification has been achieved, a large number of households still remained un-electrified in many villages, because they could not afford to pay the high upfront connection costs (especially hamlets and scattered households that were not located near village transformers) and due to the relatively complicated paperwork needed to get a formal connection.

The Saubhagya scheme was launched to overcome these connection barriers by expanding subsidies for electrification to include BPL households as well as households identified using the 2011 socio-economic and caste census (SECC) data, to provide free connections to un-electrified households having at least one 'deprivation' (out of the seven identified under the SECC). This is significant, as deprivation criteria are more encompassing, with parameters including female-headed households, scheduled caste and tribal households, landless households, etc.¹⁸

¹⁸ See <https://medium.com/energy-access-india/commentary-new-india-electrification-target-daunting-but-doable-565464ed102a> (last accessed on 31 January 2019).

The scheme was notified on 11 October 2017, at a total cost of Rs 16,320 crore (Rs 14,025 crore outlay for rural connections and Rs 2,295 crore for urban connections) and a gross central budgetary support of Rs 12,320 crore during the entire implementation period. All state and private Discoms, state power departments, and rural electric cooperative societies were eligible for financial assistance under the scheme. Each subscribing state and union territory is required to complete its 100% household electrification target by 31 March 2019, though they are also encouraged to achieve their targets earlier, by 31 December 2018, through an additional grant incentive.

5.2 Implementation Challenges

5.2.1 Technical

All Discoms expressed their concern with respect to the 'one-size-fits-all' approach that the Saubhagya scheme has adopted to provide electricity connections to households irrespective of the location, topography, and population density of the target areas. Many felt that the scheme had been designed assuming that the electricity **distribution infrastructure** was already in place in these areas and the only remaining thing was to extend connections to un-electrified households. However, this is not true for a majority of the regions being covered under the scheme, where the grid infrastructure either needs to be created anew or needs to be upgraded/augmented to service all the households in its area of supply. In regions with sparse and scattered population and those located in troublesome terrains like islands, hilly regions, and flood-prone areas, there are additional associated challenges for material transportation, the extension of power lines, and building up the distribution network, all of which are more resource- and time-intensive.

Another major bottleneck that was not factored into the scheme's implementation timeline was the chokes in the material supply chain that have been experienced by all Discoms, causing delays in implementation. As there are only a limited number of manufacturers supplying the electricity distribution infrastructure equipment, even at peak production there is a time lag in fulfilling orders.

Several Discoms are trying to manage this by identifying and sourcing from vendors in electrified states where the pressure to supply is likely to be

lower. Other factors beyond their control include trucker strikes and outsourced human resource that refuses to work during festivals, contributing to further delays in making materials available on site, pending implementations.

Discoms strongly expressed that these practical aspects and ground realities that impact implementation timelines and increase strain on the existing resources should have been taken into account while designing the scheme.

5.2.2 Financial

The Saubhagya scheme has set a service connection cost allowance of Rs 3000 per household (to cover the cost of a service-line cable, meter, single-point wiring, LED lamp, and associated accessories as required) and an additional allowance of Rs 1500 per connection to ensure last-mile infrastructure connectivity (pole erection, conductor, LT line, and so on) for un-electrified households that are not reached by the existing supply infrastructure. Discoms did not express any issues with the household-connection allowance of Rs 3000 due to a precedent, where the same connection allowance was provided under the DDUGJY scheme to connect BPL households.¹⁹ However, as highlighted earlier, to ensure 100% electrification of all households, they are expanding into areas much beyond their existing rural infrastructure, traversing new and socio-economically variable geographies with sparse and scattered dwellings, and the cost of such expansion is way beyond the given allowance of Rs 1500 under the scheme. Thus, the additional cost for last-mile infrastructure connectivity is currently being borne



¹⁹ See DDUGJY Office Memorandum, available at https://powermin.nic.in/sites/default/files/uploads/Deendayal_Upadhyaya_Gram_Jyoti_Yojana.pdf (last accessed on 31 January 2019).

by Discoms; in most cases, this is only possible with financial support from the respective state government.

While some Discoms estimated the last-mile-connectivity cost of extending lines to each and every such household at around Rs 8,000, others stated it was around Rs 25,000–30,000 per connection, which confirms the contextual and locational scenarios that different Discoms in different states are facing.²⁰ Though it is appreciated that the scheme may have based its connection and last-mile-connectivity allowances on an average-cost calculation, in context of the actual physical scope of expansion, this is not representative of the real costs being borne to provide connections. Some Discoms took this up with the REC and the Ministry of Power for necessary action, following which the money for infrastructure development has been allotted to all states in advance to be claimed against actual expenditures.

Metering of all new connections and, parallelly, of the existing unmetered connections is a mandatory condition under the Saubhagya scheme (though costs for metering unmetered connections are not covered under the scheme). Although this is a positive step towards accounting for consumption, some Discoms felt that there was too much experimentation with the metering technology, which requires frequent replacements of existing meters, even if they are in good working condition. The overall return on investment in re-metering is considered to be very low, with replaced meters ultimately becoming a sunk cost. It is seen as an inconvenience to consumers, as well as an added task for Discoms without any long-

term assurance on retention. It is suggested that new metering technologies must be piloted for suitability in the various consumer contexts and only then deployed. Many commented that graduating directly to pre-paid meters would be the best alternative.

Discoms have envisaged the need for additional human resources that will be required to manage the newly metered connections and also acknowledge that there will be near-term financial implications of the Saubhagya scheme. However, their main focus at the time was to complete the 100% electrification target within the stipulated period, and that is where all their time and resources were directed.

5.2.3 Institutional

Under the Saubhagya scheme, the **beneficiary survey**²¹ is the primary and most critical step towards planning implementation and resource allocation (material, human resource, and time). However, most Discoms said that the time available to conduct the physical survey in their jurisdiction area was very short due to which inconsistencies in beneficiary numbers were cropping up; this was specifically true in states where un-electrified numbers were very large. In most cases, surveys were conducted through contracted survey agencies, who were under pressure to deliver numbers within a very short time (though some Discoms also took help from officials in local post offices and the rural development department); in some cases, the survey was not completed due to time, information, and human resource limitations, which further impacted human resource- and material-deployment planning. Inaccuracies in past surveys conducted under the DDUGJY and the dated Census 2011 database, which were used as data sources to conduct the physical surveys, were also mentioned as causes of concern by several Discoms. It is possible that due to these gaps in the list of beneficiaries, some households may be left out and continue to remain un-electrified.

Since implementing the Saubhagya mandate involves large-scale operations with limited time frames, the Discom staff were also working intensively at the ground level and in close coordination with the **contractual**



²⁰ For example, Uttar Pradesh was said to have an average of 3.4 hamlets per village, whereas Rajasthan has extremely spread-out and scattered settlements.

²¹ Beneficiary surveys have been conducted by discoms to identify the total number of beneficiary households (district-wise) to be electrified under the scheme. Beneficiary households are identified based on specific inclusion and exclusion criteria in the Saubhagya scheme document. The survey forms the basis for the letter of intent, proposal, and estimated total project cost that discoms submit to the REC for securing the grant.

human resource . Providing household connections entails paperwork and approvals in addition to physical connections requiring the Discoms to be in sync with the physical installation process. Though the cost of hiring workers did not emerge as a big problem, co-managing the labour did present some challenges. Worker attitudes, especially during the festival season, have been a major cause of delays, as they are not willing to continue working through festivals and are even willing to give up their jobs if forced to stay. Finding and replacing suitable human resource and training them from time to time have also impacted implementation.

In some other states, outsourcing has brought up issues regarding the absorption of temporary human resource, as they have demanded to be taken on board as permanent staff. Refusal has been met with work disruptions and strikes. Since the pay scales of outsourced workers are quite low, good candidates (with requisite skills) don't get recruited, leading to continuous training needs—another cause for both delay and additional cost. Some Discoms felt they did not have complete control of decisions regarding human-resource planning and hiring and raised concerns about the state government's interference in appointing its own recruits in various staff positions.

While certain Discoms have developed complete IT-based systems to make their monitoring, billing, and demand-management processes more efficient, there are several others that lack a well-developed IT system and continue to operate in a largely 'manual mode' (especially for meter reading, billing, and collections). This results in inconsistencies at various levels that are difficult to identify or control without an automated process in place. The key stated reasons for this are a lack of direction at the leadership level and technically qualified staff, who seem to be less comfortable with IT systems and technologies. These Discoms are, therefore, unable to invest in automated systems for monitoring, billing, and collections.

5.3 Anticipated Post-Implementation Challenges

It was evident from our visits to the Discoms that practically all staff was in mission mode to complete the Saubhagya targets by the December 2018 deadline. To achieve this, they have stretched their physical and financial capabilities and have shown

commitment to ensure that all households in their areas of implementation are connected to the grid. However, while the focus at present is completely on implementation, the post-implementation phase is expected to throw up further challenges. Primary among these are maintaining revenue sustainability, managing theft, keeping the network stable, and bringing AT&C losses within the acceptable range. Interestingly, none of the Discoms expressed any concerns regarding the availability of power to meet the increased demand from the new connections and are planning to provide 24X7 supply to all consumers to achieve the objective of 'Power for All' by 2022.

5.3.1 Technical

Managing and maintaining a much wider, in some cases scattered, network is also seen as a key future challenge, especially during monsoons. One aspect is the physical scale and scope of **managing a large, spread-out network** and the limited transportation and other facilities available to maintain the network. Another aspect is network augmentation that is expected to emerge as an additional cost in the next few years as a result of the additional demand, a cost that has not been considered in the scheme. Augmenting the distribution network is critical for load management as single-phase connections are currently being provided to households under the Saubhagya scheme. As the network expands, technical and commercial losses are also expected to increase, since it is difficult to maintain the system with the current human-resource capacities. Though the metering of feeders are taken up, metering at other levels of distribution and DTs may soon become indispensable as well. For example, if other levels of distribution are not brought under metering with the expanding infrastructure, proper energy accounting will become difficult, which may in turn create problems in achieving the target of 15% AT&C losses under UDAY.

The incidence of electricity **theft** is expected to increase as illegal connections take advantage of a spread-out network, demanding stringent and resource-intensive monitoring. Though steps are being taken to replace distribution lines with overhead AB²² cables and underground cables wherever possible, as well as by metering all connections and repairing and/or replacing

²² Aerial bundled cables (also aerial bundled conductors or simply ABC) are overhead power lines using several insulated phase conductors bundled tightly together, usually with a bare neutral conductor.

defective meters, Discoms have acknowledged that consumers still find ways to bypass these measures, and that this is a behavioural issue that needs to be addressed through greater awareness and capacity building.

5.3.2 Financial

In states that have already made significant progress towards rural/universal electrification (even before the Saubhagya scheme was announced), it has been a gradual and planned climb for the Discoms towards enhancing infrastructure, network development/maintenance, and customer management. However, in states where the electrification rate has been comparatively lower, there is a huge volume of new customers that are now being added to the network, in some cases even doubling and tripling the existing customer base. Since these new customers are located in rural areas, many in scattered hamlets and remote settlements, Discoms need to make a considerable added effort to safeguard their revenue sustainability, by making sure that the customers are served correct and timely bills, provided convenient payment options, and supplied reliable and quality electricity—all of which require further monetary, technical, and human resources to be pumped in. This is already a matter of contention as most Discoms feel that the actual cost to serve such connections is significantly more than the tariff charged and, therefore, not financially favourable to the Discoms' overall performance. Interestingly, one of the Discoms shared that since new connections under Saubhagya as well as the existing connections were being metered, there has been a resultant increase in the revenue recovery because of proper energy accounting as compared to the earlier scenario (where flat tariffs were being charged without any accounting of the energy used.)

Under the '24x7 Power for All' initiative, all state governments have a plan of utilizing savings from the UDAY scheme as well as other state schemes for overhauling and augmenting infrastructure in rural areas. However, several Discoms said that this alone may not be enough to provide sustained quality supply beyond a point, as the network had expanded exponentially and

will require regular maintenance and upkeep.²³ Under-recoveries from the low-paying rural consumers may further pose operational concerns to this end.

Consumer affordability is another factor that is likely to impact revenues; and shrinking rural incomes is a key reason for this. Discoms also mentioned the lack of awareness among consumers about the scheme as they assume that in addition to the connection, service would also be free.

5.3.3 Institutional and Operational

Eventually, the effect and management of all the aforementioned issues reflect in a Discom's AT&C losses. Most Discoms highlighted the lack of an end-to-end IT-enabled system and are struggling to maintain proper energy accounting, monitoring, and governance, which is contributing to high AT&C losses every year. With the scale of consumers increasing two- or three-fold, the current system capabilities of many Discoms are not able to keep track of the growing customer base. The balance between LT and HT consumers, which is already heavily tilted to the LT side, is now slated to become even more skewed, reducing the viability factor for Discoms whose main revenue source is HT consumers. In some cases, nearly half the share of LT consumers—mostly in non-urban and non-commercial areas—will constitute the lowest consumption category for a Discom. At the same time, the UDAY scheme that seeks to bail out Discoms from their burgeoning financial debts places a condition that they bring their AT&C losses down to 15%. One Discom official pointed out that this was not a realistic or fair expectation as the ratio of LT to HT consumers is a key contributing factor in a Discom's ability to recover revenues and in keeping distribution losses low. The geographical terrain is also an additional factor, as managing networks in remote and forest areas is more demanding than urban and peri-urban areas. Since rural connections under the Saubhagya scheme have been mandated by the central government and are not at the discretion of the Discom, the Discom should not be penalized for high AT&C losses for this consumer group. A more pragmatic approach would be to benchmark AT&C-loss thresholds

²³ For example, as per Odisha's Power for All document, it plans to serve more than 54 lakh consumers with 24 hours of power supply, and achieve 100% metering of feeders and transformers by utilizing funds from central and state schemes such as the DDUGJY, the IPDS, the BGJY, and the BSJY. It also plans to reduce its AT&C losses to 20% by FY 2019. However, the plan spells out the strong need for investment and fund requirement to the tune of Rs 6,000 crore for strengthening the distribution backbone and ensuring 24x7 power supply to all consumers.

according to the voltage levels at which electricity is distributed to consumers.

Further, the newly added LT consumers will contribute a much lower per unit cost towards electricity consumption than the higher-paying industrial consumers. Since the scope for further cross-subsidizing is negligible (due to the risk of losing high-paying consumers who may opt for open-access sources), there will be added pressure on Discoms to maintain AT&C losses within the stipulated range.

On the infrastructure side, metering all distribution levels and households is a way to curb technical and distribution losses along with end-to-end IT-based monitoring systems, wherein a centralized ERP-based billing database captures all data about the sale of power and the related billing information. Additionally, all 11kV and 33kV feeders, distribution transformers,

and substations are metered and also connected and uniquely coded into the system, to capture information about the electricity units supplied and enable the Discom to accurately measure losses at the different feeder levels. A consolidated view of all this information at a centralized portal allows the Discom to view feeder data in relation to the actual demand and collections data, and accordingly take anti-theft measures as well as steps to plug any gaps in billing and collections operations. It will address most of the challenges to minimize AT&C losses through improved measurement and billing, but it requires investments that most Discoms can only afford through state-funding schemes.

The following table summarizes the key short- and long-term implications of the Saubhagya scheme as shared by Discoms.

Table 1 Saubhagya’s real and perceived implications for Discoms

Short- and Long-Term implications of the Saubhagya Scheme for Discoms		
	Short Term	Long Term
Technical	<ul style="list-style-type: none"> ➤ In some areas, infrastructure has to be built afresh, which requires intensive time and resource allocation. ➤ Difficult geographic terrain (islands, hilly regions, and flood-prone areas) to cover ➤ Delays in material supply due to: <ul style="list-style-type: none"> » Limited number of manufacturers serving demand from multiple Discoms in a state » Truck-driver strikes » Outsourced human resource 	<ul style="list-style-type: none"> ➤ Keeping technical losses down <ul style="list-style-type: none"> » Difficult to maintain network with current human-resource capacities » Increased incidence of theft on a widespread network » Lack of energy-efficient practices by the consumer
Financial	<ul style="list-style-type: none"> ➤ Allowance of Rs 1500 for last-mile connectivity under the scheme is not adequate as Discoms are expanding much beyond their existing rural infrastructure to cover all households. ➤ Cost of metering all new and existing connections is not covered under the scheme, though it is a mandatory requirement under the scheme. ➤ Experimentation and frequent changes in meter technology leads to low returns on investment. 	<ul style="list-style-type: none"> ➤ Ensuring revenue sustainability <ul style="list-style-type: none"> » Managing new and expanded network (metering, checking theft, and quality supply) » Ensuring timely billing and collections » New customers are mostly rural; thus revenue recovery may be an issue. ➤ Actual cost to serve such connections is higher than the revenue generated. ➤ Affordability levels of consumer ➤ Awareness of consumer (they seem to believe that even the service is free)
Institutional	<ul style="list-style-type: none"> ➤ Time and effort spent in conducting the beneficiary survey is not covered under the scheme. ➤ Very limited time to conduct the survey, leading to inconsistencies in beneficiary numbers, especially in states where the number of rural HHs is very high. ➤ Management of the large-scale human resource mobilized for implementation of the scheme. ➤ Dealing with worker attitudes and high attrition rates, which requires repeated trainings to be provided to new recruits. ➤ Operating mostly on ‘manual mode’ due to the lack of well-developed IT-based management systems, which leads to inefficiencies. 	<ul style="list-style-type: none"> ➤ Curbing/reducing AT&C losses post Saubhagya <ul style="list-style-type: none"> » Pressure on the existing capacities to manage a larger, more widespread network » Lack of an organized/effective IT system for proper governance and monitoring in some Discoms » Skewed LT:HT consumer ratios impacting Discom viability and performance in the long run » Blanket approach under UDAY to bring AT&C losses down to 15% ➤ Human resource management

5.4 Technology and Process Enablers

5.4.1 IT-Based Energy and Revenue Management

A strong **IT-based energy- and revenue-management** system is a key enabler to improve operational efficiency through improved data capture and monitoring, better energy accounting, and regular and accurate billing, leading to improved revenue collections and minimizing AT&C losses. Additionally, the IT platform will facilitate the integration of DRE at distribution downstream. One of the Discoms has created an integrated system to monitor actual technical losses at every level of distribution, identify points of theft, and capture power-consumption data to better rationalize and plan its power demand and load requirements. A centralized database captures energy-flow information at the feeder, substation, and distribution-transformer levels through meters installed on each of these. Parallely, ERP-based billing and collection databases are used to compare data about energy consumed and billed at the consumer level, to identify pockets of theft and subsequently improve collections.

At the field level, all Discoms have adopted IT-based billing and collection systems (such as spot billing, **mobile app**-based billing and collections, and online payment gateways) which have proved to be highly effective in reducing manual errors, have enhanced the billing efficiencies and collection rates, and improved consumer-end services.

The majority of Discoms have developed mobile applications for consumers with the following objectives: a) enhancing customer-satisfaction levels by continually improving service standards and b) ensuring effective and timely delivery of various services to the consumers. Therefore, bringing a customer-centric approach to the customer-service processes by increasing the quantum of digital payments is the broader aim, thereby also fulfilling the objectives of the Digital India mission. The consumer portals developed on the mobile application enable registered consumers to view their connection details, billing history, and consumption details, besides allowing them to apply for name change, load change, and tariff change. Through the application, consumers can also apply for a new connection, track the

application, register complaints, and provide feedback on the services provided.

Some Discoms have also developed mobile applications for their employees that enable them to undertake activities such as feeder management, load management, disconnection, meter reading, new connections, and so on. Such applications enable the employees to report power theft, deliver at-door electricity connections, and register complaints. Discoms are also able to track the total number of mobile numbers registered, which is useful for sending SMS alerts for services such as meter reading, payment, complaints, new connections, and outage information.

A system for the **quick replacement of DTs** in villages to ensure reliability of energy services to the rural consumers has also been established by one of the Discoms. At each division/subdivision level, a walk-in option has been created at the call centres to register complaints about DT burnout or malfunction. A dedicated agency has been contracted to replace the DT within 3–4 hours of the complaint being registered.

5.4.2 Augmented Revenue-Collection Methods

As the number of rural consumers expands exponentially under the current universal-electrification scheme, ensuring a high rate of billing and revenue collection in rural areas is a key challenge for all Discoms. Though the prevailing norm is to outsource billing and collection activities to contracted parties, there are still major gaps in ensuring that all consumers are served accurate and timely bills and that all bills are duly paid at the designated collection centres or through online payment gateways. Some Discoms have launched successful initiatives to supplement their existing billing and collection processes. For example, to improve billing and collection efficiencies, specifically in rural areas by engaging local individuals, Discoms are working with village enterprises or facilitation centres to manage meter reading, billing, and collections at the feeder level (11 kv) for up to 1000 households, and linking it to an incentive-based payment for each activity undertaken per household. This has not only resulted in significant improvements in the overall revenue collection from rural areas but has also provided co-benefits of enhanced consumer convenience and rural- income generation.

While in some states, local enterprises such as self-help groups (SHGs) are engaged to carry out the distribution activities, in others a *gram sewak* is appointed by the gram panchayat for each village to manage such activities. Some additional activities such as breakdown management, electricity restoration, street-lights maintenance, new electricity connections, and temporarily suspending electricity connections (in case arrears are not paid) are also the responsibility of the local individuals engaged by Discoms.

In addition to the aforementioned activities, one of the Discoms appointed a dedicated feeder incharge at each feeder level to take responsibility of the distribution activities mentioned earlier and, additionally, equipped him with a GPS-tracked mobile-van facility to report incidents related to thefts or illegal hooking in the feeder area.

Another method of ensuring better billing and collection outcomes is to incentivize the Discom staff overseeing these processes in their designated divisional areas. Division- and/or circle-level staff, such as junior engineers, executive engineers, and assistant engineers, are given a collection target and receive monetary incentive to ensure higher efficiency in collections. One of the Discoms plans to start door-to-door collections from the consumers to enhance collection efficiency.

All Discoms have processes in place for consumer grievance redressal to deal with troublesome consumers, frequent defaulters, and so on; some Discoms have taken strict measures such as aborting supply until all pending bills are paid.

Nearly all Discoms have outsourced their billing and collection processes, which are in turn monitored by the Discom staff. However, with a significant increase in the consumer base under Saubhagya, they recognize that a greater number of outsourced billing and collection agents will have to be contracted, which will in turn need an increase in the number of Discom staff to monitor and manage them as well.

5.4.3 Intensive Governance and Monitoring

As Discoms race against time to achieve their electrification targets in a time-bound and effective manner, measures to build accountability in day-to-day processes through continuous monitoring, problem-

solving, and progress review are necessarily required. Several Discoms have undertaken stringent monitoring and review processes to ensure that their field teams stay on track and any roadblocks that require strategic intervention and approval are quickly addressed and resolved. The chain of responsibility is transparent and clearly defined so that all levels of management perform their respective roles effectively.

Weekly and monthly review meetings (in person and through video conferencing) are conducted in addition to periodic field visits by the senior management. CMD-level meetings with turnkey contractors, technical officers, and managerial staff of the Discom have reinforced a positive accountability and ownership sentiment that reflects in the on-ground progress. Meetings with the MLAs of loss-making divisions are also undertaken to resolve local/contextual issues and iron out operational issues.

In some Discoms, for a more field-level progress monitoring, turnkey contractors are monitored by the gram pradhan and the project-monitoring unit, who are in turn monitored by a mission manager (representative of the turnkey contractor) and further by a junior engineer.

Some Discoms have set up a dedicated quality cell to monitor the work of their turnkey contractors and carry out stringent quality checks on the material sourced by the contractors. This includes random inspections carried out by Discom officials at various management levels—ranging from junior engineers and assistant engineers to senior engineers and general managers—and ensures that the contractor adheres to the required work standards, which in turn keeps costs low as fewer repair and maintenance activities are required later.

Re-employing retired employees as third-party evaluators to monitor the contractor's activities is another way some Discoms have built into their multistage governance.

5.4.4 Training and Capacity Building

The increasing electrification of rural areas will demand deployment of skilled workers who can understand the issues encountered while maintaining the network and identify solutions to resolve them in a time-bound professional manner. One of the Discoms expressed the need to provide regular training for field staff like

linemen and junior engineers to address the upcoming challenges and after-effects of the Saubhagya scheme. These trainings are conducted by chief engineers for the staff and the contracted human resource. To make the training more professional, university faculty are invited and training modules have been designed to cover a range of subjects such as metering, accidents, theft, safety, and so on.

5.4.5 Concentrated Implementation Approach

Some Discoms have approached universal electrification in their region in 'mission mode', by concentrating all their material and human resources in selected districts instead of spreading out across the

state at the same time. To operationalize this, tenders were called circle-wise instead of at the state level. This allowed the Discom to move in a phased manner from one target area to another, as each selected district was completed within a defined deadline; all the resources were then directed towards the next set of identified districts. While this approach definitely increases implementation effectiveness, it also gives the Discom the advantage of planning based on the density of population, seasonality, and terrain. For example, flood-prone areas can be addressed post monsoon. On the other hand, areas with high density of un-electrified households can be prioritized, so that the pressure of numbers can be reduced in the early stages of implementation.

LEARNING AND THE WAY FORWARD

Interactions with key officials during the course of this study and discussions at the Distribution Utilities Forum (DUF) meeting underlined the efforts Discoms are making to fulfil the given mandate of 100% household electrification. The discussions brought forth a number of positive outcomes, but also challenges and concerns that are the current realities for many Discoms. Further to the specific and overarching issues discussed earlier, there are other aspects as well that may require consideration.

One of the major challenges expressed by many Discoms was the absence of adequate infrastructure in all target areas, which meant that either new infrastructure had to be installed or the existing infrastructure had to be majorly overhauled and augmented, adding significantly to Discom costs. In this scenario, it would be worth considering whether a **structured approach for infrastructure development** could make maintenance of new connections more sustainable. For example, by first focusing on infrastructure development/augmentation in those areas where returns on investments were likely to be higher and more assured (commercial belts or productive communities such as weaver communities/ artisans), and then gradually moving to other areas (remote rural, scattered households).

Third-party vendors are a critical part of Discom operations and their delivery of services to an accepted and expected standard is something that must be maintained as a non-negotiable requirement. However, several Discoms have had unpleasant experiences with their third-party vendors at some point or another due to a lack of ownership/liability—whether it is at the beneficiary-survey stage or for operations like meter reading, correct billing, and efficient collections. Thus, instead of merely outsourcing activities to third-party vendors who do not have a stake in the overall performance of the Discom beyond their limited role,

adopting franchisee²⁴ or similar models may increase the accountability level of the vendor and significantly contribute to the Discom's improved performance.

Discoms are extending connections in a phased manner in order to achieve the goal of providing 24x7 Power for All. However, based on our study (of 10 Discoms across 6 states), most Discoms are currently able to provide around 18–20 hours of supply instead of the planned 24 hours a day. Moving ahead, in order to honour the 24x7 Power for All goal, Discoms will need to **augment their power supply**, by tapping into the underutilized power generated by generation companies (Gencos), whose excess capacities have not been tied in long-term purchase accords with Discoms. It would also be prudent for Discoms to explore renewable-energy-based power-generation opportunities at the substation level. For example, by solarizing rural domestic feeders, Discoms can provide daytime supply to households and enhance the reliability of electricity supply, as well as meet their 24x7 Power for All objective. Discoms can utilize the land near their substations to put up a sub-MW or MW scale solar plant to solarize domestic feeders, preferably along with a battery energy storage (BES) system. This would ensure reliability of energy supply as well as improvement of power quality in terms of voltage and frequency at least during the daytime and reduce the pressure on Discoms during peak hours. During night-time, when industrial feeders take up significantly lower levels of energy, the same can be supplied to domestic consumers. A pilot study can be taken up to establish the viability of this model, which will allow for private entrepreneurs/electricity distribution franchisees to take up the ownership and network operations and maintenance of solarized rural feeders and the LT infrastructure. Another area that needs attention is the aging infrastructure in areas where electrification

²⁴ In this scenario, franchisees would work under the guidance of the discom and follow the terms and conditions as specified by the regulator.

had taken place much earlier, in some cases several decades ago, including old and outdated transformers which are bearing higher loads than initially planned and resulting in frequent power cuts. Post-Saubhagya, in order to provide reliable supply, the **transition from old to new infrastructure** will become a necessary and continuous process, which will require resources over and above what the government has provided support for. It is in the interest of Discoms to therefore, generate enough revenues (through improved billing and collection efficiencies and reduced theft/distribution losses) to invest in infrastructure improvements. A time-scaled inventory assessment of the existing old infrastructure may be undertaken by every state, to prioritize and replace the oldest infrastructure in a phased and time-bound manner. Discoms should also take advantage of the benefits under the UDAY scheme, which has significantly reduced their financial burden, and drive improvements in infrastructure replacement, which will in turn contribute back to improvements in their overall performance and reduction in AT&C losses.

The electricity-distribution sector is governed through a **top-down approach** and state-owned Discoms are left with little or no say in decision-making. Many Discoms have spoken of a sense of disillusionment due to the top-down implementation nature of all electrification schemes that are announced by the central or state

governments. Because of this, the scheme's practical implications for Discoms are not thoroughly considered before announcement and implementation, and are usually dealt with later in a reactive manner. At the same time, Discoms are also expected to operate profitably and their performance is measured against their financial, technical, and operational efficiencies—most of which are, to a large extent, defined by a top-down decision approach. Involving Discoms at a much deeper level during the design stage of schemes than they currently are could create a more inclusive environment for them to operate in and potentially give them more control for the successful implementation of schemes.

This study has illuminated that not all Discoms perform equally well in all areas, and there are differences in what some Discoms may do better than others. This presents an important opportunity for Discoms to **learn from each other** and exchange valuable inputs and experiences to strengthen their respective areas of weakness. The Distribution Utilities Forum (DUF) can act as such a platform for sharing of knowledge and best practices. At the same time, there is also need to have a mechanism to build capacities of Discoms' staff through mutual exchange for short-duration on-the-job best practices.

SUMMARY AND CONCLUSION

In India, achieving sustainable and reliable universal electrification has followed a three-stage process.

In the first stage, electricity infrastructure, the foundation for electrification, was brought to all habitations in the country, which led to the fulfilment of the village-level electrification milestone, achieved on April 28, 2018. Over the past two decades, rural electrification has been a continuous process, accelerated through various programmes and schemes by the central and state governments. To a large extent, these schemes and programmes have been instrumental in achieving 100% village electrification in India, supporting the development and augmentation of distribution infrastructure as well as household electrification (DDUGJY and RGGVY). According to the IEA,²⁵ since 2000, approximately 500 million people have gained access to electricity in India with political efforts over the last five years significantly accelerating this progress.

The second stage was to connect all the remaining un-electrified households through established infrastructure, an effort that has been underway for the past few decades through various government programmes. The Saubhagya scheme was in a way a final big push towards achieving this second stage of universal electrification and saturating all the existing un-electrified households in the country. However, expanding networks within a relatively tight deadline (initially March 2019 and then December 2018) to electrify 30 million households proved to be a challenge. Distribution utilities were compelled to boost their operations and bring in enhancements with respect to human resources, technology innovations, improved processes, and the development of end-to-end IT-based systems for better monitoring, governance, and accountability.

Over 21 million households had been connected under the scheme by December 10, 2018. Our discussions with the Discoms also revealed that they were moving ahead with a focused approach, and those with a comparatively smaller number of remaining un-electrified households expressed confidence towards achieving their targets by December 2018. As detailed in Annex 1, several states that had significant numbers to cover made substantial progress in the last quarter of the year.

The third stage, subsequent to the achievement of 100% household electrification, would be to ensure that all connected consumers receive 24x7 reliable and affordable electricity supply, which is a critical indicator of the overall socio-economic development process and will justify the scale of investment made to reach all un-electrified households. But even as Discoms are doing whatever it takes to meet their electrification targets, several practical and financial roadblocks have been straining their resources severely, such as expansions in geographically challenging regions, delays in the material supply chain, inadequate financial outlay to cover last-mile connectivity, increased exposure to theft, and so on. Many Discoms are also already looking ahead and thinking about other issues that will emerge in time due to such large-scale expansion with concerns regarding revenue sustainability, network maintenance, managing technical and commercial losses, and keeping the Discom financially viable.

In order to sustain the '24x7 Power for All' objective and uphold the efforts and resources invested in bringing the country's electrification status to 100%, it is exceedingly essential that the Discoms remain viable, and, therefore, their performance and financial health be given due consideration. With regard to this, and based on the concerns highlighted by Discoms during the consultation process, the following are key areas

²⁵ See <https://www.iea.org/newsroom/news/2018/june/commentary-electricity-in-every-village-in-india.html> (last accessed on 31 January 2019).

of focus that could be strengthened and supported at the institutional level as well as through governmental assistance.

➤ **Building automation into the overall energy- and resource-management process through IT-based systems.** Saubhagya has led to an accelerated network expansion in many states, which means that Discoms not only have to increase their maintenance and monitoring efforts but also need to track a much larger and widespread base of consumers for billing and collections. As demonstrated by some Discoms, IT-based energy- and resource-management systems are a highly efficient means of monitoring network losses at various levels of distribution, keeping them in check, as well as tracking consumption to generate accurate and timely bills and make collections and bill payments more convenient through mobile-based applications. It would, therefore, be extremely valuable to support the standardization of IT-based systems across all Discoms in the country through an empanelled network of vendors, so that the Discoms' performance and efficiency can be improved through effective automation processes.

➤ **Developing strong localized service models** to support billing and collection processes, and improving response time to correct faults and breakdowns in supply. By engaging local community members/representatives, Discoms can leverage their reach and influence in improving collection efficiencies at the household level and check local cases of theft more effectively. These local energy-service agents can serve a two-way function of reinforcing the Discom's supervision activities and ensuring the supply of reliable and quality electricity to their community members.

➤ For Discoms to provide reliable 24x7 electricity services in a sustainable manner, **the central government should continue to support the states** even after the achievement of universal electrification under the Saubhagya scheme through continued monitoring, evaluation, and feed-forward guidance. It should also formulate supportive policy measures for strengthening the distribution infrastructure and intensify energy-accounting measures to improve Discoms' financial health and make them more viable, and to make service delivery to all new connections sustainable.

ANNEX 1

Household electrification status as on December 10, 2018

State	Total Households	Electrified Households as on 10th Oct, 2017	% of Un-electrified HHs as on 10th Oct, 2017	Household Electrified w.e.f 11th Oct, 2017	% of Balance Un-electrified HHs as on 10th Dec, 2018	HH Electrification as on 10th Dec, 2018 (%)
Kerala	9813032	9813032	0%	0	0%	100
Goa	128208	128208	0%	0	0%	100
Punjab	3689970	3689584	0%	386	0%	100
Tamil Nadu	10285848	10283678	0%	2170	0%	100
Gujarat	11414532	11373215	0%	41317	0%	100
Himachal Pradesh	1855651	1842778	1%	12866	0%	100
Puducherry	95616	94704	1%	912	0%	100
Andhra Pradesh	11427855	11281072	1%	146783	0%	100
Haryana	3467290	3415291	1%	51999	0%	100
Maharashtra	24292265	23303595	4%	986168	0%	99.99
Karnataka	10239824	9784868	4%	254485	2%	98.04
West Bengal	15057882	14325592	5%	732290	0%	100
Telangana	6522278	6084656	7%	437622	0%	100
Uttarakhand	2047937	1844305	10%	203632	0%	100
Mizoram	241712	213909	12%	27803	0%	100
Sikkim	95613	83868	12%	4913	7%	92.85
Chhattisgarh	5664705	4955330	13%	664543	1%	99.21
Jammu & Kashmir	2439547	2072861	15%	366686	0%	100
Madhya Pradesh	12621007	10636743	16%	1984264	0%	100
Rajasthan	12947931	10859210	16%	1517356	4%	95.59
Arunachal Pradesh	306969	255185	17%	6618	15%	85.29
Tripura	788800	652463	17%	136337	0%	100
Manipur	453112	349347	23%	101350	1%	99.47
Bihar	13973122	10714081	23%	3259041	0%	100
Odisha	9600149	7212901	25%	2124607	3%	97.26
Jharkhand	6606871	4892589	26%	1197690	8%	92.18
Assam	6551345	4687929	28%	1029507	13%	87.27
Meghalaya	620753	435963	30%	50845	22%	78.42
Nagaland	434765	302267	30%	79766	12%	87.87
Uttar Pradesh	33151353	21205726	36%	6410433	17%	83.3
Total	216835942	186794950		2,18,32,389		

Source: <http://Saubhagya.gov.in/>

ANNEX 2

Progress made under the UDAY scheme since its launch in September 2015

Total number of subscribing states/UTs: 32

States that have not subscribed to the scheme: West Bengal and Odisha

Performance as of December 2018

Parameter	Performance as of 30 June 2018	Based on data availability from	Performance as of 30 November 2018	Based on data availability from
Bonds Issued	Bonds worth 86% of total value (INR 2,69,056 crore) have been issued	16 states	Bonds worth 86.29% of total value (INR 2,69,056 crore) have been issued	16 states
Feeder Metering	100% (urban and rural)	25 states	100% (urban and rural)	27 states
DT Metering	59% urban; 53% rural	25 states	63% urban; 60% rural	27 states
Smart Metering	3% (>500 kWh); 1% (200–500 kWh)	25 states	3% (>500 kWh); 1% (200–500 kWh)	28 states
Feeder Segregation	63%	17 states	66%	18 states
Tariff Revisions	Done for 25 states	27 states	Done for 25 states	27 states
Average AT&C Losses	26.77%	9 states	21.78%	25 states
Average ACS–ARR gap	INR 0.62 per unit (average)	7 states	INR 0.29 per unit (average)	25 states
Demand-Side Management (Energy-Efficient Appliances)	100% target achievement of LED distribution under UJALA	25 states	100% target achievement of LED distribution under UJALA	26 states

Source: UDAY Dashboard (<https://www.uday.gov.in/home.php>)

ANNEX 3

Distribution companies covered under this study

West Bengal State Electricity Distribution Company	Kolkata	West Bengal
Grid Corporation of Odisha	Bhubaneswar	Odisha
Madhyanchal Vidyut Vitaran Nigam Ltd	Lucknow	Uttar Pradesh
Purvanchal Vidyut Vitaran Nigam Ltd	Varanasi	Uttar Pradesh
Maharashtra State Electricity Distribution Company Limited	Mumbai	Maharashtra
Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Ltd.	Bhopal	Madhya Pradesh
Jaipur Vidyut Vitran Nigam Ltd Jodhpur Vidyut Vitran Nigam Ltd	Jaipur	Rajasthan
North Bihar Power Distribution Company Ltd South Bihar Power Distribution Company Ltd	Patna	Bihar

ANNEX 4

Checklist of questions for consultations with Discom officials

- Are the regions providing electricity access under the DDUGJY and Saubhagya mutually exclusive?
- Between the DDUGJY and Saubhagya, it seems a significant budgetary support is being provided to the Discom to expand networks and provide last-mile connections. However, Discoms still have grievances. What are your views on this?
- **Challenges:** What are some of the key challenges you have encountered in the initiation and implementation of the Saubhagya scheme?
- **Beneficiaries:**
 - » How did you determine the list of beneficiaries? Did you undertake a physical 'inclusion' survey? How long did it take to conduct this survey and include findings in your proposal?
 - » Was the Discom compensated for its time and cost towards this survey?
 - » If you used secondary data (not survey), then what were your sources? Are these updated and reliable enough for your planning?
 - » Have there been cases where eligible HHs refused connections? What are their reasons for refusal? What is the share of such connections?
- **Hamlet Connections:** In hamlets, under which scheme are pole installation and service-line extension to HH being covered?
- **Human resource:** With the increasing expansion of the distribution network, is there a shortage of staff and other resources? How are you coping with this?
 - » Have you engaged in skill-building programmes for linemen and others? Is this funded under the scheme?
 - » How has this impacted your implementation targets—given the timeline/deadline to complement electrification (because you need time to train)?
- **Consumer WTP:** What is your view on the willingness and ability to pay of consumers connected under Saubhagya?
- **Government Subsidy** (grant): Are there delays in realization of grant from the government (which leads to revenue losses and impacts the working capital)? How do these impact the Discom financially and operationally?
- **Performance Improvement:** What steps have been taken to:
 - » Improve billing and collection efficiencies
 - » Reduce AT&C losses
 - » Reduce theft (How severe is the theft problem? Which consumer category is the main perpetrator?)
 - » Promote energy efficiency
 - » How has the franchisee model been effective in improving the average revenue recovered per user?
- **Metering:** Metering of the existing unmetered connections to be done parallelly, though no funding is provided for this under Saubhagya. Is this being done? Who pays for the meter: Discoms/consumers? (Is it also covered under the DDUGJY)? Do consumers refuse to get meters installed?

➤ **Feeder Separation**

- » How has feeder separation impacted your process/infra/operational management costs? Also in regulating and improving supply to agricultural and non-agricultural consumers?
- » Has feeder separation led to the need for additional resources for monitoring and management?

➤ **Load Management:** How are the increasing consumer numbers impacting load management (capacity vs demand)?

➤ **Mini-grid–Grid:** Will the mini-grid be integrated to the grid, or is there an overlap of grid connection with the mini-grid?

➤ **3 Best Practices** that worked for you in managing rural electrification well.

➤ **Pitfalls of Saubhagya**

- » In your view, what are the main pitfalls of the rate of electrification being pushed under the scheme (4 crore connections in less than 2 years)? What issues do you foresee cropping up due to this?
- » In your view, what aspects of the Saubhagya scheme should be/could be altered?

➤ -----

➤ What pressures from the state government/regulator do you face, if any?

➤ **Cross-subsidy:**

- » Are there possibilities of cross-subsidizing Saubhagya connections?
- » Is there a scope for industrial and commercial consumers to cross-subsidize Saubhagya consumers?
- » What are your views on this in terms of revenue recovery? How have the billing and collection recoveries of Saubhagya connections been in the last few months?

➤ What is covered under the awareness building camps? Are they effective? Some key highlights please.

➤ The scheme lays the onus of providing continuous and quality supply on the ability of Discoms. Are you facing issues with providing adequate and reliable supply? How are you ensuring this?

➤ Do you think you will meet the 31 December 2018 deadline to avail the additional monetary benefit under the scheme? If not, are you poised to complete implementation by 31 March 2019?

➤ What is the share of the non-eligible consumers (based on the 14 exclusion criteria) that are also being connected? How is the Rs 500 connection cost they pay being utilized towards the Saubhagya scheme? Is the recovery of this connection cost in 10 instalments an inconvenience? Who is responsible for recovering instalments? What are its implications for the Discom's revenue-recovery rates?

➤ How does the Discom operationalize remote off-grid connections (SHS)? How is its maintenance and servicing for 5 years, as promised under these connections, managed?

➤ What are the assured hours of supply supposed to be for these connections?

DUF Secretariat:

The Energy and Resources Institute,
6C, Darbari Seth Block, India Habitat Center Complex,
Lodhi Road, New Delhi, Delhi 110003
Email: DUF_Secretariat@teri.res.in
Phone: 91 11 24682100 • Extn 2205

An initiative supported by:

Shakti Sustainable Energy Foundation,
4th floor, Capital Court, Munirka Phase III,
New Delhi 110067.
Phone: 91 11 474744000.
Email: powerteam@shaktifoundation.in
