

# **Protection of Energy Efficiency and Public Goods in Electric-Utility Restructuring in Brazil**

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## **ABSTRACT**

Brazil has initiated a rapid program of electric utility privatization and deregulation. This has led to the loss of sponsorship for the public-interest programs formerly undertaken by the state utilities. In particular, of significant concern are the programs for promotion of energy efficiency, renewable energy technologies, and environmental protection. The newly formed National Agency for Electrical Energy still has not defined its position and role in these important matters. We describe a project undertaken by the authors in Brazil to bring non government organizations, utility officials, academics, and the media into the debate for public-interest advocacy in support of these public-interest programs. In particular, our efforts have focused on the privatization efforts for the Manaus region, in the heart of the Amazonas, where power system expansion has had large adverse environmental consequences in the past. Under these projects, we held two workshops in Brazil, in the cities of Campinas and Manaus. They catalyzed new communication channels among various stakeholders and hold the possibility of generating some sustained public-interest advocacy efforts in the near future for energy efficiency, renewable technologies and environmental protection.

## **Introduction**

Brazil is implementing significant changes in the management and decision-making of its electricity sector by transferring the ownership of its utilities from the public sector (State and Federal government) to private entrepreneurs. As these changes are implemented, we can expect that the public interest tasks undertaken by this industry in the past will also change. The challenge is whether and if so, how the new institutional arrangement will address and incorporate important public interest tasks such as environmental protection and energy efficiency.

This paper describes a current project to help build up local public-interest advocacy and educate consumers about alternative ways to supply energy services. This effort seeks to strengthen public advocacy for protection of public goods in Brazilian Amazonas, through transfer of knowledge about relevant aspects of the US politics of deregulation to media and decision-makers in Amazonas, Brazilian NGOs, academics, and energy utilities. While such advocacy has figured prominently in deregulation in the United States, it is virtually absent in Brazil.

We have chosen the Manaus area because it has severe energy problems and at the same time has a modern energy-dependent infra-structure. It is located in an environmentally fragile region, but has a potential for introducing energy efficiency measures as it has been analyzed previously (Gadgil et al. 1996). We describe the results to date and plans for future activity. Further, we briefly discuss the institutional,

political, and energy trends that have triggered restructuring in Brazil. We then survey the new regulatory context of the electric industry, and examine opportunities for promoting energy efficiency in the restructured system.

## **Stating the Problem**

Unlike the much longer tradition in North America (Nadel & Geller 1996), customers in Brazil only very recently were exposed to other practices of supplying energy services through energy efficiency programs, and are seldom aware of the environmental problems caused by the expansion of conventional electricity supply. The current institutional structure also does not ensure that the new private entrepreneurs in charge of electricity production and distribution services will undertake activities to promote energy efficiency and introduce renewables. Re-structuring towards a less regulated and more market-based environment has strengthened the tendency towards less investments in energy efficiency and use of renewable energy (Shioshansi 1995; Surrey 1996). Recently, Hagler Bailly (1997) reviewed the promotion of energy efficiency in five non-US countries which were undergoing such reforms in electricity markets. They observe that in each of the five countries, energy efficiency suffered a setback as a result of the reform, and that only in the U.S. has the reform process explicitly included provisions to protect public goods such as energy efficiency, renewables and the environment. The issue of market barriers to energy efficiency (Golove & Eto 1996; Howarth & Anderson 1993) is well debated in the literature and experience in the U.S. has shown the importance of public pressure in directing efforts to better explore the potential of energy efficiency and promote environmental protection. Gormley (1986) for example, discusses the effects of public hearings on a variety of environmental policy issues ranging from air and water pollution to the siting of power plants. He notes that when either citizen or staff opposition surfaces during public hearings, commissions are less likely to grant permit requests. He also discusses how organized citizen groups are much more likely to affect the process than individual citizens. Caldwell (1976) provides an overview of the role that citizens play in forcing environmental protection onto the political agenda, and the importance of information access and open channels for participation. An essay written by the non-government organization "Energy Foundation" (1996), discusses changes in regulation of the electric utility industry in the United States, emphasizing the importance of public interest advocacy.

While utility structure and ownership are important, they do not fundamentally determine the success of Demand Side Management (DSM) efforts. It has been shown (Boyle 1996) that when adequate policy and economic incentives to the utility and other actors are present, DSM can occur under many diverse circumstances. A recent study (Gouvello, Jannuzzi & Cauret 1998) compared the development of DSM efforts in the public-dominated electrical systems of France and Brazil, and showed that the relatively better performance of the energy conservation efforts in Brazil can be credited to the experience of ELETROBRAS in coordinating multi-actor initiatives which are necessary for implementing energy efficiency. For these two countries it was also shown that energy efficiency efforts received attention much later and played only a marginal role than in other countries. This also happens when the model of supply-side optimization (nuclear in France and hydroelectric in Brazil) together with public macro-economic policies showed signs of exhaustion.

Many of the conditions that favored the expansion of a capital intensive, centralized hydroelectric system in Brazil no longer exist: there is shortage of investment capital, the sector has a large debt and the argument of economies of scale has become irrelevant due to the new generation technologies. Electric-

industry restructuring has been occurring at a rapid pace in recent years in Brazil, as utilities seek to finance new capacity to meet steeply increasing demand. Electric companies are selling their generation and distribution assets in exchange for capital and technical assistance for further expansion. In the present context, re-structuring of the electricity sector means essentially a privatization process, where the public utilities sell their assets and market to private investors. It is expected that utilities will be able to make new investments and expand services, while maintaining profitability. In the case of Brazil this privatization process started even before promulgation of a set of rules that provided a regulatory landmark to the future investors<sup>1</sup>.

We are concerned that the re-structuring process comes at a time when the experience with energy efficiency is in its infancy and the public debate is non-existent, or poorly informed about the complex issues surrounding energy matters, re-structuring and privatization.

## Electricity Supply and Demand in Brazil

Installed electric capacity in Brazil now stands at slightly more than 60 GW. Overall electric consumption has been growing at a rate of about 4-5% annually. The installation of new generation capacity has been lagging behind this growing demand. Shortages have therefore become common throughout the country and particularly in the city of Manaus, the capital of the state of Amazonas and home to 1.2 million residents.

Hydroelectricity has always been an important energy source in the country. In 1960 about 72% of the country's capacity came from hydro sources, and peaked in 1995 at 87%. However, the trend is reversing towards more fossil-fueled production as can be seen from Table 1, which show the official projections up to year 2015.

**Table 1.** Evolution of the country's total capacity and shares of hydroelectricity

| Year | Total capacity (GW)  | Hydro electricity (as % total) |
|------|----------------------|--------------------------------|
| 1960 | 4                    | 72                             |
| 1970 | 10                   | 80                             |
| 1980 | 30                   | 83                             |
| 1990 | 50                   | 86                             |
| 1995 | 59                   | 87                             |
| 2005 | 85-105 <sup>a</sup>  | 80-85                          |
| 2010 | 130-175 <sup>a</sup> | 80-85                          |

Sources: MME 1996. ELETROBRAS 1994. Notes: (a) refers to different scenario assumptions.

Table 2 summarizes trends in electricity supply and demand in Brazil.

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<sup>1</sup> Several countries in Latin America are also undergoing the process of privatization. All these countries have a much smaller electrical system and fewer technical complexities. The experiences in Chile and Argentina regarding energy efficiency have shown a significant decrease in interest in energy conservation investments by the utilities (Bouyle 1996).

**Table 2.** Trends in supply and demand for electricity in Brazil

|  | 1990  | 1995  | 1996  | Avg. yearly growth rate 1990-96 (%) |
|--|-------|-------|-------|-------------------------------------|
| <b>Electricity Supply (TWh)</b>                  |       |       |       |                                     |
| TOTAL  | 249.4 | 311.0 | 326.4 | 4.5                                 |
| Coal   | 2.8   | 3.9   | 4.3   | 7.1                                 |
| Oil  | 5.3   | 7.5   | 8.9   | 8.6                                 |
| Natural gas                                      | 0.7   | 0.6   | 0.7   | 0                                   |
| Nuclear  | 2.2   | 2.5   | 2.4   | 1.4                                 |
| Hydroelectric                                    | 206.7 | 253.9 | 265.8 | 4.2                                 |
| Captive power plants                             | 5.1   | 7.2   | 7.7   | 6.9                                 |
| Imported Electricity                             | 26.5  | 35.4  | 36.6  | 5.4                                 |
| <b>Electricity Demand ( % share of overall )</b> |       |       |       |                                     |
| Industrial                                       | 52    | 48    | 47    |                                     |
| Residential                                      | 22    | 24    | 25    |                                     |
| Commercial                                       | 11    | 12    | 13    |                                     |
| Energy Sector                                    | 3     | 3     | 3     |                                     |
| Other  | 12    | 13    | 13    |                                     |

Source: Ministry of Mines and Energy of Brazil, June 1997.

## The Brazilian Electric Industry

ELETROBRAS, a government-controlled holding company, is responsible for planning, financing, and administering the operation and expansion of electric supply (including generation, transmission, and distribution). ELETROBRAS controls four large regional utilities (Eletronorte, Chesf, Furnas, and Eletrosul) which, in turn, handle transmission and generation. ELETROBRAS also holds 50% of the Itaipu hydroelectric station, whose ownership is shared with Paraguay, and at 12 GW of installed capacity, is the largest operating power plant in the world. Facilities owned by ELETROBRAS and its subsidiaries generate about 60% of the nation's electric supply; most of the remaining 40% is produced by utility companies controlled by state and municipal governments. All of Brazil's states have at least one utility company, usually state-owned, that handles distribution, but this picture is changing quickly with privatization.

## PROCEL

ELETROBRAS also administers the activity of PROCEL, Brazil's national electricity conservation program. Established in 1985 by the Ministry of Mines and Energy and the Ministry of Commerce, PROCEL directs its work toward eliminating energy waste on both the supply and the demand side. PROCEL runs projects in a number of areas — including testing and labeling of appliances and motors, financing audits and retrofits, metering, and rebates. PROCEL assists regional utilities in demand-side management.

A comprehensive project review and impact analysis estimated that PROCEL can take credit for about 790 GWh of annual electricity savings due to actions in 1996 alone and about 2,360 GWh of annual

electricity savings as of 1996 based on cumulative actions. The latter is equivalent to about 0.9% of total annual electricity consumption as of 1996. Considering cumulative actions, about 43% of the savings come from more efficient refrigerators and freezers, 22% from lighting efficiency improvements, 15% from audits, sectoral studies and seminars, and industrial awards, 11% from installation of meters, 7% from motors projects and 1% from education programs (Geller et al., 1997). The 2,360 GWh per annum of energy savings produced by PROCEL as of 1996 is equivalent to the power typically supplied by about 565 MW of hydro capacity in Brazil. Assuming an average marginal cost of US \$2,000/kW installed (including generation and associated T&D investments), PROCEL has reduced supply-side investment requirements by about US\$1.1 billion.<sup>2</sup>

However, it is still unclear to what extent and in what form PROCEL will continue its activities in the restructured Brazilian system. One possibility is that PROCEL may take on a different role in promoting demand-side management as utilities are privatized, but at the moment it is not clear how these tasks will be defined.

## **Restructuring: Energy, Economic, and Regulatory Context**

National and regional utilities are desperate to install electricity generation sources to meet growing demand, but they have neither indigenous capital nor creditworthiness among international lending institutions. Therefore, utilities are increasingly looking towards private investors from overseas. Electric companies are now proceeding with plans to sell their existing generation, transmission, and/or distribution assets in exchange for capital and technical assistance with further expansion. Since 1995, several utilities have already been privatized in several Brazilian states, and other major utilities are expected to follow by 1998. The Federal government and State governments are trying to accelerate the process in order to capture new financial resources for their economies and to solve enormous debt problems with their electrical utilities.<sup>3</sup>

Landmark regulatory reforms in Brazil support this trend: contracts for new electric installations are now to be open to competitive bidding, pending concessions are being canceled and re-tendered for competitive bids, independent power producers are being introduced, and large electricity customers will soon have access to a competitive market for power.

In late December 1996 the Brazilian Congress passed a law creating the Agência Nacional de Energia Elétrica (ANEEL). Until then all the utilities being privatized were regulated only by the terms of

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<sup>2</sup> PROCEL has also undertaken some projects to increase power generation at some hydro plants. The results of these supply-side actions are not included here.

<sup>3</sup> For example, the Energy Company of São Paulo, responsible for 84% of electricity supply in the State of São Paulo, has a total debt of more than US\$ 12 billion as of 1997.

the contract at the time of the sale of assets by the public utility<sup>4</sup>. This new agency has been entrusted with regulatory oversight of the restructured Brazilian electric industry. As ANEEL begins to organize itself, it is not clear how it will operate in the several states of the country — it is likely that state regulatory sub-agencies will emerge as more practical entities to regulate the activities of utilities operating in their respective regions. Apparently the present structure of the National Agency is undergoing some revision, since ANEEL to date has not been able to respond efficiently to customer demands.

A good example to illustrate the current stage of the regulatory “learning process” is a case from January/February 1998, when customers in Rio de Janeiro suffered severe, long-lasting, and abnormally frequent power interruptions. Only after strong public protests were echoed and magnified nationally by the press did ANEEL step forward to verify the causes of the blackouts and the responsibility of the two privatized companies in that State<sup>5</sup>. ANEEL imposed a heavy fine on one of the utilities, but wanted to keep confidential the historical records of “coefficients of performance” of those utilities. However, as a result of the continuous pressure of customers and the media, ANEEL back-tracked and finally disclosed these records to the public.

### **Tides Center Project on Building Public-Interest Advocacy in Amazonas**

Energy efficiency will require a concerted public-interest advocacy effort if it is to thrive in the restructured Brazilian utility market. Unfortunately, the electricity planning process in Brazil offers little room for public input. Moreover, non-governmental advocacy efforts are beset with lack of technical training and political sophistication. Seeking to address this problem, the authors have initiated a project conducted through the Tides Center, under the support of the W. Alton Jones Foundation, to promote public advocacy and media coverage of issues related to protection of key public goods during the electric-industry re-structuring and privatization, particularly in the Brazilian state of Amazonas.

The first major endeavor of this project, a workshop at the State University of Campinas (UNICAMP), took place in August 1997. Project Co-Director Gilberto de Martino Jannuzzi, Head of the Energy Studies Program at UNICAMP at that time, organized the workshop and moderated the discussions. This event attracted more than seventy participants from numerous regions of Brazil, including prominent journalists, NGO representatives, and academic figures from the state of Amazonas, as well as officials from PROCEL, ELECTROBRAS, and regional electric utilities. Both the US-based authors of this paper participated in the workshop as key resource persons (Chao 1997).

The Tides Center project followed the Campinas meeting with a two-day seminar in Manaus, the capital of Amazonas in January 1998. The purpose of this event was to draw the attention of local media and the general public to issues of utility restructuring and options for expansion of electric services in the

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<sup>4</sup> With respect to energy efficiency, the only relevant provisions included so far among the contracts with privatized utilities are clauses requiring a certain percentage of their annual revenues to be invested in energy conservation efforts. The latest versions of these contracts have given real strength to these conditions. The São Paulo Light and Power Co. contract signed in 1997 stated that 1% of annual net revenues need to be invested in energy conservation measures, and that 25% of this amount has to be spent in end-use measures. Moreover, the company has to submit a global plan with physical targets and a planned budget by September 30th each year.

<sup>5</sup> The city of Rio de Janeiro is served by one utility (Light) and the rest of the State by other utility (CERJ).

state. In particular, the meeting was intended to raise public awareness of strategies involving energy efficiency and renewable energy, which might minimize environmental damage and other social costs of electricity generation. This meeting was co-organized by the Fundação Djalma Batista (a Manaus-based non governmental organization), the University of Amazonas, and the University of Campinas, under the overall coordination of the authors. Local media were present and active at the workshop. Newspaper coverage was extensive. In addition, at least three local television stations covered the event. The workshop attracted participants from a wide variety of federal agencies (including ANEEL), universities, media organizations, utilities, and private-sector companies.

The Manaus workshop had a second important outcome, besides the extensive media coverage: it catalyzed the creation of new communication channels among various stakeholders, including university researchers, utility representatives, and the media - none of whom seemed aware of what the others were doing. It allowed ANEEL to publicize its role and its plans for regional oversight at the state level, and to receive local responses in turn. The conference also created a forum in which University of Amazonas researchers could share information on their research, especially in technology and economics of biomass and hybrid photovoltaic systems.

At the end of the Manaus workshop, a group of participants composed a list of important points to be brought to the State government and to be published in the media. These points summarized the main discussions conducted during the seminar and included, among other items:

- the need to produce periodic published State energy balances;
- the need to create a local regulatory agency, closer to regional problems;
- greater support for activities involving energy efficiency, especially in the areas of building codes, air conditioning and refrigeration;
- greater use of renewables in the region; and
- identification of funding sources to develop projects in the areas of energy technology and planning suitable to the Amazon region.

Since 1997, Manaus has been suffering from acute electrical energy shortages, with daily interruptions of 3-4 hours in several parts of the city. The population is already very sensitive to this energy problem. During 1997 a short-term solution was proposed with an international contract with 2 independent power producers from the U.S.- CMI Power and El Paso, which should add a total of 150 MW of new capacity to meet the city's needs. Unfortunately, as of March 1998, these producers could not supply adequately to the city and are still facing technical difficulties.

The Tides Center project has the potential to help to broaden the discussion over different supply options, and to publicize other ways to meet city energy needs besides the independent power producers. The workshop helped to demonstrate that the independent power producers represented short term solutions and it was necessary to investigate other options available to the city, including the use of renewables and energy efficiency.

In summary, the Tides Center project had a short term effect in getting public attention in the media. The long term impacts are expected to occur as a result of the active work from the utility officers, research activities of academics and projects from NGOs. The Tides project helped to catalyze a more active interaction between the key local actors.

## Future Steps

The project team is working with the Fundacao Djalma Batista in order to have a new series of workshops throughout the next two years. In addition, the University of Campinas is maintaining a training program available to lecturers from the Technology Faculty of the University of Amazonas. Currently three lecturers are conducting Ph.D. degrees and developing research for dissertations on themes related to the improvement of the energy situation of Amazonas. One of the projects is investigating the potential for demand-side management in a Amazonian village of 400 households supplied with a 50 kW fossil-solar hybrid plant, located 200 km from Manaus, along the Solimoes river.

## Conclusion

As the literature has demonstrated (Caldwell 1976; Gormley 1986; Energy Foundation 1996), we are convinced that as a response to the privatization of the energy sector, consumers must take a more active advocacy role with regard to complex issues at the technical and political levels of energy and environmental issues. The public authorities in charge of restructuring the energy sector are now focusing on large bureaucratic regulatory issues, and so far have not been able to protect public goods effectively unless the public is alert and well-informed. A better educated public will be able to demand from competent authorities, actions to protect public benefits and commonly held values. We have taken some useful first steps to awaken the interest of stakeholders in protecting public goods. Sustained and more vigorous efforts will be needed to intensify the public debate on how to protect public goods during Brazil's electricity restructuring. Public pressure resulting from such debate may be the best insurance against bureaucratic neglect of this important matter.

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