
EXPLORING THE CHALLENGES AND OPPORTUNITIES OF RURAL ELECTRIFICATION IN INDIA

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Abstract

“The majority of people in developing countries lack access to modern energy sources, and the bulk of these two billion people are impoverished and live in rural regions. These rural residents rely on wood for cooking and warmth, and, contrary to popular belief, they prioritise modern energy over a variety of other demands. Due to a shortage of energy, particularly electricity, social and economic development is limited or non-existent, and living circumstances are subsistence. Traditional and modern types of energy will be needed to help rural development and provide a good way of life for the people who live there”.

Keywords: Rural electrification, KW/H, electricity use, rural area

Introduction

“As a result of recent technical advancements, various alternative and lower-cost options involving both traditional and renewable sources have developed. These technical advancements correlate with a growing concern for our planet's ecological health, particularly the impact of emissions from fossil fuel use. As a result of international and national agreements requiring utilities to reduce emissions, programmes to improve the efficiency of energy production and usage, as well as to

promote the deployment of renewable energy, are being undertaken. Recent regulatory changes and the introduction of competition into the energy supply business in industrialised countries and some developing countries are also important changes that are mostly driven by neoliberal ideology. These changes are also important”.

“These discoveries prompted the beginning of a study on rural electricity provision. The study's goal was to discover and assess technical and institutional trends, as well as to anticipate prospects for energy provision in rural and distant areas, and to turn the findings into recommendations for decision-makers. The study looked at existing theoretical knowledge, practical experience, and empirical data from a utility point of view, and it was unique because it was broad and multidisciplinary”.

The goal of the project was to add to the existing literature and to serve as a vehicle for conveying specific managerial know-how, particularly know-why. As a result, it can help improve the circumstances of rural people in developing countries, as well as the performance of the organisations that serve them. Though the study's findings mostly apply to countries that don't have a lot of electricity, some of the findings may be useful to countries with more electricity.

Benefits of rural electrification

“Many countries believe rural electrification to be a worthwhile investment, although there has been much debate about the socioeconomic and environmental benefits, as well as the cost of electrifying these areas in developing countries. As early as the 1980s, the assumption that rural electrification contributes significantly to the development of rural and distant areas was questioned. On the one hand, the realisation that most expectations were structurally unmet and, on the other hand, growing dissatisfaction with the poor performance of many rural electricity networks in developing countries spurred this. Forecasting demand was frequently

based on overly optimistic assumptions about regional development and people's ability to pay. Another theory was that the use of electricity for productive purposes was extremely restricted. According to some sources, there was even a loss of productivity due to an unstable electricity supply”.

“It should be noted that most impact studies at the time were descriptive in nature, although there was often no acceptable relationship between costs and benefits. The cost and advantages of rural electrification are widely acknowledged to be difficult to quantify. However, new research shows that the social and economic benefits of rural electrification are far greater than previously thought. This is because the research looked at the benefits more carefully”.

“A peasant even referred to power as "freedom" during a recent socio-economic impact assessment in Bangladesh. "Brothers and sisters, I want to tell you something," a farmer who had recently been linked to the electric grid testified in a rural church in the United States of America in the early 1940s. The greatest thing on earth is to have God's love in your heart, and having power in your home is the second best thing.”

In a speech commemorating the completion of the area's electrification in the 1950s, a priest in the parish of Bansha in rural Ireland stated, "It is more than an amenity, it is a revolution that will sweep away inferiority complexes."

Review of literature

CS Adam, DL Bevan (2006)

“Current policy debates on assistance macroeconomics frequently focus on short-run Dutch disease effects, ignoring the potential supply-side impact of aid-financed public spending. Public infrastructure has a long-term effect on productivity in the

simplified model of aid and public spending that is shown here. This model may have a sector-specific bias”.

Objectives

- To expand and decartelized power generation project in rural areas.
- To mobilize fund from various area to rural areas to non government organization, private power developers.
- To optimize electricity rate in rural area to maintain equality.
- To ensure client satisfaction in rural areas.

Challenges in ensuring sustained electricity access

Metering and billing issue

“Over a long period of time, there is strong evidence in rural regions of supply being provided without proper metres, metres not being read, and bills being issued without proper metre readings. There have also been cases of billing delays, with large delays in the first bill being issued following the connection. Consistent billing delays drive up bill amounts, making them unaffordable for many customers. This raises the likelihood of non-payment and the accumulation of arrears, which leads to customer disconnection. The distribution company's job is to read the metres, issue invoices, and collect money once the connections have been established. However, despite the need to track metering and billing status for newly electrified families, entities such as the Rural Electrification Corporation (REC), which implements significant rural electrification programmes, as well as regulators, do not do so”.

Low hours of supply

“With concentrated attempts to manage supply hours for rural, distant, and newly electrified families, this built-in disincentive to supply must be eliminated.

Furthermore, the rural distribution network necessitates investments and suffers from operational and maintenance issues, resulting in frequent distribution transformer failures and line faults with lengthy repair delays. This also makes it difficult to maintain a constant supply”.

Lack of affordable power

“Many regulatory commissions offer discounted rates to consumers who are classified as being below the poverty line (BPL), although many impoverished people who are not classified as BPL are not eligible for this advantage. Consumers in other states who use fewer than a certain number of units per month are eligible for reduced rates”.

“Rural locations in many developing countries have the potential to implement small-scale hydropower, solar energy, and biomass-based power systems. These places provide an electrification green field where the technological option chosen is based on locally accessible resources, financial position, supply area characteristics, and environmental impact. The general conclusion is that rural energy has always been significantly more expensive than urban electricity, and utilities have been hesitant to extend service to rural regions as a result. Table 1 summarises a number of characteristics unique to urban/industrialized supply areas and rural supply areas for mutual comparison. The combined effects of the unique characteristics of rural power systems, as well as their more difficult operation and maintenance, raise the marginal cost of energy supply to rural consumers in comparison to urban users”.

“Feature	Industrial/urban supply areas	Rural supply areas
Area load density (kW/km ²)	500 to 100,000	2 to 50
Consumer density (conn/km ²)	> 500	1 to 75

Number of consumers per km line length(both MV and LV included)	> 75	1 to 75
Consumption density (kWh/km ²)	> 2,000,000	5,000 to 200,000
Total costs/kWh (USct)	10 to 15	Grid based: 12 to 50 Diesel based: 25 to 100 or more PV home systems based: 50 to 500
Investment costs per connection (US\$), excl. gen & transm.	<500	500 to 7000, average 1200, extremes of over 100,000
Social aspects	Limited	specific financial support and solutions needed
Technical/organisational aspects	large projects; often heavy power technologies on supply and demand side; reasonable load factors as a result of mixed loads	various technologies and small scale applications; low load factor because of dominant domestic and agricultural loads; intensive customer support needed; ratio of labour to capital high.
Socio-cultural aspects	seldom of importance	Important
Economical aspects	profitable business opportunities	limited profitable business opportunities"

Table no.1 Typical features of industrial/urban and rural supply areas.

“A cost-benefit analysis of a rural electrification project in and of itself will likely indicate a negative result if inexpensive rates are anticipated. In the case of tiny grid networks, Figure 1 depicts the high cost per connection. There is evidence that only a small percentage of the rural people in industrialised countries have taken the

initiative to self-finance the electrification of their communities. Almost all countries were able to accomplish affordable electrification only through particular national programmes and financial arrangements. Government subsidies of up to 50% have been offered for early investments, and long-term, low-interest, or interest-free loans have been issued to fund the electrical infrastructure. Cross-subsidization was and is still widely used. At the end of the 1960s, rural prices in Ireland were expected to be 29 percent lower and urban prices about 9 percent higher than they would have been without cross-subsidisation. In some situations, despite financial assistance, returns on investment were as low as 5%.”

The challenge and success factors

“The connections between sustainable development and suitable energy services have long been discussed, but they are now widely acknowledged as vital. Leaving fairness, equity, and socioeconomic growth aside, the globe can no longer ignore the still unserved rural and distant places in terms of inexpensive power. Progressive unification will progressively compel the international community to meet the global population's material requirements, and energy, particularly electricity, will play a key role in this regard. The question will be when, not if, rural areas will be electrified”.

“Humanity is technically and organizationally capable of completing complex and impressive tasks, as proved by space research. We have the ability to keep a group of people extraterrestrial for months at a time. The astronauts have an exceptionally stable electricity supply at their disposal for food preparation, air conditioning, heating, telecommunication, video equipment, and scientific investigations while being further away from us than the farthest rural person on this planet. There is enough power on board the Space Station Alpha for housekeeping and medical care to power a few hundred rural homes in countries that aren't very developed”.

If you think extraterrestrial power is more practical, easier to use and cheaper than energy delivery to the world's undeveloped rural and far-away places, you're wrong.

“Rural electricity is widely acknowledged to be more expensive than urban electricity, and companies have long seen it as a nuisance. However, continuing with "business as usual" is not a viable option for the two billion people who still lack access to power. Rural electrification should be viewed as a challenge, given the present technology choices and worldwide community assistance. To meet this challenge and successfully conduct future rural electrification programmes, the right conditions are required, and the study has identified a number of essential success factors in this regard”:

- A stable political and social context;
- Appropriate institutional circumstances. Appropriate law and regulation should allow for a commercial approach to power supply and utility operations that is independent of politics.
- The international community's assistance In developing countries, the majority of the rural population is impoverished, but they are ready to spend a significant portion of their income on reliable energy. There will still be a need for early investment subsidies and proper financing schemes with smart subsidies for the people who need them.
- An effective electrification procedure. The electrification process should include all local options for power production in order to meet demand for energy services in the most efficient, sustainable, environmentally and socially acceptable manner. Ideally, electrification should be part of a comprehensive rural development strategy.

Conclusion

“Rural electrification of rural areas in developing countries has long been debated. There is general agreement that the cost and benefits of rural electrification are very difficult to value. But results from ongoing research suggest that socio-economic benefits are much higher than earlier assumed. A study has been carried out on electricity supply to rural and remote areas in developing countries. The objective of the study was to identify and assess technical developments and institutional trends. It also aimed to look ahead to opportunities for electricity supply and translate the results into recommendations for decision makers”.

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