



A case study on subsidizing rural electrification in Chile

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Message from the editors

Reform of the energy sector and reform of subsidies ideally go hand in hand. Structural, ownership, and regulatory reforms aimed at making services more efficient should lead to rethinking of both the level of subsidy and the delivery mechanism. Chile, one of the earliest and most thorough energy reformers, has also been one of the more innovative in restructuring its subsidy schemes. It has seen electrification as a key measure in alleviating poverty in rural areas—in 1992 about 47 percent of its rural population had no access to electricity. Its rural electrification program includes subsidies designed to be consistent with the broad principles of energy reform—decentralization of decisions to the regional and community level, competition (between technologies as well as suppliers), and a requirement that all partners in the process—users and private companies as well as the state—contribute to the financing of expansion projects. The short-term result: an increase in rural electrification of about 50 percent in the first five years of the program.

In Chile in the early 1990s, nearly 240,000 rural households—more than 1 million people, or almost half the rural population—had no access to any source of electricity (figure 1). By contrast, 97 percent of urban households had electricity supply. The lack of access was concentrated in a few regions where most of the rural population lives (figure 2). It affected mainly lower-income families, since the wealthier could usually afford to install generators or pay for extension of the distribution grid.

To increase rural access to electricity, Chile launched a rural electrification program in 1994. Like many rural electrification projects, the program has had to address these challenges: how to ensure sustainability, how to avoid politicization and corruption of the process (and subsidy delivery mechanisms), how to develop ways to deliver service to isolated communities, and how to involve the private sector.

The program set up a special fund to competitively allocate a one-time direct subsidy to private electricity distribution companies to cover part of their investment costs in rural electrification projects. Operating costs have to be financed with tariff charges set by the regulatory authority. Bids are conducted annually. To apply for a subsidy, companies present their projects to the regional governments, which allocate the funds to those scoring best on several

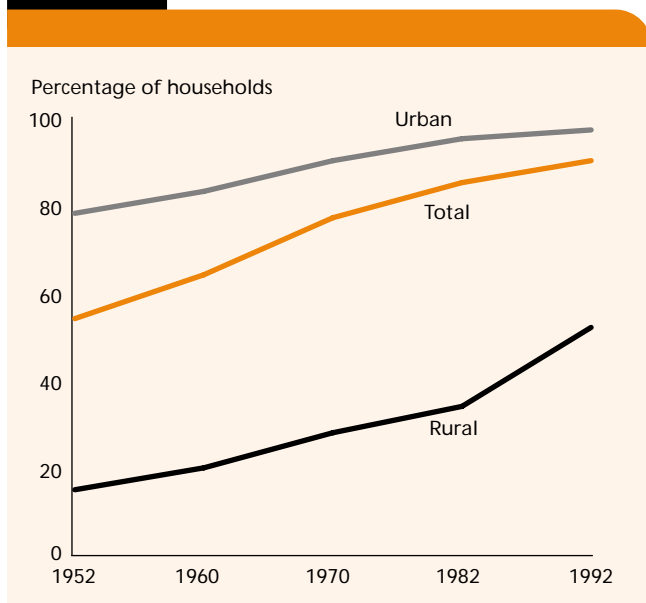
objective criteria: cost-benefit analysis, amount of investment covered by the companies, and social impact. The central government allocates the subsidy funds to the regions on the basis of two criteria: how much progress a region made in rural electrification in the previous year and how many households still lack electricity. Regional governments also allocate their own resources to the program.

The program, which is expected to run until 2004, has made significant headway in achieving its goals. It has increased the coverage of electricity systems in rural areas from 53 percent in 1992 to 76 percent at the end of 1999, exceeding the 75 percent target set for 2000. The program has promoted social equity and improved the living conditions of the poor. And it has shown that it is possible to create market incentives that lead to efficient private solutions to rural electrification—an important lesson at a time that so many developing countries are reforming their power markets and privatizing their state-owned electric utilities.

Institutional background

Rural electrification in Chile had traditionally been the province of state-owned power companies, which followed centrally developed plans and relied on subsidies from the central government or cross-subsidies from tariffs set above

Figure 1 Electricity coverage in Chile, 1952–92



Source: Chilean National Statistics Institute, census data.

cost in urban areas. Lack of funding and more pressing priorities had resulted in slow progress.

In the 1980s important changes in the administrative organization of the country and in the electricity industry called a halt to the scheme. Chile liberalized its markets, privatized

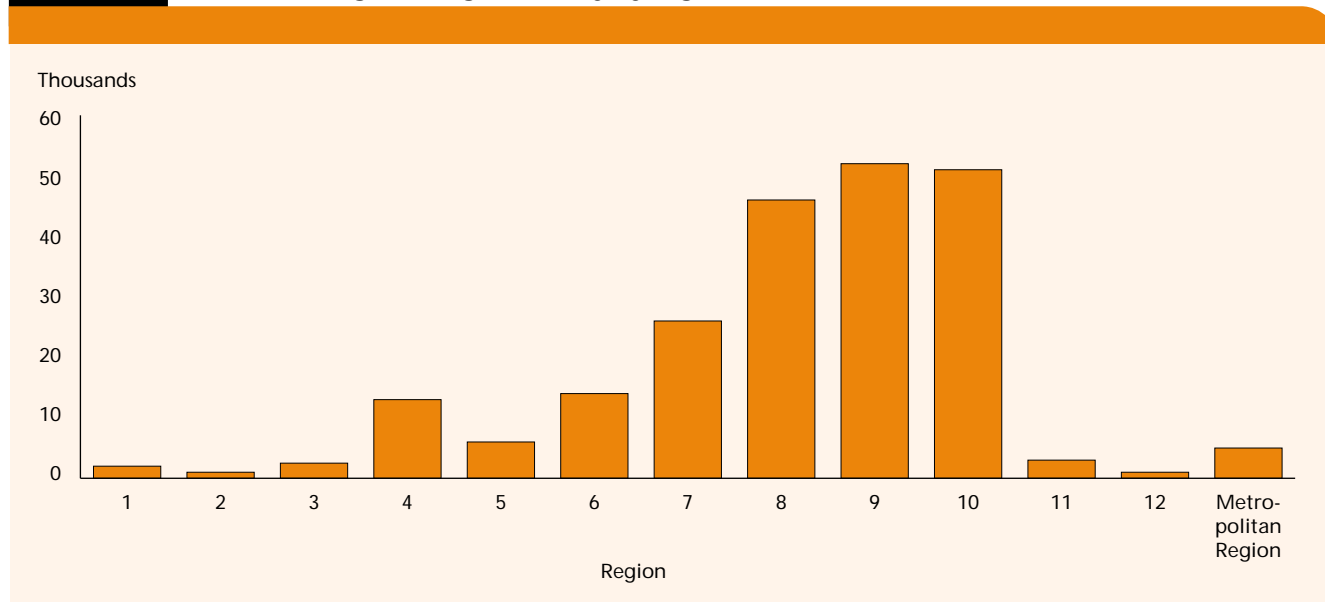
state-owned electricity companies, and allowed the private sector the key role in investment. Before selling the electricity companies, the state split them into generation and transmission companies and distribution utilities. The distribution utilities were divided according to the areas in which they operated, but no exclusive distribution rights were granted. The National Energy Commission (Comisión Nacional de Energía, CNE) was created as the main policymaking and regulatory body. A new electricity law established free entry and competition in generation, a nonexclusive concession system for distribution, and a pricing scheme based on marginal costs, with generation charges reviewed every six months and distribution charges every four years (Jadresic 1997b).

The national government had traditionally been highly centralized, which tended to concentrate decisionmaking and wealth in the capital and the main cities and to promote rural-urban migration. To counter these forces, in the 1970s the country was organized into twelve regions and a metropolitan area for the capital, Santiago. The new regional governments acquired growing decisionmaking rights in such matters as allocating the state investment budget among projects and designing and implementing regional development programs. The role of the central government increasingly became to define national policies, design policy tools, and provide investment funds to the regional governments (Jadresic 1996).

The principles of the program's design

The designers of the rural electrification program set out to devise a scheme that would promote private investment,

Figure 2 Rural dwellings lacking electricity by region in Chile, 1992



Source: Chilean National Statistics Institute, 1992 census data.

stimulate competition, and take into account the structural reforms in the power industry and the decentralization of the national administration. They built the program around four central principles.

Decentralized decisionmaking

To ensure appropriate technology choices, promote local commitment and sustainability, and fit the new decentralized structure, the program designers decided that the regional governments would identify needs, choose the solutions, and participate in the decisions on the allocation of central funds. To involve local communities, the program would require that projects be requested by organizations rather than individuals. But the central government would provide economic resources and technical assistance and help to coordinate the institutions involved in the program. It would also provide the criteria and tools for evaluating projects to ensure coherent decisions and efficient allocation of investment resources.

It is possible to create market incentives that lead to efficient private solutions.

Joint financing

To ensure sustainability, all participants—the state, the electricity companies, and the users—would contribute to the funding of investment projects. The state’s participation was needed because rural electrification projects usually are unprofitable for electric utilities, as a result of low electricity consumption, the distance from distribution centers, and the dispersion of dwellings. But state subsidies would be allocated only to projects with a positive social return. The state’s contribution, delivered through the special fund, would also cover expenditures related to managing the overall program.

The state would not own or operate any facility built under the rural electrification program—that would be the role of private investors. The aim was to make rural electrification projects an attractive business opportunity for electric utilities. Companies would be required to invest their own resources to increase their commitment to the success of projects. Users would contribute both at the investment phase of projects—to increase their commitment to projects

and to help extend the resources for rural electrification—and during the operation of projects—to support adequate service and maintenance.

Competition

To reduce the risk of politicization, minimize project costs, and encourage innovation, competition would be used at as many levels and stages as possible: among projects proposed by different rural communities, among distribution companies interested in supplying these communities, and among regions requesting funds from the central government. In the first two cases decisions on the allocation of investment funds would be made at the regional level, and in the third case by the central government.

The rules for deciding among competing projects would be transparent and stable and established by the central government. They would consider the average cost required to provide a certain quality of service, the local electricity needs, and the sustainability of proposed solutions. Priority would be given to zones showing the capacity to implement the program. Zones with high poverty and low community involvement—where sustainability is more likely to be a problem (particularly where self-generation is used)—would initially require more institutional assistance.

Appropriate technologies

For solutions to rural electrification needs, the program would consider not only extension of the existing distribution grids but also other technological alternatives. These alternatives, mainly for self-generation in isolated communities, could include:

- Photovoltaic solutions for isolated rural dwellings.
- Hybrid systems that reduce fossil fuel dependence and operating costs.
- Small hydroelectric power stations, independent or combined with other energy sources.
- Experimental solutions based on wind power and biomass systems, which would require a resource assessment program before being applied.

Evaluations of these alternatives would take account of minimum cost criteria and recognize that these solutions might not be the final ones. Electrification based on these technologies, along with other programs supporting rural development, could lead to greater and more concentrated electricity demand. In the medium and long term connection to the main grid might turn out to be the lowest-cost and most reliable solution. Self-generation could be just the first step (Chile, National Energy Commission 1997).

The program in action

The rural electrification program (Programa de Electrificación Rural, PER) was launched in November 1994 to carry

out the new rural electrification policy. The CNE was to lead and coordinate the program. And the goals were set: supply electricity to 100 percent of electrifiable rural dwellings within ten years and reach 75 percent coverage by 2000 (Jadresic 1997a).

In 1995 the average state subsidy per rural dwelling amounted to US\$1,080; in 1999 it reached US\$1,510.

To reach 75 percent coverage by 2000, it was estimated that the state would have to invest about US\$150 million, which would allow electrification of roughly 110,000 rural dwellings. This estimate covers subsidies from the special fund and resources allocated by regional governments. The private sector would have to invest a similar amount. Users would also have to contribute (Chile, National Energy Commission 1997).

The CNE prepared a planning and management model for the technical units of the regional governments that would lead the process. It also created methodological tools to ensure efficient allocation of the state subsidies, based on national and international experience. And it prepared preinvestment studies to generate initial project portfolios for each region.

The program is based on the idea that the technological solution should fit the needs. If technically and economically feasible, the first choice would be to provide service at the standards offered by the distribution grid (220 volts effective monophasic alternate voltage and 50 hertz frequency, with twenty-four-hour availability). But where the costs of this solution are too high, alternative technologies would be considered. To ensure sustainability in these cases, all costs over the life of the projects would be considered in the appraisal, as well as organizational schemes for operating and maintaining the projects (Chile, National Energy Commission 1997).

Management of the program

The central government's tasks of providing funds and technical assistance and coordinating the program are handled mainly by the CNE. The CNE has supplied technical, method-

ological, and organizational assistance in the preparation, analysis, and management of projects. It has signed work agreements with the governments of regions with the largest rural electrification deficits to create small regional technical units. It has played an important role in promoting the program at the national level and in the follow-up to the program. And the CNE has developed the norms allowing alternative energy sources in rural electrification and promoted experimental projects using these technologies.

Management of rural electrification projects

Communities in areas lacking electricity supply generally propose the rural electrification projects, supported by local distribution companies interested in providing the service. A community presents a project to its municipality, which then asks the distribution company to prepare a technical proposal, at no cost to the municipality, or contracts for this service with an independent consulting company. Once the proposal is prepared, the municipality lists the project in a publicly accessible register.

Using the prescribed criteria and tools, the regional planning agency evaluates the projects, analyzing their economic and financial costs and benefits and calculating the contribution of the company and the subsidy required. Only projects with a positive social return but a negative private return are considered for subsidies. This scheme allows a 10 percent real rate of return on investment, similar to that used for setting tariffs for the projects, over a thirty-year horizon (Chile, National Energy Commission 2000; *Diario El Mercurio* 2000).

After being analyzed, the projects are submitted to the head of the regional government in a portfolio of all those meeting the minimum requirements. The head of the regional government then presents a proposal to the regional council, which has to allocate the state funds among the projects taking into account the number of beneficiaries, the unit cost, and the financing needs. The regional government then allocates the funds to the companies that presented the projects selected.

Once a project has been implemented, the distribution company takes care of operation, management, and maintenance, recovering its costs through the tariffs charged consumers, which are set by the CNE.

Financing of the program

The responsibility for financing the projects is split up as follows:

- Users have to cover the costs of the in-house wiring, the electric meter, and the coupling to the grid. These expenditures, nearly 10 percent of the costs of each project, are initially financed by the distribution company and repaid by the users over time. Once the project is operating, the users have to pay the regulated tariffs.

- The distribution company is required to invest at least the amount calculated using a formula set by the government—to avoid such risks as goldplating. The company also must operate the projects once they are built.
- The state has to provide a subsidy for the investment costs that is no more than the (negative) net present value of the project, which in any case has to be smaller than the total investment.

Until 1994 rural electrification subsidies had been financed with resources that came from a central government fund. The fund was the main source of financing for the regional governments, which allocated its resources to many areas, including health, education, and infrastructure. Rural electrification therefore had to compete with many other needs.

To ensure that the rural electrification program could achieve its goals, a separate fund was created in 1995 to provide additional resources. The fund could be used to finance projects (grid extension or self-generation), feasibility studies, and preparation of project portfolios. To encourage regional governments to invest their own resources in rural electrification projects, it was decided that the special fund would be allocated among regions on the basis of their achievements in rural electrification in the previous year and the number of dwellings still lacking electricity.

Grants from international organizations have also been used in the program, especially for experimental projects based on self-generation systems using alternative energy sources (Chile, National Energy Commission 1999a).

Results

The rural electrification program has had a significant impact. It has not only greatly improved coverage but has also changed the way things are done in the field. It has shown that it is possible to achieve rural electrification—usually thought to be possible only by the state—in a competitive environment dominated by private companies, and that competition results in better use of resources and better results. The program has also helped to broaden the technologies used in these projects, though grid extension has been the predominant approach used. And by the end of 1999 the program had reached the coverage and investment goals originally set for 2000 (Chile, National Energy Commission 1999a).

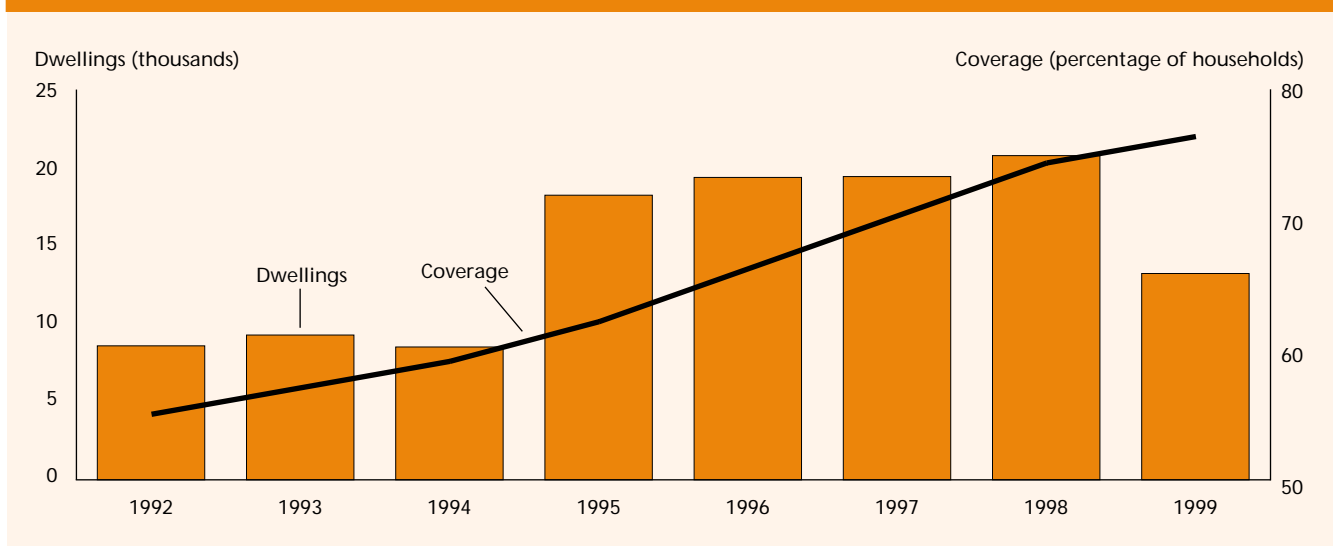
Coverage

The program has greatly increased the number of rural dwellings electrified each year as well as the coverage of the electricity system (figure 3). It has achieved the best results in the regions that started with the lowest coverage and that have the largest rural populations (see figures 2 and 4).

Investment

The state has contributed the most funding to the program, investing US\$112 million in rural electrification in 1995–99, something less than what was estimated at the beginning of the program. That has meant more than doubling its average investment over the previous years. As the private sector has increased its investment in rural electrification, however, the state's share has declined—from 70 percent in 1992 to 61

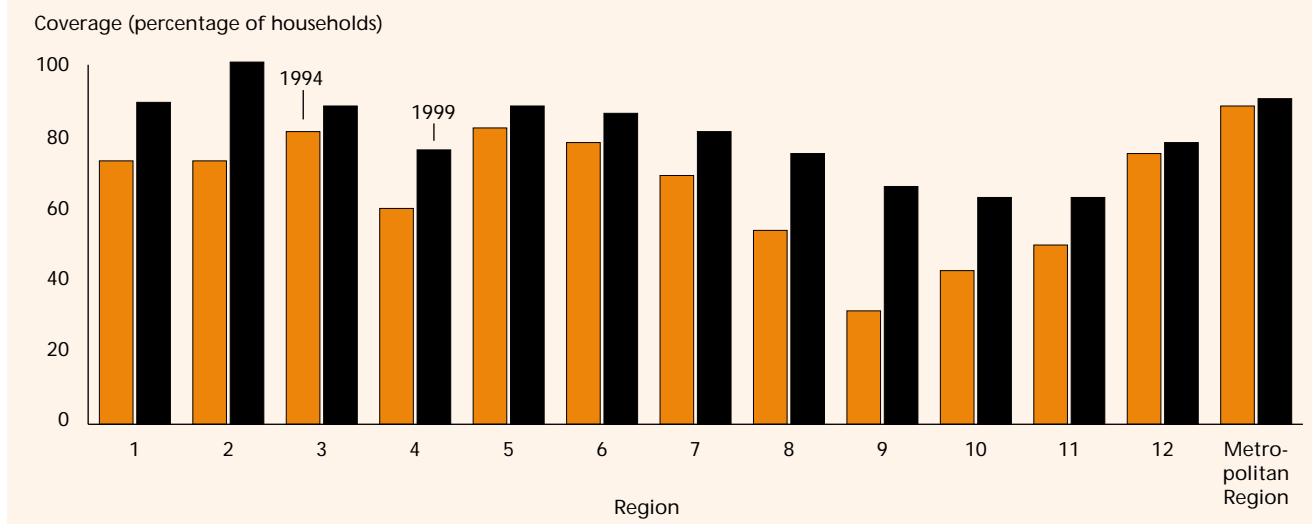
Figure 3 Rural dwellings obtaining electricity and rural electricity coverage in Chile, 1992–99



Note: Data for 1999 are estimates.
Source: Chile, National Energy Commission 1999a.

Figure 4

Increase in rural electricity coverage under the rural electrification program in Chile



Note: Data for 1999 are as of September.
Source: Chile, National Energy Commission 1999a.

percent in 1999 (*Diario El Mercurio* 2000). Private investment in the program so far has totaled US\$60 million.

Performance of participants

Users have participated in identifying and defining the projects—helping to establish the needs and priorities in each region—and in financing the investments. Companies have helped define the projects, invested resources, and undertaken the commercial risk, and continue to own and manage the installations. The most successful companies have created or strengthened special units for rural electrification.

Regional governments have managed the program well. They have promoted the program among communities, provided basic assistance in preparing the projects, decided which would be implemented, and allocated resources accordingly. They have also coordinated and monitored the implementation of the projects. Some regions—mainly those with the greatest needs and those in which rural electrification is more politically sensitive—have created special units for rural electrification, in some cases based on their experience in the field. Essential in involving regional authorities is the fact that success in the program has become a key political achievement.

The central government, primarily through the CNE as the program’s coordinator, has ensured proper design and implementation of projects, clear rules (for example, for allocating funds), well-defined responsibilities, and incentives to promote efficient decisions—all essential for success.

Use of alternative technologies

Most of the projects have involved extension of the grid, a solution that usually means a lower cost per connected dwelling and a higher quality of service. But several projects have relied on alternative technologies, primarily one-house photovoltaic systems. These systems have been installed in isolated areas in the northern part of the country (for nearly 1,000 dwellings), which has some of the strongest solar radiation in the world. Micro wind, biomass, and hydropower generators have been used too, mainly in the southern part of the country. Wind and biomass technologies have been used in experimental projects and usually with technical assistance from international organizations, given the lack of experience with them in Chile and the need for further research on the availability and sustainability of these energy sources (Chile, National Energy Commission 1999a, 1999b).

The nonconventional technologies generally provide electricity at a higher cost and poorer quality (lower voltage, fewer hours of service). But they have been an attractive alternative where extending the grid is too costly because of the distance from the existing grid or the high dispersion of dwellings. Both these causes have increased the marginal cost of rural electrification in Chile. In 1995 the average state subsidy per dwelling amounted to US\$1,080; in 1999 it reached US\$1,510 (Chile, National Energy Commission 1999b).

This outcome is nevertheless consistent with the program’s goal of maximizing rural electricity coverage within

budget constraints, which mandates first implementing the projects with the highest impact per unit of investment. At the same time, however, it allows a growing role for nonconventional technologies in rural electrification projects, as improvements in these technologies reduce their costs and make them increasingly competitive with conventional solutions.

Given the lack of exclusive distribution rights, companies see rural electrification as a strategic move.

Role of markets

An innovative aspect of the program has been its promotion of rural electrification in a competitive environment dominated by private companies. It has successfully introduced competition at several levels: among communities, for financing for their projects; among distribution companies, for implementation of their projects; and among regions, for the funds provided by the central government.

The participation of private distribution companies has been critical to the program's success. From the companies' perspective, rural electrification is a long-term business and riskier than traditional distribution. Customer payments, even with generally low default rates, are usually small, while operating and maintenance costs are high compared with those for urban distribution. Companies expect consumption to increase gradually, as users realize the potential of electricity for income-generating activities (for example, for water pumps, cooling installations, and processing plants for agricultural, fishing, and forestry products). But given the lack of exclusive distribution rights, companies have seen participation in rural electrification as a strategic move to protect the existing distribution area and discourage entry by competitors.

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