

Rural Electrification in India: Looking Beyond ‘Connections for All’ to ‘Power for All’

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Around INR 55,000 crores have been invested over the last 15 years in rural electrification and government has reported 100% village electrification and over 90% household connections. But if this investment is to return rural development dividends, it is important to focus on affordable, sufficient, quality electricity supply, especially to the small consumers, to promote productive use. Without this, there is a danger that the new rural infrastructure will fall to disuse – as had happened in states like Bihar and UP after the first wave of rural electrification. Thus, there is a need for a shift in policy and political focus from universal connections to quality supply and service.

A lot has been written since the government launched the Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya) for universal household electrification in September 2017 and subsequently announced the electrification of all villages in April 2018. In these times, when most updates or analyses from rural India are about agrarian distress or livelihood crises, some positive news is indeed welcome. In fact, significant progress has been made with respect to village electrification and providing electricity connections to rural households for over a decade. This article is an attempt to take stock of the achievementsⁱ and discuss the next (many) goal posts to meet the political commitment towards reliable, affordable power for all, made by successive governments.

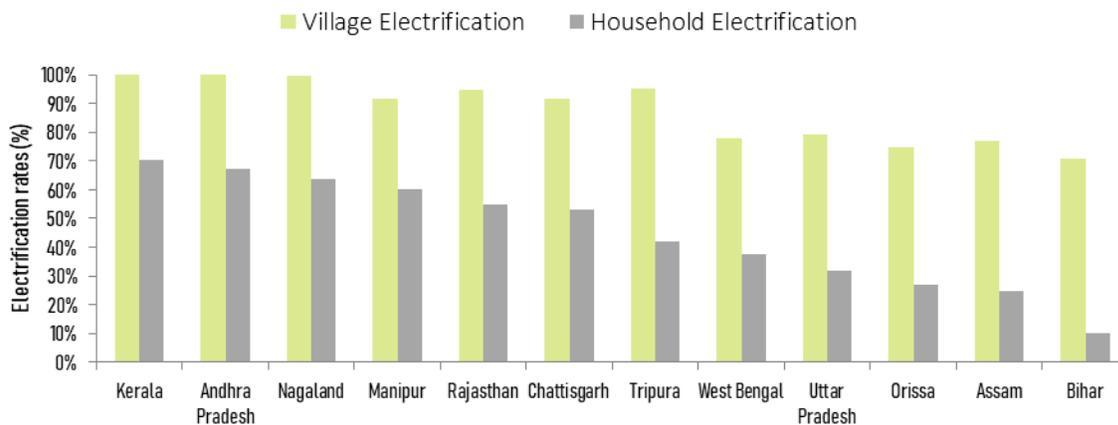
India’s rural electrification story has been in the making over decades- from demand driven village electrification programmes (1950s to 1990s), to small targeted household electrification drives (1980s to 2005). Concerted efforts began with the Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) in 2005, that aimed to provide free electricity connections to rural households below the poverty line, besides creating rural electricity infrastructure. This was followed by successive central government schemes, which were based on similar programme design. Through these schemes, the vision for rural electrification was to provide quality, reliable, affordable power to enable livelihood and productive activities, such that electrification catalyses development (SCoE, 2018; PEO, 1965). This has been the vision for electrification the world over and has been central to electrification drives in the United States of America, China, Thailand, Brazil and South Africa (Barnes, 2007; Niaz, 2010).

Rural Electrification before RGGVY

The State Electricity Boards (SEBs) set up immediately after independence had the mandate to supply electricity beyond the major cities. Rural electrification was then a by-product of electrifying towns, and villages near the grid benefited. With the advent of the green revolution, the focus of electrification was also on shifting agriculturalists to electric pump-sets, especially in Punjab, Haryana, Maharashtra, Gujarat and the southern states. A lot of these efforts were also strengthened and sustained due to farmer demands.

The pace of rural electrification slowed down during the power sector reforms initiated in the 1990’s where the focus was on efficiency improvement and financial health of the sector. The expectation perhaps was that improvements in electricity access will automatically follow. During this period, rural electrification departments in many SEBs were neglected or even removed and only households close to electricity lines, who could afford connection charges benefited. By 2001, as shown in Figure 1, many states with high village electrification levels had low household access.

Figure 1: States with high village electrification but much lower household electrification rates in 2001



Source: Census 2001

Recent rural electrification drives

Concerted focus on rural electrification, beyond network expansion was initiated by the National Common Minimum Program of the UPA (United Progressive Alliance) government whose main electoral agenda for coming to power was the contemporary rural distress. RGGVY, launched in 2005, was driven and financed by the central government and focussed on giving free connections to below-poverty-line (BPL) households. It also had provisions for capital investment in rural distribution networks. This was also the first programme to provide required funds directly to the project implementers (Distribution Companies – DISCOMs, or Central Public Sector Utilities) on a turnkey basis, instead of the state governments. Between 2005 and 2014, about 2.16 crore BPL households were provided connections under RGGVY and capital investment worth Rs. 33,800 crores was made to strengthen rural networks (MoP, 2014). However, there were several challenges in planning, implementation and sustainability of this rural electrification programme (Dixit & Sreekumar, 2011) ; one such being the exclusion of non-BPL households, implying that more than half of the non-electrified households were not eligible for free connections by 2011-12.

The rural electrification drive has been continuing since then, with the Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY), launched in 2014. The programme had infrastructure works and connections as envisaged under RGGVY and also allocations for further investment works. Notable among them, is the separation of agricultural feeders. The efforts to increase connections were also bolstered by state-level initiatives especially in West Bengal, Rajasthan, Chattisgarh and Odisha which focussed on electrifying habitations with less than 100 households and providing connections to households excluded under central sector electrification programmes.

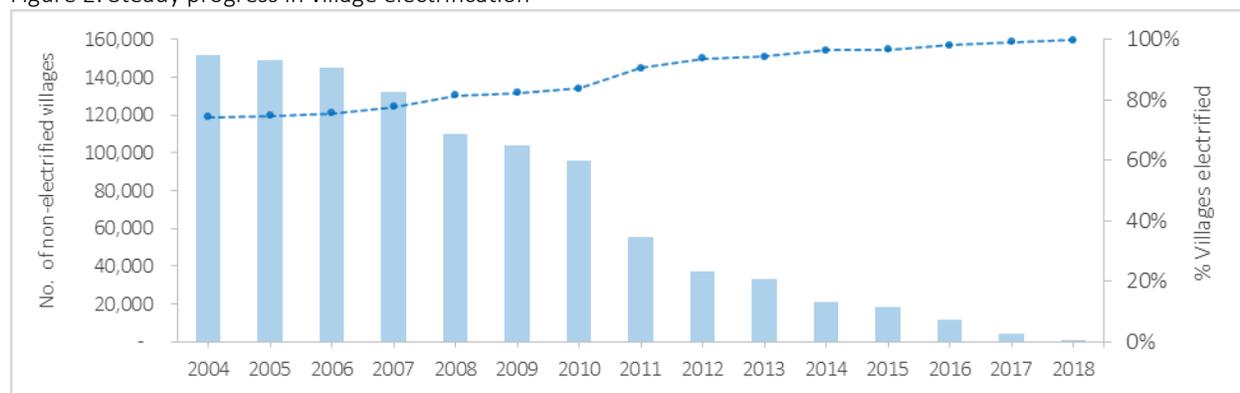
Further, around the same time, the Central and State Governments also drafted joint plans to ensure 24x7 “Power for All” (PFA) by 2022. These detailed and ambitious plans included investments for capacity addition, network strengthening and electrification to provide uninterrupted power supply (Josey & Sreekumar, 2015). Thus, reliable supply quality was seen as not only a political commitment but an attainable goal with joint efforts by the Central and State governments.

When the Ministry of Power (MoP), in 2017, reported that 84% of rural households have electricity connections, the current government further launched the “Saubhagya” scheme to provide connections to the remaining 3.4 crore unconnected households by 2019 (MoP, 2017). Unlike the previous schemes, Saubhagya, aims to provide connections to all non-electrified households, whether BPL or not. While the BPL households can get free connections, non-BPL households have to pay a nominal Rs. 500 in 10 instalments. To cover rural households, the scheme has allocated Rs. 14,000 crores, of which 70% will come from central government grants and the rest is met through DISCOM contribution and loans (MoP, 2017).

Facts and Figures of Rural Electrification (2004-2018)

Back in 2004, only six states (Kerala, Tamil Nadu, Punjab, Haryana, Gujarat and Andhra Pradesh) claimed more than 99% villages were electrified as per the new definition (CEA, 2005). Today, almost all villages have been connected to the grid and around 4,500 villages with 1.62 lakh BPL households have been covered under off-grid schemes (MoP, 2018a). It is likely that the grid will reach these villages soon, to replace or supplement off-grid power. The steady progress towards this commendable achievement is shown in Figure 2.

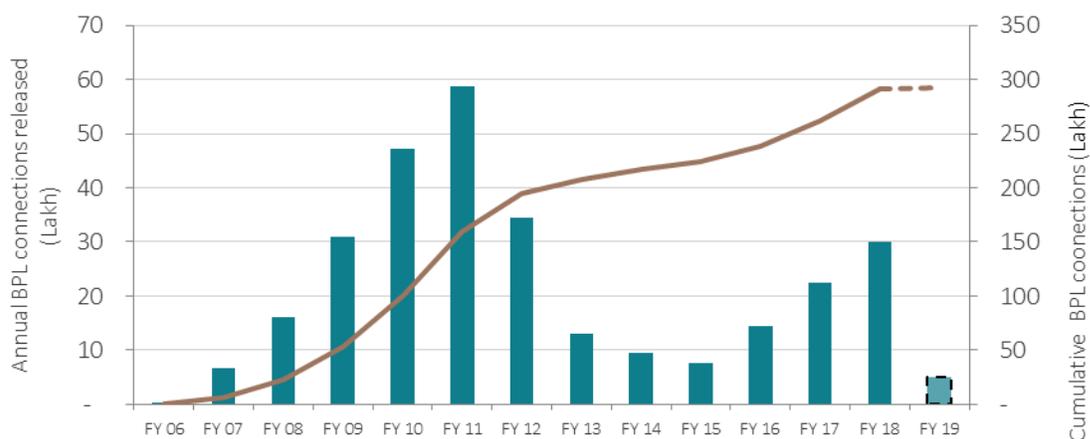
Figure 2: Steady progress in village electrification



Source: CEA

The progress has been not just with village electrification, but also with household electrification. With the Saubhagya scheme claiming to have already achieved 49% of its targeted 3.4 crore unconnected households by October 2018, 92% of rural households now have connections, compared to 44% in 2001 (MoP, 2018b). There has been a steep rise in BPL connections since the launch of RGGVY in 2005. Figure 3 shows cumulative number of BPL connections (line graph) has evinced steady rise across the years. It also shows disbursal of connections, which was highest towards the end of the 11th Five Year Plan followed by a slump in new connections, which has been rising steadily in the recent years. This variation in connections annually can be attributed to programme design, planning and implementation issues in the program (PEO, 2014).

Figure 3: Progress in release of BPL connections since the launch of RGGVY



Data for FY19 only for the months of April and May

Source: (REC, 2016; REC, 2017; REC, 2014; MoP, 2018a)

In this context, it is important to highlight that while there is progress in giving connections; network investments for rural electrification have been slower than planned. Table 1 shows the cumulative achievements and funds spent under all central sector programmes since 2005.

Table 1: Scope and achievement of recent rural electrification programmes

Aspect	Target	Achievement	% Achievement
Total Funds (Rs. Crores)	108,682	55,214	51%
Grid electrification projects (Nos.)	1,557	531	34%
Village electrification (lakhs)	1.29	1.29	100%
Villages - intense electrification (lakhs)	7.80	5.19	67%
BPL Households connection (crores)	3.90	2.96	76%
Rural APL connections (SAUBHAGYA) (cr.)	2.50	0.60	24%
33 kV Substations (Nos.)	2,727	1,186	43%
Distribution Transformers (DT) (lakhs)	1.50	0.75	50%
Low Tension Lines (lakh Ckm)	8.62	5.46	63%
11 kV feeder lines (lakh Ckm)	7.62	3.66	48%

Source: Scope and achievements of rural electrification programmes as on May 2018 (MoP, 2018a)

The table clearly indicates that despite steady progress in connections, much of the works envisaged for network investment and strengthening are yet to be completed. Since 2005, over Rs. 1.08 lakh crores have been allocated for rural electrification of which only 51% has been spent. This explains why only 34% of the projects have been completed, only 40% to 50% of the sub-stations and distribution transformers (DT) planned have been installed and only 50% to 60% of the lines below 11 kV have been laid under rural electrification projects. Delays in execution are not just a legacy from the initial years of the programmes. Of the 273 DDUGJY projects sanctioned under the 12th Plan, almost 1/3rd have been delayed more for than three years (MoP, 2018c). Lack of timely network investments jeopardises the provision of reliable, affordable power supply. Evaluation of rural electrification programmes also highlighted that the distribution transformers catering to villages had the capacity to only support the load of 10% of the households and thus the instances of overloading and transformer breakdowns were significant (PEO, 2014; REC, 2012).

Even with these issues, going by the pace of rural electrification reported by the Ministry of Power, it seems likely that India will have 100% household connections by 2022. As of June 2018, 41% of total districts have more than 95% household electrification and only 5% of districts have less than 50% electrification (MoP, 2018d). With the further progress in rural electrification, by October 2018, seventeen states, among them Gujarat, Andhra Pradesh, Madhya Pradesh, Chattisgarh Tamil Nadu, Kerala, Punjab, Haryana and Maharashtra – reported more than 99% rural household electrification. In fact, 88% of the remaining non-electrified households (about 8% of total households) are concentrated in six states – Uttar Pradesh, Odisha, Rajasthan, Bihar, Jharkhand and Assam. Of this, Uttar Pradesh alone accounts for 59% while other states account for 4% to 8% (MoP, 2018b). Thus, concerted drives in some areas and states can help achieve connection goals in the near future. However, even with universal connections, several challenges will persist in the context of rural electrification which needs to be addressed.

Many of these supply and service quality issues, crucial to the sustainability of electrification efforts, have also been identified in successive government-led evaluations of the rural electrification programmes. This is summarised in Table 2. Unfortunately, no major efforts have been made in successive programmes to address these issues.

Table 2: Observations from government-led evaluations

Study Description	Observations
PEO study in 1982-83 (PEO, 1983; PEO, 1965)	Billing centers, DT repair facilities > 5 km away from villages. 87% consumers faced interruptions. 93% faced voltage fluctuation which damaged motors.
Rural Electrification Corporation (REC) study in 2012 (REC, 2012)	Delays in billing led to arrears, disconnection. Limited electrification of public spaces. DT sizing based on 10% village electrification norm. DT under-sizing resulted in overloading and frequent DT failure.
Standing Committee on Energy evaluation of RGGVY programme in 2013 (SCoE, 2013)	32% of villages received < 12 hours of supply. DT under-sizing sustained.
PEO evaluation of the RGGVY programme in 2014 (PEO, 2014)	Arrears high due to delay in billing. 80% consumers to travel > 6km to access billing centers. Franchisees help with bill distribution not bill payment. Low evening supply. Minimal electrification of rural institutions. Lack of post-implementation infrastructure maintenance.
Comptroller and Auditor General evaluation of the RGGVY programme in 2014 (CAG, 2014)	Unmetered connections, issues with meter installation. 32% consumers not receive regular bills. Billing delay led to arrears. 15% consumers getting > 6-8 hours supply /day.

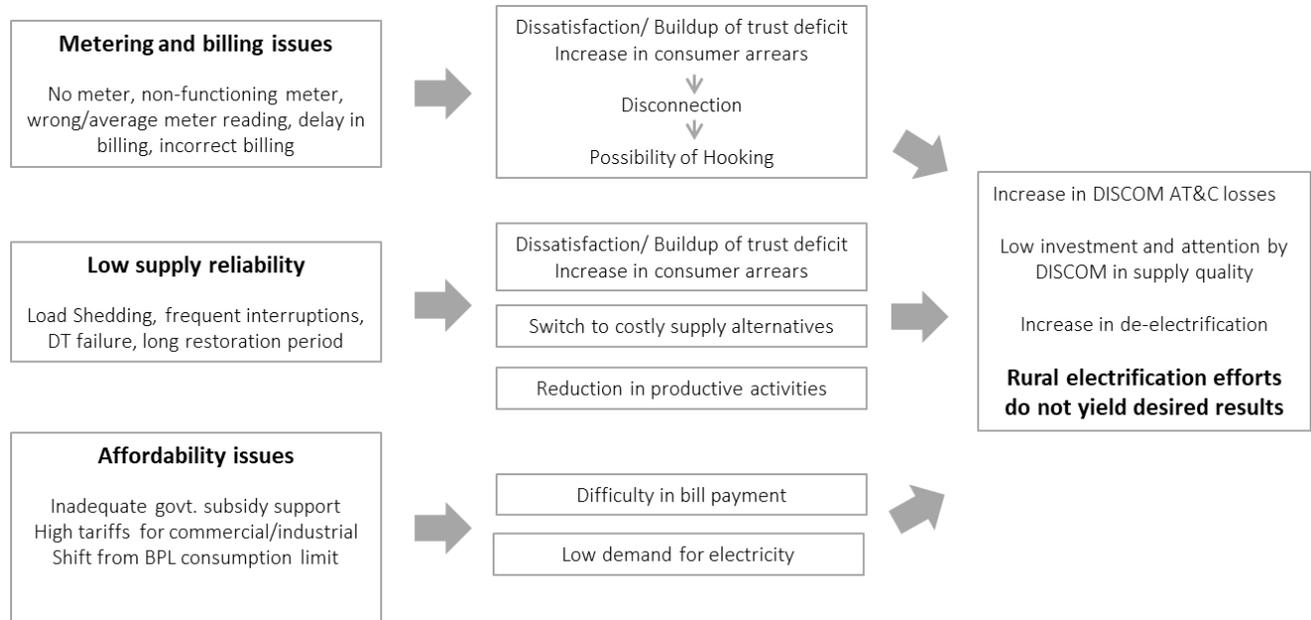
Source: Various evaluation reports.

As policies perceive “electrification” to be synonymous with “access to connections” alone, there have been no concerted efforts to improve the quality of supply. While the connection challenge has been nearly addressed, supply and service quality issues still persist in the sector. In fact, translating investments in connections to sustained use of electricity hinges on efforts to improve supply and service quality. It is time that we focused on policy and programme efforts at the central and state level in this regard, especially for poor and small consumers.

The unaddressed and pressing challenges of rural electrification

Once the connection is given, consumers have to face several challenges to retain the connection and realise the benefits of electrification. These challenges are illustrated in Figure 4.

Figure 4: Challenges in ensuring sustained electricity access



Source: PEG analysis

If supply is not affordable or the quality of supply and service is poor, it is likely that consumers will get disconnected. Poor quality of supply and service can also worsen the trust deficit between newly electrified consumers and the distribution companies (DISCOMs). This, in turn would make programme implementation, increasing tariffs and even future metering and billing reforms challenging. Thus, if adequate attention is not given, such issues could impede the progress towards meaningful access to electricity, increase the possibility of the networks being dis-used or consumers resorting to power theft.

The risk of increased losses and disconnection emphasises the need for policy makers, regulators and the distribution company to focus on the following major components of supply and service quality which are not getting adequate attention.

Metering and Billing Issues: There is significant evidence in rural areas of supply being given without proper meters, meters not being read and bills being issued without proper meter readings over a long period of timeⁱⁱ. Further, there are also instances of billing delays with significant lags in issuing the first bill after connection. Consistent delays in billing increases the bill amounts, making it unaffordable for many consumers. This increases the likelihood of non-payment and build-up of arrears which leads to disconnection of the consumers. Once connections are given, reading the meter, issuing bills and collecting the money is the function of the distribution company. However, agencies such as the Rural Electrification Corporation (REC), implementing major rural electrification efforts as well as regulators are not tracking metering and billing status for newly electrified households even though it is crucial for retention of the connections.

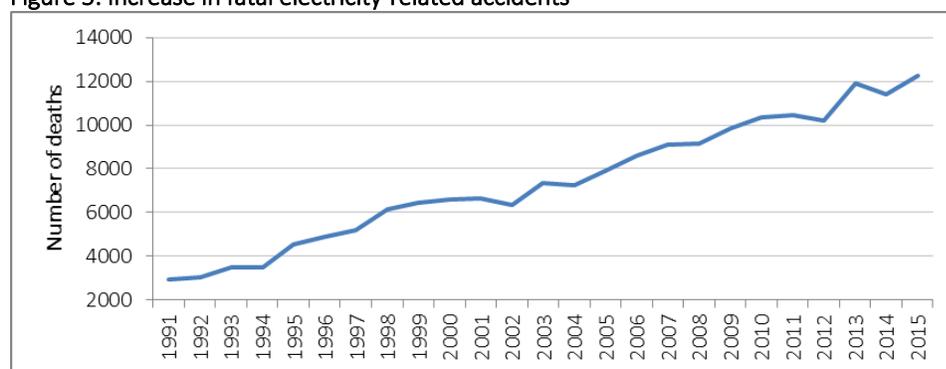
Supply outages and low hours of supply: Despite India claiming to have surplus power, many homes do not have reliable power supply. A majority of households consume less than 50 units per month; enough to cater to the basic minimum electrical needs (PEG, 2017a). While the Ministry of Power reports 12-16 hours of supply in rural areas, the monitoring devices installed by Prayas at multiple rural consumer locations indicate about 3-4 interruptions/day with power outages for 30-40% of the time. Further, only 7-10% rural locations receive supply during the full evening hours (5 to 11 PM) (PEG, 2018a; MoP, 2018a). The National Power Portal Dashboard provides data on average hours of supply for over 10,000 rural feeders which is a significant step towards greater transparency and accountability for quality of supply (MoP, 2018e). However the accuracy and reliability of this data needs to be establishedⁱⁱⁱ. Since the tariff for small, rural domestic households is low and the cost of supply high, distribution companies lose 4-5 rupees for every unit supplied. Hence, there is a tendency to restrict the hours of supply (PEG, 2017b). This in-built disincentive to supply needs to be addressed with concerted efforts to monitor supply hours for rural, remote and newly electrified households. Further, the rural distribution network requires investments and faces operation and maintenance challenges which lead to frequent distribution transformer failures and line faults which have long repair times. This also impedes uninterrupted supply. There is a need to hold DISCOMs accountable for supply based on monitoring of supply quality and operation and maintenance efforts in rural areas.

Lack of affordable power: Many regulatory commissions provide concessionary tariffs to consumers identified as Below Poverty Line (BPL) and many poor consumers, who are not identified as BPL are excluded from this benefit. In other states, consumers using less than a pre-identified number of units per month are eligible for concessionary tariffs. Thus, households using less than 30-50 units per month typically pay about Rs.3/unit when it costs the about Rs.7/unit to supply to them. In these states, once such consumers exceed the 30-50 units of consumption in any month, they are ineligible for the concessionary tariff and face significant tariff shock. Making an annual consumption limit, as done in some states, will address this issue. Beyond households, newly electrified enterprises and small establishments can also find tariffs unaffordable. In many states, small industrial and commercial consumers pay tariffs comparable to large industrial units and commercial complexes on a per unit basis (PEG, 2018b). There needs to be innovation in tariff design to encourage home-based or small enterprises in newly electrified villages. In the future, the question of affordability of power for smaller and rural consumers will be crucial with large industrial consumers who were cross-subsiding the consumption of small consumers, increasingly meeting their needs through alternate options like open access or captive generation rather than the DISCOM. The consequent loss of revenue will further deteriorate the DISCOMs' financial health and reduce existing support to small consumers.

Electrification and rural enterprises and institutions: It was hoped in vain that with electrification, supplementary efforts to bolster non-residential connections and demand in rural areas would take place. Beyond the issues of affordability and hours of supply, which serves to discourage the expansion and proliferation of enterprises, it is not even clear if the network has the capacity to support productive use. Evaluation reports of RGGVY indicated that the distribution transformers in the village are sized assuming only a certain number of household connections and thus demand. Thus, electrification of rural enterprises was not even planned for. This issue has not been addressed under DDUGJY as well. Productive activities need not be limited to enterprises but can also encompass schools, primary health centres, anganwadis, police stations, post offices and other village level institutions. Electrification of these centres, let alone the quality of supply to them, is not tracked in a systematic manner.

Safety concerns with growing connections: Accidents arising from electricity shocks and fires due to electricity short-circuits have been steadily increasing over the years and reports indicate that most of these accidents happen in rural areas. Figure 5 shows the alarming trend in the increase of fatal human electricity accidents from 1991.

Figure 5: Increase in fatal electricity-related accidents



Source: PEG analysis of NCRB reports from various years

Poor construction and maintenance of rural distribution network is an important reason for these accidents. One shudders to think of the further increase of such accidents with the extensive spread of rural network and the increase in rural consumers.

Managing growing rural consumer base: In the first phase of RGGVY, rural franchisees were expected to manage distribution operations in newly electrified areas. However, most of them are not operational and DDUGJY does not envisage such franchisees. Bihar and Odisha have appointed franchisees in rural circles to ensure proper metering, billing and investments but their success in this regard is unclear. It is not clear how DISCOMs will operate and maintain the significant rural infrastructure, especially as investments will be needed with increase in consumption and supply quality.

Way Forward

Around INR 55,000 crores have been invested over the last 15 years in rural electrification. For this to return development dividends, rural electrification drives should look beyond “100% village electrification” and “100% household connections” benchmarks, to sustainable service delivery. If urgent measures are not taken, there is a danger that new consumers will be disconnected and the rural infrastructure fall to disuse – as had happened in states like Bihar and UP after the first wave of rural electrification. In this context, some suggestions are given below.

Periodic tracking of key parameters of newly electrified households and villages: Parameters such as distribution transformer failure rate, hours of supply (especially during evening hours), metering and billing information (time

taken to issue first bills, delay in subsequent bills, number of instances of average billing and zero billing, rate of bill payment), information on consumer disconnections, new connections for productive use, electrification of schools, primary health centre, anganwadis and the panchayat office etc., could be tracked and reported on the national dashboards on a monthly basis for every district or division. There can also be periodic state-level and third party evaluations of the program based on this information. Such transparent and periodic tracking would go a long way in holding DISCOMs accountable for service.

Harnessing technology to monitor hours of supply: Across states, there are many capital investment schemes under way for metering feeders and DTs. State electricity regulators can mandate DISCOMs to make this metering interface fully automatic and to make the data publicly available. Thus, the duration of supply and interruptions can be recorded without manual intervention and tracked at a disaggregated level. This information can be used by SERCs and consumers to make DISCOMs more accountable for power supply. In addition, independent monitoring of supply reliability, as demonstrated by efforts such as the [Electricity Supply Monitoring Initiative](#) (which monitors consumer level supply across locations in 22 states) can play a crucial role in making supply data publicly accessible and should be encouraged.

Hold DISCOMs accountable for rural supply quality in the same manner as financial performance: The financial health and operational efficiency of DISCOMs is subject to tremendous scrutiny and attention, especially with the tariff determination processes and the performance evaluation processes under bailout schemes like UDAY (Ujwal DISCOM Assurance Yojana). There needs to be similar emphasis and political discourse on supply and service quality issues to hold DISCOMs accountable for the same. Some suggestions in this regard are:

- Disbursal of rural electrification funds can also be subject to improvements in select supply quality parameters and not just based on capitalisation related project milestones. Thus, the sustainability of past investments should be taken into account during future grants disbursal.
- Ministry of Power can prepare annual reports analysing progress and ranking DISCOMs for rural electrification and rural quality of supply.
- Electricity Regulatory Commissions can hold public reviews to hold DISCOMs accountable for rural electrification efforts and supply and service quality in a process similar to that of tariff determination.
- District Electricity Committees (DECs) are to be set up to monitor progress of electrification works. DECs have the senior most MP of the district as the Chairperson and Collector as the convenor and could be used to periodically monitor supply quality as well.
- Ground pressure is needed to ensure that DISCOMs work to provide quality rural supply. Civil society groups and political parties can play a role in demanding this. Civil society groups can also take up independent studies on the quality of supply and service of newly electrified areas, using surveys, RTI queries and public hearings.

Subsidy and changes in tariff design to ensure affordability for rural small consumers: Currently, supply of one unit of power costs the DISCOMs about Rs. 7 and this cost will most likely increase at a rate of more than 4% per unit in the coming years (PEG, 2018b). As such costs will be unaffordable for many consumers, and with the contribution of cross-subsidies reducing, substantial subsidy support will be necessary. Supplementary efforts to provide support and rationalise tariff design are suggested below:

- Need to explore options for providing low cost power for rural supply such as allocation of low cost captive coal blocks for rural households, provision of surplus power at concessional rates or the allocation of cheaper, depreciated plants.
- Mega-watt scale solar plant to supply day-time, low cost, power to an entire feeder with many agricultural consumers can be explored. Maharashtra is already contracting more than 1700 MW of feeder-level projects to cater to farmers in 280 talukas in a similar arrangement (MERC, 2018; Prateek, 2018).
- Design BPL tariffs such that the consumption limit is annual and not monthly to provide flexibility. Additionally, the monthly consumption limit can also be increased. The Ministry of Power recently proposed that this could be 60 units/month (MoP, 2018f).
- Introduction of a general category where domestic, commercial and industrial consumers have the same telescopic tariffs for the first 300 units of consumption can support small enterprises and also reduce the

harassment faced by home-based enterprises. This tariff design is currently being implemented in Maharashtra^{iv} and the Ministry of Power has floated a similar proposal (MERC, 2016, p. 431; MoP, 2018g).

Pilot projects: Several ideas like pre-paid metering and direct benefit transfer (DBT) are being proposed to handle the metering, billing and subsidy issues (MoP, 2018f). Considering the limited financial and IT literacy of rural consumers, as well the challenges in internet reliability, it is better to try out pilots before such solutions are rolled out on a large scale. Institutional mechanisms to operate and maintain rural distribution also require innovative thinking and options such as circle/village level franchisees, electricity cooperatives (Richmond & Patwardhan, 2018) and ways to strengthen rural DISCOM departments need to be explored.

Need for a central agency whose sole mandate is to coordinate and monitor rural electrification efforts: REC has always been the nodal agency for central sector rural electrification projects, but today it's disbursements are highest in generation and transmission sectors. Its share holding pattern has also changed over the years and now government ownership is at 58% and Foreign Portfolio Investment is 23%. It seems that its financing decisions are guided by better and faster returns rather than social investments like rural electrification. Even after the targets of connections are met, there is a need for a national institution, with rural electrification as its key focus. Its mandate need not be to operate the rural distribution businesses but to provide knowledge and financial support to DISCOMs for maintaining and strengthening the rural network and ensuring supply.

Central government can continue to play an important role in this, especially by tracking progress and sustainability of electrification. But it is important that different states evolve appropriate plans to sustain efforts. There is also a need for longer term political attention and resource allocation. This should involve a transparent participatory approach with maximum inputs from the newly electrified community.

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ⁱ For the analysis in this article, the authors have largely depended on publicly available sources of data. The data available on central sector schemes is mostly limited to electricity connections and the physical and financial progress as per project plans reported by project implementation agencies. There is limited, consistent information especially with respect to reliability of supply, metering and billing issues.

ⁱⁱ There is evidence of metering and billing issues even in urban areas. For example, in 2011, the Madhya Pradesh Electricity Regulatory Commission noted that there are increasing instances of incorrect billing in cities of Bhopal and Ujjain (MPERC, 2011b; MPERC, 2011a) and an increasing trend in defective and non-functioning meters across the state (MPERC, 2018). In Rajasthan, the distribution companies reported that 8-9% of domestic consumers have defective meters (RERC, 2015). Even in states mostly electrified states such as Andhra Pradesh and Maharashtra, consumers have regularly presented evidence before the regulatory commissions of rising number of defective meters, delay in meter readings and billing (MERC, 2016; APERC, 2016).

ⁱⁱⁱ For example, the total duration of interruptions reported (in seconds) annually for Pune, Hyderabad and Lucknow is much more than the number of seconds in a year. The same data set also shows a counter-intuitive result of smaller towns in backward districts having less interruptions and lower total duration of interruptions than the large cities in the state (PEG, 2018b).

^{iv} In Maharashtra, consumers undertaking business enterprises from their homes, whose monthly consumption is < 300 units and annual consumption < 3600 units will be charged the same tariffs as domestic consumer tariff slabs. If consumption is > 3600 units in the previous year, the consumer is not eligible for these tariffs.

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