Transformative Power: Meeting the Challenge of Rural Electrification

by **Douglas F. Barnes**

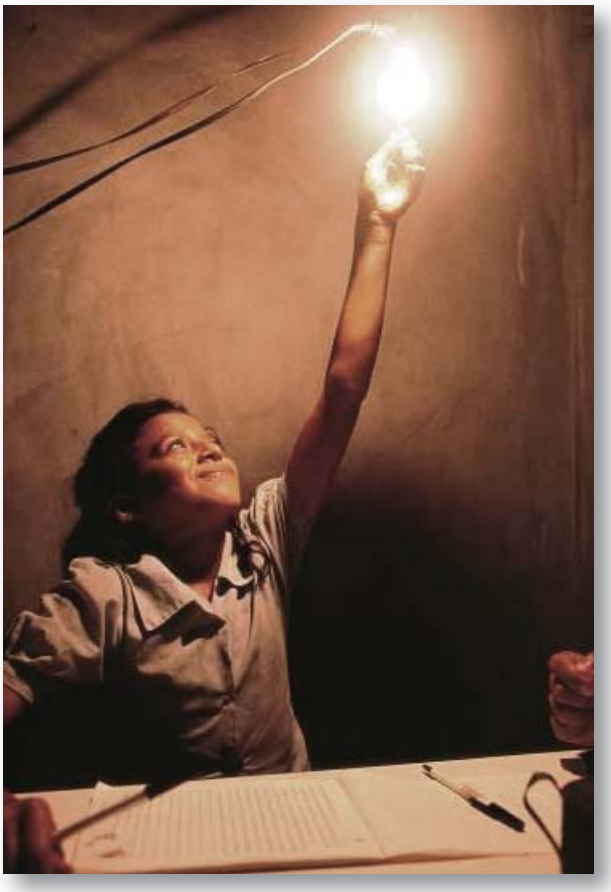
This brief is designed to illustrate in summary how a variety of countries have addressed the problems inherent in having successful rural electrification. By providing a snapshot of various programs and the many different ways in which these programs provide electricity to their rural populations, this note attempts to highlight best practices that should be emulated, and those factors that should be avoided.

Today about 1.6 billion people, mostly in rural areas of developing countries, lack access to electricity, despite its power to transform human lives. Electric lighting allows for study and other productive activities during evening hours, electric appliances reduce household drudgery and eliminate indoor air pollution, and electricity-driven irrigation and post-harvest processing can transform subsistence agriculture into profitable enterprises.

Despite proven benefits, many energy policymakers hesitate to invest in rural electrification; the challenge of serving remote rural areas is formidable, and failed subsidies are all too common. Within this context, Meeting the Challenge of Rural Electrification in Developing Nations: The Experience of Successful Programs, a report of the Energy Sector Management Assistance Programme (ESMAP), draws on the experience of 10 diverse countries to identify characteristics of effective rural electrification programs.

Rural electrification presents a daunting task. Rural populations are often widely dispersed across difficult terrain, raising the cost of per-consumer investment and making service quality difficult to maintain. Poor rural customers often cannot afford the upfront connection costs of grid

ESMAP is a global technical assistance program managed by the World Bank Water and Energy Department that promotes the role of energy in poverty reduction and economic growth in an environmentally responsible manner. Its work applies to low-income, emerging, and transition economies and contributes to the achievement of internationally agreed development goals.

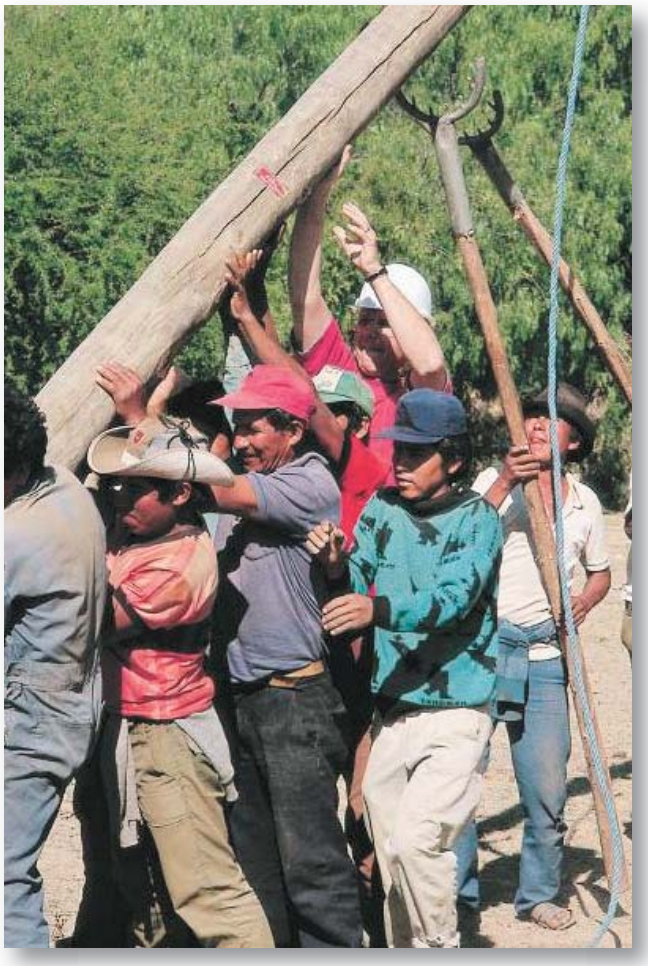


electrification, and their low consumption levels result in low load factors. Politicians may distort electrification extension and interfere with pricing, bill collection, and disconnection policies. Moreover, the problems of local communities may be overlooked, resulting in disputes over rights of way; and power-sector reform can leave rural people without service.

Despite these problems, the socioeconomic benefits of electrification are substantial. Electric lighting allows for extended study hours and social activities, while appliance use eliminates household drudgery and increases leisure time. Electrification and education are mutually reinforcing programs. The dilemma is how to ensure that these benefits reach the rural poor. In most developing countries, poor residents adopt electricity at a lower rate than

wealthier households. Even so, many poor households below the poverty line, particularly in higher-income countries, adopt electricity, thereby reducing rural inequality.

Countries as diverse as Costa Rica and Ireland have succeeded in bringing electricity to nearly all of their rural populations. China now supplies service to more than 1 billion of its rural citizens, more than 90 percent of Thai villagers have service, and some 85 percent of rural Tunisian households have a supply. In Bangladesh, where nearly 36 percent of people remain in poverty, an estimated 2.5 million rural households are connected to the grid. And despite its political problems and setbacks, the Philippines supplies some 4.5 million rural households. How have such diverse countries overcome the dilemma of rural grid electrification?



STUDY APPROACH

ESMAP systematically evaluated 10 countries' rural electrification programs to determine which factors led to successful programs. All of the case studies were conducted based on a similar set of issues to allow for comparisons across countries. The authors of each study conducted field visits, collected data, and interviewed major policymakers in rural electrification.

Key issues included:

- How to encourage poor rural consumers to connect to the grid and thus policies for financing initial connection charges to increase consumer access;
- Tariff structure and how distribution companies cover the higher costs of low density regions;
- Subsidy effectiveness;
- Avoiding the potential for political interference;
- Coordination with related rural development and infrastructure objectives;
- Billing, customer service, and consumer education on increasing productive uses; and
- Financial viability of the distribution company.

NO ONE INSTITUTIONAL MODEL FITS ALL

Rural electrification necessarily involves large investment capital combined with poor financial returns. The case studies demonstrate that successful rural electrification programs meet this core challenge through various institutional forms: rural electric cooperatives based on the U.S. model of the 1930s (Bangladesh, Costa Rica, Philippines), public companies (Ireland, Mexico, Thailand, and Tunisia), private distributors (Chile), and decentralized power companies (China). The cases reveal that success relies more on adhering to strict business principles in distribution company operations than on institutional form.

WHAT MAKES SUBSIDIES EFFECTIVE?

All rural electrification programs involve subsidies, but, as these case studies show, no one type is superior. The countries studied included capital subsidies (Ireland), subsidy funds based on principles of output-based aid (Chile), bulk power subsidies (Thailand), and others. To be effective, subsidies should be easy to administer, affect the desired population, and reach the poorest of society. The studies demonstrate that effective subsidies strike the right balance between extending electricity to the poor and meeting the goal of serving paying rural consumers.

PRINCIPLES, NOT PRESCRIPTIONS, FOR SUCCESS

These cases also demonstrate that rural electrification is a dynamic problem-solving process. For programs to succeed, governments must take a long-term view. While the nature of the problems change as programs evolve and mature, certain underlying principles, regardless of culture or society, guide successful programs:

Creating effective institutional structures. Regardless of its form, an effective institutional structure has a high degree of operating autonomy and accountability, strong management, and dynamic leadership with the capacity to motivate and train staff.

Encouraging politicians to raise and contribute funds. To avoid political interference and ensure transparency in rural electrification planning, politicians can be encouraged to raise and contribute funds to ensure that their constituents receive electricity before the planned time.

Setting clear criteria for rural electrification. Rural electrification will contribute significantly to rural development when the other necessary conditions, such as secure land tenure and availability of reliable water supplies, are present. All successful programs have a system for prioritizing areas for obtaining a supply. Factors considered include capital investment costs, level of local contributions, numbers and density of consumers, and likely demand.

Box 1. Setting Realistic Tariffs in Costa Rica

Setting electricity tariffs extremely low, often below their true supply costs, is not required for rural electrification to benefit rural residents. Unelectrified regions that use lighting, television, and other electricity-using services spend large amounts on more expensive, less efficient energy sources.

In Costa Rica, tariffs are set through a regulatory process; however, they are high enough for the rural electric cooperatives to make a profit. In 1996, the price for residential electricity started with a minimum charge of US$1.28 for the first 30 kWh of service. Subsequently, charges increase from 4 cents per kilowatt hour up to 100 kWh, and then to 6 cents per kilowatt hour up to 250 kWh per month. Due to the thermal factor, after the first 30 kwh, there is an additional 4 cents per kilowatt hour added to the bill. Setting realistic rates also shifted the electricity company's focus to consumer service and the need to provide value for the prices it charged.

Pursuing cost recovery. When cost recovery is pursued, most other program elements fall easily into place. Conversely, electricity supply organizations dependent on operational subsidies are critically vulnerable to any downturn in their availability.

Charging the right price. Rural electrification tariffs set at realistic levels allow the electricity company to provide a supply in an effective, reliable, and sustainable way to increasing numbers of satisfied customers (Box 1).

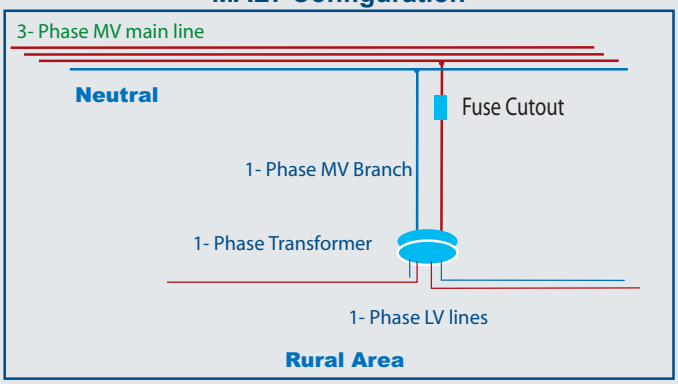
Lowering barriers to obtaining a supply. Reducing initial connection charges or spreading them out over several years allows more low-income rural families to obtain a supply.

Box 2. Analysis of Design Assumptions Pays Off in Tunisia

Early in its rural electrification program, Tunisia decided that using expensive three-phase distribution systems was too costly in rural areas. After extensive technical analysis, the decision was made to adopt the MALT design—a blend of three-phase backbone and single-phase network distribution. As a result, financing costs were reduced 20 percent.

Making this technical decision was not easy for Tunisia's electricity company, which faced opposition from the conservative electricity industry. This case demonstrates how careful and critical analysis of design assumptions and implementation practices can reveal potential for significant cost savings.

MALT Configuration



Involving local communities. Local communities—often overlooked by utilities—are critical in promoting electricity use. Setting up rural electrification committees or holding consumer meetings in advance of electrification can help to assess demand and avoid disputes over rights of way and construction damage.

Reducing construction and operating costs. Careful attention to system design can reduce construction costs by up to 20-30 percent, thereby accelerating a program's pace and widening its scope (Box 2).

PUTTING PRINCIPLES INTO PRACTICE

Well-planned, carefully targeted, and effectively implemented grid-based electrification programs can provide rural people enormous social and economic benefits. While electrification alone cannot solve all rural development problems, it is also true that poor people in developing countries cannot take full advantage of other forms of development assistance without access to an electricity supply. These case studies underscore the many forms that successful rural electrification programs can take. This is reason for optimism among countries about to embark on or in the early stages of electrifying their rural populations.

Putting the principles derived from these case studies into practice can help to ensure that many more consumers will enjoy the benefits of an electricity supply at acceptable costs without burdening their national governments and power utilities with unsustainable subsidies.

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Mr.Douglas F. Barnes is the author of the forthcoming ESMAP report "Meeting the Challenge of Rural Electrification in Developing Nations: The Experience of Successful Programs." The feedback received from peer reviewers and colleagues was most helpful in defining the agenda for further work.

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