Journal of Science Engineering Technology and Management Science
Volume 02, Issue 02, February 2025 *ISSN: 3049-0952*
www.jsetms.com *DOI: https://doi.org/10.5281/zenodo.14948515*

India's Shifting Power Sector Reform Paradigm: Rural Electrification

Srikanth[1] and Niharika[2]
Department of Electrical Engineering, Amrita University, Chennai,
[1]Corresponding Author: sriharika@gmail.com

To Cite this Article
Srikanth and Niharika, "India's Shifting Power Sector Reform Paradigm: Rural Electrification Application", Journal of Science Engineering Technology and Management Science, Vol. 02, Issue 02, February 2025, pp: 15-17

Abstract*: A country's rural development and poverty reduction depend heavily on rural electricity. While the agriculture industry contributes 1.9 percent of India's GDP, the country's GDP is growing at 8%. The Indian government has set the lofty goal of electrifying every village by 2008 and every rural home by 2012. With the Electricity Act of 2003, deregulation, the unbundling of State Electricity Boards (SEB), Independent Power Producers (IPP), Electricity Regulatory Commissions, Rural Electric Corporation (REC), the Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY), the Accelerated Power Development and Reform Program (APDRP), and other initiatives, the Indian government has already taken proactive measures. The socioeconomic development of the town has not benefited greatly from electricity. This article attempts to evaluate the state of power sector changes and their effects on rural India's electrification. The difficulties this method faces are also noted.*

Keywords*: Rural, electrification, power, sector, urban*

I. Introduction

India is not the only country going through significant reform in the power sector. India's whole power sector is going through a transition. India's power sector reforms were started in response to growing commercial losses brought on by the state utilities' weak financial standing, chronic capacity, energy shortages, and the states' growing reliance on subsidies. The sector's investment was significantly less than the need for power. In 1991, the Government of India initiated a comprehensive reform program with the primary goal of making the energy sector an efficient business. India's power sector is transitioning from a regulated to a competitive one. The Electricity Act 2009 and other recent developments in India have cleared the way for the growth of the nation's power market.

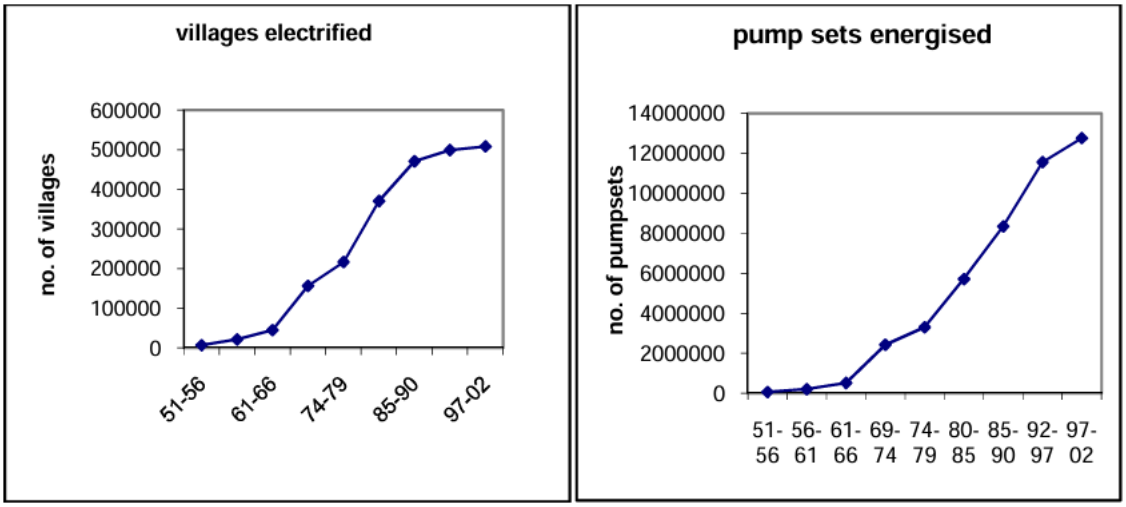

Fig 1: Rural electrification in India

Designing the best market for the nation is now crucial during this transitional period. India is not an exception to these reforms, which are all in line with the idea that competition should be brought into the energy delivery sector wherever it is technically possible. Transmission and distribution, pricing rationalization, and power

supply availability have all seen notable improvements. India is the world's sixth-largest energy consumer and has one of the fastest-growing economies in the world. Eighty-two percent of its human resources live in six thousand communities (census 2007). About half of all energy is used in rural areas, where the household sector is the main source of energy demand and consumption. Coal and oil are the primary energy sources; other sources include hydro, wind, nuclear, and biomass. Despite having good potential, hydropower has not yet reached its full potential. 0.7% of the world's oil reserves and 9% of its coal deposits are in India. Some of the important factors that directly and indirectly affect the energy supply are listed below.

II. Steps Initiated by Government of India

July 1979, the Indian government established the Rural Electric Corporation to promote the electrification of rural areas. In order to achieve "Power for All by 2014," the goal is to expedite electrification. Additionally, the goal is to find technologies that could be used to supply rural areas with dependable and reasonably priced electricity, and when practical, implement them through distributed generation schemes. The remaining "one lakh villages and one crore households" are to be electrified. A village was previously considered electrified if electricity was used for any purpose within the village's revenue boundary and in the populated locality. On October 19, 2008, the Ministry of New and Renewable Energy (MNRE) changed this definition to read. According to the accepted definition of village electrification, isolated villages or hamlets will be considered electrified if at least 23% of the homes have access to power, which is also made available for community amenities and, if applicable, for the village's Dalit Bastis (residents). There are essentially two components to rural electricity. Although there is electricity in the area, 24% of houses do not have access to the supply network. Villages are not connected to the grid or independent power systems since they are remote and difficult to reach.

III. Status of State Electricity Board

According to Article VII of the Indian Constitution, electrification falls within the concurrent list of duties, and state governments are in charge of this with strong backing from the federal government. The electric power industry has seen significant changes over the past 20 years, notably in the areas of politics, technological mix, market structure and formation, and regulation. The 1990 unbundling of the SEBs, the Electricity Act 2006, the National Electricity Policy (NEP), and other reforms in the power industry have established a robust policy framework to guarantee investment in all sectors. SEB has contributed significantly to the production (Fig. 2), transmission, and distribution (Table II) of energy over the past 50 years.

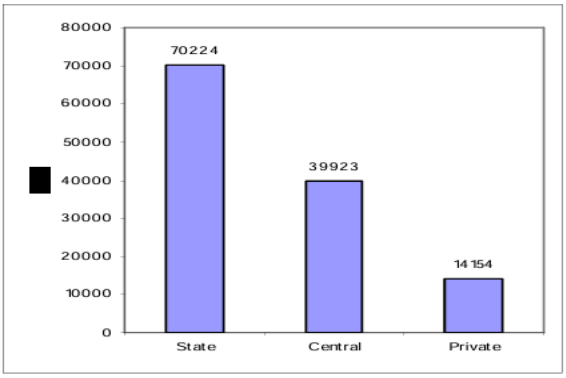

Fig 2: Generation of electricity

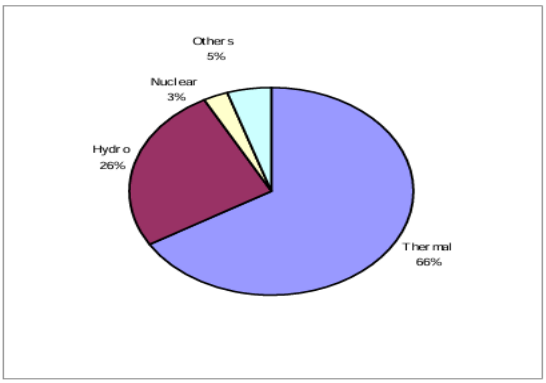

Fig 3: Generation of electricity

The development of rural power distribution has three distinct phases: (i) an extremely slow rate between 1966 and (ii) faster expansion between 1966 and 1994 and (iii) a gradual decline after the 1990s according to data shown in Fig. 1. The state governments generate 86.5% of the entire electricity output based on data in fig.2. Thermal power generation exceeds hydal power and other forms by 69% to 29% percent. (Fig. The geographical extension of main power lines extends with low power density demand throughout the region. High distribution losses emerge as a result. Increased energy consumption during future years will create higher distribution losses. The present technical and commercial losses surpass 20 % in the system (Fig. 4 and Fig. 5) specifically at the 22 kV and 220 V network distribution levels. Farmers need to buy pump sets with larger capacity because of which their motors frequently breakdown and distribution transformers stop functioning.

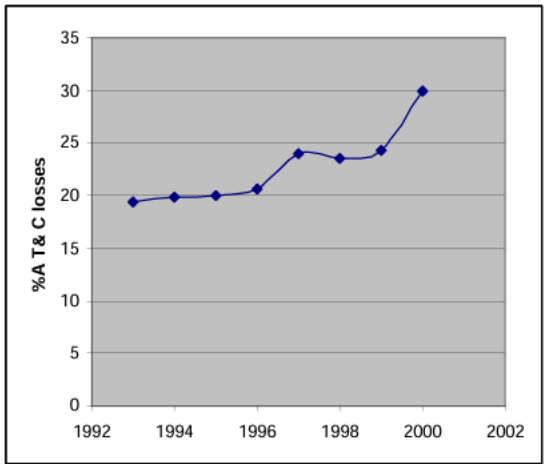

Fig 4: Transmission losses

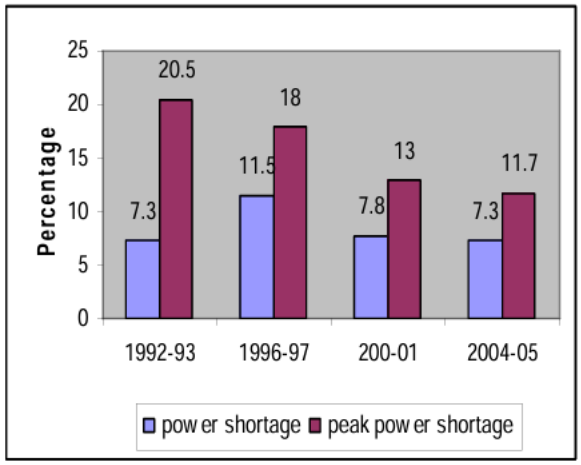

Fig 5: Power shortage

Power Sector Reforms

Power sector reforms exist to create enhanced efficiency in generation, transmission and distribution operations and achieve increased financial stability and reduced government dependency by power utilities together with lower infrastructure losses and theft management while delivering high quality service to consumers at reasonable prices. Rural electrification problems get effectively resolved through reforms. The power sector reforms have brought about specific modifications to the rural electrification sector.

Critical Challenges Ahead: The challenge to electrify rural areas requires modern methodologies for its solution. The persistent delay to reform this sector will escalate future challenges when attempting to address the matter. The Indian government stays dedicated to enhancing rural energy services because access to electricity by itself leads to improved well-being. The following key points should be addressed for quick execution of reform initiatives.

IV. Conclusion

The core goal of power sector reforms in India requires threefold objectives including industrial sector competition development while strengthening the financial health of SEBs as well as drawing private investment into this struggling power sector. Through regulatory changes regulators achieved transparency along with rationalized tariffs for consumers while ensuring regulatory process protection measures. Some positive outcomes of power sector reforms began to manifest when the SEBs reported lower AT&C losses together with decreased commercial losses. Future challenges need equivalent restructuring components that successful industrialized countries deployed. Building a powerful and profitable power sector requires the phased removal of cross subsidies and pricing based on costs along with improved technical and commercial performance through political backing.

References

[1] Khaparde S A, "Power sector reforms and restructuring in India," Proc. IEEE Power Engineering Society Meeting 2004, vol. 2, pp. 2328-2335.

[2] Bajaj, H.L, et al." Power Sector reforms in India,"Proc. of International Conference onPower Electronics, Drives and Energy Systems (PEDES '06) 2006, pp1-5.

[3] Byabortta, S., et al., " Power sector reform and power market design in India," Proc. of 7th International Engineering Conference 2005, vol.2, pp1188-1193.

[4] Rahi, O.P, et al., " Power sector Reforms in India: A case Study," Proc. of International Conference on Power system Technology 2008(POWERCON 2008), pp1-4.

[5] Mohan Munasinghe, "Rural Electrification in the third world", IEEE power engineering Journal, vol.1, July 1999, pp.189-202.

[6] Kamalapur, G D, Udaykumar, R Y, Karajgi, S.B.,"Strategies for Sustainable Rural Electrification in India" Proc. of International Interdisciplinary Conference on Sustainable Technologies for environmental protection, Coimbatore,7-9, January 2006