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National Energy Policy: Brazil

SERGIO V. BAJAY
State University of Campinas
Campinas, SP, Brazil

Glossary

cogeneration The simultaneous production of power (either electrical or mechanical) and useful heat (e.g., process steam) using a single fuel source.

firm power Continually available power, or power that is available for a large, prespecified, part of the time.

"free" electricity or gas consumer A consumer free to choose a supplier of electricity or gas, in contrast to a "captive" consumer.

energy service company A business that implements energy conservation measures for its customers and is paid by them part of the corresponding cost savings.

independent power producer An electrical power producer that is not a generation utility, i.e., does not have a concession contract and is not regulated. Independent producers compete, at their own risk, with other producers and, sometimes, with generation utilities in a power supply market.

indicative forward planning Prospective studies, carried out or contracted by government bodies, indicating possible expansion paths and providing guidance about future investment needs to interested agents.

Some of the current national energy policies in Brazil were adopted during the two terms of President Fernando Henrique Cardoso, from 1995 to 2002. Other policies that were set up earlier have evolved over time to their present form. Since the middle of 2003, under the government of President Luis Inácio Lula da Silva, who took office in January 2003, there have been proposals to change some of these energy policies. Potential shifts that may impact the national energy policy of Brazil include institutional and managerial changes in the country's energy supply industry; the fostering of some types of energy supply development and demand-side management programs; the formulation of energy price regulations; tariff making, with cross-subsidies for some large consumers; the granting of subsidies to the poor for fuel and electricity purchases; increasing the cross links between energy and environmental policies; and integrating the approach to energy policy making and forward planning. In this latter matter, the roles of the Ministry of Mines and Energy

and the National Council for Energy Policy are of paramount importance.

1. ORGANIZATION OF THE BRAZILIAN ENERGY SUPPLY INDUSTRY

From the 1940s and through the 1950s and 1960s, the federal government of Brazil, with the help of the state governments, undertook the charge of assuring, through state-owned companies, the supply of most of the electricity, oil and gas consumed in the country. A state monopoly for the production, importation, processing (with the exception of private refineries existing at that time), and transportation of oil and gas was defined by the 1953 mandate, Law No. 2004, and was granted to Petrobras, a federal-government-owned company created for the purpose. Distribution and retail trade of oil products were kept out of the monopoly, instead being shared among BR, a subsidiary of Petrobras, and large transnational oil supply companies such as Shell, Exxon, and Texaco. Some Brazilian states formed state-owned companies to distribute and trade initially town gas and later natural gas.

The Brazilian government created Eletrosul, Furnas, Chesf, and Eletronorte to generate and transmit electricity for, respectively, the southern, southeastern / midwestern, northeastern and northern regions of the country, putting all of these entities under the control of a holding company called Eletrobras. Chesf also sells electricity for some very large consumers in the northeastern region, and Eletronorte, besides doing the same in the northern region, also provides distribution services in the capitals of the northern states. All of the state governments formed electrical energy distribution and retail supply companies; some of them, such as Cesp (in the state of São Paulo), Cemig (in the State of Minas Gerais), and Copel (in the State of Parana), also generate and transmit power. At a later stage, the federal government acquired control of two large electricity distribution utilities, Light and Escelsa, which supply areas located in the States of Rio de Janeiro and Espírito Santo, respectively.

Petrobras and Eletrobras, the latter with the cooperation of all the large state-owned electricity supply utilities in the country, did the required forward (expansion) and operation planning exercises for the oil and gas and electrical power supply industries, respectively, and proposed the associated energy policies for the Ministry of Mines and Energy. This scheme, of having state-owned companies as the main operators in the Brazilian energy supply industry, involving both federal and state governments, succeeded up to the mid-1980s, when a number of policy positions cast shadows on the adequacy of the scheme for the future. The missteps included (1) the artificially low tariffs for electricity (mirroring most public service tariffs imposed by the federal government, in often vain efforts to control high inflation rates) and (2) the political misuse of electricity supply and gas distribution utilities (involving incompetent and often corrupt management and the initiation of construction of several plants, particularly electric power stations, primarily to reap political benefits to some politicians, but without the necessary funding to finish them on schedule), coupled with the desire of the federal government to have substantial and fast increases in domestic production of oil and gas. Discussions about what institutional changes should be made to correct the problems dragged along through several governments and lasted nearly a decade, up to the time when a deep financial crisis in the electricity supply industry required urgent action. President Fernando Henrique Cardoso, in the beginning of his first term in office, decided to sell all of the federally owned electrical power utilities to private investors and also to exert political and economic pressures on state governments to do the same. At the same time, two amendments to the Brazilian Constitution were passed in Congress, ending the legal monopoly of Petrobras and allowing the state governments to grant concessions to

investor-owned gas distribution utilities and not just to state-owned ones, as was the case before this change. The control of Petrobras continued to be in the hands of the federal government, but Petrobras was expected to compete with private companies in the production, importation, processing, and transportation of oil and gas, allowing, according to the government wishes, lower prices in the market and substantial increases in the domestic production of these commodities.

At the end of President Cardoso' second term (December 2002), some competition was achieved in domestic exploration; four bidding rounds were carried out to grant exploration and production (EP) licenses, but no licenses have been granted for production of oil and gas (no large findings have occurred outside Petrobras' EP areas), of oil and gas, and few licenses were granted for importation of natural gas. No competition has occurred in the processing and transportation of oil and gas. Several transnational companies operating in this industry have preferred so far to set up joint ventures with Petrobras, rather than to challenge a competitor with such market power as Petrobras still has in Brazil.

Privatization in the electricity supply industry occurred to a much more limited extent than was planned initially by the government. Around 70% of the distribution capacity was actually privatized but less than 30% of the generation capacity went to private hands (the large generation and transmission utilities Furnas, Chesf, Eletronorte, Cemig and Copel continue to be state-owned). This partial failure of President Cardoso's government plans was caused by strong political opposition to the privatization of these utilities, not just from opposition parties but also from the government's own rank and file, particularly after the electricity supply shortage of 2001. Rolling blackouts were avoided due to a power rationing program, in effect from June 2001 through March 2002; also, several short-construction-time generating plants were built, to provide reserve capacity, and some generation and transmission facilities were brought online ahead of schedule.

Big changes however were made in the Brazilian electrical power supply industry. A regulated third-party access system was mandated for both transmission and distribution networks. An independent regulatory agency (ANEEL), a national system operator (ONS), and a wholesale market (MAE) were created; because of legal disputes among some utilities, the latter did not settle the short-term transactions (spot market) up to the end of 2002. The distribution and trade activities of the distribution utilities now have separate accounting systems and for some utilities, the generation and transmission businesses were split into different companies during the privatization process. Some new agents in the electricity market were created, such as the independent power producers (IPPs), the "free" consumers (who, as opposed to the traditional "captive" consumers, can choose their electricity suppliers), and the pure traders (who do not own any generation, transmission or distribution assets).

In the oil and gas supply industry, a negotiated third-party access scheme was defined by Law No. 9478, which detailed, in 1997, the new "rules of the game", to promote competition in the industry. The same law created the National Petroleum Agency (ANP), an independent agency that regulates the whole oil supply chain and the upstream activities of the natural gas supply chain.

The opening up of the Brazilian energy supply industry to private investors, in order to redirect public investments to other areas and to introduce competition in the industry, in line with what is happening in several other countries, was the main energy policy of President Fernando Henrique Cardoso. As a result of this policy, there are now both private and state-owned large companies in both main branches of the industry (oil/gas and electricity supply). Electricity tariffs, rising much faster than the country's inflation rates, represent a big problem facing the new federal administration. This

has been exacerbated in the past few years by growing marginal costs (particularly for generation), by clauses in concession contracts linking the annual tariff updates to an inflation index (which has been overvaluing the strong devaluation of the local currency, the real, since 1999), and by the perception among private investors in the industry of a high risk business environment, which, in the short term, either increases profit expectations or decreases investments.

In order to solve this problem, by making some changes in the current institutional model of the Brazilian electric power supply industry, the government of President Luis Inácio Lula da Silva intends to negotiate with the utilities the inflation index issue and to pursue programs to reduce the perceptions of high risk. The main changes proposed by the Ministry of Mines and Energy in July 2003 and, after discussions with the interested parts, reaffirmed with minor modifications in December 2003, are as follows:

1. The electricity supply market will be divided into two parts, one comprising the free consumers and the other comprising the captive consumers. Free consumers choose their suppliers among independent power producers, or traders, and buy from them their energy requirements, through freely negotiated bilateral contracts; the captive consumers deal with a distribution utility, through a pool managed by a new entity, the Administrator of Electricity Contracts (ACEE), which will replace the current electricity wholesale market (MAE) organization.
2. The tasks of ACEE will be management of long-term bilateral contracts among generators and distributions utilities and settlement of contractual differences for all market agents.
3. A new state-owned company, the energy research company (EPE), will be created to carry out the long-term (20 years ahead) and medium-term (10 years ahead) expansion planning exercises for the Ministry of Mines and Energy (MME); the resulting plans will be publicly discussed and eventually modified before final approval and implementation by the Ministry.
4. The plan for 10 years ahead will define the hydropower plant projects, the pre-defined energy and capacity generation blocks for thermal power plants, the regional constraints, and the transmissions lines that should be auctioned by MME (no longer ANEEL), in addition to the required commissioning dates, to meet the forecasted demand of the pool consumers.
5. The bidding process referred to previously will allow proposals, by interested agents, of alternative projects to fulfill the energy supply or transmission needs as outlined in the plan. The proposal requiring the least revenue during the concession period will be the winning bid.
6. Preference will be given to public service generation utilities, instead of independent power producers, to supply the pool. Such utilities will sign a concession contract with MME and will have their firm power shared among all distribution utilities of the national interconnected grid, through compulsory long term bilateral power purchase contracts.
7. Meeting the forecasted demand of the distribution utilities for the next 5 years should be fully assured through these long-term power purchase contracts. Special contractual arrangements are proposed for additional power purchases, in association with nonpredicted demand requirements.
8. EPE, ONS, ACEE, and ANEEL will help MME to oversee the supply conditions over the next 5 years, proposing corrective measures whenever necessary, which includes setting up generation reserve margins.

These changes were brought to the Brazilian Congress in December 2003, in the form of

proposals of two new laws, to be enacted in the first half of 2004.

President Silva has emphasized that no further privatizations in the electricity supply industry will take place during his presidency. The partial deverticalization process carried out in this industry under the previous administration will continue in the new administration; vertically-integrated utilities will form separate companies to carry out generation, distribution, and trade activities with free consumers, whereas separate accounting systems will suffice in the case of generation and transmission.

2. THE NATIONAL COUNCIL FOR ENERGY POLICY

The National Council for Energy Policy (CNPE) was created in 1997 by Law No. 9478, but was not actually installed until October 2000. According to a report issued in 2001 by a commission formed by the government to search for the causes of that year's electricity supply shortage, earlier activation of the council would have helped to avert or, at least, to minimize the effects of the shortage.

The National Council for Energy Policy consists of ten members, seven ministers of state bureaus (Mines and Energy, Planning, Economy, Environment, Industry and Trade, Civil House, and Science and Technology), one representative of the state governments, one representative of the universities, and one citizen expert on energy policy issues; the President of the Republic appoints the latter two members. The CNPE is headed by the Minister of Mines and Energy, who forwards proposals of energy policy resolutions to the President of the Republic; once approved, the proposals have the power of a presidential decree. Thus, CNPE is the most important forum for setting energy policies in the country. At the end of President Cardoso's second term, three technical committees were lending support for the council activities: one committee addressed the activities of the electrical power sector, another dealt with fuel supply chains, and the third focused on activities concerning required changes in the institutional model of the Brazilian electrical power supply industry.

3. FOSTERING ENERGY SUPPLY

Most of the national energy policies aiming to foster various forms of energy supply in Brazil were conceived in the 1970s. Policy development focused on medium- and large-scale hydroelectricity plants, coal-fired power plants, nuclear power stations, large-scale petroleum and gas production from offshore wells located in deep waters, and fuel alcohol production from sugar cane. Policies to boost the generation of electricity from gas-fired power plants, small hydropower stations, wind power, and biomass resulted from decisions made during President Cardoso's government. All of these policies are briefly reviewed in the following sections.

3.1 Hydroelectricity

Brazil has a large hydroelectric potential, i.e., 258.420 MW, of which just 23.9% corresponded to plants in operation in 2002 and 4.3% represented hydropower stations under construction at that time. Since the middle of the 20th century, particularly after the 1960s, the federal and state governments have made large-scale efforts to tap this valuable and comparatively cheap resource, building the plants themselves through state-owned utilities or, more recently, providing credit facilities for private investors, through the National Bank for Economic and Social Development (BNDES).

Of the total installed capacity of electrical power plants in Brazil as of December 2001, the share of hydropower stations was 82.25%; the corresponding figure for public supply plants at that time was 84.92%. During President Cardoso's government, there was a policy guideline establishing that investments in new hydroelectric power plants should be carried

out preferentially by private entrepreneurs, with possible minority participations of state-owned utilities in the case of projects of strategic interest for the federal administration. Spokesmen from the new government have declared recently that state-owned utilities will have more opportunity to invest in hydroelectricity than they had in the previous administration.

3.2 Coal-Fired Power Plants

Brazil's recoverable coal reserves as of December 2001 were estimated at 32.4 billion tons, the largest coal reserves in Latin America; the mines are located in the southern states of Rio Grande do Sul, Santa Catarina and Parana. The coal's high content of ash and, in most of the mines, sulfur severely limits the use of Brazilian coal in the iron and steel industries, and the remoteness of the mines necessitates great transport distances; in the year 2001, 99.9% of the coal consumed in Brazil's iron and steel plants was imported.. The lack of appropriate railway networks in the mining regions also adds a further difficulty to the transportation problem. The Brazilian coal-mining industry has therefore always depended on the construction of new coal-fired power plants to survive. However, these plants haven never been competitive with hydropower stations in Brazil, and have thus required subsidies to be built and operated.

Under the old rules of the Brazilian electricity supply industry, state-owned utilities have been building coal-fired power stations in the southern states of the country, close to the mines, for strategic reasons (diversification of the fuel mix for power generation and, as a result of an industrial policy, aiming to increase the domestic production of components for such plants; a fund (CCC) created by an electricity surcharge was formed to subsidize the operation of these plants when required, i.e., during years and seasons of low inflows to the hydro plant reservoirs. A minimum capacity factor for the plants, however, has been fixed, because of minimum annual consumption levels specified in the coal supply contracts, required to keep the mines running.

The new rules of the game in the Brazilian electricity supply industry, aiming to foster industry competition, cast shadows on the future of the coal mine industry in the country; the CCC fund, for instance, will be downsized from 2003 to 2005 and eliminated in 2006, according to 1997 legislation (Law No. 9648). Law No. 10,438, passed by the Brazilian Congress on April 26, 2002, however, opened a new door for the coal producers; the resources of a new fund (CDE), created by this law for the electricity supply industry, can, among other uses, be employed to finance both old stations (for operating expenses, replacing the cash flows from the CCC fund) and new coal-fired power stations. The amount of the CDE fund to be made available for such purpose will be defined on a regular basis by the National Council for Energy Policy.

3.3 Nuclear Power Stations

President Cardoso's administration created Eletronuclear, a subsidiary of Eletrobras, to assume responsibility for the nuclear plants in Brazil. Brazil has two operational nuclear power plants, Angra-1 (675 MW) and Angra-2 (1.3 GW), both located at the town of Angra dos Reis, in the state of Rio de Janeiro. Angra-1 was bought from the U.S. company Westinghouse in 1969. The Angra-2 plant came online in 2000, 23 years and $10 billion (U.S. dollars) after construction began; it was the single outcome, in terms of power plant building, of a very ambitious nuclear power agreement signed between the Brazilian and German governments in 1975, which envisaged the construction, by Siemens of Germany, of eight nuclear power stations in Brazil; the agreement also specified the transfer of German technology related to fuel cycle activities (mining, processing, fuel enrichment, fuel element manufacturing, and reprocessing), and the

joint development of a new uranium enrichment process.

The construction of a second nuclear plant (Angra-3, with an installed capacity of 1.3 GW), included in the Brazilian/German agreement, was started in 1981, involving foundation works and the acquisition of German equipment. Due to budget cuts and to some opposition from environmental groups, the construction was stalled and the equipment for the plant has been mothballed. However, the electricity supply crisis of 2001 bolstered interest in bringing the Angra-3 plant into service. Those in favor focus on the need of the country to diversify its sources of power generation and to take advantage of its substantial uranium reserves (the world sixth largest: 309,370t of U_3O_8 as of December 2001); furthermore, there is the fact that about $750 million (U.S. dollars) has already been spent on the plant, including the purchase of about 60 per cent of the required equipment. These resources will be lost if the project is abandoned and Eletronuclear will be unable to develop sufficient scale to become competitive. On the other hand, those against Angra-3 point out that the project will require around an additional $1.7 billion (U.S. dollars) and will take at least five years to be completed; it is also emphasized that the population still views nuclear energy with suspicion, because issues surrounding safety and the final disposal of the radioactive residues have not yet been resolved.

CNPE authorized Eletronuclear in 2001 to carry out the necessary economic and environmental feasibility studies (Resolution No. 05, approved in December 2001). In August 2002, the Council voted in favor of Eletronuclear resuming the construction of Angra-3 after the necessary environmental licenses have been granted, if the new government does not decide to halt the process (a CNPE meeting was scheduled for May 2003 via Resolution No. 8, of September 17, 2002); major outlays in the project should occur only after that meeting). This decision was postponed for 2004 by the new federal administration, in part because of current surplus power supplies in MAE and in part because of urgent cash problems at Eletronuclear, requiring a tariff revision by ANEEL.

Apart from Angra-3, no other new nuclear plants are planned for Brazil. Such plants may be built in the future only if safer and less expensive new technologies, still at the research and development stage, succeed on an international scale.

3.4 Oil and Gas Production from Offshore Deepwater Fields

Brazil has the second largest proved oil reserves in South America (after Venezuela), at 1.35 billion m^3, or 8.48 billion barrels, as of December 2001; 88% of the total is in offshore basins and 80% is at depths above 400 m. The natural gas proved reserves as of December 2001 stood at 219.84 billion m^3, or 7.76 trillion ft^3, the fifth largest in South America behind Venezuela, Argentina Bolivia and Peru; 60% of the total is in offshore basins and 40% is at depths above 400 m.

The production of both petroleum and natural gas has been rising steadily in Brazil since the early 1990s, reaching, in 2001, 75.22 million m^3, or 1.3 barrels per day (bbl/d) of petroleum, which met 79.3% of the consumption at that year, and 14.04 billion m^3, or 1.36 billion ft^3 per day of gas. Imports of gas from Bolivia started in 1999 and imports from Argentina in the next year, totaling 4.61 billion m^3, or 0.45 billion ft^3 per day in 2001. The offshore Campos Basin, north of Rio de Janeiro, is the country's most prolific production area for both oil and gas, containing around 80% of the national reserves. The Santos Basin also holds large gas fields. Brazil's oil imports come mostly from Venezuela and Argentina.

As was the case with many other national oil companies, Petrobras initially concentrated on building up its downstream infrastructure, particularly from 1965 to 1974. In the wake of the first oil price shock, in the middle 1970s, the Brazilian government ordered the management of

Petrobras to implement three new policies aiming to decrease the effects of the oil price rises on the national balance of payments: (1) the international expansion of the company in upstream activities, through a subsidiary, Petrobras International (Braspetro); (2) signature of service contracts, with a risk clause, with private oil companies in regions not yet under exploration; and (3) an increase in the national production of oil and gas through exploitation of offshore, mainly deepwater, fields, which make up most of the Brazilian reserves. The first two strategies failed, but the last one has been highly successful. Petrobras' accomplishments in deepwater production have been internationally acknowledged and the Campos basin's success at proving giant reserves at great depths has attracted attention worldwide. Many companies have been encouraged to come to Brazil to participate in ANP's promoted bidding rounds, in order to develop upstream exploration, some of them without partnering Petrobras.

In 1986, Petrobras began the first of the Procap programs (Petrobras technological development program on deepwater production systems, or Procap 1000). The main objective of this program was to improve the company's expertise in oil and gas production in water as deep as 1,000 meters. It also consolidated Petrobras' production concept based on floating production systems. Petrobras' Procap 2000, launched in 1993, emphasized the development of technologies aimed at reducing investment and operational costs as well as improving efficiency and extending the working life of equipment at water depths of 1,000-2,000 m. Procap 3000, implemented in 2000, goes even further, seeking to develop technologies that will make oil and gas production in ultra-deep waters, below 2000 m, technically and economically feasible. In 2000, the US Geological Survey published new estimates of global oil reserves, suggesting that Brazil might still have some 47 billion barrels of undiscovered oil, almost all in offshore fields, with about 35% in the Campos basin.

Apart from the second half of the 1980s, when Petrobras' management became involved in a long battle with the Ministry of Economy, which decided to cut back the company's expenditures and investments, the rest of the time the federal administration has supported the company's effort to boost oil and gas production from offshore deepwater fields, striving in the medium term for self-sufficiency in oil production. This is likely to continue with the new administration.

3.5 Fuel Alcohol from Sugarcane

Since 1975, with the creation of the National Alcohol Program (Proalcool) by Federal Government Decree No. 76,593, Brazil has produced anhydrous alcohol from sugarcane; this alcohol is blended with gasoline in Otto cycle car engines in proportions of up to 25%. With the second phase of Proalcool, which started in 1979 (Federal Government Decree No. 83,700), hydrated alcohol has also been produced for use in Otto cycle engines modified to run on 100% ethanol, or neat alcohol.

Currently Brazil is the world's largest producer of sugar cane, with crops often yielding over 300 million tonnes of crushed cane per harvest season. Prior to Proalcool, the Brazilian share was less than 15% of worldwide production. During the 1970s, many ethanol distilleries were installed in the country, either as new plants or as distilleries annexed to existing sugar mills. The main alcohol-producing states are São Paulo (contributing over two-thirds of the total), Rio de Janeiro, Alagoas and Pernambuco. Since Proalcool was created, two main products have been obtained from sugarcane: sugar and fuel ethanol. The former has been an important component of the basket of commodities exported by the country since the time Brazil was a colony of Portugal; in contrast, exports of fuel ethanol have been sporadic and have faced many protectionist barriers abroad.

The production rate of fuel ethanol has varied according to the relative prices of

both sugar, particularly in the export markets, and alcohol, which are the main factors affecting production, besides climatic and environmental variables. When sugar prices are high, the production of alcohol decreases, and vice versa. Up to the beginning of the current decade, the price of fuel ethanol was fixed by the government, tracking with the controlled price of gasoline; now both prices are determined by market forces, although they will eventually be subject to government pressures on Petrobras and on the alcohol producers when prices increases are considered too high.

The main objective of Proalcool, rapid growth of the alcohol industry, in conjunction with subsidies that increased alcohol production capacity in the 1970s and early 1980s, has facilitated the building of a large alcohol industry. Within the industry, there is still considerable need for increasing energy efficiency and reducing production costs; government policies for this industry have so far failed to address the important issue of cost-effectiveness. The Proalcool program was discontinued in the early 1990s during President Collor de Mello's term in office. The federal government, however, continues to foster the production of fuel ethanol by maintaining the requirement of a mandatory blend of anhydrous alcohol with gasoline. The blend formulation set by the government is between 18 and 25% ethanol, depending on the annual production of ethanol, which, as already pointed out, is strongly affected by sugar prices abroad.

In support of the fuel ethanol program, there are discounts on federal taxes applied to alcohol-fueled cars (the IPI tax) and to fuel ethanol (the recently created CIDE tax). The share of alcohol-fueled cars in total sales of new cars dropped from 96% in 1985 to 1.15% in 2001, after a low of 0.07% in 1997. At the end of 2001, there was an aging fleet of neat alcohol-fuelled cars, estimated at about 2.5 million vehicles. New policies have been considered by the federal government to boost the production of hydrated ethanol once more. The most important measures that have been envisaged are the compulsory addition of ethanol to diesel oil in buses and lorries and the establishment of government "green fleets" that will run on neat ethanol. None of these measures, however, has yet been adopted, and the outlook for hydrated ethanol production in Brazil is not promising. On the other hand, the prospects for future growth in the production of anhydrous alcohol to blend with gasoline are bright, not only because of the environmental benefits of such blends, in terms of reduction of air pollution, particularly in large cities, but also because of the good prospects for "flexible fuel" vehicles. These vehicles employ electronic fuel management technologies that allow use of any blend of anhydrous alcohol with ethanol. Some flexible fuel models are already available in the Brazilian market. Because the prices for these vehicles are higher than the prices for the low-ethanol-blen counterparts, the government is evaluating the adoption of financial incentives to help boost sales.

A rapid hydrolysis process to produce ethanol from sugarcane bagasse is being developed in the State of São Paulo. A demonstration plant should be operating soon. If this technology proves economically feasible, it will allow an increase of around 30% in alcohol production with the use of 50% of the currently available sugarcane waste (tops and leaves, or "barbojo"), without any additional contribution from sugarcane plantations. There have been significant improvements in the productivity of both sugarcane agriculture and the ethanol-based industrial sector. These gains have been due to a combination of factors, including: (1) introduction of new and improved sugarcane varieties, (2) better economies of scale from larger and more efficient new plants, and (3) technological improvements and energy conservation measures in old plants. However, there is still room for further cost reductions. Finding better uses for the sugar and alcohol by-products, such as sugarcane bagasse, barbojo, and vinasse (organic wastewater), is certainly an excellent route to improving the economic performance of these plants.

The prospects to increase the current generation of surplus electricity in cogeneration plants located in sugar mills and alcohol distilleries are also promising.

3.6 Gas-Fired Thermal Power Plants

Brazil has a large natural gas pipeline network to transport the gas produced in the Campos and Santos basins to the cities of Rio de Janeiro, São Paulo, and Belo Horizonte. There is also a long pipeline for collecting and transporting the output of gas fields located in the northeastern region of the country to the local capitals and industrial areas; there are plans to interconnect these two systems. There are also smaller transportation networks to receive the production from the offshore Espirito Santo Basin and from the onshore field of Urucu; the former delivers gas to Vitoria, the capital of the State of Espirito Santo, and to industrial areas in the northern part of that state, and should be connected soon to the Campos/Santos network. Commissioning of the onshore field of Urucu awaits completion of pipelines that will supply Manaus and Porto Velho, the capitals of the states of Amazonas and Rondonia, respectively. All of these gas pipelines are owned by Petrobras.

There are two international gas pipeline connections in the country. The first pipeline to connect Brazil to foreign gas sources was the Bolivia-to-Brazil pipeline, tapping Bolivia's Rio Grande sources and servicing the states of Mato Grosso do Sul, São Paulo, Parana, Santa Catarina, and Rio Grande do Sul; this pipeline came onstream in July 1999. In the Bolivian part of the pipeline, there is a diversion to supply a power plant and other consumers in Cuiaba, the capital of the state of Mato Grosso. Partners in the Brazilian section of the pipeline include Petrobras, which is the major shareholder, Enron, Shell and BBPP Holdings. The second international pipeline links the city of Parana, in Argentina, to Uruguaiana, in the state of Rio Grande do Sul, Brazil, where it supplies gas to a 600 MW power plant. Transportadora de Gas del Mercosur is the pipeline's operator. Service began in July 2000. An extension of the pipeline, which will connect Uruguaiana to Porto Alegre, the capital of the State of Rio Grande do Sul, to service a new power plant in Porto Alegre, was planned but has been postponed. Additional Argentina-Brazil pipelines are in various stages of planning, although recent natural gas discoveries in Bolivia and Brazil could discourage the development of these projects. It is also possible that a second Bolivia-Brazil pipeline will be built.

The primary motivation behind the projects of most of the recently built or planned pipelines has been the hope for a fast buildup of natural gas demand in Brazil, in conjunction with expectations that there will be construction of a large number of gas-fired thermal power plants. The source of these expectations was the belief of President Cardoso's government that the private investors, under the new rules of the Brazilian electrical power supply industry, would prefer to build efficient, combined cycle, gas-fired power plants, as has been the case in many developed and developing countries, instead of new hydro plants, as has been the Brazilian practice in the past decades. Some initial uncertainties among the potential investors caused the Brazilian government to step in; in September 1999, the Gas-Fired Thermal Power Plants Priority Plan, or simply PPT, was announced. The first version of the PPT identified 15 projects, totaling 12 GW, expected to be on line by 2003. Specific regulations were established for these projects, such as a specific value for the upper limit pass-through that the electricity distribution companies are allowed to pass on to their "captive" consumers' tariffs. To reassure investors concerned about fluctuations in gas prices, which were in U.S. dollars and were indexed to a basket of fuel oils, the government, through Petrobras, set price ceilings on 20-year fuel supply contracts. There was just one gas price, revised quarterly, regardless of the power plants' location. In addition, the national

development bank, BNDES, offered a special loan program.

Uncertainty among the investors remained, however, such that none of the 15 projects got underway. The variation of gas prices with fuel oil prices, the exchange rate, the quarterly price revisions, and the lack of synchronism between the revisions of electricity and gas prices generated investor anxiety. So Petrobras was required to offer an alternative solution with a blended gas price indexed to the U.S. Producer Price Index (All Commodities) (PPI), revised annually. In April 2000, the federal government issued a revised version of the PPT, with the new price option and, in response to political pressure from local politicians and state governors, increased the number of projects from 15 to 51, all over the country. Apart from the ambitious and unrealistic number of proposed plants, the rapid devaluation of the Brazilian currency, the real, against the U.S. dollar created further difficulties, given that the gas price was set in dollars.

The electricity shortage of 2001 forced the government to launch its Emergency Thermal Power Plant Program, the last version of the PPT program, improving the conditions for all the project developers with gas already contracted or coming onstream before June 2003 (this was later extended to December 2004), up to a maximum volume of 40 million m^3/day. For these plants, MME/MF Order No. 176, on June 1, 2001, set a new gas price formula, valid for 12 years. The timetable for tariff revisions was rescheduled to bring gas and electricity into line. Petrobras will assume the exchange rate risk for 1 year before passing it on to the power plants at the time of their tariff revision. The annual revision of gas prices considers the Brazilian inflation index IGPM, with a weighting of 20%, and the exchange rate plus the PPI, with a weighting of 80%. Prices will be renegotiated every 3 years and the gas supply contracts are transferable. A further benefit to the plants under the new program, established by Law No. 10,312 on November 27, 2001, was the elimination of PIS/PASEP and COFINS, two federal taxes on the gross revenue accruing from the gas sales to such plants. According to estimates made by the Ministry of Mines and Energy in October 2002, based on the regular follow-ups carried out by the Ministry and considering plants in operation, undergoing trial runs, and under construction, at several stages and contracting levels, 19 gas-fired thermal power plants are likely to come online by 2004, with a total installed capacity of 7,157.6 MW, under the umbrella of the last version of PPT.

When the gas supply contract for the Uruguaiana power plant was signed, during the early stages of the Brazilian electric power supply industry reform, new gas-fired thermal power plants were competitive with new hydropower stations, according to calculations made using the prevailing cheap gas price negotiated for the contract and the reference unit costs for both types of plants, in Brazilian reals. The sharp devaluation of the real since 1999 and high oil prices, however, changed this picture, against the gas-fired thermal power plants. The Brazilian government believed that, in the medium term, such plants would regain their competitiveness. This reasoning was based on (1) decreasing thermal power unit costs accruing from competition among gas suppliers and from the growth in industrial uses for the gas, creating the necessary conditions for the development of a secondary gas market, which, in turn, would allow more flexible “take or pay” and “ship or pay” contractual requirements, and (2) increasing hydropower unit costs arising from plants located farther from the main load centers. Thus the government of President Cardoso decided to subsidize the cost of transporting gas in the country. Law No. 10,604, enacted on December 17, 2002, allows such a subsidy up to R$ 500,000,000 per year, using the CIDE tax as a resource. With this subsidy, with the lower prices for the commodity expected to accrue from negotiations with the Bolivian government and producers, and with the substantially increased medium term local production made possible by recent discoveries of large

fields in the Santos and Campos basins, the government expects to reduce by $0.50 (U.S. dollars) per million British thermal units or more the price of the gas, which should make the gas-fired power stations competitive again in Brazil.

A fundamental issue is the fact that, in Brazil, in contrast to most other countries, the opportunity cost of natural gas for power generation in public supply plants is determined by hydro generation in new plants. Thus, indexing the price of such gas to the prices of a basket of fuel oils, as is traditional in the oil and gas industry, is meaningless, in economic terms, in Brazil. The new federal administration is less enthusiastic than the previous one about large expansion plans involving gas-fired thermal power stations. Regarding possible new energy policies to boost gas demand in the medium term, incentives may be given to other gas uses, particularly for cogeneration plants in the industrial and services sectors.

3.7 Generation of Electricity from Small Hydropower Plants, Biomass, and Wind Power

Power generation units employing renewable sources of energy (e.g., small hydropower plants, wind power, solar energy and biomass) and cogeneration plants have received financial incentives in some countries. During the 1970s and part of the 1980s, the major reason was that they represented indigenous sources of energy, reducing the dependence on foreign sources. More recently, with globalization and the formation of economic blocks of countries, this argument has lost much of its early appeal. However, the potential of these generating units to create environmental benefits is being realized. The financial incentives can be orthodox, such as tax relief and attractive credit facilities, or heterodox, such as (1) compulsory purchases by utilities of the power generated by these plants at avoided costs; (2) purchase, for the public grid, of energy blocks through bidding restricted to some types of these plants; or (3) granting of purchase tariffs above the market rate for the energy generated in these plants (to be paid for by all consumers, or on a voluntary basis, depending on the willingness of consumers to pay more for "green" energy).

The sugar and alcohol, and paper and pulp sectors are the Brazilian industrial branches that rely more heavily on self-production to meet their electricity needs. They use mostly cogeneration plants burning industrial residues from biomass, e.g., sugarcane bagasse, firewood, and black liquor (a mixture of chemicals and dissolved wood materials). The new rules of the Brazilian electricity supply industry tend to encourage greater use of such industrial residues for process steam and power generation in cogeneration units, together with forestry residues and sugarcane waste (barbojo), since recent developments in harvesting machinery design and new collection practices are reducing the cost of the latter waste fuels for power generation, particularly if gasification is involved.

During the period 1996-1997, the Brazilian Minister of Mines and Energy discussed with interested parties a possible federal government decree that would oblige utilities to buy surplus power from cogenerators, up to a certain share of their market growth, more or less along the same lines of the American Public Utilities Regulatory Policies Act (PURPA) legislation, during its first phase. The project was badly designed and the proposed measures came up against the main directives dealing with the opening up of the Brazilian power sector. As a consequence, many utilities rallied against the project and succeeded in aborting it. Bearing in mind the American experience related to the application of the PURPA legislation, the board of directors of Brazil's regulatory agency for the electrical power industry, ANEEL, defined, through Resolution No. 021, on January 20, 2000, the minimum share of thermal energy production and the minimum total efficiency requirements that a cogeneration plant owner should meet to

become a “qualified cogenerator”. The creation of this qualification process aimed to set up procedures allowing the selection of eligible cogeneration units to receive incentives still to be defined. (Some of the requirements of ANEEL Resolution No. 021 should be revised, however, because they are either too slack regarding some combinations of technologies and fuels, or they are too strict regarding other combinations.) The first of the incentives was specified in December 2000 through MME Order No. 551, which included qualified cogeneration plants, using any kind of fuel available in the country, to be commissioned up to December 2003 (this was later extended to December 2004) in the PPT program, having rights to all program benefits.

For quite a while, Brazil’s most important development bank, Banco Nacional de Desenvolvimento Econômico e Social (BNDES), has been offering some credit facilities for the building of cogeneration units and electrical power plants using nonconventional renewable energy sources for quite a while. Although the conditions specified by BNDES are more favorable than what usually can be found on the Brazilian credit market, they are worse than those in the international market, particularly because of the long-enduring prevailing high interest rates in the country. Thus, this credit line was little used before 2001.

Before 2002, the owners of small hydropower stations (up to 30 MW) were the only renewable power producers to enjoy “heterodox” financial incentives in Brazil. In 1998, Law No. 9648 granted these producers access to any consumer with a contracted demand higher than 0.5 MW and relieved them from the payment of half the value of transmission grid use fees. The current minimum power demand limit, which defines “free” consumers, is 3 MW. Law No. 10,438, enacted on April 26, 2202, created the Incentive Program to Generate Electricity from Alternative Sources (Proinfa), comprising wind power, biomass, and small hydropower plants, to be implemented in two stages. Associated with this program, the law defined a new kind of agent in the Brazilian electrical power supply industry – the autonomous independent producer, whose business cannot be controlled or associated with any electricity generation, transmission, or distribution utility. Producers that do not meet this requirement can participate in the program, provided their share in the contracts does not exceed 25 per cent (50 per cent for wind power producers, in the first stage of the program), and no autonomous producer is precluded because of the requirements. Equipment manufacturers can be autonomous independent producers if at least 50% of the value of the equipment involved in the program is produced in the country.

Proinfa will hold public solicitations for each kind of power source. Priority will be given first to plants that have already obtained the Installation Environmental License (LI) and then to those holding a Preliminary Environmental License (LP). If more capacity is offered, satisfying the conditions above, than the capacity scheduled to be contracted, the plants with the shortest remaining environmental license periods will be chosen. In the first stage of the program, 3,300 MW, equally distributed among small hydro power plants, wind power stations, and biomass-fueled thermal power stations, will be installed up to the year 2006. Eletrobras will provide long-term contracts to purchase the energy produced by these plants, paying the so-called “economic value” associated with each technology, which should correspond at least to 80 per cent of the average electricity tariff in the country. The cost of theses acquisitions as well as the administrative cost of Eletrobras to manage this scheme will be shared among all categories of consumers in the National Interlinked System, proportional to measured individual consumption.

After completion of the first stage, a second stage will continue up to 2022, during which the generation from the plants should meet 15% of the annual load growth

and, considering the results of the first stage, 10 per cent of the electricity consumption in the country. Throughout 15-year-long contracts, Eletrobras will again buy the output of these plants, equally among the three technologies if there is enough supply. The purchase will, as before, be preceded by public calls and there will be the same selection criteria as used in Proinfa's first stage, but the price paid will be equal to the weighted average unit cost of new hydroelectric plants with an installed capacity above 30 MW and new gas-fired thermal power stations. The expenses associated with this purchase will again be shared among all consumers proportional to their measured consumption. The difference between the generation cost of each technology and the average unit cost will be paid straight to the producers, using the resources of a new fund (CDE) created by Law No. 10,438. ANEEL is responsible for overseeing the whole process, using, for this purpose, the Renewable Energy Certificates issued by the generators. The CDE fund consists of monies from the annual fees paid by the electrical power supply industry investors to the government for the right to use public goods, the revenues collected by ANEEL from the application of fines, and a new annual fee paid by all agents who sell electricity to consumers.

The creation of Proinfa by Law No. 10,438, inspired by successful legislation in Germany and Denmark, is a landmark approach to foster the generation of electricity from distributed renewable energy sources in Brazil. It has, however, some drawbacks, which should be addressed in future legislation. The first problem is the fact that the market share targets set for the generation of the renewable energy sources have no relation to environmental policy targets, to the amount of these resources available in Brazil at reasonable costs, to the indigenous manufacturing capacity the government wishes to foster, or to supplementary power sources, e.g., new thermal power plants, required to complement the generation of random energy sources such as wind and hydropower. Also, there was no study of the impacts of Proinfa targets on electricity tariffs, which is a major issue in a country with so many poor consumers. These targets should be reviewed in the future. Apart from eventually decreasing "economic values" for each technology, set by the Ministry of Mines and Energy, the program provides no further incentives to increase the cost-effectiveness of these sources; making the Renewable Energy Certificates tradable would be an important step forward in this direction.

In December 2003, the new federal administration put forward a proposal that would limit the annual addition of plants generating electricity from distributed renewable energy sources in the second stage of Proinfa, through specific auctions for such sources, to amounts which would not cause increases in the new pool prices (discussed in section 1) above 0.5% in any single year and 5% on a cumulative basis. According to the same proposal, from January 2005 onward, the generators interested in participating in the auctions will have to prove that at least 60% of their equipment and services will be produced in Brazil; this share will increase to 90% in 2007.

4. ENERGY EFFICENCY AND RESEARCH AND DEVELOPMENT PROGRAMS

Several energy efficiency programs have been sponsored by the federal government, as well as by the governments of some states (São Paulo, Bahia, Minas Gerais, and Rio Grande do Sul), since the 1970s. Of the national programs implemented in previous decades and still in operation, the most important ones are Procel, Conpet and the mandatory energy efficiency programs run by the electricity distribution utilities and overseen by ANEEL.

The Ministry of Mines and Energy and the Ministry of Industry and Trade created, through the MME/MIC Order No. 1877, on December 30, 1985, the Program to Reduce

the Waste of Electrical Energy (Procel), to be managed by Eletrobras. A presidential decree of July 1991 gave the coordination of the program to the Ministry of Mines and Energy and increased its scope, which included electricity consumption labels for household appliances and electrical motors; electricity consumptions audits in small and medium-size industrial and commercial premises; financing of research and development initiatives (particularly at the Eletrobras research center, Cepel), directed to the manufacturing of more efficient electrical appliances and motors; support for new legislation and regulation in the country concerning energy efficiency; support of projects directed to reduce losses in the generation, transmission and distribution of electricity; setting up of information systems and marketing activities on energy efficiency; and running educational and training programs aiming to bolster a culture of energy conservation. The Procel program has impacted households, the commercial and industrial sectors, public services such as illumination and water supply, and efficient management of electricity consumption in public buildings. Procel has gone through ups and downs. Since the mandatory energy efficiency programs run by the electricity distribution utilities were set up, in the late 1990's, Procel's role has been downgraded; its activities have been redirected to support ANEEL in the evaluation of the utilities' programs.

A 1991 presidential decree created the National Program to Rationalize the Use of Oil Products and Natural Gas (Conpet), to be coordinated by the Ministry of Mines and Energy and to be operated by Petrobras. "Conpet in the School" is its main institutional project. In the transportation sector, Conpet has two successful projects, SIGA-BEM and ECONOMIZAR. SIGA-BEM is a partnership with BR, Petrobras's subsidiary company for the distribution and retail trade of oil products, directed to advice truck drivers in BR's filling stations about how to reduce the consumption of diesel oil in their vehicles. ECONOMIZAR is a partnership with the National Confederation of Transportation, which, through mobile units, provide assistance to garages and service shops of load/passenger transportation companies in the search of the optimal management of their diesel oil stocks, aiming to reduce specific fuel consumption and pollutant emissions of the serviced fleets. Most of Conpet's initiatives in the industrial sector have been directed to energy efficiency improvements in Petrobras' refineries, including a wider use of efficient cogeneration units. In the residential / commercial sectors, Conpet is responsible for pioneering the labeling of liquefied petroleum gas (LPG) consumption of stoves. So far, Conpet has been managing with less financial resources and a shorter scope of action than Procel, but has shown a much more stable performance in running its projects.

Since 1998, the concession contracts of the electricity distribution utilities have contained a clause that requires them to apply at least 1% of their annual income to energy efficiency and research and development programs, with at least 0.25% going to demand-side management programs and at least 0.1% going to research and development activities. ANEEL regulates these programs and oversees their results with the help of Procel's staff and experts from some state regulatory agencies that have contracts with ANEEL. ANEEL has set boundary conditions for the range of activities covered by these programs, which, in essence, has been similar to many of those developed earlier by Eletrobras in Procel. Law No. 9991, enacted in July 2000, rules that the electricity distribution utilities should apply annually at least 0.75% (0.5 per cent up to December 2005) of their net operational income to research and development projects and at least 0.25% (0.5% up to December 2005) to energy efficiency programs on the demand side. Electricity generation utilities, independent power producers, and distribution utilities are also required by this law to spend at least 1% of their net operational income on research and development programs. Half of all these research and development

resources will be managed by ANEEL, and the other half will be channeled to the Electricity R&D Fund, created by Law No. 9991, to be managed by the Ministry of Science and Technology. The new federal administration intends to redirect half of the resources managed by ANEEL to partially fund EPE's activities.

Petrobras has been sponsoring research and development activities related to the production chain of oil and natural gas since the early days of the company, particularly at its research center, Cenpes. The Petroleum National Agency has, since its installation in 1998, been regulating research and development programs in this field, with resources coming from the royalties paid for by oil and gas concessions (Presidential Decree No. 2851, November 30, 1998, which created the National Fund for Scientific and Technological Development for the oil and gas industry) and by the concession contract of Petrobras (1% of the company's gross revenue accruing from production activities). The Ministry of Mines and Energy also funds several applied research projects in various universities, involving alternative fuels and/or technologies, particularly in the Amazon region.

In terms of energy policy, the most important incentive in recent years to the search for a higher level of energy efficiency in Brazil was the enactment of Law No.10,295, on October 17, 2001; this law allows the government to set up maximum levels of specific energy consumption, or minimum levels of energy efficiency, for energy-consuming equipment produced in Brazil or imported, after public hearings involving the interested parties. This law also mandates the government to promote energy efficiency measures in buildings. A permanent committee (CGIEE), with members from several ministries, was formed to set goals and to elaborate proposals for the public hearings (Decree No. 4059, December 19, 2001). The first type of equipment to fall under the mandate for minimum energy efficency levels is the three-phase induction squirrel-cage rotor electrical motor (Decree No. 4508, December 11, 2002).

The mandatory energy efficiency programs run by the electricity distribution utilities, and the electricity supply shortage of 2001, boosted the market of the Energy Services Companies (ESCOs). The main barrier found for further development of this market is the financing of ESCOs, which has been addressed by the Ministry of Mines and Energy through proposals for the opening of new credit lines in state-owned banks and the setting up of a funding with resources provided by Eletrobras and/or BNDES. The certification of ESCOs and the technical qualification of energy efficiency projects are other measures being considered by the Ministry to push forward this market. The promotion of a greater use of high-efficiency electrical motors and household appliances, via credit facilities and tax reductions, and a gradual integration of the national programs directed to energy efficiency improvements are two other important policy measures that have been pursued recently by the MME.

5. ENERGY PRICES AND SOCIAL ISSUES

The prices of oil products (gasoline, diesel oil, fuel oil, LPG, naphtha, aviation kerosene, and lubricating oil) in Brazil has been set by market conditions, without any regulation, since January 2002, as mandated by two laws (No. 9478/97 and No. 9990/00. The price of LPG was subsidized before January 2002 because a large number of poor people in the country use this fuel for cooking purposes. Resolution CNPE No. 4, on December 5, 2001, followed by Decree No. 4102 (January 24, 2002), and Law No. 10,453 (May, 13, 2002), substituted the cross-subsidy then existing for all consumers of LPG with government grants just for the low-income consumers, registered in government aid-to-the-poor programs, using the resources of the CIDE tax. During the same meeting, on December 5, 2001, CNPE decided that the Ministry of

Mines and Energy and the Ministry of Economy should keep regulating the prices of the natural gas produced in the country after December 2001, because, in practice, Petrobras has retained its monopolistic position. This control should remain in place until real competition in this market materializes. As defined at the end of the last government by the Ministry of Mines and Energy, this "real" competition will be obvious when there are at least three suppliers, none of which hold a market share larger than 75%. The state governments regulate the gas price for the consumers and there will be no competition in the downstream part of the gas chain in the short to medium term unless a general understanding is achieved among the federal and state governments or the Constitution is changed. There are currently far fewer subsidies available for the sugarcane producers and fuel alcohol manufacturers than in the past, but they still exist, using resources provided by the CIDE tax (Law No. 10,453, December, 13, 2002), particularly for the poor northeastern region.

Frustrating the expectations of President Cardoso's government, so far few eligible "captive" electricity consumers have opted to become "free" consumers, to choose their supplier and negotiate the price to be paid for energy consumption. The main reason is that there are cross-subsidies for energy-intensive large consumers, based on past regulations, discouraging the move from regulated to free arrangements. Recognizing this distortion, but concerned about likely losses in export revenues and job losses in the short term if large tariff increases are imposed on the energy-intensive industrial branches, the previous federal administration decided to spread these increases along 4 years, at 25% per year (Decree No. 4562, December 31, 2002). The current administration has thus decided to increase the transition period to 5 years, with just a 10% increase in 2003, provided the interested energy-intensive industrial consumer invests in generation expansion (Decree No. 4667, April 4, 2003). The government also aims to convince this type of industrial consumer to buy at favorable prices, through medium term contracts (duration of 1 to 2 years), about 2000 MW, on average, out of a total of 7500 MW, on average, available in the generation system in the first months of 2003, because of the decrease in demand caused by the current recession. The current recession was triggered by the electricity shortage of 2001, which also speeded up the construction and commissioning of several new power plants.

There have been cross-subsidies to low-income electricity consumers in Brazil for many years. Law No. 10,438 broadened the definition of the low-income consumer, particularly in the poor northern and northeastern regions of the country. In order to avoid sharp tariff increases for certain utilities, especially in those regions, the government also decided to create direct subsidies to low-income electricity consumers using resources provided by the eventual extra income earned by the federally owned generation utilities. This extra income could come from trading in the public biddings defined by Law No. 10,438; it was also decided, if necessary, during 2002 and 2003, to use resources from the RGR fund, managed by Eletrobras.

Expensive thermal energy, generated by engines fueled by diesel oil or, for the larger machines, fuel oil, supplies isolated networks, located mostly in the northern region of the country. This generation is subsidized by all consumers in the national integrated network through a fund known as CCC-Isol, which, according to Law No. 10,438, should last up to 2022.

Between 10 and 15% of the Brazilian population, comprising from 4 to 5 million households, mainly in remote rural areas, has no access to electricity supply. To improve this situation, the Federal government set up two rural electrification programs in the 1990s, "Luz no Campo" and "Prodeem". Luz no Campo, managed by Eletrobras, has the goal of electrifying 1 million rural properties, basically through grid extensions, using resources from the RGR fund. Up to the beginning of 2003, 541.115 properties were electrified by the

program. Prodeem, on the other hand, was conceived to meet the basic social demands, in terms of electricity supply, of isolated small rural communities through local generation, with preference to the use of renewable energy sources. The program, managed by the Ministry of Mines and Energy, has been employing photovoltaic panels as generating units in most cases. Law No. 10,438 determines that the payments for the use of public goods, and fines applied by ANEEL, which contribute to the CDE fund, should be applied with preference to rural electrification programs. The law also states that ANEEL should assign rural electrification targets to each distribution utility. The Agency board of directors hopes to have all Brazilian households electrified by 2016.

The new federal administration report on changes in the institutional model of the Brazilian electric power supply industry, issued in December 2003, proposes that the subsidies for power plants consuming distributed renewable energy sources should be borne by (small) tariff increases; thus the government hints that the whole of CDE resources should be channeled with priority to rural electrification programs and for granting subsidies to poor electricity consumers.

6. ENERGY AND THE ENVIRONMENT

Brazil has an advanced body of legislation concerning the environment. Enforcement of this legislation, however, has had failures, mainly due to short budgets of the regulatory bodies, at both federal and state government levels; the situation has improved since the electricity shortage of 2001.

In terms of regulatory tools, the Brazilian environmental legislation uses "command and control" measures such as environmental licenses, pollutant emission limits, and establishment of zones where certain activities are restricted due to potential environmental damages. The regulation leave little room for market-driven measures involving economic incentives and for negotiated agreements among the regulatory bodies and the agents they regulate, as is happening now in some countries. Environmental policies, planning, and regulation activities are decentralized in Brazil, involving not only federal and state government bodies, but also municipal ones. The same kind of decentralization was established by Law No. 9433, of August 1, 1997, for water resources. This law created a new agent, the Hydrographic Basin Committee, made up by representatives of municipalities, who are responsible for elaborating a Hydrographic Basin Plan and for defining the priorities of water usage in the basin; needless to say this committee is very important to the interests and activities of the energy supply industry.

There has been little connection so far between environmental and energy policies in Brazil. The energy supply shortage of 2001 brought together the work carried out by the Ministry of Mines and Energy and that of the Ministry of Environment, but essentially only on particular projects and mostly to speed up environmental licensing procedures. A joint agenda for the electrical power sector set by the two ministries in 2002 is expected to enlarge the scope of joint activities, including formal exchanges between technical committees of CNPE and CONAMA, the National Council for the Environment, and a more proactive treatment of environment issues in the electricity supply industry's 10-year forward planning.

7. AN INTEGRATED APPROACH

Energy policies in Brazil have been formulated in the past mainly by the federal government. Separate policies have been developed for each energy supply industry branch (oil and gas, electricity, coal, nuclear, etc.), and these have had little or no relation to other public policies. This has been changing slowly in recent years. The installation of CNPE, which includes the

seven most important ministers of state, was a big step forward toward the integration of energy policies with other public policies in Brazil. The development of long-term (20 years ahead) integrated prospective studies each year by the Ministry of Mines and Energy for CNPE, since 2001, for the energy sector as a whole, using alternative development scenarios that take into account the current and possible new economic, technological and environmental policies, has provided a consistent technical background for such integration. There is, however, a big challenge still to be faced, which is to engage the state and municipal governments, similar to what has happened in the environmental and water resources areas, in order to decentralize to some extent the policymaking process in the country, under the direction of CNPE and with the technical support and supervision of MME. Two important measures in this direction were taken in the second half of 2002 at MME, involving the integration of the National Energy Balance with the state balances, in terms of methodology and data basis employed, and the start of integrated resources planning studies in four Brazilian hydrographic basins.

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