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Toward Cleaner, Cheaper Power *Streamlined Licensing of Hydroelectric Projects in Brazil*

Brazil is confronted with steadily increasing demands for electricity. The country has the ability to meet that demand by developing its considerable hydropower potential, but the regulatory process that governs the approval of new hydroelectric plants imposes unnecessary delays that push up project costs and increase uncertainty. The process, among other reasons, has created a shortage of investment in otherwise viable hydropower projects in favor of less efficient and more harmful technologies.

Brazil's electricity sector serves roughly sixty million residential and commercial customers and generates revenues of US\$20 billion. With demand growing at a rate of 4.4 percent annually, an additional 3,000 megawatts of generating power will be needed by 2015. The cost of the new power plants needed to provide that power is estimated at US\$40 billion. Presently, five-sixths of the country's power needs are met by hydroelectric plants, though in recent years only *half* of the new plants receiving licenses to begin construction have been hydroelectric. The other half of the licenses have been issued for coal, diesel, and nuclear plants that provide electricity at higher unit costs than hydroelectric plants and have greater adverse effects on people and the environment. The seeming anomaly can be explained by the fact that the licensing process for thermal plants is simpler and more predictable than that for hydroelectric plants.

Escaping this predicament will depend on the country's ability to devise a modern, predictable,

and transparent process for licensing and regulating hydroelectric generation projects that will not discourage the investment needed to satisfy future demand in a sustainable way. The history of Brazil's energy industry casts long shadows over its ability to keep up with demand. For years the industry was controlled by the government; when its financial capacity collapsed in the late 1990s the era of public and private partnership began. Much of the current legal, regulatory, technical, and institutional framework was put in place at that time—and in a rather ad hoc fashion. Fortunately, some relatively simple changes in this structure can bring a more unified, holistic approach to this critical energy sector, in which Brazil has such great potential. Other pieces of the puzzle will require more ambitious reforms.

Costs of the licensing process

The costs of obtaining a license for a new hydroelectric plant in Brazil are such that projects must promise an annual return on investment of 15 percent, almost double the breakeven rate in well-regulated countries such as Chile. What makes profitability so elusive in Brazil are the substantial social costs assessed as part of the licensing process, as well as the uncertainty and opportunity costs associated with the regulatory regime. The excessive costs cannot be imputed to environmental mitigation, as the environmental costs of hydroelectric plants are much lower in Brazil than in many countries.

This note highlights important information from "Environmental Licensing of Hydroelectric Projects in Brazil: A Contribution to the Debate," Volume 1, World Bank Report 40995-BR, March 28, 2008. Readers may download the complete paper from www.worldbank.org/water.

Table 1. Environmental licensing costs as a share of total costs of hydroelectric generating projects

Cost	US\$ per installed kilowatt	Share of total (percent)
Direct costs	133	14.1–14.7
Social	94	10.0–10.4
Environmental	19	2.0–2.1
Regulatory uncertainty	20	2.1–2.2
Indirect (opportunity) cost	10–50	1.1–5.4
Total costs of environmental licensing	143–183	15.2–20.1
Total project costs	906–946	100

Note: The total cost per installed kilowatt provided by Eletrobrás is US\$876. This excludes the regulatory uncertainty and opportunity costs shown here, which do not directly affect plant construction costs.

Almost three-quarters of the direct costs of the licensing process stem from the various social contributions that developers must make in exchange for their license (table 1). Those contributions fund road and school construction and the distribution of goods to the poor. Whether such costs should be borne by developers alone is a political matter that deserves careful scrutiny. Government could help make hydroelectric projects more attractive to investors by sharing the burden of social-improvement activities tied to the projects, justifying the cost-sharing on the grounds that successful projects benefit everyone.

The direct costs paid by developers during the licensing process make hydroelectric projects less economically viable, but the indirect costs of delaying, postponing, or rejecting the projects are borne by the country as a whole. Since demand for electricity is ever-increasing, the lengthy timeline for licensing such projects means that less-desirable alternatives must fill the gap to stave off shortages. Plants that burn diesel or coal, though generally less expensive to build, are more expensive to operate, resulting in electricity costs that are roughly 10 percent higher than with hydroelectric plants. In addition, the environmental damage associated with coal, diesel, and nuclear generation is much greater than with hydroelectric generation, and the total long-term costs are difficult to accurately assess. A significant increase in the efficiency of the hydroelectric licensing process would quickly reduce reliance on these more problematic sources of electricity.

Legal and regulatory issues

Other aspects of the licensing process are more susceptible to quick change than are the social costs just reviewed.

The legal framework surrounding Brazil's hydroelectric power industry has remained largely unchanged since the 1980s. One of the biggest problems is jurisdictional overlap and lack of coordination between the states and the federal government. Investors often are unsure which level has jurisdiction in a given situation, and state and federal requirements sometimes conflict. Clarifying jurisdictional responsibilities at every step would greatly improve the licensing process and along with the adoption of alternative dispute resolution mechanism to avoid protracted court battles.

Public prosecutors in Brazil have the authority to intervene in any stage of the process, introducing yet another level of uncertainty. Although the public prosecutors have qualified staffs, ample resources, and a mandate to ensure favorable social outcomes, they have tended to act in an adversarial rather than a problem-solving manner. Too often, disputes land in the courts, stalling projects and raising doubts about whether they will emerge intact from the legal proceedings.

If Brazil's prosecutors and its environmental and energy agencies were to cooperate to establish explicit guidelines for hydroelectric projects, problems would be less likely to arise, as developers would

understand upfront what they must do to meet social goals. The creation of an overarching body to handle disputes, one comprising experts from all relevant sectors, would also help to ensure that the interests of all stakeholders were further protected.

The structure of the licensing process itself could benefit from revision. Brazil stands alone among nations in having a three-stage process, each with separate requirements. During the project planning stage, an environmental impact assessment must be submitted before a preliminary license is issued. In the second stage, as a condition for receiving a second license to begin construction, developers must submit an environmental impact report that encompasses the engineering aspects of the project and its ramifications for the local population. In the third stage, once all conditions for the project are met, an operating license is granted.

In a multi-stage process, disputes can and do occur repeatedly, and the initial conditions under which a project is undertaken often change—sometimes dramatically. What is needed is a more coherent approach in which all project conditions are specified at the outset and government agencies work closely with developers to resolve disputes as they arise.

Technical and institutional issues

One of the biggest challenges in preparing the environmental impact assessment and report is that the terms of reference that governments issue to guide project proposals tend to be overly general and not site-specific. When factors that might affect the decision to issue or refuse a particular license are omitted from the terms of reference, they tend not to be addressed in the environmental impact assessment and report. Delays ensue when the licensing body must then request the missing information. This situation could be avoided by developing site- and region-specific terms of reference, with each of the agencies involved in the licensing process specifying in detail what it will require to approve the project. Notwithstanding, the quality of reports prepared by developers is generally very poor.

Baseline information for environmental impact assessments and reports should be provided by

state and federal government experts, not only to reduce the cost to industry of preparing the reports, but also to increase confidence in their conclusions. Ideally, the government should take a systematic inventory of the biological and physical environment of the country. Given the current lack of information, officials tend to be suspicious of information provided by developers and apply the “precautionary principle” of rejecting projects where the benefits seem even remotely questionable. That the legal system holds officials personally liable for the negative consequences of their decisions encourages excessive caution; changing this law to absolve individual bureaucrats of legal responsibility, except in cases of gross malfeasance, would mitigate this tendency.

Better communication between governing bodies would further improve the licensing process. It is understandable that different agencies should focus on different aspects of a particular project, yet a more holistic approach would enable potential developers to fine-tune their projects from the start. The establishment of independent consultative panels with multi-sectoral expertise could provide much-needed guidance for developers, expertise that should be codified in an operations manual to assist both developers and officials. Building the capacity of agency staff is needed where agencies are understaffed and lack qualified specialists to review proposals in a timely manner. The paucity of explicit decision-making criteria, already mentioned, compounds the effect of capacity shortages and increases the likelihood of subjective, unpredictable agency findings that raise project costs and cause delays.

Perhaps a significant improvement would come from creating a governing council that engaged all levels of government and the various agencies and sectors involved in the planning and approval process. Such a body would provide a unifying presence that would inevitably lead to greater understanding and awareness of the multiple needs that projects must address and greater certainty in the likely outcome of the licensing process. A governing council would also be able to remove potential obstacles from the beginning and serve as a forum for the resolution of problems that might occur along the way. What is needed is a new spirit of cooperation, not only between the public and private sectors, but—importantly—within the public sphere.

Statistics, scenarios and hypotheses

Basic relevant statistics

1. The average total time for a UHE to go on line in Brazil, considering the sample employed, is 6.5 years, albeit with high variances. This average is approximately 30% longer than those incurred in the USA.
2. Issuing a Preliminary License (PL) takes 2.5 years on average, with 1.1 years (44%) spent on preparation of the TOR by IBAMA. Developers take an average of only 6 months to submit an EIA/RIMA.
3. Issuing an Installation License (IL) (including the time required to issue the PL) takes 3.4 years.
4. According to ANEEL (the energy regulatory agency), of the 66 hydro plants of the portfolio examined, only 27 have exceeded the dates planned for their contracted start-up.

Scenarios and hypotheses for delays

1. We have assumed that all delays beyond the contract end-date were due to delays in environmental licensing, which clearly overestimates the opportunity costs of such delays.
2. Only 8 units remained delayed at the time data collection was finalized for this study. Two possibilities are considered for the start-up dates: (i) using the past average of 78 months; or (ii) devising scenarios for these data beginning in September 2007 and splitting them into consecutive 6-month periods (March 2008, September 2008, etc.).
3. Since some power units have started operations earlier than foreseen, we again adopted two alternatives: ignoring the schemes completed ahead of schedule (adiantamentos)—(which provide for an 11.8-month average delay per plant), or compensating the latter with the delays incurred by the others (thereby reducing total delays by 25%).
4. Another hypothesis in the analysis (of a static type) was to ignore (or not) grossly delayed plants such as Cubatão and Monjolinho. These alone were responsible for 22.5% of total delays. By excluding these two units, the average delay was reduced from 11.8 to 9.2 months.

Scenarios and hypotheses for the marginal costs of alternative energy

1. Two different approaches for assessing the substituted energy cost were adopted: the first hypothesis is that the 'substitute' plants would also be hydropower plants. In the second hypothesis, we assumed that substitute energy would be provided by 'thermal' plants. In the first case, the change in total costs per MW of installed capacity was estimated by using a multiple linear regression based on the size of the plant and on temporal values. For thermal alternative energy the difference in unitary prices between thermal and hydropower energy was assumed to be that used in the 2005 auction (19.8%) and we applied it to all the units in our data base.

Total opportunity costs of licensing delays

These costs depend on three elements: the monthly opportunity cost of a delayed hydropower plant, the type of substitute source, and a composite factor reflecting both the cost increase over time (temporal value) and the number of months by each unit was delayed. The first was a three-factor product: the cost of installed capital per kW for the delayed plant, its size, and a monthly capital remuneration factor (assumed to be 1% per month).

Assuming that the other plants substituted for the plants delayed by licensing problems, and assuming that the 'before schedule' units were ignored, we obtained an estimated total opportunity cost for delays of 6.6% of the installed capacity costs. Other hypotheses could, if taken into account, reduce this percentage to a mere 1.0%.

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