Rural Electrification in India – an overview

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Introduction

Expansion of electrification and electricity services are vital to both the economic and social development of India. The current state of electricity services in most of the states of India is worse than ever. Some of the signs of this crisis are severe shortcomings in
  a) Access to electricity for rural and urban poor,
  b) Generation capacity that cannot meet peak demand and
  c) Reliability of supply, in terms of predictability of outages and quality of power supply.

According to National statistics, shortages in energy demand and peak power demand have been around 8% and 12% on average between 2000 and 2003. Industry, farmers and households have invested in a substantial amount of equipment and capital in the form of captive power plants, generators, inverters, and voltage stabilizers to address issues of supply and its quality. India, with an average annual per capita electricity consumption of 400 kWh, is far behind countries such as China (900 kWh), Malaysia (2500 kWh), and Thailand (1,500 kWh).

Inspite of various attempts to achieve 100% rural electrification, India has achieved 44% electrification to rural households only. According to the 2001 Census, 6.02 crore households use electricity as the primary source of lighting out of a total of 13.8 crore households in the country.

Countries with large population without access to electricity

<table>
<thead>
<tr>
<th>Country</th>
<th>Population w/out access to electricity (Million)</th>
<th>% of world total</th>
<th>Per capita electricity consumption (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>579.10</td>
<td>35.44</td>
<td>393</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>104.40</td>
<td>6.39</td>
<td>102</td>
</tr>
<tr>
<td>Indonesia</td>
<td>98.00</td>
<td>6.00</td>
<td>390</td>
</tr>
<tr>
<td>Nigeria</td>
<td>76.15</td>
<td>4.66</td>
<td>85</td>
</tr>
<tr>
<td>Pakistan</td>
<td>65.00</td>
<td>3.98</td>
<td>374</td>
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<tr>
<td>Ethiopia</td>
<td>61.28</td>
<td>3.75</td>
<td>24</td>
</tr>
<tr>
<td>Myanmar</td>
<td>45.50</td>
<td>2.77</td>
<td>74</td>
</tr>
<tr>
<td>Tanzania</td>
<td>30.16</td>
<td>1.85</td>
<td>55</td>
</tr>
<tr>
<td>Kenya</td>
<td>27.71</td>
<td>1.70</td>
<td>107</td>
</tr>
<tr>
<td>Nepal</td>
<td>19.50</td>
<td>1.19</td>
<td>61</td>
</tr>
<tr>
<td>DPR of Korea</td>
<td>17.80</td>
<td>1.09</td>
<td>1288</td>
</tr>
<tr>
<td>Mozambique</td>
<td>16.42</td>
<td>1.00</td>
<td>47</td>
</tr>
<tr>
<td>World Total</td>
<td>1634.20</td>
<td>100.00</td>
<td>2343</td>
</tr>
</tbody>
</table>

Source: IEA, 2002

Transmission and Distribution (T&D) losses in India have risen from 25% in 1997-1998 to around 33% in 2003-2004. In countries such as China, Malaysia, and Thailand, they are less than 10%. The State Electricity Boards (SEBs) that bear primary responsibility for distribution face irregularities in billing and rampant theft of electricity. It is estimated that of the total power generated, only about 55% is billed, and around 41% is realized. Cost recovery has declined from 82% in 1992-1993 to 69% in 2001-2002. While just about everyone agrees on the end-point, (restoring the financial health of the SEBs and power utilities, increasing generation capacity, and lowering T&D losses) how to tread the narrow and difficult political path to achieving that goal remains a challenge.
Despite of all these challenges India has to move forward with its Rural Electrification program as it plays a crucial role in overall development of the country.

**Rural Electrification – in view of Electricity Act 2003**

For the first time Electricity Act 2003 mentions rural electrification in a law. Section 6 of the act mandates the hitherto implied Universal Service Obligation by stating that the government shall endeavor to supply electricity to all areas including villages and hamlets. Section 5 further mandates the formulation of national policy on RE focusing specially on management of local distribution networks through local institutions. Giving a further boost to RE, the act in Section 4 also frees stand-alone generation and distribution networks from licensing requirements. Subsequently, the GoI has released a draft paper on National Rural Electrification Policy.

Definition of Electrified Village according to the Union Government is –
“A village will be deemed to be electrified if electricity is used in the inhabited locality within the revenue boundary of the village for any purpose whatsoever”

New definition proposed by the Standing Committee on Energy reads as

- The basic infrastructure such as distribution transformers and or distribution lines is made available in the inhabited locality within the revenue boundary of the village including at least one hamlet/ Dalit Basti as applicable.
- Any of the public places like schools, Panchayat office, Health centre, Dispensaries, Community Centres, etc avail power supply on demand; and
- The rating of distribution transformer and LT lines to be provided in the village would be finalized as per the anticipated number of connections decided in consultation with the Panchayat/ Zilla Prishad/ Distirct Administration / who will issue the necessary certificate of village electrification on completion of works; and
- The number of households electrified should be minimum 10% for villages which are unelectrified, before a village is declared electrified.

This definition is wider and more inclusive and it is hoped that a similar or a slightly modified version of the same will be accepted for census purposes.

The broad goals of RE as set out in the draft REP(Rural Electrification Policy), referred to as AARQA goals, are as follows:

- **Accessibility** – electricity to all households by 2012
- **Availability** – adequate supply to meet demand by 2012
- **Reliability** - ensure 24 hour supply by 2012
- **Quality** - 100% quality supply by 2012
- **Affordability** - pricing based on consumer ability to pay

REP seeks to achieve 100% household electrification by 2012 primarily through grid extension, and stand-alone systems. Pursuant to the REP all state governments are required to formulate state level strategies and notify the same within 6 months from the notification of the REP.
Govt. Strategy

Both the Government of India Planning Commission’s strategy for the development of rural India as well as the United Nation’s Millennium Development Goals (MDGs) for the next ten years are inherently dependent on the integration of electricity services to achieve a set of varied development goals.

Viable and reliable electricity services result in increased productivity in
   a) agriculture and labor,
   b) improvement in the delivery of health and education,
   c) access to communications (radio, telephone, television, mobile telephone),
   d) improved lighting after sunset,
   e) facilitating the use of time and energy-saving mills, motors, and pumps, and
   f) increasing public safety through outdoor lighting.

Rural electrification at a household level provides at the very minimum services such as lighting and communications (e.g. radio/television) and can increasingly meet the aspirations of the rural populations to own other household appliances. Household electrification also increases the likelihood that women will read and earn income.

Under the current 5-Year Plan, the Planning Commission states that rural electrification and power service reforms are high development priorities. The central government also recognizes that the current state of energy services could significantly impede India’s economic growth on a national scale – beyond the rural and agrarian contexts. This realization, along with India’s gradual economic upswing, has brought the depressed state of energy service providers into the forefront of energy sector reforms.

Rural Electrification in India – in view of five year plans

The 1st Plan emphasized that support for projects that ensure that irrigation potential is met. At this point, only 1 in 200 villages were connected to grid supply across the country.

The 2nd plan named rural electrification as an area of special interest, and proposed to cover all towns with a population of 10,000 or more. Only 350 out of a total of 856 were eventually electrified.

The 3rd Plan for the 1st time raised the issue of efficiency in the sector. The REC (Rural Electrification Corporation) was created in 1969 with renewed focus on poverty alleviation.

The target based approach of rural electrification was developed in the 4th and 5th Plan periods, with focus on pump set energization and guidelines for village grid connectivity for all villages with a population of at least 5000.

The early 80’s saw major changes in conjunction with the creation of the Commission for Additional Sources of Energy (CASE) in 1981, which evolved into a full-fledged Ministry for Non-Conventional Energy Sources (MNES) in 1992.

The 6th and 7th Plan periods witnessed the launch of innovative rural energy programs like the National Program on Improved Chulha (NPIC) in (1983), The National Project on Biogas
Development (1981-82), Special Program Agriculture (SAP) and integrated energy programs like IREP (Integrated Rural Energy Planning) and Urjagram.

With the institutionalization of the MNES in the early 90s, rural energy provision now largely rests with the RECs and MNES. Covering a wide range of technology and fuel options including renewable sources, national efforts at rural energy provision offer a variety of programs to address the range of energy requirements of rural populations.

Growth in the period from 1947 until reforms were instated in 1991 was impressive in increasing capacity generation from 1362 MW in 1947 to nearly 1,23,558 MW by 2004-2005. Despite a per capita power consumption increase from 15.55 Kwh to 606 Kwh, SEBs were financially weak.

The 4th Plan and the findings of the Venkatraman Committee report (created to examine the financial working of the SEBs), concurred that SEBs should at the very least aim at revenues sufficient to cover operational and maintenance charges, depreciation of reserves and interest charges on the capital base

Even as the 40 year period saw nearly 80% of the country connected to grid supply, up from the few urban pockets of electricity supplied at the time of independence, the SEBs cumulatively were being given an annual gross subsidy of Rs.7,450 crores by 1991-92, losing about Rs.4,021 crores a year and showing an average rate of return (without subsidy) of about -12.5%. By March 31, 2001 the gross subsidy had shot up to Rs. 38,000 crores a year with total SEB outstanding to CPSU and others at Rs.27,760 crores.

While electricity was perceived as a public good, there was lack of clarity as to who should pay for it. The lack of transparent and well defined subsidies that would be paid from the exchequer to the SEBs to implement specific government policies led to tariffs that were not sustainable.

Despite the recommendations of the Venkataraman Committee (1964), which suggested that SEBs should aim at an overall return of 11 percent, and the 6th Plan’s calling for an energy pricing policy, the commercial principles underlying tariff revision more often than not were superseded by political considerations.

The first report of the Standing Committee on Energy, Fourteenth Lok Sabha 2004-05, had identified rural electrification as an essential infrastructure input for improving production-oriented activities and speeding up the pace of development of the rural economy. In its submission to the committee for the year 2004-05, the Ministry of Power outlined a new strategy involving creation of a Rural Electricity Distribution Backbone (REDB), Village Electricity Infrastructure (VEI). This also included distribution transformers in each village where grid access was feasible, and a decentralized distributed generation (DDG) and supply for villages where grid connectivity or NCES (non conventional sources of energy) might not be possible or cost effective. The committee, while accepting the Ministry of Power’s new proposal, had, however, highlighted that despite the availability and sanctioning of funds, the actual utilization of funds for rural electrification projects was low.
Irrigation pumping for agriculture has been cited by many as one of the principle causes of poor cost recovery of SEBs and a prime cause of the poor financial health of the SEBs. However, one needs to acknowledge that irrigation reduces poverty by increasing employment, incomes and real wages and by reducing food prices for rural and urban poor. In India, in un-irrigated districts (less than 10% area irrigated), 69% of people are poor, while in irrigated districts (more than 50% area irrigated), poverty level drops to 26%. Agricultural performance is fundamental to India’s economic and social development and will critically determine the success of efforts in poverty reduction. Hence a sudden and substantial shift away from current pricing of electricity for agriculture could have jeopardize agriculture, an activity that is the primary source of livelihood in rural areas, accounting for 72% of India’s population.

Irrigated agriculture is critical to the Indian economy. Hence a nuanced approach to reforming agriculture pumping (AP) tariffs is needed. A move towards greater cost recovery must be accompanied by reliable service that meets the needs of agriculture. A two-step approach is proposed by Mr. Vijay Modi in his work ‘Improving Electricity Services in Rural India’, The Earth Institute at Columbia University with the first being recommended in the short term in areas where metering of AP with 24-7 supply is not immediately feasible.

a. The first step would be to separate the three-phase AP supply from household single-phase supply and then this AP network would be energized by scheduling power supply when it is needed most through reliable timed-delivery (determined by rainfall and soil moisture requirements) in accordance with the local agriculture needs and during off-peak hours to reduce costs. This will allow the system to better meet agriculture needs while at the same time reducing the supply of electricity for agriculture and hence effectively curtailing agriculture subsidies (allowing flat-rate tariffs to become closer to cost recovery) and at the same time reducing wasteful use of energy and groundwater. This will require co-ordination of the utility with local agriculture/water experts along with a campaign and community dialogue that would promote the benefits of such an approach.

b. The next step would be to move toward agriculture subsidies that are provided directly to the consumer in the form of a “smart card” that incorporates low tariffs for the first block of “lifeline” consumption. Smart-card metering technology makes it possible to provide the subsidy directly to the consumer as opposed to the service provider. The higher initial investment of such a technology is already cost-effective for consumption levels typical of agriculture. The “lifeline” electricity consumption level would correspond to the demands and sustainable water yields of small farmers in a region. In aggregate, this would then pave the way for substantially higher cost-recovery from agriculture while ensuring that the small farmers growing non water-intensive crops are not adversely impacted. Metering technologies using smart cards are already used in South Africa. Higher cost recovery would pave the way for facilitating greater generation capacity as well as in reducing the adverse impact on industry of higher tariffs and poor quality supply.
Review of Select Rural Electrification (RE) Schemes

Rural electrification is the backbone of rural economy and a basic input for rapid rural development. It is also the main infrastructure for ensuring speedy growth of the agriculture sector and agro based industrial structure in rural areas. By March, 31st 2004, 86% of villages had been electrified. In addition, out of the total estimated pump set potential of 195.94 lakh, about 141.15 lakh pump sets (63%) had been energized. During 2003-04, about 2,706 new villages had been electrified and about 2.5 lakh pump sets were energized.

The main sources of funding for current rural electrification programs are:

1. The Rural Electrification Corporation
2. Plan allocation to the States.
3. Funds support from Government as loan and grant
4. Institutional financing bodies like commercial banks
5. International financing agencies like OECF etc

The Rural Electrification Corporation (REC) was established as a public sector undertaking in July, 1969. Initially, the principal objectives of the corporation were to finance RE schemes and promote rural electricity co-operatives for funding rural electrification projects across the country. The tasks assigned to the corporation have occasionally been expanded. The main objects currently are:

i. To subscribe to special rural electrification bonds that may be issued by the State Electricity Boards on conditions to be stipulated from time to time.
ii. To promote and finance rural electricity co-operatives in the country.
iii. To administer the money received from the GoI and other sources such as grants.
iv. To promote, organize or carry on the business of consultancy services and/or project implementation in any field of activity in which it is engaged in India and abroad.
v. To finance and/or execute works on small/mini/micro-generation projects, to promote and develop other energy sources and to provide financial assistance for leasing out the above sources of energy.
vi. To finance survey and investigation of projects.
vii. To promote, develop and finance viable decentralized power system organizations in cooperative, joint, private sector, panchayat and/or local bodies.

Reported status of Rural Electrification, March 2004

<table>
<thead>
<tr>
<th>Electrified states</th>
<th>Electrified villages (%)</th>
<th>Electrified households (%)</th>
<th>Electrified states</th>
<th>Electrified villages (%)</th>
<th>Electrified households (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punjab</td>
<td>100.00</td>
<td>91.90</td>
<td>MP</td>
<td>97.43</td>
<td>70.00</td>
</tr>
<tr>
<td>Haryana</td>
<td>100.00</td>
<td>82.90</td>
<td>Rajasthan</td>
<td>98.38</td>
<td>54.70</td>
</tr>
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<td>100.00</td>
<td>80.40</td>
<td>Chhattisgarh</td>
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<td>77.50</td>
<td>West Bengal</td>
<td>83.63</td>
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<tr>
<td>Tamil Nadu</td>
<td>100.00</td>
<td>78.20</td>
<td>Orrisa</td>
<td>80.15</td>
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<td>Kerala</td>
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<td>70.20</td>
<td>North-east</td>
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<td>AP</td>
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<td>UP</td>
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<td>31.90</td>
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<td>Himachal Pradesh</td>
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<td>Bihar</td>
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<td>Karnataka</td>
<td>98.91</td>
<td>78.50</td>
<td>Jharkhand</td>
<td>26.00</td>
<td>24.30</td>
</tr>
</tbody>
</table>

Source: Planning Commission, 2005
Some of Rural Electrification Schemes run by GOI discussed below.

**Pradhan Mantri Gramodaya Yojna (PMGY)**

The PMGY launched in 2000-2001 provided additional financial assistance for minimum services by the central government to all states on a 90% loan and 10% grant basis. These included rural health, education, drinking water and rural electrification. The PMGY, with an outlay of about Rs 1600 crores during the 10th Plan period, was being coordinated and monitored by the Rural Development Division of the Planning Commission. More importantly, under PMGY states had the flexibility to decide on the inter-reallocation of funds amongst the 6 basic services. Thus states could enhance allocations to expedite the pace of rural electrification. The scheme has been discontinued from 2005 onwards.

**Kutir Jyoti Program (KJP)**

KJP was initiated in 1988-89 to provide single point light connection (60 w) to all Below Poverty Line (BPL) households in the country. KJP provides 100% grant for one time cost of internal wiring and service connection charges and builds in a proviso for 100% metering for release of grants. Nearly 5.1 million households have been covered under the scheme to date. The scheme was merged into the ‘Accelerated Electrification of One Lakh Villages and One Crore Households’ in May 2004 and now into the Rajiv Gandhi Gramin Vidyutikaran Yojana (RGGVY).

**Minimum Needs Program (MNP)**

The MNP, exclusively targeted states with less than 65% rural electrification (by the old definition) provides 100% loans for last mile connectivity. The program resources are drawn from the Central Plan Assistance. Rs. 775 crore was released during 2001-03 for rural electrification under the MNP. The scheme was discontinued in 2004-05 on account of difficulties in implementation.

**Accelerated Rural Electrification Program (AREP)**

The AREP, operational since 2002, provides an interest subsidy of 4% to states for RE programs. The AREP covers electrification of un-electrified villages and household electrification and has an approved outlay of Rs. 560 crore under the 10th Plan. The interest subsidy is available to state governments and electricity utilities on loans availed from approved financial institutions like the REC (Rural Electrification Corporation), PFC (Power Finance Corporation) and from NABARD under the Rural Infrastructure Development Fund (RIDF).

**Rural Electricity Supply Technology Mission (REST)**

The REST was initiated on 11th September 2002. The mission’s objective is the electrification of all villages and households progressively by year 2012 through local renewable energy sources and decentralized technologies, along with the conventional grid connection.

REST proposes an integrated approach for rural electrification and aims:

- To identify and adopt technological solutions
- To review the current legal and institutional framework and make changes when necessary
- To promote, fund, finance and facilitate alternative approaches in rural electrification, and
- To coordinate with various ministries, apex institutions and research organizations to facilitate meeting national objectives

Accelerated Electrification of One Lakh Villages and One Crore Households, MNP and Kutir Jyoti have now been merged with the RGGVY
Rajiv Gandhi Grameen Vidyutikaran Yojna

The RGGVY is the latest national RE scheme launched by the Ministry of Power to execute the vision for rural electrification as enunciated in the NCMP and recommended by the Chief Ministers conference in 2001. The plan was instated in April of 2005 with the following objectives:

- 100% electrification of all villages and habitations in the country
- Electricity access to all households
- Free of cost electricity connection to BPL (Below Poverty Line) households

For achieving the said objectives, the RGGVY envisions creating a:

- Rural Electricity Distribution Backbone (REDB) with at least one 33/11 KV (or 66/11 KV) substation in each block
- Village Electrification Infrastructure (VEI) with at least one distribution transformer in each village/habitation
- Decentralized Distributed Generation (DDG) systems where the grid is not cost-effective or feasible

Upon launching the RGGVY Smt. Sonia Gandhi, Chairperson of the National Advisory Council, stated: "Rural electrification in all its aspects forms a key - I would say the key - component of Bharat Nirman. The diversification of the rural economy, so very essential to manage the demographic pressures in the countryside, depends critically on the easy availability of reliable power."

Conclusion

There has been substantial investment in the physical electricity infrastructure of the country since independence. There have been numerous programs in just the last decade for accelerating rural electrification. These programs have focused on infrastructure investments but not on management; on ambitious coverage targets but not on financing or creating incentives for sustainable maintenance of infrastructure stock; on triage of emergency measures and not on providing reliable services. The windfall if any from reduced subsidies would have to be invested back in the maintenance of the crumbling infrastructure, in modernization of the system for transparent accounting and in new infrastructure. Additionally, investment in building management skills within newly created Distribution Companies (DisCom) would be needed. With a missionary zeal on the quality and reliability of electricity supply, it will be possible to charge industry (large and small) tariffs that will ensure full cost-recovery and more - resources needed to cross-subsidize social goals of the electricity sector. The economies of scale in power production have a unique advantage in that the cost of captive power for industry and the cost of coping mechanisms adopted by medium level consumers (SMEs, commercial enterprises, shops or wealthy households) is significantly higher than the bulk costs of electricity generation that a large DisCom would have to otherwise pay.

Reliable 24-7 supply to schools, clinics, hospitals, water schemes (where needed), telecom facilities, government offices, rural markets and small businesses (e.g. grinding and agro-processing) is essential to meeting the services that the rural populations need. Many of these institutions are public facilities and a close dialogue with the district officers and the representative local bodies is needed to ensure that the supply to these institutions is reliable, and that costs of supply are accounted for through either transparent “subsidies” or funds transferred between the appropriate government body and the service provider.
For domestic supply in rural areas, the RGGVY scheme has set an ambitious challenge. For this to succeed the political climate will need to be created that empowers the SEBs to enforce the rules of the Electricity Act 2003. This will require that rural household connections receive reliable service at least during evening hours when domestic rural supply is most needed. One way to carry out this tricky balancing act while generation capacity constraints are being met and AT&C (aggregate technical and commercial) loss reduction requirements are met is to supplement timed evening hour supply with installation of load-limiters in households that were connected with Kutir Jyoti scheme or for new households that are going to be covered under the BPL provisions of the RGGVY.

The Chief Ministers conference held on 3rd March 2001 recognized the need to take approach RE in a de-politicized manner. This political commitment towards achieving the goal of 100% village electrification in a sustainable manner is evidenced through the passage of the Electricity Act 2003, through changes in the definition of an electrified village and through the merging of a number of RE programs into one umbrella program - the Rajiv Gandhi Grameen Vidyutikaran Yojna (RGGVY).
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