

People's Participation in Rural Electrification -A successful case

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Abstract

Rural electrification is an integral component of poverty alleviation and rural growth of a nation. A developing nation, like India has 72.2 percent people living in rural areas. Still, electricity has not played an effective role in the socio-economic growth of villages. The Government of India has an ambitious target of providing electricity to all villages by 2008 and all rural households by 2012. Steps are already initiated with Rural Electric Corporation, Rural Electricity Supply Technology Mission, State Electricity Boards led reforms, Reforms in Power Sector, Electricity Act 2003, etc. An attempt has been made in this paper to assess the present status of rural electrification in India and the major factors contributing to rural electrical distribution. Steps initiated by the Government of India through Rural Electric Corporation (REC) and a successful case study of the people's participation model is presented.

Key words: rural electrification, present status, people's participation.

1. Introduction

Electricity as a prime mover of the economic development of the country has been well established [1]. India's first hydroelectric power station was commissioned in the year 1880 at Darjeeling and commercial production was started in Calcutta way back in 1889. From the last 117 years the electric power generation, transmission, distribution and utilization sectors have grown considerably in magnitude.

At the time of independence, power generation capacity was 1362 MW by private companies like Calcutta Electric Company and others. There has been a phenomenal increase to 1,42,000 MW as on 31 April 2007 as evident from figure 1. Electricity is a concurrent subject specified in list III and VII schedule of the constitution of India under which both the Parliament (Central Government) and state legislatures have the authority to legislate on the subject. In India states have their own State Electricity Boards (SEB) constituted under Section 5 of the Electricity (supply) Act 1948. Hence they played a major role in rural electrification and are well supported by the Central Government. 72.2 percent of the population of India lives in rural areas and rural electrification is only by grid extension.

1.1 Rural Electrification in India

The progress of electrification and energisation of pump sets are shown in figure 1 and 2.

Status of Rural Electrification in India as on 30-12-2007

(Source: Ministry of Power Report)

| | | |
|----------------------------|---|----------------------|
| Total Number of villages | - | 5, 93,732 |
| Villages electrified | - | 4,39,502 |
| Villages to be electrified | - | 1,54,230 |
| Total number of households | - | 13, 82, 71, 559 |
| Electrified households | - | 6, 01,80,685 (43.5%) |
| Un-electrified households | - | 7,80,90,874 (56.5%) |

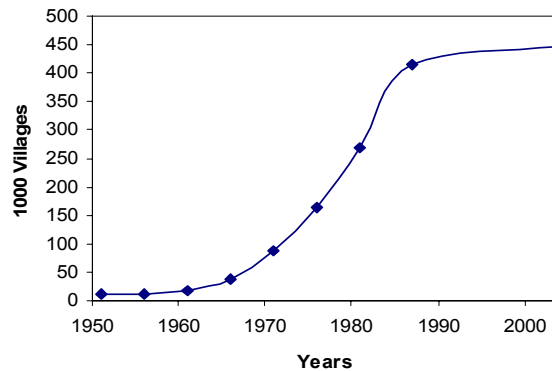


Figure 1 Progress of Rural Electrification

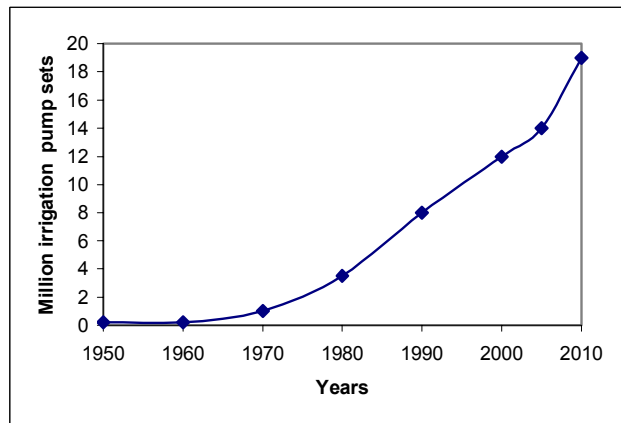


Figure 2 Progress of Irrigation pump sets

2. Impact of rural electrification

Recent studies of Rural Electrification (RE) indicate the following broad consensus concerning the impact of electrification in the rural areas. [1]

A. Quantifiable benefits: cost saving and increased productivity

1. Industrial and commercial uses of electricity
 - (a) motive power –replacing liquid fuel
 - (b) lighting-replacing liquid fuel or gas
 - (c) processing food-replacing liquid fuel, gas, biomass, animal waste
 - (d) transport-replacing liquid fuel
2. Household uses of electricity
 - (a) lighting-replacing liquid fuel, gas, biomass or animal waste
 - (b) cooking-replacing biomass, animal waste, wood, liquid fuel, coal, gas
 - (c) drinking water-replacing liquid fuel for pumping
 - (d) home appliances (fan, TV, Radio)-replacing batteries, biomass, coal
3. Agricultural uses of electricity
 - (a) water pumping-replacing liquid fuel, coal, muscle power
 - (b) heating and drying-replacing biomass, coal, liquid
 - (c) milling, chaff cutting, threshing etc-replacing liquid fuel, hydro or muscle power

B. Benefits those are difficult to quantify

1. Modernisation, dynamism and attitude changes-catalytic effects
2. Quality of life, community services and participation
3. Income distribution and social equity
4. Employment creation

1. Features of rural loads

Rural loads are characterized by the following features-

- Dispersed loads require long medium voltage lines.
- Unreliable supply of about 6-8 hours per day and phase imbalance.
- Average load in the villages ranges from 5 KW to 25 KW per village.
- Poor load factor around 0.2(average demand / maximum demand).
- Low load factor due to dominant domestic consumption-in particular, lighting, agricultural demand with seasonal periodicity and absence of industrial demand.
- Rural grids are often weak and high peak loads and relatively large inductive loads can occur. As the number of irregular, decentralized, power generators increases, so will their impact on the dynamic behavior of the power system.

- Farmers go for higher capacity pumps, use capacitors and phase converters. Thus leading to higher energy consumption.
- Poor quality of power increases their cost on account of various factors including frequent motor burnouts, interruptions due to transformer burnouts, unscheduled power cuts.

This is lead to the potential crop loss of about 3.1 percent to 13.3 percent of agricultural GDP (Gross Domestic Product) (TERI 2001).

4. Major factors affecting the rural electrical distribution systems in India

As the number of consumers increased drastically, the electrical transmission and distribution network has increased in size (Refer Table I).

Table I

| | |
|--------------------------|-------------|
| Transmission line 800 kV | 1311 km |
| Transmission line 400 kV | 56,090 km |
| Transmission line 220 kV | 1,03,724 km |
| Sub stations 400 kV | 73,175 |
| Sub stations 220kV | 1,38,312 |

State electricity Boards found this task unmanageable and were compelled to several techno-socioeconomic constraints in their functioning. Following are the salient factors that made the rural transmission and distribution more complex.

- Unviable electrical tariff to agricultural sector.
- High transmission and distribution losses about 22.4% (double the International Standards of 10%) due to inadequate transmission network, low voltage distribution lines, sub-standard equipments, theft, pilferage and commercial losses.
- Only 70 percent of energy supplied is metered and billed.
- Low Economic Rate of Return (amount received/amount billed) 15%-30%.
- Low quality of power supply, scheduled and unscheduled load shedding, low voltage, frequency fluctuations adversely affected agricultural, domestic and industrial consumers.
- Rural electrification has been almost entirely carried out by extending the grid; rarely have local resources been utilized for generating power.
- Initially the growth of rural electrification was-(i) very slow up to 1966, (ii) increased from 1966 (due to severe draught) up to 1990 and (iii) slowed down later after 1990s (figure 1).

2.Steps initiated by Government of India

During the 1965-67 drought, focus shifted to food security through higher food production. In order to augment input for agricultural production the infrastructural rural

electrification programme started. To implement the program effectively Rural Electrification Corporation (REC) was set up in July 25, 1969 under the companies act, 1956. REC is a fully government owned by public sector enterprise. It provides financial assistance to State Electricity Boards (SEB), State Government Departments and Rural Electric Cooperatives for village electrification and energisation of pump sets for increasing agricultural production. It is the nodal agency for channelising finance to aid the Government of India's socio-economic objective of 100% rural electrification by 2012.

The absence of private sector players in rural electrification sector further enhances REC's stature in this sector [3]. It's main objectives are-

- To promote and finance rural electricity co-operatives.
- To administer the money received from the Government of India and other resources.
- 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.

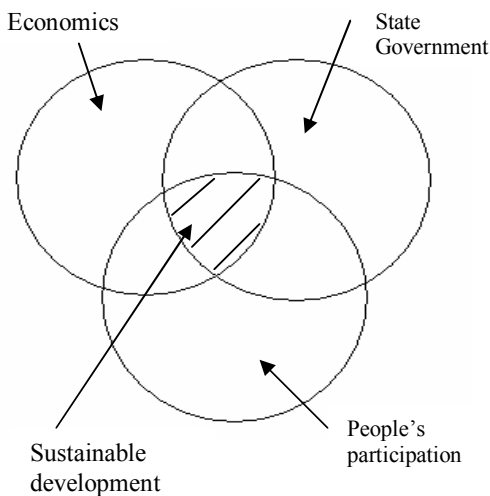


Figure 3 People's participation model

- 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.
- To finance survey and investigation projects.
- To promote, develop and finance viable decentralized power system organizations in cooperative, joint, private sector, panchayats and / or local bodies.(figure 3).

Electrical power sector was recognized as Universal State Obligation (USO) sector. The Five Year Plans of the Government of India, World Bank, International Monetary Fund, and other agencies have identified this and have given it due importance.

- Power sector reforms and unbundling of generation, transmission, and distribution have begun in the 1990s.
- Electricity act 2003 provides statutory licenses for private participation including local enterprises, Non-Governmental Organizations, local bodies, and cooperative user associations
- Rural electrification has increased in size and complexity, thus State Electricity Boards are finding it difficult to manage.
- Rural electrification is not a profitable business and hence private companies may not prefer this business

Though India has a fairly robust democracy and a system of governance that delivers, the government cannot be expected to bear the entire burden of ensuring progress. It is with this view that the concept of people's participation model (figure 4) is found to be a viable option for sustainable development in the wake of Electricity Act 2003. Rural Electric Corporation started five rural electric cooperative societies as pilot projects-

- 1 Hukeri in Karnataka state started on 12-10-1970
- 2 Sircilla in Andhra Pradesh state started on 1-11-1970
- 3 Kodinar in Gujarat state started on 10-1-1971(presently liquidated)
- 4 Mula Pravara Maharashtra state started on 1-3-1971
- 5 Lucknow in Uttar Pradesh state started on 29-3-1971 (presently liquidated)

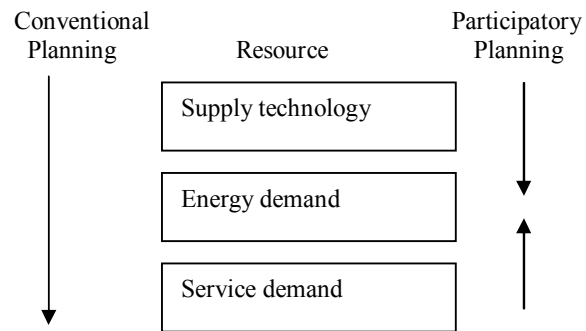


Figure 4 Conventional versus participatory planning model

3. People's Participation in Electricity distribution Model - A successful model

The existence of The Hukeri Rural Electric Cooperative Society at Hukeri, Belgaum District, Karnataka state, is the outcome of a natural rural movement lead by Late Sri Appannagouda, Patil [5].

- The Hukeri Rural Electric Cooperative society came into existence in July 31, 1969. Government of India, sponsorship from United States Agency for International Development (USAID) in collaboration with National Rural Electric Cooperative Association (NRECA), USA, supported the project.
- Area of the society covers Hukeri taluka and Sutagatti village of Belgaum district

- The main object of the society is to make electric energy available to its members and other consumers at the lowest cost consistent with sound economic and good management.
- Hundred percent village electrification achieved in 1981.
- It had a license of 40 years from 12 October 1970. Karnataka Electric Regulatory Commission (KERC) renewed this license from October 2001 to next 5 years, then to 25 years from October 2006.
- The Board of Management of the Society is headed by a Chairman, consists of 14 members including 12 elected members, one nominated from REC and a Managing Director.
- Finance resources are project loan from-Rural Electric Corporation, Karnataka State Government share, Share amount from members and deposits from members.
- It has about 85,000 consumers as its members
- Number of shareholders is 69,325, with a share of rupees 100 and members elect the directors for five-year term.
- Society purchases power from the Hubli Electric Supply Company (HESCOM) and Karnataka power Transmission Corporation Limited (KPTCL), supplies it to its consumers at cost fixed by KERC on par with HESCOM tariff rates as in figure 5.
Profit of Society = Selling cost (fixed by Karnataka Electricity Regulatory commission) – Buying Rate (fixed by Hubli Electric Supply Company)
- The area of operation of the Society is divided into five administrative divisions, each headed by an engineer. The staff comprises 178 employees deriving Electricity Boards pay scales, 73 daily wage workers. All are from villages.

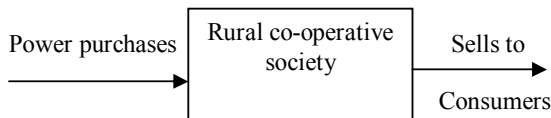


Figure 5 Rural Electricity Distribution Management system

- Initially to be self-reliant, the society has set-up a workshop for the manufacture of Guy-sets, Cross-Arms, and Clamps.
- The society, which was initially carrying out only the repairs of its 100KVA transformers, started a transformer-manufacturing unit in 1995(Table II). Empty tanks are purchased, windings, other parts are locally manufactured and assembled in the factory. The establishment of this unit has helped the society to save rupees 42,000 per 100 KVA distribution transformer. While the market price of such a transformer is around rupees 90,000.
- The society has the capacity to repair 100 transformers per month and hence the State Electric Supply

Company has assigned the repair, annual maintenance of nearby four divisions Belgaum, Chikkodi, Bailhongal and Ghataprabha belonging to Belgaum circle.

- Pre-Stressed Cement Concrete, Reinforced Cement Concrete poles are manufactured in its own cement pole unit started in 1996 that has a capacity of producing 1000 poles per month.
- Besides computerizing all its accounts, and other information about its operations, the society has also introduced computerized billing system for its consumers in 1997.

Table II

| Year | Transformers Manufactured | Pre-stressed cement concrete poles | Reinforced cement concrete poles |
|------|---------------------------|------------------------------------|----------------------------------|
| 2002 | 52 | 1074 | 315 |
| 2003 | 59 | 976 | 100 |
| 2004 | 40 | 1344 | 145 |
| 2005 | 20 | 320 | 82 |

- It has built 14 residential quarters for its technical staff in Hukeri town.
- The Society, which has today an authorized share capital of rupees four crore, including rupees 41.70 lakh provided by the state government towards the share capital, has nearly rupees three crore as its working capital.
- Of the total amount of rupees 2.84 crore received as project loan from the Rural Electric Corporation, the Society has to repay rupees 22.4 lakh on March 2007.

Table III Electrical Distribution Details

| | | |
|-----------------------------|-----------------------------|------------------------------|
| Villages electrified-107 | HT line-978.193km | House/Commercial - 63074 |
| Sub Villages - 15 | L T Line -3244km | Irrigation Pump sets -17013 |
| Rehabilitation Centers - 14 | Transformer Centers - 1278 | Small scale Industries -1995 |
| HT agriculture - 4 | Industries -10 | Street Lights points-220 |
| Connected load -110MVA | Sustations-5 | Substations proposed- 6 |
| H T Industries -15 | Units allotted 135000/month | Street light Brackets -9892 |

- Electrical Transmission and distribution losses are reduced to 16.41 percent due to improved design of distribution substations, installing more distribution transformers, metering and billing, operation and maintenance and service quality.
- Economic Rate of Return (ratio of amount collected to amount billed) above 93 percent.

- Average consumption of electricity per house is 10 kWh to 25 kWh per month and the amount spent is 5 to 15 percent of their income.

Few challenges in rural people managed, rural electric electricity distribution management systems are as follows.

- Waiver of electricity dues by State Government in February 2004. Society has to get the financial compensation by the state government.
- Free electricity to farmers irrigation pump sets by the state government has affected the recovery from farmers.
- Dues from local institutions like municipalities, community services.
- Considering society as a private company.
- Collecting 1 percent interest on the non-recoverable dues from the society, that is not there for other electric supply companies.

4. Key factors of success

Following are salient success factors of this society.

- (1) Strong cooperative movement existing in this area from last 36 years like-sugar factory, consumer cooperative movement.
- (2) High Economic Rate of Return of 93 % compared to 10% -15 % in other rural areas.
- (3) Reduction in transmission and distribution losses to 16% compared to 24% in other rural supplies due to minimized pilferage and theft by rural people.
- (4) Power outages are 35 per month due to attentive staff compared to average 90 per month in India.
- (5) Trust on customers and immediately attentive staff for customers complaints.
- (6) Independent from government intervention, hence no free power supply to agricultural pump sets and also subsidized cost.
- (7) Good transparent management system involving people in all decisions.
- (8) Local people are given jobs in the society and locally available materials are used in manufacturing accessories.
- (9) God-fearing psychology of the co-operative membership [4].

People's participatory democracy created the conditions for rural technology. The success of the society inspired the state government to propose one rural electric society in every district of Karnataka state, in the year 1990. The REC recommended for starting at Aland (Gulburga district) and Hoovinahadagali (Bellary district). However, they could not take off due to following main reasons. –

- a. lack of visionary people
- b. political will, and
- c. resistance from State Electricity Board employees.

Conclusion

Rural electrification should be 'demand based' and not 'target oriented'. Rural poor should not be burdened with technology, but provided a good service so that their quality of lives can improve. Customer is a key stakeholder and an active member of cooperative society. Hence cooperative type of approach is the best solution in the present situation, as it has proved in other nations like Argentina (EJESA and EJSEDSA), Srilanka (Community based Electrification Programme), America (National Rural Electrification Co-operative Association), Philippines (Rural Electric Cooperatives), Brazil (Luz no Campo) and Bangladesh (Pilli Biddut Samity). Pilot projects have proved this in Indian conditions like Mula Pravara Electric Co-operative society, Shrirampura (Maharashtra state). It is a self-involved, self-invested, self-designed, self-maintained and self-managed system. It can be made more efficient. The Electricity Act 2003 is the right step in providing statutory provisions for licensing procedures for local bodies for distribution in this direction. Rural Cooperative movement is successful in producer, consumer, credit and insurance sectors. Being well within the reach and reality, it promotes rural employment, community living and other multiple socio-economic benefits.

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References

- 1 Mohan Munasinghe, Rural Electrification in the third world, July 1990, *Power Engineering Journal*, pp-189-192
- 2 Kamalapur, G D, Udaykumar, R Y, Karajgi, S.B., 7-9 January 2006, Strategies for Sustainable Rural Electrification in India, *Proceedings of International Interdisciplinary Conference on Sustainable Technologies for environmental protection*, Coimbatore
- 3 M P Jayaprakash, Electrifying Villages, *IEEMA Journal*, August 2006 pp14-30
- 4 Samuel Tumiwa, Experiences in Cooperative Rural Electrifications and Implications for India, NRECA background paper, June 2002
- 5 Kamalapur, G D, Udaykumar, R Y, Karajgi, S.B, Implementing the cooperative model in rural electrification, September 2006, *Regulatori Newsletter-TERI*, issue 30, pp 6-10