Rural Electrification: Lessons Learned

Based on the World Bank’s experience to date, Rural Electrification (RE) programs rarely support themselves financially. However, there are external benefits that rural populations derive from key synergies facilitated by the introduction of electricity (such as improved access to communication, education and economic opportunities, extended and more reliable health services, and improved security). RE programs should seek to maximize both economic and social benefits. Some lessons learned and good practices (drawn from the sources listed on page 3) are summarized below.

**Lessons Learned**

- Key to scaling-up are conducive macro-economic conditions, sustained government commitment to the project objectives, competent public institutions, and decentralized decision-making.
- Grid extension is sometimes not the most cost-effective solution: decentralized delivery options and alternative energy sources—such as solar PhotoVoltaics (P.V.), mini-hydro and other renewable energy sources—should be considered, following the principle of least-cost development. There remains considerable potential to lower the unit network costs of new connections by introducing equipment standards, reticulation design, and construction, operations and maintenance practices that are better suited for rural area conditions, instead of relying on high cost and “gold-plated” practices more appropriate for use in urban areas.
- Criteria for selection and priority-setting for RE should be open and objective. Political interference in the implementation of RE programs can add considerably to the costs of system expansion.
- The benefits of electrification are directly related to the uses to which it is put and to the costs of alternative sources of power and energy. RE should ideally be introduced in areas where there is already a demand for electricity-using services—usually where there is agricultural growth, rural businesses and rural incomes. However, to increase and accelerate the development impact, technical assistance and rural business services could be provided to stimulate demand.
- Pricing policies play an important role in determining project viability.
A rational system of cost recovery (coupled with smarter ways of allocating subsidies where needed) is the most important factor determining the long-term sustainability of RE programs.

- **Initial connection charges** are a greater barrier to rural families than the monthly electricity bill. Extended financing arrangements are necessary to make connection more affordable.
- **Subsidization of operating costs** has widely proved to be counter-productive and to undermine the utilities’ financial position, their ability to extend service, and ultimately the RE programs themselves.
- The **private sector** can be attracted to participate in rural electrification schemes, even in a poor country, if an appropriate legal framework and risk management options are in place, including the assurance of a level playing field in terms of competition and the ability to charge full cost-recovery tariffs.³
- RE programs can benefit greatly from the involvement of local communities—or suffer because of its absence.
- RE will stimulate economic growth and employment, if other necessary conditions are met. REL RE reduces rural poverty mainly through a general rise in income, obtained by productive uses.
- Evidence from successful rural electrification projects shows that, once electricity becomes available in an area, upper middle class and wealthy households are the first to adopt it. But if the project focuses on promoting electricity for poor households—through low connection fees and lifeline rates—the rate of electricity adoption grows significantly, even among the poorest households. Surveys reveal that, in regions with high overall adoption rates, the poor benefit significantly from rural electrification programs, and although they may lag behind wealthy households, the poor will adopt electricity if the connection policies are appropriate. Without a rural electrification program, or other program aimed at encouraging extensive coverage of the poor, the poor are left paying for kerosene, a meager and high-priced source of light.⁷
  - It is difficult to estimate suppressed demand and the ability and willingness to pay.⁸
  - Demonstration projects (the typical donor approach) are not a fair test of viability.

**GOOD PRACTICES**

**Power sector reform** (ideally on-going at time of project appraisal)
- Establish a transparent, arms-length regulatory framework with legal guarantees that utilities can operate with autonomy—e.g. through management/concession contracts.
- Enforce regulatory principles to ensure financial discipline, adequate tariffs, and incentive-based, competitive contracting of services.
- Separate responsibilities between regulating authorities and operating companies.
- Open the market to private investment and operators.

**Priority-setting**
- Successful rural electrification programs have all developed their own—transparent—system for ranking or prioritizing areas for obtaining a supply.

**Financial viability/cost recovery**
- Identify economic limits to extensions to the grid and the economic potential of lower-cost options and alternative energy sources.
- Ensure commercial viability to assure RE’s sustainability.
- A rational system of cost recovery should take into account capital investment costs, level of local contribution, number and density of consumers, likely demand for electricity, also, the willingness to pay and payment capability of the population.
- The tariff regime should ensure that RE programs are financially sustainable and will not drain operational resources. Tariffs should cover the full cost of medium-voltage generation/transmission, plus low-voltage operations/maintenance costs, and should provide for eventual capital replacement costs.
- The tariff structure needs to ensure that any subsidies are fair, equitable, and sustainable. A “good” subsidy scheme enhances access for the poor (improving the quality of life/reducing energy expense); sustains incentives for efficient delivery/consumption; and must be practicable within the financial and human resource constraints of government/power utility. Successful subsidy programs encourage the rural electrification business. A portion of the capital may
be subsidized, obtained at concessionary rates, or as a government/donor grant. Subsidies should be avoided for operating costs. A low lifetime tariff is acceptable on income redistribution grounds.

- Minimize construction/operating costs: assess technology and available standards during the planning stage; deploy low-cost equipment; use innovative technologies/approaches and local suppliers; standardize materials. Consider the use of "ready-boards" to reduce connection costs. Design the system for expected loads (much lower in rural than urban areas) to reduce construction costs; provide for future upgrades.

- Consider the provision of financing to spread the costs of connection fees over an extended period, or lower connection rates for the poor, so that the benefits of electrification may reach larger numbers of people; consider also arranging financial assistance for the credit/hire purchase of electrical appliances.

- For grid electrification, it is generally important to meter all electricity consumption. There may be some exceptions to this rule for households with very low consumption rates that are being provided electricity service by a small local generator during evening hours only. Under such circumstances, it may be necessary to charge a fixed amount for each appliance, as they can only be used for a particular period of time. This avoids unnecessary expenses involved in reading meters and the cost of the meters.

- Include demand-side management programs in project design to shift some of the rural load to off-peak time periods.

**Implementation agency**

There is no single model for an institutional structure. However, in all countries with successful RE experience, the implementing agencies had a high degree of operating autonomy and were held accountable: leadership tended to be dynamic and employees had job security and career prospects. Clear contractual arrangements between the government and implementing agencies are important.

**Involvement of local communities**

- Projects are more likely to be viable and sustainable if local stakeholders are involved in their design and implementation. One way to approach this is to set up a Rural Electrification Committee to help assess level of demand, educate consumers, and promote the wider use of electricity. This may also help reduce potential problems over rights of way for the construction and maintenance of electric lines.

- In some cases (e.g. Thailand), the community has made contributions of capital or labor, thereby helping to defray the costs of the program. Labor-intensive activities in the distribution and customer services function may be contracted out to village-level organizations on a fee-for-service basis.

- The establishment of appropriate institutional and organizational procedures for project planning.

financing, procurement of goods and construction services is very important for the successful implementation of RE projects involving small communities.

- The concept of "Area Coverage Rural Electrification" (ACRE) - a distribution system based on member-owned rural electric cooperatives - has been successfully used (e.g. in Bangladesh).

**Sources**

1. Consultations with Douglas Barnes, SASEG, Arun Sanghvi, AFTG1, and Alan Townsend, PSAPP, Selina Wai Sheung Shum, EASEG, also suggested sources.
6. "Case Study: Thailand’s Approach to Rural Electrification: How was it successful?" Tuntivate Voravate and Douglas F. Barnes, Draft, April 2000. Not to be quoted without permission.


Footnotes

1 Several RE programs in Asia were rated satisfactory in OED audits. Thailand is considered to be a particularly good practice example. However, none has demonstrated financial viability without significant cross-subsidies. Source: OED.

2 A poor macroeconomic environment — depressing incomes and demand for new connections — was found to be the overriding factor in the failure to provide sustainable electricity service to low-income households in several SSA countries. Source: OED.

3 SSA utilities are peculiarly vulnerable to bad management, and their poor performance is one reason underlying the weak fiscal situations in many SSA economies. Source: OED.

4 Photovoltaic systems are increasingly demonstrating that they can be competitive with conventional energy sources on cost-service grounds. Source: Barnes and Foley.

5 Source: Sakairi.

6 Conditions necessary for RE to make a significant contribution to sustainable rural development include: security of land tenure, availability of agricultural inputs, access to health and education services, reliable water supplies, adequate dwellings, access to markets, and disposable income for improved lighting and ownership of electricity-using appliances. Source: Barnes and Foley.

7 Source: Barnes.

8 In a pilot rural electrification project in Mozambique, cost recovery tariffs were introduced which were substantially higher than the national tariffs. Despite this, demand has grown very rapidly, billing/collection currently exceeds 98%, and non-technical distribution losses are low (around 5%).

9 Self-contained switch and socket boards. The incoming supply is connected to the board, and lights and power are plugged directly into the board. They are used to save on wiring costs and are ideal for small premises. Source: Sakairi.

10 Successful arrangements have included: a separate rural electrification authority (Bangladesh); rural electric cooperatives (Costa Rica); allocating rural electrification to a department of the national distribution company (Thailand); delegating to regional offices of the utility (Tunisia). Source: Barnes and Foley. A pilot project in Mozambique successfully used 3-year management contracts (with bonuses and penalties related to specific performance criteria) with local as well as international companies, as an interim arrangement. The project is expected to be privatized at the end of the contracts. Source: Sakairi.

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