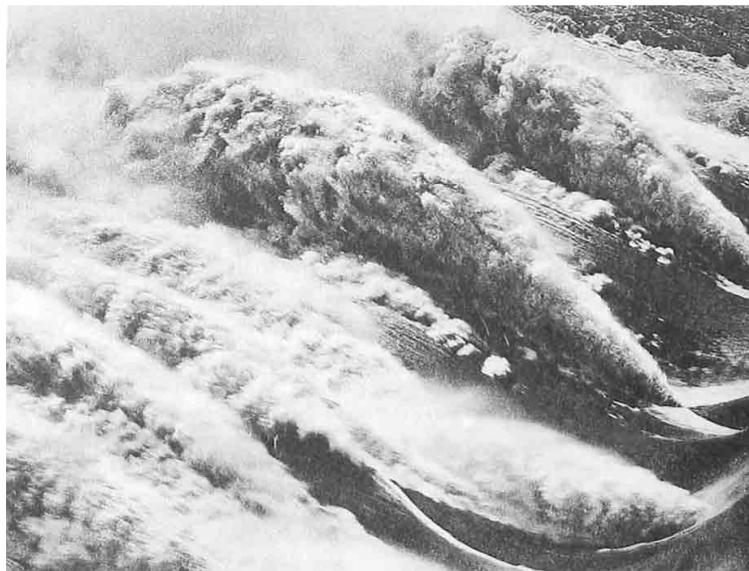




## Brazil's difficulties in making decisions **Blackout in Energy Policy**

Norman Gall



Blackout in Energy Policy	03
Solutions Instead of More Confusion?	19
Brazil can do better	17



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# BRAUDEL PAPERS

## 03 Blackout in Energy Policy (Norman Gall)

*"We were lucky. The rains came. Thanks to heavy rainfall in early 2002, Brazil danced away from electricity shortages that last..."*

04 Dancing Away

04 Harvesting the Streams

06 The Unnecessary Crisis

07 What Have We Learned?

09 In State Hands

16 Living with Instability

17 A False and Needless Dispute

## 19 Solutions Instead of More Confusion? (Peter Greiner)

*"I. Stalling a fairly well conceived reform strategy Brazil's electricity sector reform began in 1995 without a clear market model..."*

## 22 Brazil can do better

*"Here are some ideas for discussion on how to strengthen public institutions for achieving more security of electricity supplies..."*

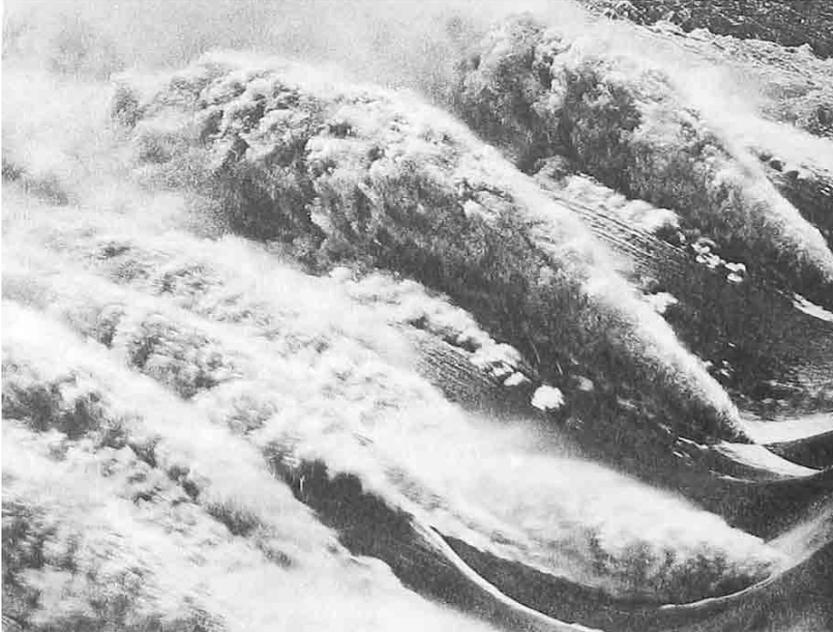
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# Brazil's difficulties in making decisions

## Blackout in Energy Policy

Norman Gall



We were lucky. The rains came. Thanks to heavy rainfall in early 2002, Brazil danced away from electricity shortages that last year threatened blackouts and forced rationing of 20% of what was then considered normal consumption. Effective rationing, managed by the government and supported by the population, revealed consumption economies that heightened the impact of abundant new rains. The rains suddenly flowed into Brazil's reservoirs, feeding one of the world's largest hydropower systems, to raise water from levels of acute scarcity (18% of capacity in dams supplying the populous Southeast) to an average approaching 70%. In the drier Northeast, reservoir levels had fallen to only five percent.

Technicians now talk of an electricity surplus over the next few years instead of the chronic shortages that were feared only a few months ago. But they also say that faster economic growth and/or more years of low rainfall after 2003 would throw Brazil back into the desperation and confusion over failing

electricity supplies that led to rationing in 2001. The government's Committee for Revitalization of the Electricity Sector warned, as rationing ended earlier this year, that "a mistaken forecast of future abundance could lead to an overuse of reservoirs and a deterrent for using electricity from thermal plants, leading to a supply crisis in case of another severe drought in the future." Despite heavy downpours in early 2002, rains for the year as a whole remain 20% below long-term historic averages. Based on historic averages, Brazilian energy authorities predict rainfall shortages in 10% of all years on record, producing a worst-case scenario of a 20% shortfall between supply and demand. However, recent irregularities in global rainfall patterns have increased the uncertainty of even these predictions.

Last year's energy rationing is a painful reminder of how Brazil, in energy policy as in other areas, is suffering as a result of having failed to strengthen sufficiently its institutions, in this case those that manage and regulate the electricity system. This problem is not new. Because of disputes over electricity tariffs and the resulting failure to invest in new generating capacity, the drought of 1952-54 continued to cause power shortages for the next decade. In the course of the 20th Century, electricity was woven into the fabric of modern life throughout the world and came to be regarded, along with air, water and food, as one of the pillars of human survival. The civilizational pillar of electricity began to totter during the surges of chronic inflation in the late 1980s and early 1990s. State power companies collapsed financially under the burdens of swelling demand at low real prices, compounded by political

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interference that undermined their investment and operational capacity. While the spread of electricity contributed spectacularly to its economic development, Brazil would have grown faster, with more stability, without recurrent uncertainties of power supplies.

### Dancing Away

Brazil danced away from electricity rationing in 2001 into the electoral season of 2002, after which in 2003 newly elected politicians will face problems not solved by their predecessors. The main goals of President Fernando Henrique Cardoso (1995-2003) were to (1) end chronic inflation; (2) achieve fiscal balance, and (3) get Congress to amend the 1988 Constitution to permit his reelection for a second four-year term in 1998.

These achievements created a climate of political and price stability unseen in Brazil for decades, with big gains in living standards. However, each measure needed to stabilize public finances and open the economy to the outside world needed support from a volatile coalition in Congress, whose members demanded and obtained power over key ministries and state companies, including those governing the electricity sector. State electricity companies were privatized, despite resistance from bureaucracies and politicians, in return for federal restructuring of state debts that was managed by the National Bank for Economic and Social Development (BNDES).

Political resistance was revived in the confusion over recent power shortages. Privatization of electricity supply and distribution has been stalled for the past three years. Many unresolved issues plague this vast system of 64 distribution firms (44 of them now in private hands), 20 transmission companies and 15 generating corporations, all linked together by a transmission grid of continental proportions, dependent on rainfall to sustain fast-growing consumption. Privatized distribution companies now cover 65% of the Brazilian market, but 80% of generating capacity is owned by the

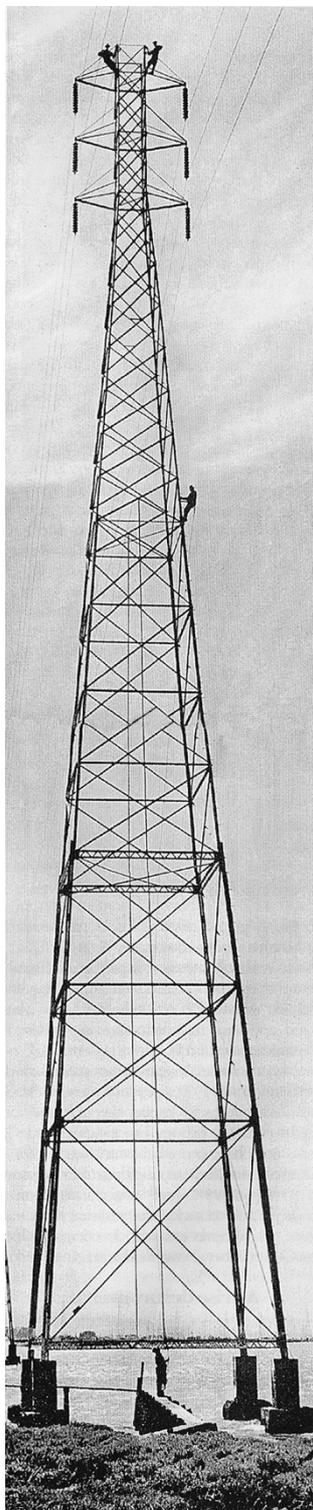
State. Gas supplies, needed by private investors for rapid expansion of thermal generation, are in the hands of a state monopoly, Petrobrás, which for many years was reluctant to develop and market this new energy source. The basic issue raised by this essay is: How to establish a legal and political framework with enough credibility to mobilize investment for meeting Brazil's electricity needs in coming decades?

### Harvesting the Streams

Brazil is a lucky country because of its three great river basins, the Paraná, the São Francisco and the Amazon. In the second half of the 20th Century, big rivers were dammed at many of their numerous waterfalls to flow through giant turbines, transforming Brazil's economy and society with cheap and abundant electricity transmitted from dams to distant cities. These hydropower stations were audacious undertakings of a backward nation, the largest and most complex projects in Brazil's history, enabling it to quickly harvest technological progress that gathered speed around the world over the previous century.

The ancient Greeks and Romans could convert the power of streams into the rotary motion of stones to mill grain. The use of rivers as a source of energy spread widely in medieval Europe not only for milling grain, but also for sawing wood and making cloth, iron, paper, silk, copper pots and weapons. Towns and cities grew around these industries and markets. But mobilizing the power of rivers on a truly massive scale had to await more recent discoveries and inventions.

The critical advance was the discovery in 1831 by Michael Faraday that moving a conducting circuit in the presence of a magnet can create an electric current. Before and after Faraday's discovery came independent explorations by hundreds of men, almost none of them scientific professionals in today's sense. After one of the most celebrated of these early experiments, attracting lightning to a key hung from a kite in a storm, Benjamin Franklin announced in 1751: "That the Electric Fire is a real



Element, and different from those heretofore known and named....” Electricity still was, according to the economic historian David Landes, “a scientific curiosity, a plaything of the laboratory.”

In the decades after Faraday’s discovery, however, cascading inventions led to more advances: the first self-exciting electromagnetic generator; the ring dynamo to generate direct current commercially; alternators and transformers to produce and convert high-voltage alternating current, and advances in making armatures, cables and insulation. Joseph Swan (1828-1914), inventor of the incandescent lamp, recalled:

*The days of my youth extend backwards to the dark ages, for I was born when the rushlight, the tallow dip or solitary blaze of the hearth were the common means of indoor lighting [when] the common people, wanting the inducement of indoor brightness such as we enjoy, went to bed soon after sunset.*

In 1900 Brazil was still in these “dark ages,” consuming almost no commercial energy. Its population was only 18 million, compared with 170 million today. Life expectancy at birth was only 30 years in 1900, against 68 years in 2000. But Brazil already had begun to capitalize on technological advances elsewhere, enabling this vast country, shackled by illiteracy and disease, to become one of the fastest growing economies of the 20th Century.

In 1881, the world’s first public power station was installed in England. As early as 1883 Brazil’s first municipal power plant began operating in the town of Campos in Rio de Janeiro State. A few years later the first hydroelectric plants started up in France and Switzerland with a technology that spread fast. In 1889 Brazil’s first hydropower plant began providing electricity for a textile factory and public lighting in Juiz de Fora, Minas Gerais.

A German importing firm sent salesmen into the interior of São Paulo State, offering easy credit to planters wanting to set up hydroelectric stations to supply plantations, factories and towns. Foreign investors quickly installed the new technologies throughout Latin America. In Brazil the main investors were the Toronto-based Brazilian Traction, Light and Power Co. (at first called “Light” and later “Brascan”) and American and Foreign Power Co. (AMFORP).

Since 1899, Light provided and operated public services in São Paulo and Rio de Janeiro (trolley, gas and telephone companies), installing hydroelectric

and thermal plants to power these operations and to meet fast-growing urban demand. AMFORP operated utilities in the interior of São Paulo State and in several state capitals.

Between 1913 and 1929, world output of hydropower multiplied 240-fold to produce 40% of all electricity. Brazil accompanied this world trend, as increases in electricity demand far exceeded economic growth. In the early 20th Century, these developments were driven by foreign investment and technology. In 1928 Light ingeniously reversed the course of the Tietê River at Cubatão, creating a 720-meter waterfall in the Serra do Mar near São Paulo that fed a complex system of dams, canals, pumping stations and surface and underground generating plants, transforming a coastal mountain range from an obstacle to inland development into an abundant source of electricity through the 1930s and 1940s.

As recently as 1951, Brazil still had none of the 170 largest hydroelectric plants, above 75 megawatts (MW) capacities. But by 1997 Brazil had become the world’s third-largest producer of hydropower (after Canada and the United States) and second in the world in dependence on hydropower (after Norway), relying on it for 92% of its electricity supplies. In 1950, the United States had the world’s largest concentration of big hydroelectric stations. Soon after, Brazil absorbed this culture of great dams, along rivers that cut into the massive shield of its Central Plateau.

The first of these big projects was Paulo Affonso I on the São Francisco, finished in 1962, followed by Furnas (1963), Jupuíá (1969), Funil (1969), Ilha Solteira (1973) and many others. Most of the early projects were designed and managed by foreign engineering and construction firms while Brazilians gained experience with these technologies.

Brazilian engineers traveled to dam sites in the United States, Scandinavia, Switzerland, France, Egypt, Russia and China to learn about organizing these huge projects. Brazilian engineers were wary of doing big dam projects. But Sebastião Camargo, who began his career as a contractor by moving earth on the backs of burros for building roads in the interior of São Paulo State, boldly submitted an alternative design to build Jupuíá on his way to establishing what was Brazil’s biggest construction firm.

“We were a poor, vast, empty country and there were no roads to the dam sites,” recalled José Gelásio da Rocha, who headed construction of Jupuíá. “We

had to build the infrastructure ourselves.” For the first time, great mobilizations of materials, machinery and workers concentrated resources in Brazil’s immense backlands. Rivers were diverted and millions of tons of concrete, poured from giant mixing plants, were carried by huge cranes to coat the rock core of colossal walls stretching across canyons and valleys. Temporary cities rose beside these rivers for workers, technicians and their families who migrated among dam sites over the next few decades. At the Jupia and Ilha Solteira dam sites, ice plants were built to keep the cement from cracking in the intense heat. Foreign manufacturers, such as Voith, Siemens, General Electric and what is now Asea Brown Boveri, began to build big generators, turbines and transformers in Brazil to meet growing demand from the state companies.

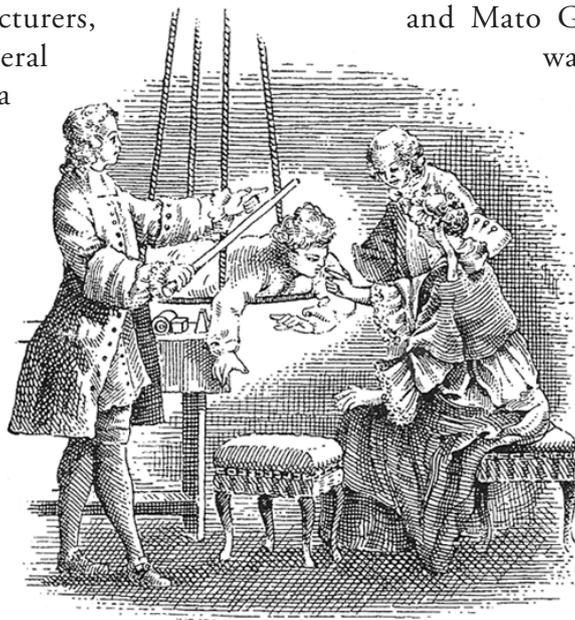
These technical achievements enabled Brazil to develop a hydroelectric monoculture that nourished rapid urbanization and industrialization as well as improvements in communications, distribution and information networks and in the processing of food and medicine. Since 1950 electricity output grew from only 5.5 billion kilowatt-hours (KWh) to 332 billion KWh, a 20-fold increase in consumption per capita. Since 1970 the share of homes with electricity soared from 35% to about 95% today, signifying a great leap in the modernization of Brazil’s society. The question posed by recent electricity shortages is whether this modernization can continue.

### The Unnecessary Crisis

The promise of Brazil’s abundant natural resources is undermined by institutional weaknesses. The technical and economic issues of electricity supply and demand are lost among dispersed and negligent centers of decision. Compounding the difficulties of planning and coordination was the backlog of unfinished projects that would have added enough generation and transmission capacity to compensate for the lack of rainfall in 2001. Brazil’s Tribunal de Contas da União (TCU), equivalent to the General Accounting Office of the United States, reported

that “delays and failure to implement planned projects contributed to an emptying of the reservoirs by some 41% and were identified as the main cause of the energy crisis.” These public projects were delayed by lack of funds, onerous bureaucratic procedures, environmental disputes and political manipulation, all causing huge cost overruns. Some examples:

- In 1980, São Paulo Governor Paulo Maluf signed contracts for the Porto Primavera dam to generate 2,000 MW at where the mighty Parana River forms the border between the states of São Paulo and Mato Grosso do Sul. Porto Primavera was one of five hydroelectric projects launched by Maluf at the request of Economics Minister Antonio Delfim Netto to generate cash from foreign suppliers’ credits on the eve of the Latin American debt crisis of the 1980s.



Maluf happily complied, distributing contracts for the five projects among big construction companies that normally contribute to election campaigns. But managing five major projects at the same time overwhelmed CESP, the heavily indebted São Paulo state electricity company. CESP ran out of money, causing delays and a pileup of interest charges as construction of Porto Primavera dragged on for two decades before being inaugurated in 2000, now renamed in memory of Communications Minister Sérgio Mota Mello. But the dam’s reservoir could not be filled until 2001, on the eve of electricity rationing, because of disputes with the state government of Mato Grosso do Sul over environmental impacts and relocation of displaced population. The station is generating sat only two-thirds of capacity because its turbines are being installed only now instead of during construction. Originally budgeted at \$2 billion, the project’s final cost is estimated at \$10 billion.

- Rationing also could have been avoided if the government had built transmission lines to bring surplus power to the cities of the Southeast from southern Brazil and from the 12,600 MW bi-national Itaipú dam, the world’s largest, on the Paraná River where it forms the border with Paraguay. A third transmission line from Itaipú

was delayed until 2002 because a supplier from the Ukraine offered the lowest price in international bids for transformers. The Ukrainian transformers burned out upon being installed. New transformers had to be ordered. The government failed to build a relatively cheap transmission line between Curitiba and São Paulo that could have pumped surplus power into the national grid from the hydroelectric stations of the South, which had heavy rains in 2001 while the Southeast suffered drought.

- The nuclear power station Angra II (1,360 MW), the first and only of eight plants that were to be built under the Brazil-German nuclear deal of 1975, was under construction for 25 years, accumulating interest charges and cost overruns that fed into the enormous debts of the federal electricity sector. Even after completion in 2000, Angra II had to run the gauntlet of approvals by several government agencies before it could start producing electricity in 2001. The missed deadlines of Angra II in starting generation led to default by Furnas, the federal power company, on its supply contracts to distributors, undermining the government's credibility in dealing with private investors.

- As international financial markets were expressing concern over Brazil's energy shortages and mounting public debt, Eletronorte, the federal power company for Amazônia, was completing the \$1.5 billion second phase of the giant Tucuruí dam on the Tocantins River, with 11 new turbines to add 4,000 MW to the 4,000 MW already installed. However, Tucuruí II will operate far below its designed capacity during the dry season, since there is little upstream reservoir storage to regulate river flow.

### **What Have We Learned?**

In 2001-02, Brazil managed its shortages creatively to avoid the kind of electricity blackouts that California suffered around the same time. In Brazil, however, the blackout was in energy policy, in the inability of government to make decisions that would stabilize the flow of resources into a critical and fastchanging industry. As rationing was winding down late in 2001, two distinguished ex-Ministers of Mines and Energy and two ex-Presidents of Eletrobrás wrote in the newspaper *O Estado de São Paulo*, that "our worries increase when we observe that the country still has not identified the way



to assure success in implementing the new model [because of] discord between the Ministries of Finance and Energy, between Eletrobrás and BNDES over conflicting goals and over the privatization of state enterprises." Earlier, Francisco Gros, former president of the Fernand Braudel Institute of World Economics, then president of the BNDES and now president of Petrobrás, told a professional audience: "The confusion is so great that it looks like it was designed by officials of the electricity sector to guarantee their own jobs for many, many years."

Faced with the threat of recurrent shortages, Brazil's government has launched major initiatives to concentrate decisions in an Energy Crisis Commission; to raise electricity prices to levels that would sustain investment; grant concessions for new transmission lines; provide a realistic legal and economic framework for long-term supply contracts; reorganize the new wholesale electricity market, and settle conflicts between public and private providers and between generators and distributors. But many policy decisions were bogged down in trench warfare between bureaucratic and commercial interests, in contradictory laws and regulations and seemingly endless judicial and regulatory disputes. The government lacks the political machinery to make decisions along economically rational lines and to implement its decisions.

#### **1. A vacuum in decision-making**

No institutional authority for setting priorities and making policy has replaced the giant public corporations whose size and powers were reduced by privatization. New laws were passed in 1995-98 that ended public monopolies in electricity generation and authorized private operation and ownership of the infrastructure. A basic strategy was drafted to (1) create the National Agency for

Electrical Energy (ANEEL) as the main regulator; (2) break up vertically integrated state companies into independent units for generation, transmission and distribution; (3) set up competitive market mechanisms and institutions, granting independent producers free access to transmission and distribution networks; (4) gradually phasing the transition from regulated to competitive pricing as the new electricity market went from 98% state ownership to private participation.

In its first four years the Cardoso Administration more than doubled annual increases in generating capacity, built new transmission lines and gas pipelines to link regions and reach remote areas, completed 23 paralyzed projects and revoked concessions for many projects that never began construction. Nevertheless, the legacy of neglect had taken its toll.

Nobody was able to implement the new strategy effectively after a leadership change in the Energy Ministry in 1995 under pressures of coalition politics. Public sector technicians and executives were recruited to regulate a new system for which they had little sympathy, while others took early retirement to join the private sector, depriving the government of experience and technical competence needed to operate in a new regulatory environment. The politicians who made the laws and appointed these officials knew little of the organizational and technical complexity of the system. New regulatory agencies and old state companies, such as Eletrobrás and Petrobrás and their many subsidiaries, operated in a floating world, with little policy direction or supervision.

The energy sector remained a field of patronage and political rivalry, among Congressional leaders, regional bosses and lords of bureaucracy, even as average levels of Brazil's main reservoirs declined steadily during the 1990s. For decades, all political factions succumbed to the temptation to use the state electricity companies as cash cows to balance budgets, finance election campaigns or win votes by subsidizing consumption with "social tariffs."

The Ministry of Mines and Energy lost power, leaving a vacuum of responsibility for decisions. Unresolved disputes over rules and prices emerged between diametrically opposed interests of generating and distribution companies, with 80% of electricity generation in the hands of state managers with little interest in restructuring the industry. To obtain support in Congress, Cardoso ceded control of the electricity sector to his main coalition ally

then, the Liberal Front Party (PFL), in an industry demanding high levels of capital and technical knowledge. Economic stabilization prevented the government from using the inflation tax to finance public investment. State electricity companies invested less so that the government could keep within limits on increases in public debt.

Between May 1999 and January 2001, water storage in reservoirs of the Southeast, Brazil's main electricity market, fell from 70% to 18% of capacity. Some technicians urged rationing of 10% of consumption in early 2000 without waiting for shortages to worsen, but they were overruled. "The occurrence of severe rationing a few months after officials said that there would be no problems," the Revitalization Committee observed, "means that risk aversion must be introduced into the system's operation."

With the onset of 20% rationing in mid-2001, Cardoso named Pedro Parente, his trusted and widely respected Superbureaucrat, to head a temporary Energy Crisis Commission, with Cardoso claiming that the traditional electricity bureaucracy failed to warn him of impending shortages. Since the new Energy Czar had no prior experience in the electricity sector, a frantic period of learning ensued in the second half of 2001 until the rains came.

Brazil's rationing, with general consumption economies and a secondary market trading quotas among industrial users, was managed more intelligently than California's panic-provoking "rolling blackouts." The successful rationing effort then was suspended, with many institutional and regulatory uncertainties plaguing Brazil's energy economy still unresolved.

The Energy Crisis Commission organized several working groups that labored furiously between June 2001 and June 2002, publishing 43 technical and economic "issues for perfection of the sector model." Few of the 43 proposals were implemented until they were cut to six by a new Energy Minister, Francisco Gomide, in hope of getting something done in the last few months of Cardoso's administration. Appointed in mid-2002, Gomide is the first electricity sector professional to become Minister since Cardoso took office in 1995.

The next government will have to face issues such as the continuity of privatization; making the new wholesale energy market a commercial reality; ending vertical integration of Brazil's new natural gas industry, now controlled by Petrobrás, opening the market to competition; compensating for

price and exchange fluctuations, and clarifying the respective roles of hydropower, thermal and nuclear generation and alternative energy sources.

The real electricity crisis is structural, aggravated by the paralysis of the reform process. The Energy Czar returned to his job at the Presidential Palace. Gomide assumed command of the Energy Crisis Commission, which was relegated to an advisory role in July 2002. Several pending measures await action by the new Administration and Congress to be installed in 2003.

## 2. Electricity prices: dialogue of the deaf

The story of Brazil's electricity prices for most of the 20th Century is linked to the long-term problem of chronic inflation. Fiscal deficits were sustained by the government's foreign and domestic borrowing and by the erosion of the purchasing power of successive Brazilian currencies. Although Brazil was able to increase electricity consumption enormously in recent decades, the moral of this story, in the end, is that you get what you pay for. Even if prices for electricity consumption are kept artificially low, higher costs, including debt service, eventually will be paid through taxes.

The political manipulation of electricity rates began with the Water Code of 1934, decreed by President Getúlio Vargas (1930-45; 1950-54), empowering the federal government to set tariffs. The Water Code limited utilities' profits to 10% of the nominal historic cost of their assets, without adjustment for inflation that averaged 18% yearly from 1946 to 1961, eroding the real value of both assets and income.

The Water Code's impact on electricity supplies was delayed because the foreign companies' generating capacity remained far above peak demand until after World War II. However, as surging economic growth and electricity demand absorbed excess capacity, long periods of rationing followed over the next two decades, even in years of abundant rainfall.

In 1954, the Joint Brazil-United States Economic Development Commission observed: "At times of serious system overload the power company has no option but to disconnect certain circuits...without warning the power users concerned....Tiremakers lose a day's production when such a stoppage occurs, and another day is required to clean out the machinery. Stoppage of power to glass furnaces cuts off the air circulation used to cool the walls of the furnaces, endangering the life and strength of these walls."

The foreign power providers received only one rate increase in the two decades after passage of the 1934 Water Code, but the government contrived to keep them in the game by granting preferential exchange rates and allowing surcharges for specific cost increases. But this improvisation failed to persuade them to invest in new generating capacity. Instead, they purchased electricity from the new government power companies that were building new dams.

Public investment in electricity generation was so intense that, according to former Energy Minister Antonio Dias Leite, in the ambitious Plano de Metas of President Juscelino Kubitschek

(1956-61) "the energy sector absorbed almost half the total budget of this plan, and electricity half of that half. In the plan's execution, electricity had priority."

A tug-of-war ensued between advocates of public and private power. In 1960 John Cotrim, then head of Furnas and a leading advocate of rate increases, issued this challenge: "Either we decide once and for all to give to private enterprise the conditions for survival and expansion, or else the country has to face up to the take-over of these services by the government."

In 1962, Eletrobrás, the state holding company, was incorporated, providing the legal structure for government control of the industry while allowing the Light companies to retain electricity distribution in Rio de Janeiro and São Paulo. In 1964, the Energy Minister of the new military government, Mauro Thibau, persuaded the Finance Minister, Octávio Bulhões, to issue decrees providing automatic adjustment for inflation of electricity prices and of the value of assets. "Bulhões was worried about the impact of electricity rates on inflation," Thibau said later, "but I told him that things will be much worse if we run out of electricity."

## In State Hands

Throughout the world, large hydroelectric projects tend to be carried out by state enterprises, producing sudden surges in capacity. There were exceptions, of course. The great Pacific Gas & Electric Co. (PG&E), which filed for bankruptcy in the recent California crisis, was a pioneer of hydropower systems. However, as recently as 1949, four-fifths of all hydropower capacity, installed and under construction in the United States was in government hands. During the Great Depression, private investors attacked the dam-building projects

of the New Deal, fearing that government intrusion into the power-generating business would produce unmanageable excess capacity. Yet by the early postwar years there were widespread fears of shortages. In an article on "The Great Power Shortage," Fortune magazine in 1948 scolded Congress for cutting the budgets of federal dam projects.

By the 1970s, Brazil's state companies were carrying out one of the world's most ambitious hydroelectric programs, supported by robust tariffs that assured financial viability. These rates provided the international credibility that enabled Brazil to borrow heavily and invest roughly \$70 billion [2002 prices] in 1974-86 to build dams and nuclear power plants during the liquidity boom of the 1970s. From 1965 to 1979 hydroelectric capacity multiplied five-fold, while consumption was growing by roughly 12% annually. However, in the mid-1970s the military government began manipulating electricity prices in a futile effort to control inflation. By 1986, residential rates fell to 22% of their 1974 level, from \$120 per MW-hour to \$26, while industrial rates, already heavily subsidized, shrank by 20%-30%. By 1999, residential electricity rates lost 90% of their 1975 value in dollar terms, while industrial tariffs fell by 75%.

The loss of real income, compounded by the surge of international interest rates in the debt crisis of the 1980s, led to financial collapse of the state utilities and truncated their investment capacity. Yearly investment in the system fell from about US\$15 billion in the mid-1980s to US\$4.5 billion in the mid-1990s. Aging equipment and installations deteriorated. This kind of deterioration in a substation of Baurú, in the interior of São Paulo State, provoked a blackout in 13 states in 1999.

A spiral of circular defaults ensued among large electricity consumers, distributors and generating companies. The government finally had to compensate for mismanaging tariffs with a US\$26 billion bailout in 1993 in which the federal treasury absorbed their debts. After the bailout, state utilities began another cycle of defaults until they were privatized.

Brazil still is struggling with the consequences of the financial collapse of the state system. Throughout the 1990s, Brazil's overuse of its hydropower resources and its financial inability to invest in new generating capacity led to a frightening decline in the water levels of its reservoirs. Successive governments ignored the warnings of technicians. A decade ago the Fernand Braudel Institute of World Economics

published a major study, *Electricity and Chronic Inflation in Brazil*, which argued:

*The state electricity corporations in Brazil are decapitalized and incapable of expanding output to meet growing demand, which is artificially stimulated by low tariffs. The deficits of these and other public service companies intensify chronic inflation, forcing the government to print money to keep them running. Beginning in 1975, the government eroded the world's highest electricity price structure, destroying its main method of capital-formation and compelling it first to resort to foreign and domestic borrowing and then to inflation. Meanwhile, a disincentive to cost control was created once electricity tariffs, the main source of income for these companies, became playing cards hidden up the sleeve of a magician. But the magic is turning against the magician. Repression of tariffs, manipulated obstinately as a way of combating inflation, itself became a main source of inflation and today threatens collapse of Brazil's electricity supply system.*

A decade ago, when our report was written, new technologies were changing the economics of electricity as a result of intensive development of jet engines in the 1980s and the end of political restrictions on the use of natural gas to produce electricity. The development of combined cycle gas turbines (CCGTs) were cutting the cost of thermal generation while low-cost, large-scale river sites to produce hydropower were becoming scarcer in Brazil and the rest of the world. The CCGTs add flexibility because they can be built near power markets, reducing the need for investment in long-distance electricity transmission.

The International Energy Agency (IEA) expects gas-fired generation to grow, at continuously declining costs, to 350% of its current levels by 2020 and its share in electricity output to double, with power demand growing fastest (by 4.6% yearly) in developing countries, most dramatically for residential and commercial uses. In Brazil, the capital cost of installing a kilowatt of gas turbine capacity already has fallen to \$600-\$800, within the range projected by the IEA for 2020 and also below the capital costs (\$1,000-\$1,500) for new hydropower installations in Brazil. But investment in these plants has been paralyzed because energy pricing policy has failed to bridge the gap between the extremely low cost of electricity from old, amortized but still highly productive hydro plants and the much higher cost of

fuel to generate power from new gas-fired plants. These new thermal plants must earn faster returns to repay borrowed money and justify the opportunity cost of private investment.

In the words of the Revitalization Committee: “With a mistaken prediction of excess supply, future price estimates would be too low, leading to a decision by distributors – also mistaken – against signing future contracts for part of their demand. Thus there would be less incentive to add new generating capacity, which needs long-term contracts to mobilize project finance.” At this writing, Brazil is deadlocked on this issue, with both its privatization program and the building of thermal plants paralyzed as pressure on electricity supplies has been relieved by the recent rains.

Brazil may be returning to something like the destructive wrangling of the 1940s and 1950s over electricity prices between public and private suppliers. The old debate continues in the style of the sterile disputes of medieval theologians and philosophers over the “just price,” without solving any of the institutional problems of Brazil’s future electricity supplies.

The quandary of calculating the “just price” for electricity has many facets. According to calculations by Peter Greiner, low electricity prices for industry in recent years worsened income inequalities through irrational subsidies at a rate of US\$10-\$20 billion per year. Industrial subsidies apply to high-voltage consumers, using 55% of Brazil’s electricity but paying only 37% of distributors’ revenues. Big consumers were paying US\$22 per megawatt-hour (MWh) while households paid US\$92. These subsidies forced state-owned electricity companies to make low-return investments to meet artificially increased demand while freeing private capital to invest more profitably.

The cost of underspricing electricity for big consumers has been compounded by the investment inefficiency of state companies that experience more project delays than private companies and pay 30%-40% more for equipment, construction and services. Deficits bred by inefficient investments of state companies also contributed to Brazil’s fast-growing public debts.

Politicians have been distorting electricity prices by pursuing their own agendas. Congress amended a new law intended to compensate utilities for their revenue losses during rationing by adding a provision that households consuming up to 80 KWh per month would get their electricity very cheap

under a “social tariff,” so 70% of residential users in the Northeast pay almost nothing. The financial settlement with utilities is being held up pending litigation attempting to annul the new “social tariff.” In this labyrinthine pricing maze, knowing who pays what to support the system is not easy. At the retail level, taxes absorb 40% of all charges.

The profitability of Brazil’s retail electricity network is limited by its low density, in both the number of paying consumers in an area and the intensity of consumption. Brazil’s per capita electricity consumption (2,000 KWh) is roughly one-third that of Britain, France and Germany and one-fifth that of the United States, with transmission losses three times as high.

Given uncertain regulation and a distorted price structure, Brazilian electricity distributors earned net profits on assets of 0.7% in 2000, before suffering large operating losses in 2001 because of rationing. This compares with 15% return on assets for Chile’s privatized Chilectra and 10% as the worldwide industry standard. More important, there seems to be little notion of the cash flow for the system as a whole. Is the system financially solvent? Who pays for what? Does the system earn enough to meet its expenses and invest to satisfy future demand? Or will an under-financed electricity system feed a relapse into blackouts, chronic inflation and spiraling public debt?

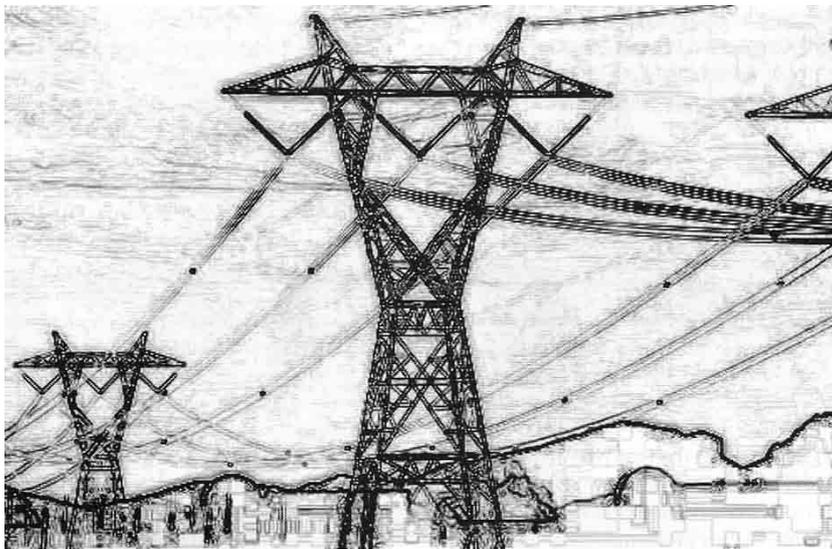
### 3. Transmission problems

Brazil’s transmission grid is an intricate and delicately balanced logistical enterprise operating on a continental scale. One of the marvels of electricity is that people can activate life enhancing and life-enriching systems with the flick of a switch, only faintly aware of the complex networks that sustain these systems. Many national grids grew spontaneously from separate and independent generation and distribution utilities, achieving operational flexibility by linking neighboring systems. Brazil gained huge economies by developing a vast transmission network connecting distant points of hydroelectric generation and consumption. Like great cities, national electricity grids may arise spontaneously, but they also demand careful management and investment to avoid degradation. Professor Paul Joskow of MIT explained the challenge for both the continental United States and Brazil’s system:

*The transmission system is not simply a transportation network that moves power from*

*individual generating stations to demand centers, but a complex “coordination” system that integrates a large number of generating facilities dispersed over wide geographic areas to provide a reliable flow of electricity to dispersed demand nodes while adhering to tight physical requirements to maintain network frequency, voltage and stability...A failure of a major piece of equipment in one part of the network can affect the stability of the entire system. Efficient and effective remedial responses to equipment failures can involve coordinated reactions of multiple generators located far from the site of the failure. Finally, there is generally no meaningful direct physical relation between the electric power produced by a specific generator connected to the network and a specific customer taking energy from the network....[Within regions] there must be a single network operator responsible for controlling the physical operation of a control area, coordinating generator schedules, balancing demand for and supply of generation services flowing over the network in real time and coordinating with neighboring control areas.*

Brazil has taken steps to fill the gaps in its transmission network that aggravated the electricity



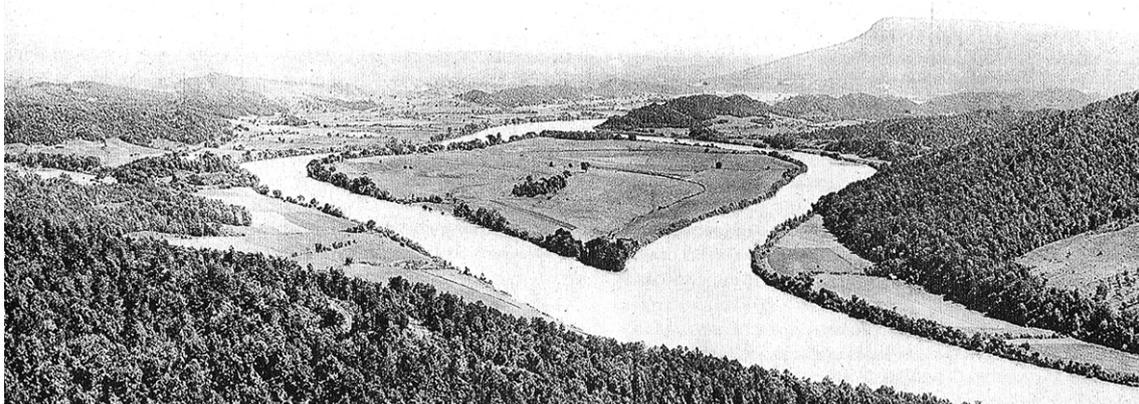
shortages in 2000-01. However, some key problems remain unsolved. Under the original restructuring proposal drafted in 1994, transmission on the huge national grid was to be a natural regulated monopoly, controlled for the time being by state-owned utilities providing open access to other providers and buyers, while generation and distribution were being privatized. A National System Operator (ONS), a regulated private non-profit corporation, dispatches power between points on the grid, its decisions based on real time information flows processed by central computers to coordinate hydropower output throughout the grid.

However, the Concession Law passed by Congress in 1995 mandated piecemeal concession of additions to the transmission network to private bidders, thus tending to Balkanize the system and depriving it of standardized management and equipment that would make it easier to detect the causes of power failures. The recent transmission concessions have fallen behind their construction schedule, largely because of financial difficulties. This balkanization was intensified by ANEEL's auction in August 2002, financed by BNDES, of 11 more sections of the transmission grid. The U.S. Federal Energy Regulatory Commission is moving in the opposite direction in its new Standard Market Design, applying lessons learned in the recent California and East Coast electricity shortages, to avoid congestion and traffic surges by streamlining and further integrating transmission between regional operators of the national grid.

Under the regime of fixed prices per kilometer to pay for transmission services, private concessionaires may be tempted to increase profits by using lower-grade materials and equipment to lay new lines. ANEEL let bids for private concessions for 5,700 kilometers of transmission lines to interconnect different regions of this vast country with different rainfall regimes, claiming that an integrated grid would enable utilities to save 20% on new investments. But the Revitalization Committee noted “the great difficulties of [obtaining] analytical and computational information for efficient planning of transmission and, especially, interconnections between regions in a competitive environment.”

Traditionally, the planning group at Eletrobrás did this job. The group was moved to the Energy Ministry when its boss, Benedito Carraro, briefly became Energy Secretary in 1999, but was allowed to disintegrate after Carraro quit in a dispute with the minister of the day, Rodolfo Tourinho. In early 1999, Tourinho rejected a \$500 million World Bank loan that would have supported the expansion of transmission lines and development of the ONS and the new Wholesale Energy Market (MAE) as well as strengthening the ministry's technical staff.

Since 1999, all three Energy Secretaries stayed in office for less than a year, under the four Ministers of Mines and Energy who succeeded each other so far during Cardoso's second administration. The ONS was blamed for failing to use power from



thermal plants on the national grid in order to stem the draining of hydroelectric reservoirs during the recent drought. ONS used calculations based on the operating costs of hydropower instead of the economic costs of electricity shortages.

#### 4. Confused and arbitrary regulation

Under the old system, the state-owned electricity companies were regulated by the National Department of Water and Electrical Energy (DNAEE), a federal agency of the Ministry of Mines and Energy that set tariffs, authorized use of water resources and granted and supervised concessions under performance standards that it established. In practice, the DNAEE could do little to influence state governors, many of whom siphoned away funds from the state utilities as “tax advances,” since the governors controlled the state Congressional delegations on which federal authorities depended for legislative support. In effect, Brazil had little experience in electricity regulation when new demands on the system were created as privatization intensified after 1995.

After many months of bureaucratic and Congressional debate, ANEEL was created in 1997, two years after privatization was launched, incorporating most functions of DNAEE and the Ministry of Mines and Energy. The staff of ANEEL, an acronym sometimes ironically identified as the “Association of Employees of Eletronorte,” was drawn heavily from the Brasília headquarters of Eletronorte, the least efficient of the state companies, under the influence of political bosses of Amazônia and the Northeast.

The ANEEL staff also included lawyers and economists without prior experience in the electricity sector. Members of Congress have no technical support and show little interest in the economic implications of their legislative actions. The federal government delegated to ANEEL, beyond its role as regulator and supervisor, special powers to “organize public bidding and contract concessions

for generation, transmission and distribution of electricity.... regulate tariffs and establish conditions for access to transmission and distribution systems.” Among ANEEL’s many tasks was to supervise and authorize the activities of the ONS and to approve rules for the new wholesale energy market.

With appointments of senior officials serving fixed terms approved by the Senate, subject to political bargaining, ANEEL accumulated 43 different functions. Despite the threat of rationing and blackouts, ANEEL delayed approval of production of electricity from new privately owned thermal plants to avoid higher fuel costs, which would have forced rate increases but would have conserved reservoirs in the face of imminent water shortages. This underscored the Revitalization Committee’s warning: “Since state companies control a large share of the market for generation, new private investments could be inhibited by the fear that public enterprises would adopt a mix of ‘old’ and ‘new’ electricity to be sold at lower prices than the marginal cost of output from new plants.”

Of 287 new power plants authorized by ANEEL, 179 have fallen behind in their construction schedules. Work never started on most thermal plants. The TCU attributed “the scarcity of new private investment in new generation projects” to “vagaries in the regulatory framework, as well as its lack of consolidation and stability.”

#### 5. Privatization stalled

According to the IEA, most of the three million MW of new generating capacity to be installed worldwide over the next two decades would meet the needs of poorer countries, where investments in new plant would total \$1.7 trillion. Over the past two decades, despite both chronic inflation and the debt crisis, Brazil was able spectacularly to double its generating capacity to roughly 80,000 MW today, with dams on more than 140 river sites. But now the government clearly has neither the credit nor the savings to continue these investments, which grow

in scale as the system becomes larger.

Public debate fails to focus on how the future expansion of electricity supplies can be supported financially. Institutional weaknesses, aggravated by ideological disputes, increase the danger of market failure and regulatory failure as well as the cost and perceived risk of private investment.

As Brazil developed a hydroelectric monoculture, it failed to diversify its power supply risks. As demand grows, this monoculture tends to limit supplies, especially in droughts and consumption peaks, intensifying the risks of rationing and violent price fluctuations. The Inter-American Development Bank warns:

*A growing market and reliance on hydroelectric resources makes an energy constrained system more of a norm than an exception, exacerbating price volatility. The lack of human resources, the weakness or lack of institutions to oversee and regulate competition, and the ambiguous role for the judiciary make difficult the oversight of competition and the enforcing of other regulatory measures.*

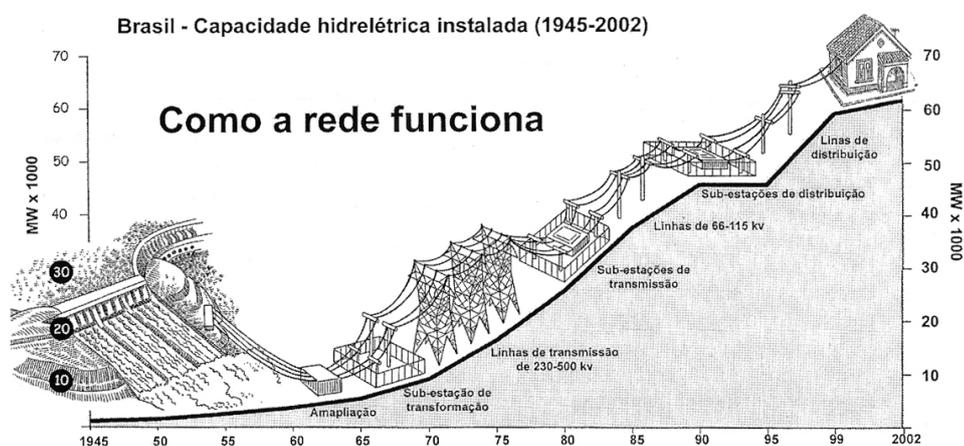
These risks of hydroelectric monoculture can be reduced by creating sufficient reserve capacity in the system, drawing partially on thermal generation, with clear rules to avoid sudden price fluctuations. On the other hand, investments in renewable hydropower offer huge advantages because of their longer useful life and lower operating costs, without the air pollution caused by oil, coal and gas.

Over the past decade, Latin America led the world in privatization of its power systems. In the 1990s, Latin America absorbed 40% of the \$193 billion invested in private electricity projects in developing countries. Privatization in Brazil was concentrated in distribution companies. Key buyers paid very high prices during the financial boom of the 1990s, justified by the high profit margins embedded in the distribution tariffs. However, they now are having trouble servicing the loans that financed these purchases.

According to Abradee, the distributors' association, regulated electricity rates rose by 141% between May 1994 and May 2002, while prices of telephone service and bottled gas increased

respectively by 445% and 400% and Brazil's currency depreciated by 242%. On September 3, ANEEL shocked the industry by decreeing that scheduled tariff reviews for distributors will be guided by the depreciated stock market value of assets instead of their minimum price at privatization auctions, handing investors a capital loss of some \$5 billion as well as erosion of current revenues.

Meanwhile, prices for electricity generation (\$25-\$28/MWh) remained far below the costs of expanding capacity, offering little profit for prospective buyers to privatize state generating companies. Most potential buyers of these state companies now are heavily subsidized high-voltage consumers, in industries such as aluminum and heavy chemicals. Under present programs, these large consumers will gradually lose their subsidies



beginning in 2003, as contracted generation will be freed yearly for public bidding in increments of 25% through 2006.

The Brazilian privatization program now has stalled, along with the privatization wave that swept through Europe and Latin America in the 1990s. The debate on public vs. private ownership of electricity production and distribution which began in the 1950s, remains unsettled. It subsided in the decades of state control (roughly, 1965-95) only to be revived during privatization.

- There is consensus on the need for private capital because the government lacks the financial capacity to invest in large-scale electricity projects to meet future demand. But private power companies are unwilling to invest in the absence of electricity prices that provide an adequate return on capital employed and of clear legal and regulatory rules providing stable business conditions.

Under the privatization program, government generation and distribution companies were sold to private investors to raise US\$21 billion mainly

to service public debt, of which US\$17.5 billion came from sale of state utilities and only US\$3.5 billion from sale of federal companies. Privatization began even before a regulatory structure was established by law and organized. While some 65% of the distribution network was privatized, the main exceptions being the state companies of Minas Gerais, Paraná and Santa Catarina, only about 15% of generating capacity was sold.

Since 1999, little or no progress was made in defining the new role of Eletrobrás and in drafting and applying regulations for the new market-oriented model. In the panic and confusion of electricity shortages, aggravated by a series of contract defaults by major public sector suppliers, distributors were paying spot prices in the wholesale energy market that fluctuated wildly, from R\$5 to R\$684 per megawatt-hour, before spot trading collapsed during rationing.

The confusion in the electricity market was compounded by sudden depreciation of Brazil's currency during the pre-election financial panic of July 2002, reducing it to 30% of its 1998 dollar value. A cheaper real made imported electricity, priced in dollars, much more expensive. Utilities lost money on power from the bi-national Itaipú dam and previously contracted "take-or-pay" imports from Argentina, for which a new transmission line recently was built.

Foreign investors have curtailed capital spending. Some are trying to withdraw from Brazil because of low return on their assets and the confusion in Brazil's decision-making process. Privatized distributors suffered big foreign exchange losses because of three surges of currency devaluation since 1999 and big revenue losses during rationing in 2001 and as demand stayed at historically low levels in 2002. Both Enron and AES paid very high prices for Brazilian distribution companies, but now must expect much lower prices from their efforts, so far unsuccessful, to sell these assets. Enron was trying to unload its Brazil properties early in 2000, nearly two years before its scandalous bankruptcy. Enron's collapse, involving accounting and trading fraud, shook world financial markets and especially the electricity sector. It came only weeks before the political and economic failure of Argentina, also impacting investors in Brazil.

Among the casualties of these crashes was AES, with power plants and distribution companies in 33 countries, owner of Eletropaulo, the huge São Paulo distributor, and other major Brazilian

utilities. Burdened by debts incurred in dollars to finance its aggressive acquisitions that concentrated half of its worldwide assets in Latin America, with severe currency devaluations cutting returns on those assets, AES saw its stock price fall from \$70 in October 2000 to \$1.77 in July 2002 and its bonds downgraded to junk status. Commenting on AES efforts to get out of Latin America, Bear Stearns, an investment bank, observed that "there are no buyers for most of the company's high risk/underperforming assets" in Argentina, Brazil, Venezuela and Colombia, adding that "possible AES asset sales imply a worsening supply glut that could undermine privatizations in 2003 and beyond." Eletropaulo/AES was saved from default on \$120 million in foreign bonds, which would have plunged Brazil deeper into financial crisis, by a last-minute payment by BNDES in long-delayed compensation for revenue losses during rationing. Eletropaulo's debt to its preprivatization retirement fund, Fundação CESP, is R\$3 billion, or twice its market capitalization.

Eight privatized utilities, with debts totaling \$4 billion and annual revenues of \$5.9 billion, are now for sale. Brazilian power companies lost \$800 million in the first half of 2002, with two-thirds of these losses incurred by CESP, the São Paulo state utility that now owes \$1.8 billion. Electricité de France (EDF), unable to collect \$200 million in unpaid consumer bills, is trying to sell its giant Light distributor in Rio de Janeiro. Pennsylvania Power & Light (PPL), which bought a utility in the Northeast state of Maranhão, is walking away from a \$300 million investment with half of its monthly billings unpaid and an 83% customer delinquency rate. The Companhia Energética de Maranhão (CEMAR) is being run by a receiver named by ANEEL. With so many privatized utilities for sale, representing foreign investment of more than \$12 billion, opportunists are fishing for bottom-of-the-barrel prices. Mighty Petrobrás is now a scavenger of wrecked foreign investments and ambitions in Brazil, Argentina and Bolivia, including most of Enron's properties. Other privatized utilities may fall into the hands of the BNDES or private Brazilian investors.

The newsletter *Global Power Report* observed in May 2002 that "the stream of companies retreating from overseas markets has turned into a stampede." Robert J. Munczinski of BNP Paribas said that "it is very difficult to finance on a hard currency basis transactions that generate a local currency cash flow."

Carol Mates, counsel for the International Finance Corporation, a branch of the World Bank, added: "Only in the last 10 years have we as a community been financing private projects in emerging markets. One thing we all are appreciating now is that when you have a private provision of a public service, you can never get out of that country. The end users are paying you in local currency, and you have the macroeconomic risk of the whole country and the whole system. To a certain extent, you are really stuck. Can this country support its currency? That's a different issue than one faces in a domestic deal."

The confusion in Brazil finds a parallel in the United States. In both countries, power shortages in 2001 became surpluses in 2002. The recent uncertainties in the United States, dramatized by the California emergency, shows how sudden disruptions and changes of direction can appear. With generating capacity (700,000 million MW) roughly 10 times bigger than Brazil's, the United States added 100,000 MW of new capacity since 1997, but another 125,000 MW of announced projects were cancelled or delayed indefinitely as financing was shut down because of the end of the stock market bubble and the scandals surrounding Enron and other energy companies.

Many companies are selling assets. Regulators are considering a freeze on further deregulation. The federal government is investigating electricity-trading practices. California is trying to break long-term contracts signed under duress in 2001 to secure electricity at very high prices. According to Vincent Duane of Mirant, "electricity is a volatile commodity. If it is to be traded in the wholesale market, there is a tremendous need for risk management. The electricity market is not as liquid and efficient a market as the market in other commodities because of the physical dimensions to it.... The political climate at the moment favors those forces that have not traditionally supported change and innovation. You are even seeing a renaissance of public power and municipalization in some areas—places like New York—that we have not seen for some time."

### **Living with Instability**

So Brazil is going to have to live with this instability and to manage its consequences. There may be tradeoffs between energy security and efficiency. Under both private and public ownership, Brazil's electricity industry always depended on international finance to expand and

diversify capacity to ensure security of supplies. Market failure and regulatory failure are forcing Brazil to struggle with institutional weaknesses that limit the viability of investment. Under both private and public ownership of utilities, Brazil needs a stable and effective legal framework and a structure of electricity prices that create conditions for markets to work and for levels of investment to produce future supplies. Electricity is so critical to civilization as we know it that the price of adequate supply is much cheaper than the disruption and confusion produced by chronic shortages.

Under the new government that takes office in January 2003, political time and space will have to be allotted for regulatory and institutional stabilization that would create conditions for more private and public investment. Private investors have been discouraged by arbitrary breaches of contract by the state governments of Minas Gerais, Pernambuco and Bahia after receiving privatization payments. In coming years, state corporations will play a key role in expansion of capacity, raising prices for low-cost generation to finance investment.

Federal and state electricity companies embrace a wide range of corporate behavior. The professional excellence of CEMIG in Minas Gerais, COPEL in Paraná and the federal utility Furnas contrasts with the overstaffing and inefficiency of state distribution companies in São Paulo, Rio Grande do Sul, Mato Grosso and the Northeast, undermining the financial structure of the electricity sector by chronic defaults on payments to generating companies. Many state utilities, together with state-owned banks, formed a nexus of corruption and illicit funding of political campaigns that contributed to fiscal deficits and public debt. State banks and utilities were privatized in what was essentially a bankruptcy procedure managed by the Finance Ministry and the BNDES under the Cardoso Administration to refinance state debts. A danger of more privatization failures, akin to that of CEMAR in Maranhão, would be a relapse into the old ways of running state companies.

### **6. Petrobrás and the natural gas economy**

In the disorder of Brazil's energy policy, the skilled and focused bureaucracy of Petrobrás, with its historic legal monopoly, usually could get its way with politicians. An example of this influence is the ability of Petrobrás to turn to its own advantage its failure to modernize its refineries, part of its investment program since the 1970s.

In 1985, as two decades of military rule were ending, the Association of Petrobrás Engineers

reported to the incoming civilian government: “Our refineries are aging and in many cases are obsolete. At times their maintenance is precarious.... With greater use of natural gas, large quantities of [heavy] fuel oil would become unusable surplus that cannot always be sold abroad because the world market is glutted with this product, almost always sold at debased prices.”

In May 2002, the head of the National Petroleum Industry Organization (ONIP) warned of a “refinery blackout” in four or five years, forcing Brazil to import petroleum products worth \$4-\$5 billion annually, if at least two new refineries are not built at a cost of \$2 billion each. Yet a worldwide glut of refinery capacity, with low value added, led Petrobrás and many other companies to prefer trading in oil products to investing in new refineries.

The government’s 43 proposals for reform failed to mention the Petrobrás monopoly over gas supplies, which are needed if generation is to complement hydroelectric monoculture. Petrobrás gained a large share of Bolivia’s gas resources by buying into producing fields and building the \$2 billion pipeline from Corumbá, on the Bolivian border, to São Paulo and Porto Alegre. The pipeline operates at only 40% of capacity because of high transport charges, lower electricity demand and failure to develop the Brazilian gas market. Petrobrás blocked open access to the Bolivia pipeline for other gas producers, violating a provision of the World Bank loan contract to finance the project.

Natural gas in Brazil, although expensive for thermal electricity generation, could compete against fuel oil for furnaces and large heating and refrigeration installations, in ovens for making steel and glass in industry and in homes for air conditioning and bathroom showers. This potential market for gas has been undermined by the cheapness of low-grade fuel oil from obsolete Petrobrás refineries, discouraging investment in local gas distribution networks and in more efficient industrial equipment using gas.

Since Petrobrás itself became a major supplier of natural gas, it has been modernizing its refineries to reduce its production of heavy fuel oils in recent years. But the market for electricity from gas-powered thermal plants suddenly shrank in the new surfeit of hydropower created by the rains that followed the drought of 2000-01, leading Petrobrás and private investors to curtail their programs of building thermal plants.

A stable institutional environment is needed to provide secure, long-term electricity supplies from different energy sources, overcoming today’s investment risks. Under present conditions, nobody knows how future investments in generation, transmission and distribution capacity will be made.

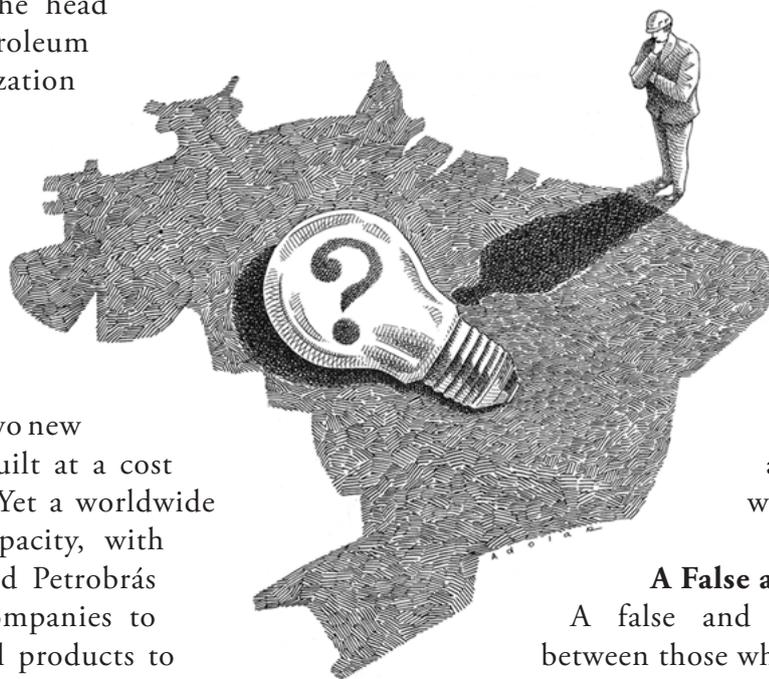
### **A False and Needless Dispute**

A false and needless dispute persists between those who believe that either public or private power must prevail. Both are needed. We also need clearer operating rules, better regulation and a market that works, independently of ideological constraints.

Brazil lacks the savings needed to finance by itself the growth of electricity supplies needed for the coming decades. Its public sector lacks the financial capacity to make these investments. Also, state power companies have been paying much more than the private sector for equipment, construction and support services.

These inflated investments shrank Brazil’s capital stock and increased public debt. Generous pensions and subsidies made public power even more costly. Yet political and bureaucratic resistance and uncertainties in financial markets make total privatization of the state electricity sector unlikely for the time being. Meanwhile, the government’s target of increasing generating capacity by 26,000 MW by 2004 has been cut in half.

Brazil needs foreign investment, but it cannot depend wholly on foreign investors to develop and manage secure electricity supplies. With its weak regulatory structure, Brazil would be an easy victim of the kind of market manipulation and accounting frauds by private energy companies such as Enron,



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Reliant, El Paso, CMS and Dynegy discovered recently in the California electricity shortages, despite several decades of industrial regulation in the United States.

According to a Wall Street Journal survey: “Energy companies seized on loopholes and local shortages to charge prices hundreds of times higher than normal. Suppliers withheld power from the state’s primary market, and sometimes idled power plants to induce shortages and boost power prices. Gas companies manipulated supplies and prices, driving up the cost of a main ingredient of electricity. Enron played a much bigger role than previously believed in California’s energy market. Its trading strategies overwhelmed regulators and drove up prices”.

Reformulation of energy policy in Brazil comes during retrenchment of privatization worldwide, especially in the electricity and telecom sectors, with project cutbacks, bankruptcies and consolidation by mergers becoming common. So foreign investors are trying to sell their Brazilian holdings, because of regulatory/political problems and market failure in Brazil or financial pressures at home.

Brazil needs a balanced policy of well-regulated electricity companies under both private and public ownership. Efficient state companies could still absorb 20%-30% of the market, in both generation

and distribution, avoiding regional monopolies. State companies should be organized as competitive and professional organizations, protected from political manipulation. Competing in a free market would help these state utilities to gain efficiency.

Brazil must learn to live with the uncertainties of both public and private ownership of its electricity complex while guaranteeing security of supplies. Progress can be made only by keeping the goal of security in mind, by developing clear and enforceable rules and by creating adequate incentives for investment and production.

Energy security comes at a price. But the cost of not paying the price could be much greater, in the form of chronic power shortages and degradation of the fabric of Brazil’s economy. The real causes of the blackout in energy policy lie not in rainfall or reservoirs, but in the weakness of Brazil’s public institutions, incapable of making effective strategic decisions on the future of a complex and fast-changing society. In all countries and at all times, institutions tend to lag behind technological development. Brazil gained stability and progress over the past decade by stopping chronic inflation. In coming years we must build on this progress by investing more and strengthening public institutions, especially in the critical areas of education, public security and electricity.

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## 2. Solutions Instead of More Confusion?

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**Peter Greiner**

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### **I. Stalling a fairly well conceived reform strategy**

Brazil's electricity sector reform began in 1995 without a clear market model, which was proposed by the 1997 Coopers & Lybrand report drawn from the RESEB – Electric Sector Restructuring process which involved 200 Brazilian technicians. A regulatory agency (ANEEL), a non-profit National System Operator (ONS) and a Wholesale Energy Market (MAE) were created. Capacity expansion efforts in stalled projects were reactivated and enhanced through partnerships with private capital, and the Bolivia-Brazil gas pipe line was built to help to meet demand over the transition period.

Successive economic crisis triggered political disputes and weakened the political basis for support to government reforms. After 1999 a new Minister of Mines and Energy decided to focus on a wide thermal-electric generation program, neglecting privatization and the development of a competitive market. Without firm steering, reform and deregulation went askew as illustrated by the following facts:

1. The wholesale market (MAE) has not operated until now: - over R\$ 13 billion of invoices are waiting to be cleared.

2. Confusion over rules for new generating capacity entering the electricity market, notably the uncertainties and risks faced by thermal plants on how to compete with cheap hydropower and very strict take-or-pay gas supply conditions, under heavily dollar-related costs.

3. When privatization was interrupted, 80% of generation was still in government hands, 30% corresponding to the binational Itaipu hydropower and the Angra I and II nuclear plants, and the remaining 50% to amortized state controlled

hydropower plants, operating at very cheap costs.

4. New investments may be curtailed by the low prices of these amortized hydroelectric plants and a surplus on the supply side due to rationing, markets contraction and slow economic growth.

5. Natural gas market is still dominated by Petrobrás, which may be able to solve short-term investment problems but drives away private capital in the long run.

6. Uncertainties and institutional weaknesses drove away experts from the Energy Ministry and Eletrobrás, while the increasingly powerful regulatory agency ANEEL remained lacking qualified and trained staff.

These deficiencies are being amplified in the absence of a clear energy policy and balanced redefinition of the role, limits and relations among state agencies.

### **II. The 2001 Electricity Crisis and additional complications**

By relying solely on the thermal program the government failed to pay close attention to the timely conclusion of important projects like Porto Primavera (1,800 MW), Angra II Nuclear Power Plant (1,360 MW), two additional units at Itaipu (1,500 MW) and key transmission interconnection lines to increase interchange capability.

Thanks to consumers' extraordinary collaboration with rationing efforts, the government was able to avoid "rolling blackouts" as in California, by reaching a 20% saving on the previous years consumption corresponding to a 24% reduction of the projected income. By the end of the year and the beginning of the rainy season, the crisis had already been averted. As early as March 2002, existing reservoir levels had secured supply for 2002 and 2003, According to

ANEEL and ONS authorized ongoing projects meet the demand until 2006. But the following factors continue to generate confusion and uncertainties:

1. Decrease in demand pushed the utilities into deep financial trouble. Recovery measures considered by the Administration and Congress provoked controversy.

2. Resistance to change increased. Opponents may not be able to revert privatization, but are tempted to promote a mixed model of state and private enterprise. However, with state corporations controlling 80% of electricity generation, competition and efficiency can be hardly achieved.

3. An electricity surplus in 2002, combined with regulatory uncertainty, could discourage and delay investments in projects already awarded by public bidding, thus exposing Brazil to future shortages.

4. Brazil's internal difficulties are being compounded by distrust of foreign independent power producers, such as Enron and AES, lack of foreign investors' confidence in emerging economies after Argentina's collapse, and disappointing results in telecommunication and electric service sectors around the world.

### **III. Guidelines to avoid more confusion, failures, and a new, more serious supply crisis.**

Biased diagnosis argue that the new market model failed and that investments were insufficient. But they fail to acknowledge that the market model has not yet been duly implemented and tested, and that annual average capacity has actually tripled when compared to the 1990-1995 period of state control. But, if no appropriate institutional and regulatory measures are taken, current private capital commitments may be at risk. At this very moment investors wonder what the next Brazilian President's policy for the electric sector will be.

Calls for a "hybrid" model of state and private capital often overlook the fact that state-owned corporations may hinder competition and manipulate prices specially when controlling, as they do, amortized assets that allow for dumping.

Given that all candidates are in favor of resuming economic growth, it is likely that any

next president will be tempted to ensure capacity expansion through state investments that avoid more lengthy systemic reforms. An obvious temptation is to use the state controlled generators as cash cows by floating their amortized energy output, and maintain PETROBRAS' leverage over the US\$ 11/bbl national oil, representing 80% of the country's total consumption.

This short lived strategy would endanger fiscal balance, driving away private capital and posing the risk of a even more dramatic energy crisis in the future. Under these conditions any new government should consider the following guidelines in setting responsible energy policies:

1. Establish a comprehensive energy policy in conjunction with an economic development strategy focused on securing supply, rationalizing consumption and establishing a more credible financing model.

2. Give energy policy a permanent place in the government economic agenda, enforcing a key role for the National Council for Energy Policy.

3. Create, within Eletrobrás, an Energy Development Institute to: (a) manage remaining state assets and promote strategic projects, and (b) advise the Ministry of Mines and Energy in managing energy programs.

4. Maintain the role of Petrobrás in diversifying Brazil's access to primary sources of oil and gas at home and abroad, but under conditions of fair competition in the national market, especially in natural gas, oil refining and distribution.

5. Diversify the energy matrix to emphasize security of supplies to minimize risks of instability and dependence, with stocks of strategic reserves and emergency plans.

6. Promote energy exchanges within Latin America, assuring the greatest possible direct or indirect access to primary energy sources, such as oil, gas, hydropower and coal, to strengthen the regional market and promote development of participating countries.

### **IV. Energy Policy and Institutional Efficiency**

As indicated by the brief analysis and guidelines, the energy sector demands not only good intentions and proposals but a stable, long-lasting and competent management, as implied by the following proposals:

### *Electricity*

1. Instruct ANEEL to delegate to Eletrobrás all nonregulatory technical functions, such as inventories and research.

2. Establish data banks with systematic and frequently updated information, transparent and independently audited, so the government, society and consumers can have current, unbiased knowledge of the reality of the electricity industry.

3. Resume long-term planning.

4. Maintain the new model principles competition, free consumer choice, regulation seeking market efficiency, clear and stable rules preserving the regulator's independence and consistent with market principles.

5. Correct faults, omissions and uncertainties of existing legislation: clarifying concepts such as "public service," "service by price," "economic and financial balance" and the public auction process.

6. Organize a coherent new Energy Code.

7. Uniform pricing of "old" electricity from amortized plants in relation to new capacity being added to the system.

8. Find a balance between the current economic financing criteria (10–12 years amortization) and concession terms (30 years) to avoid huge windfall profits and discretionary regulatory intervention.

9. Establish transmission tariffs providing better economic signals and guarantees of open access.

10. Create a new hydroelectric inventory to identify priorities, including long-term benefits not considered today, such as useful life of facilities and avoidance of fuel imports.

11. Study the option of building the Angra III nuclear plant to maintain technological development in this area.

### *Oil and Natural Gas*

1. Create a competitive natural gas market by creating a new gas transportation company,

separate from Petrobrás, eventually complemented by part of Petrobrás' gas and imports from Bolivia.

2. Promote the partial privatization of Petrobrás' refinery system, in exchange for private commitments to increase refinery capacity. These measures would depend on international market conditions, today allowing for imports of refined products below the cost of expanding Brazil's refineries.

3. Controlled deregulation of prices charged by Petrobrás.

4. Ease imports of crude oil, refined products and natural gas, emphasizing free access to transportation and storage facilities.

5. Harmonize regulation of electricity and natural gas production and distribution to sustain thermal plants.

6. Build pipelines in Amazônia to transport natural gas from the reserves of Urucú and Juruá to the cities of Manaus and Porto Velho. Produce diesel or methanol in Coari to supply liquid fuels for electrification of communities on the Amazon river basin.

### *Alternative Energy Sources*

1. Revive the ethanol program in stable fashion to sustain employment, gaining greater efficiency with increases in production scale and stabilizing the sugar-alcohol industry while enhancing fuel security.

2. Stimulate co-generation with sugar cane bagasse and increase the use of multi-fuel vehicles to expand the market for alcohol.

3. Promote co-generation (electricity with process heat or refrigeration) with special financing.

4. Rationalize subsidies linking them to amortization of transparent investment credits for different alternative energy sources and technologies, inhibiting long-lasting subsidies of uncompetitive operational costs.

### 3. Brazil can do better

Here are some ideas for discussion on how to strengthen public institutions for achieving more security of electricity supplies:

1. Energy policy is ultimately a Presidential responsibility. The decision-making process should be strengthened by increasing the powers of the Energy Ministry, under Presidential supervision, and by removing it from coalition politics. The goals can be achieved by only appointing qualified professionals to top positions, including that of Minister.

2. The National Council for Energy Policy (CNPE) was established by the Petroleum Law of 1997 and lapsed into inactivity shortly after its regulations were approved in 2000. Recently revived by the new Energy Minister, the Council should be supported by a qualified staff to plan for contingencies and to produce an overall flow-of-funds analysis of the electricity sector every two years for submission to Congress and the President. The Council should have powers to subpoena information from market participants, including ANEEL.

3. With information provided by the Ministry and the National Energy Council, the government should publish a 10-year energy plan in the second year of each administration, to be approved or rejected without amendment by Congress. The plan should state investment needs, identify prospective sources of funding and outline a set of economic signals and incentives needed to attract investment.

4. The administration that takes office in 2003 should propose to Congress a new Energy Code to replace the Water Code decreed by Getúlio Vargas in 1934. The new Energy Code should be drafted by a commission of five leading specialists in energy policy, supported by a small staff with expertise in economic and legal aspects of electricity, who would consult extensively with producers, distributors and consumers. The new Code should authorize contracts in foreign currencies, with

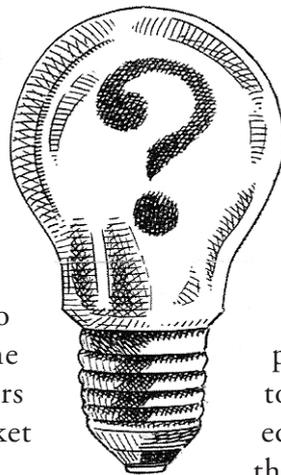
electricity prices and asset values to be readjusted for inflation. The new code should provide a sound legal framework for competitive pricing and clarify basic concepts of existing legislation on public service, financial accounting and profitability. The new code also should better define the roles and responsibilities of public agencies such as the Energy Ministry, ANEEL, National Council for Energy Policy (CNPE), National Petroleum Agency (ANP), Eletrobrás and Petrobrás.

5. The professional staff of the electricity industry and its regulatory agencies badly needs renewal. An Institute for Higher Energy Studies should be established, with curricula in specific areas of engineering and economics. Directors and senior technical staff of regulatory agencies and state enterprises should be required to pass rigorous competitive examinations administered by the Institute. This system of advanced study and examination would qualify professionals for salary supplements to guarantee incomes competitive with equivalent jobs in the private sector. Also, these professionals would participate in exchange programs with regulatory agencies and utilities in other countries, involving periods of residence abroad.

Congress should create a Joint Committee on Energy Policy, supported by a permanent staff of graduates of the Institute for Higher Energy Studies, to review new legislative proposals and monitor developments in planning, finance and supply in energy industries.

Further privatization of generating companies should reduce their market power to create effective competition, with state utilities keeping assets needed for water flow regulation as instruments of public policy.

6. Distribution companies should increase their long-term supply contracts from 85% to 95% of estimate needs, as proposed by the Revitalization Committee, with standby reserve capacity of 12% contracted mainly with thermal plants. Long-term



contracts are needed because financial markets require firm commitments to support project finance.

7. Instead of open bidding for each new project on the interconnected national grid, there should be at most one transmission company, public or private, for each geographic region. Transmission companies should be carefully regulated, within international standards of employment ratios for their workloads, under a rate structure sufficient to support financially investment and maintenance responsibilities in their areas.

8. In 1995 all electricity concessions were renewed for 30 years, with possible extension in 2025 for another 20 years. The government will be exposed to intense political pressure in 2025 to renew all concessions at once, incurring huge economic losses while concessionaires reap windfall profits after a short payback period for project finance over 10-15 years. The maximum term of future concessions should be 25 years, renewable at 10-year intervals subject to pre-established performance criteria and increased royalties upon renewal.

9. Tariffs for generating electricity should be raised to compensate for the big fall in the share of generating companies in revenues of the system during decades of chronic inflation. This increase would make thermal plants financially viable, facilitating further privatization, and would remove excessive subsidies to large industrial consumers.

10. To avoid windfall profits to older hydroelectric producers, the large gap between generation costs of amortized hydropower stations and new thermal plants would be breached by an equalization tax, to be revised every 10 years in line with evolution in costs and technologies, on electricity generated by hydro plants more than 10 years old. In addition to making new thermal plants more competitive, the equalization tax would raise government revenues, permitting tax reductions in other areas, and would help to rationalize consumption patterns.

11. A competitive gas market is needed for effective competition in electricity generation. For a competitive gas industry to develop in Brazil, the vertically integrated Petrobrás monopoly of production, transport and distribution of gas resources of Brazil and Bolivia must end. Under present contracts, Petrobrás forbids distributors from resale of gas, thus blocking development of a secondary market. To allow competition, Petrobrás must divest itself of majority ownership of the Brazil-Bolivia gas pipeline and, in two or three tranches, eventually auction off 60% to 70% of its intake from the Bolivian gas fields that it owns wholly or partially. The World Bank loan that financed the project requires this divestiture. Instead, a new independent company should be formed to transport gas with open access to all producers and consumers, including Petrobrás. The price of gas is inflated by the cost of financing the politically-inspired and uneconomic decision of the government in the mid-1990s to extend the Bolivia-Brazil pipeline to Porto Alegre in the far south of Brazil. The federal Treasury could reduce the price of gas by assuming part of this debt service. Reducing this debt burden also would enable Petrobrás or any future owner of the pipeline to lower the gas price by modifying “ship or pay” contracts with distributors and thermal plants, lowering compulsory transportation payments from the 95% of contracted gas nearer to the 75% in current “take or pay” deals.

12. Distributors must contract for additional power supplies to provide a margin of security above projected peak demand, with some of these marginal supplies purchased from thermal plants. Long-term contracts are needed because it takes at least two or three years to finance, develop and build a thermal plant, with costs recovered over roughly 15 years.

13. Electricity conservation in Brazil is still in its infancy and should be intensified. Rationing in 2001-2, cutting demand by 20%, suddenly demonstrated the huge economies to be harvested from reducing waste.