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Business Focus Series

Cogeneration In Argentina

Prepared by:

**U.S. Agency for International Development
Office of Energy & Infrastructure**

in Cooperation with:

Bureau for Latin America and the Caribbean

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This report is part of the Business Focus Series of the Office of Energy and Infrastructure of the U.S. Agency for International Development (USAID), and was prepared by the Washington International Energy Group and Harza Engineering. The opinions expressed are those of the authors and not necessarily those of USAID.

The Business Focus Series includes reports on promising energy and environmental markets and business opportunities in developing countries. The reports are of varying length and content, and may be regional, country-specific, or focused on a particular market segment.

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FOREWORD

This document was prepared by the Washington International Energy Group and Advanced Engineering Associates, under Harza Engineering Company Contract No. ANE-0241-I-00-9022-00, for the Office of Energy and Infrastructure of the Bureau for Research and Development of the U.S. Agency for International Development. The report was written by Roger Gale, Karin Santoro, Suzanne Maia, Joseph Chalom, and John Meyers of the Washington International Energy Group, and Gopal Kadagathur, Tadeusz Swierzawski, and Sharad Gaudbhir of Advanced Engineering Associates. Substantial input and editing assistance was also received from Henry Chen, Ellen Hassett, Karen Humphrey, Jennifer Anthony, Deborah Gaibler, and Peter Gordon. Review comments and guidance were received from Samuel Schweitzer, Alberto Sabadell, Mark Murray, and Shirley Toth of the AID Office of Energy and Infrastructure and from Jose Trujillo, Christopher Donatelli, and Andrew Ottolenghi of AID's Private Sector Energy Development (PSED) program. The authors gratefully acknowledge the guidance provided by RCG Hagler, Bailly, Inc., Winrock, the Embassy of Argentina, the Inter-American Development Bank, the International Finance Corporation, the World Bank, and Buenos Aires-based Estudio Mugica.

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Note: Sources for figures and calculations in this document can be found in the following report: *Global Climate Change Mitigation Through Cogeneration: A Market Assessment of Cogeneration Project Opportunities in Key Developing Countries*, Office of Energy and Infrastructure, Bureau for Science and Technology, U.S. Agency for International Development, June 1992.

EXECUTIVE SUMMARY

Following its historical vulnerability to economic difficulties, including high inflation, over- and under-valued exchange rates, and high unemployment, Argentina currently seems to be heading towards greater economic stability. Developments during 1991 and early 1992 indicate solid progress towards reducing the role of state enterprise in a more stable economic environment.

Argentina currently seems to be heading towards greater economic stability

Argentina is in the midst of a privatization sweep of all its national industries. The federal government has decided to downsize its own role in the economy and to promote greater free enterprise. The decision to downsize the government is an attempt to reduce the fiscal deficit, which historically has been the root of Argentina's high inflation. Among the industries being privatized is the electricity industry.

Argentina is in the midst of a privatization sweep of all its national industries, including the electricity industry

Argentina has a fairly large and growing manufacturing sector, with dominant industries including pulp and paper, refinery and petrochemicals, chemicals, food processing, and metallurgy.

Argentina has substantial reserves of oil and natural gas, although gas pipeline bottlenecks often limit supply of this attractive, low-cost fuel option during periods of peak demand. Recent policy initiatives to increase the capacity of the natural gas transportation network are expected to overcome these bottlenecks and increase overall production.

There is no difference in the treatment of foreign capital and domestic investors are treated equally. Foreigners generally are allowed to be 100% owners in any enterprise. Only in very rare cases are local partners required. In general, Argentina seems to have good prospects in the foreseeable future for direct foreign investment.

Cogeneration Issues

Argentina's electricity sector, consisting wholly of government-owned utilities prior to the recent privatization scheme, has faced a series of problems, including management difficulties, limited financial resources (leading to low levels of investment and maintenance problems), and critical supply shortfalls.

As a result of *State Reform Law 23696*, Argentina's Executive Branch issued *Decree 634/91* on April 12, 1991, to privatize the generation, transmission, and distribution of electricity, to be accomplished by January 1, 1993. The new regulatory framework for privatization and regulation of the electricity industry was issued by the Congress under *Law No. 24065* in 1991.

The privatization of the electricity sector will change the nature of the entire electricity market from a monopolistic one to a competitive one. As a result, a substantial wholesale power market will emerge, with open access and with greatly increased opportunities for all sources of generation including industrial self-generators and cogenerators to sell power to the grid.

The privatization of the electricity sector will produce a competitive wholesale power market with open access and increased opportunities for all sources of generation—including self-generators and cogenerators—to sell power to the grid

As of April 1990, the government of Argentina committed itself to replacing the old system of electricity pricing based on accounting costs with the competitive-market philosophy of pricing based on short-term marginal costs. Wholesale prices are intended to reflect fair market value based on short-run marginal costs of the system, while prices at the retail level will be regulated.

The aim of the new generation market structure is to encourage competition, draw private investment capital, and assure that sales through the transmission system are nondiscriminatory and optimize the operation of the entire electric system.

Air quality is addressed in the privatization plans. Buyers of privatized units will have to invest in equipment to retrofit plants to meet specific environmental conditions. These requirements are fairly lenient at the moment, but in a few years new national air quality standards similar to those in the United States are expected to be introduced and unlike existing environmental standards in Argentina be strictly enforced.

There is a sufficient industrial base, with considerable thermal and electric load requirements, providing opportunities for the development of private-sector cogeneration projects.

Prior to the recent move toward privatization of the electricity sector, cogeneration existed in Argentina's pulp and paper, sugar and alcohol, and petrochemical industries. Rising electricity tariffs, burdensome local taxes, and the deteriorating quality of the public power supply drove these large, industrial, electricity users to build or expand their own generating capacity and even construct their own lines to interconnect with the local utility grid.

A sufficient industrial base remains with considerable thermal and electric load requirements especially in the pulp and paper, petrochemical, sugar, food processing and other industries which provides appropriate market conditions for the development of private sector cogeneration projects.

Both existing and would-be self-generators and cogenerators in Argentina have expressed interest in business opportunities in the new generating market for the sale and purchase of economically-produced electricity. Many companies in these industries have been seriously exploring the possibility of new or expanded cogeneration facilities, and some cogeneration projects are already under development.

1. COUNTRY OVERVIEW

After a history of political volatility and economic instability including chronic inflation, a persistent budget deficit, a cumbersome debt burden, and price and wage controls Argentina seems to be making progress in its attempt to bring about stable growth based on sound and internationally-approved rational economic policies. Foreign and domestic interest in investment appears to be on the rise in Argentina, a reflection of the trend towards a more favorable overall business investment climate. Privatization, one of the overarching economic policies of the Menem administration, is progressing steadily. Using the Chilean privatization experience as a model, Argentina is carefully working through all the issues surrounding privatization. In the electricity sector, the government is selling its generating, distribution and transmission facilities during 1992. As a result, competition is expected to increase in the generating sector.

Argentina seems to be making progress in its attempt to bring about stable growth based on sound and internationally-approved rational economic policies

1.1 Political Background

Historically, the Republic of Argentina has vacillated between military rule and democracy. As a result, Argentina has grown accustomed to government intervention in national economic affairs.

In May 1989, Carlos Saul Menem, the current President of Argentina, was elected for a six-year term. He is of the Peronist party, which has a clear majority in both houses of the new Congress that began in December 1989. In addition to controlling the Congress, Menem's party possesses the majority representation in the provinces, enabling the government to operate relatively easily.

Menem surprised most observers, especially members of his own party, by adopting economic policies that are virtually the opposite of those traditionally espoused by Peronists. Historically, the Peronists have favored state intervention, including nationalization of industries and government planning of the economy. Menem, however, supports a greater role for free enterprise.

Menem supports a greater role for free enterprise

Consequently, Menem's economic policies have generated some resistance among traditional Peronists (and some sectors historically aligned with the Peronists). However, the opposition remains fragmented, and Menem's popularity remains relatively high.

According to the 1853 Argentine Constitution, the President and Vice President are elected to a six-year single term and cannot run immediately for re-election. Considerable power is allocated to the President by the Constitution, including a line-item veto power. As in the United States, the Argentine Constitution divides the government into executive, legislative, and judicial branches at both the national and provincial levels.

Each province has its own constitution, and has a fairly high level of autonomy. In matters pertaining to the economy and other areas, the federal government does cede certain authority to the provinces. The strength of each province varies, with Buenos Aires Province being the strongest.

1.2 Economic Background

Argentina is highly endowed with natural and human resources. In terms of natural resources, as well as per capita income, it is one of the richest countries in Latin America. However, for many years, the country has been subject to the consequences of fiscal and monetary difficulties, plaguing it with both stagnation and hyperinflation. Argentina has a history of large fiscal deficits, which, fueled by inflation, led to low levels of investment, inefficiencies, and overly-protected sectorial policies. In the past, the economy has also

Argentina is highly endowed with natural and human resources

typically been closed to foreign trade, supporting policies that tended not to favor investment in the export sector.

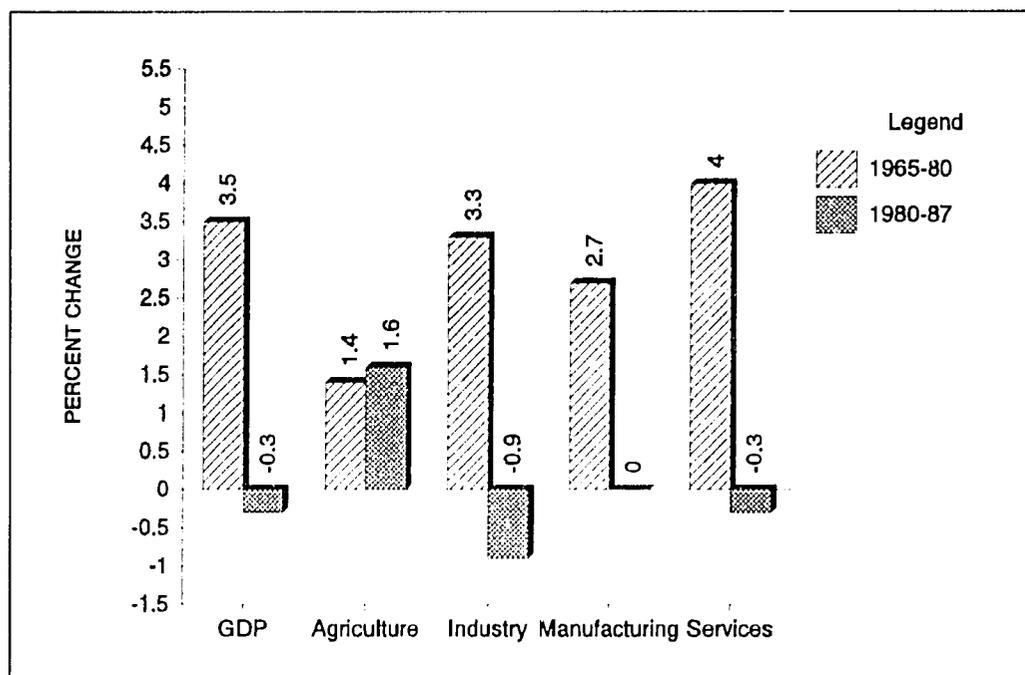
With regard to natural resources, Argentina has the largest amount of cropland per capita and the largest area of land with no inherent soil constraints in Latin America. It also has large crude oil and natural gas reserves. Regarding human resources, Argentina has a 96% adult literacy rate; along with Chile, it leads Latin America in terms of literacy.

Argentina's Gross National Product (GNP) per capita is US\$ 2,394, which, in Latin America, is second only to Venezuela (although the figures for Brazil and Uruguay are in the same range). Argentina has a total external debt, as of 1987, of US\$ 53,955 million, following only Brazil and Mexico. Argentina's average annual rate of inflation between the years of 1980 and 1987 was close to 300%. In 1992, inflation has averaged around 20% per year.

These figures demonstrate Argentina's history of economic problems, but show also the country's development potential.

Argentina's chronic high inflation and closed economy have resulted in reduced industrial output and varying degrees of poor maintenance, aging, or obsolescence of plant and equipment. Likewise, the debt crisis and recessions in the 1980s dramatically compounded the downturn of Argentina's economic growth.

Figure 1
Growth of Production in Argentina
Periods of 1965-80 and 1980-87



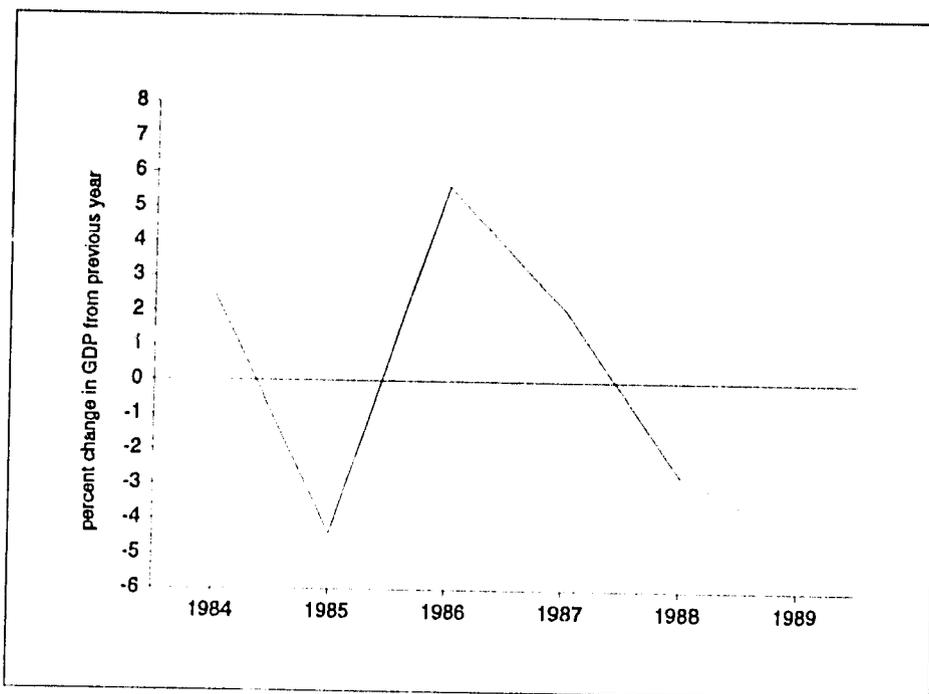
SOURCE: *World Development Report*, The World Bank, 1989.

However, Argentina's economic history has been marked by attempts to bring the economy back into line. Most of these attempts have worked in the short-run, but have ultimately failed. In 1978, Argentina embarked on a strategy to move away from a closed economy and increase free-market activity. Despite the implementation of this plan, Argentina entered a recession, along with most of the rest of the world in 1980. During this period, Argentina's external debt skyrocketed, dragging down growth in subsequent years. In 1986, under President Alfonsín, the *Austral Plan*, an austerity program, was undertaken to attempt to curb inflation. In 1986,

inflation slowed and growth increased, but in 1987, the budget deficit swelled, accompanied by enormous price and wage inflation. In 1988, another economic plan was started, but it too collapsed, bringing about a deterioration of the economy which was worsened by uncertainties regarding the upcoming 1989 election. Prior to the institution of President Menem's economic programs, Argentina's economic growth was erratic (as indicated in the following chart).

Figure 2

**Economic Growth Rates in Argentina, GDP
(percent change from previous year)**



SOURCE: *Doing Business in Argentina*, Price-Waterhouse, 1991.

1.3 Economic Changes and Privatization Initiatives

When President Menem took office in July 1989, he embarked on yet another program to ease Argentina's economic problems. According to analysts, Menem's program is promising, and seems much more sensible and viable than previous plans. The main goal of the current economic policy is to achieve overall economic growth in a climate of internal economic stability, including containment of inflation, fiscal surplus and a reduction of foreign debt.

The principal methods applied by the Argentine government to achieve its policy of stable growth are the reduction of the budget deficit, privatization of state-owned business entities, increased competitiveness, encouragement of foreign investment, further opening of the economy, and adoption of steps to slash subsidies and transfer payments. In November 1989, the International Monetary Fund (IMF) approved a stand-by agreement for Argentina, and in June 1990, for the first time in two years, the government made an interest payment on its vast foreign commercial debt.

President Menem has committed himself to a new model for the country's economic growth, featuring fiscal and monetary discipline and an increased role for market forces, including privatization of government-owned companies. The main tools chosen by the government to pursue its re-adjustment policy are:

The main goal of the current economic policy is to achieve overall economic growth in a climate of internal economic stability, including containment of inflation, fiscal surplus and a reduction of foreign debt

- fiscal balance through a double process of drastic reduction in public spending and raising income through the simplification and strengthening of the tax system;
- reduction/elimination of federal subsidies and transfers;
- opening the economy to international trade by reducing tariffs and non-tariff barriers;
- regional integration through the creation of the Southern Cone Common Market (MERCOSUR);
- transformation and development of the financial system and capital markets;
- broad and continued privatization of state-owned enterprises; and,
- market deregulation and the reduction of “red tape” between the private and public sectors.

Through these means, the government has embarked on an effort to re-activate and open the overall economy in the form of what has been called a *productive revolution*, and to integrate with the industrialized countries.

Two *Emergency Laws* were pushed through Congress in late 1989, which served as the key to the progress made during 1990 and 1991. They consist of an *Economic Emergency Law*, related to the monetary policy and the reduction of the fiscal deficit, and an *Administrative Emergency and Restructuring of State-owned Companies Law*. Under the present government policy, practically all price controls have been eliminated, except for those on a few pharmaceutical items.

Practically all price controls have been eliminated

One of the most significant actions taken by the government towards economic stability has been its *Convertibility Law*, which became effective April 1, 1991. This law pegged the Austral (the currency in place at the time) to the U.S. dollar at the flat rate of 10,000 Australes per US\$ 1 (fractionally above the prevailing free market rate at the time). The law recognizes contractual commitments in U.S. dollars, with free convertibility. The law prohibits the government and the Central Bank from printing unbacked local currency; for all currency issued, there must now be gold or dollar reserves to back it. The law also outlaws the long-standing contractual practice of automatic price indexation. There is a fundamental difference between this measure and previous Central Bank resolutions and Ministerial decrees to curb inflation and regulate exchange devaluation: the measure has been passed by Congress and is now founded in law, thereby binding the government as well as the public.

The law recognizes contractual commitments in U.S. dollars, with free convertibility

On January 1, 1992, Argentina officially returned to the Peso. 10,000 Australes converts to one Peso, such that the dollar and the Peso are virtually equal in value (1:1).

The economic results of the first year of application of the Convertibility Law have been a spectacular reduction of inflation and interest rates and a noticeable reactivation of the economy

The economic results of the first year of application of the *Convertibility Law* have been a spectacular reduction of inflation and interest rates and a noticeable reactivation of the economy, without any adverse signs of strain on the Central Bank's dollar reserves or on the exchange rate. Interest rates were down to 89% in 1991, and interest rates on commercial loans were about 25% for 30-day commercial loans in 1991, but were about 15% in March 1992.

In 1991, Argentina's stock market underwent a tremendous burst of activity, and it has maintained a strong position since then. Also, the money supply is controlled, and there is no pressure on the exchange rate. Growth is not as fast as the government would like, but all indicators are pointing up. Most importantly, there is no pent-up demand or inflation waiting to be released, making the equilibrium sustainable at least in the short-run. In March 1992, the consumer price index rose 2.1%, bringing the first-quarter rate to 7.48%. Wholesale prices in March rose at 1.4%, giving a first-quarter rate of 2.11%.

Eventually, if there are economic problems in Argentina, they are expected to come from the disparity between local and international prices, which will lead to exchange-rate pressures. Some analysts feel that the Argentine Peso is currently overvalued.

According to one analyst, there is a 75-80% chance of long-term success of the Argentine economy. Most people in Argentine businesses agree with the new rules, but there continue to be political tensions and some uncertainty persists over how the new regulation of the economy will work, especially in light of the historic instability of Argentina's policies and its economy.

There is also some apprehension, especially in some specific industries such as steel, regarding the effects of MERCOSUR in the 1996 time-frame. For example, Argentine steelmakers have made claims that their Brazilian competitors are selling steel below cost. Currently many industries, due in part to their operation as subsidized public enterprises, are highly inefficient. For example, the steel industry wastes 42% of its energy consumption. Still, it is expected that the opening up of the Argentine economy will force industries to modernize and become energy-efficient and cost-effective in their production, or else they will be uncompetitive and will be forced out of business. This aspect of an open economy could have dramatic impacts on the overall economic success of Argentina, and is likely to have a major influence on electricity demand, although it is not clear in which direction.

2. INDUSTRY AND PRODUCTION STRUCTURE

The Argentine industry and production structure as a whole is broken down as follows:

Table 1

Structure of the Argentine Economy, 1990

Sector	Output Share
Agriculture and farming	17%
Mining	3%
Manufacturing industries	19%
Electricity, gas, etc.	5%
Building	2%
Commerce	14%
Transport	13%
Finance	8%
Other services	18%

SOURCE: *Sector Eléctrico Argentino: Reseña y Principales Equipamientos*, Secretaría de Energía, Buenos Aires, Argentina, September 1991.

Argentina has ample rich farmland, making it one of the world's largest exporters of food, especially beef, grain, fish processing, and oilseed. Agricultural products constitute the major source of the country's foreign exchange earnings.

Ownership of companies until the current drive for privatization is completed has been very mixed across the sectors and at various levels of production. Basic industries, such as steel and utilities, are generally 100% government-owned, though now many of these industries are being privatized. Intermediate industries, such as the petrochemical industry, are a mixture of 100% state ownership, a 51%/49% split between public and private ownership (or conversely, with majority ownership held by private interests and a minority share owned by the State), and 100% private ownership. Advanced, downstream industries, such as automobiles, are all private.

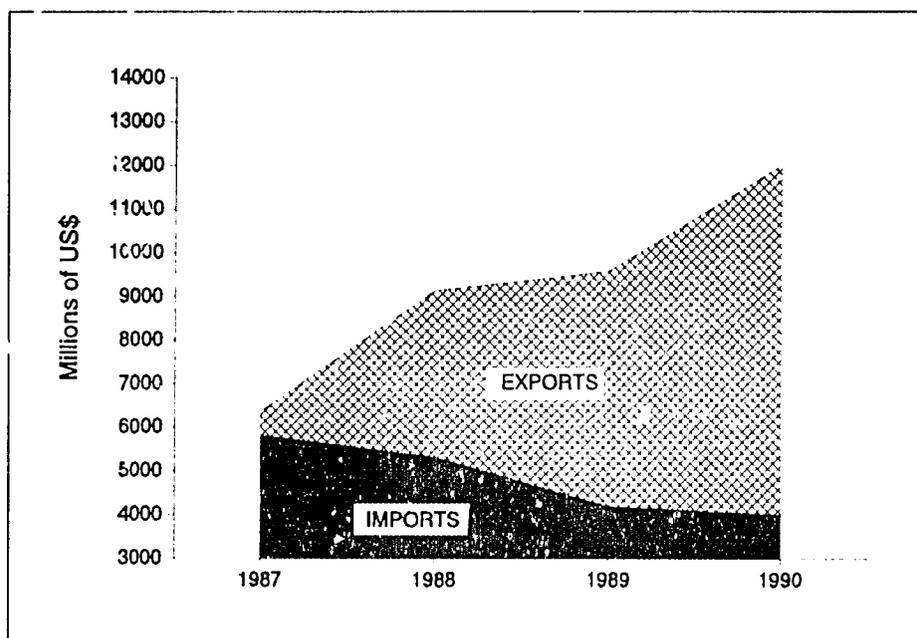
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Argentina has a fairly strong export sector, bringing about a consistently positive trade balance

Argentina has a fairly strong export sector, bringing about a consistently positive trade balance, as can be seen in the following chart:

Figure 3

Argentina's Trade Balance



SOURCE: *Doing Business in Argentina*, Price-Waterhouse, 1991.

21% of Argentina's imports are from the United States, and 12% of its exports are to the U.S. However, despite a positive trade balance, high financial and other services (including debt repayment) result in a current account deficit (that is, a net outflow of currency) in Argentina.

2.1 The Manufacturing Sector

Government-owned pulp and paper mills are currently being privatized

The chemical and petrochemical industry is thriving

Major manufacturing industries in Argentina include agro-industries and food processing, chemicals and petrochemicals, textiles and hides, paper and cellulose (including newsprint for internal consumption), metallurgical (including steel), and trucks and automobiles.

Of the industries in the manufacturing sector, the pulp and paper industry is currently depressed. It is facing low world prices, high inventories, and strong competition. Government-owned pulp and paper mills are currently being privatized. The chemical and petrochemical industry is thriving and is expected to grow with the expansion of oil and natural gas production.

The percentage breakdown of the manufacturing sector is as follows:

Table 2

Structure of the Manufacturing Sector, 1990

Industry	Percent
Food processing & beverages	25.8%
Textiles and hides	9.7%
Wood and furniture	1.2%
Paper and printing	5.2%
Chemicals and others	18.7%
Non-metallic minerals	4.3%
Metallurgical	8.8%
Machinery and equipment	19.4%
Other	6.9%

SOURCE: *Doing Business in Argentina*, Price Waterhouse, September 1991.

2.2 Energy Resources

Argentina has considerable reserves of petroleum and natural gas. Though Argentina was a net energy importer as recently as 1987, now more than one-sixth of the oil produced in Argentina is exported, and there are plans to export natural gas as soon as the infrastructure is in place (around 1995). Development of the 50-year old petroleum and natural gas industry, under the auspices of Yacimientos Carboníferos Fiscales (YPF) and Gas del Estado, stagnated until the 1980s, when investment by the private and foreign business sector was encouraged in contrast to previous nationalistic policies. Menem has carried out further private sector initiatives in petroleum exploration, resource development, refining and petrochemicals. These initiatives required allowing the price of crude to rise to world price levels. This began in late 1990 and then officially in 1991, with the per barrel price estimated at \$24 for the purpose of selling oil concessions.

Argentina has considerable reserves of petroleum and natural gas

Natural gas that previously had been vented in major quantities during oil exploration has begun to be captured on a programmatic basis for the growing gas market. Currently, there are about 744 billion cubic meters of proven natural gas reserves, with another 250 billion cubic meters in estimated reserves. This supply would provide more than 40 years of gas reserves for Argentina at its current consumption level.

As of 1989, it was estimated that Argentina had petroleum reserves of 345 billion cubic meters of petroleum equivalent. The country produced 38 million cubic meters of crude, and had a domestic consumption demand of 23 million cubic meters per year during the recessionary late 1980s.

Although Argentina's petroleum industry is considered to have a greater role in the economy than natural gas, the natural gas industry is growing steadily, and the role of gas in the nation's energy market has increased. Natural gas consumption has increased from 8.6 billion cubic meters in 1977 to 18.9 billion cubic meters in 1990.

Natural gas is also being encouraged as transportation fuel. Over the past several years, more than 40,000 public fleet vehicles and taxis have been converted to use natural gas as the primary vehicle fuel. This increase in use is the result of a federally-sponsored program to promote substitution of liquid petroleum fuels and to promote environmental goals.

Prices for natural gas vary according to distance from fields (currently the price varies from \$1.83 per million Btu (mmbtu) to \$2.82/mmbtu). These prices are very close to some international commodity prices for natural gas. However, the price of diesel oil, the major industrial back-up fuel for natural gas, is considered very expensive at \$245/cubic meter.

Currently, several U.S. oil companies are active in the development of oil and gas fields, refineries, and distribution networks in Argentina

Currently, several U.S. oil companies, including Exxon, Texaco, and Amoco, are active in the development of oil and gas fields, refineries, and distribution networks in Argentina.

Coal reserves in Argentina, located mainly in the Rio Turbio and Santa Cruz regions, constitute about 76% of Argentina's fossil fuels, in terms of energy output. However, coal is not used on a large scale. Most coal is used for coke in steelmaking; only 1% of electricity generation uses coal as a fuel. Because of the low demand for coal, resources have been allocated away from coal development and toward the development of other fossil fuels, including natural gas and oil. Recently, the privatization of one of Argentina's few coal-fired plants was linked to the re-development of a coal mine; the sale of the power plant is contingent upon the sale and development of a coal mine in the south.

Coal is not used on a large scale

Table 3

Energy Resources for Electricity and General Consumption

	Existing Domestic Energy Resources Available	Actual Annual Consumption
Total (millions of tons of oil equivalent)	3035 mtoe	48 mtoe
Hydroelectricity (%)	50%	3%
Crude oil and natural gas (%)	35%	90%
Uranium (%)	8%	2%
Coal and other (%)	7%	5%

SOURCE: Sector Eléctrico Argentino, Secretaría de Energía, Republic of Argentina, September 1991.

3. THE BUSINESS INVESTMENT CLIMATE

3.1 Foreign Investment Issues

The Argentine government policy and current legislation place foreign investment on an equal footing with local investment; that is, no special incentives are granted to, nor are restrictions placed on, foreign investment. In addition, the government will assure a fair rate on repatriation of currency. Furthermore, the free trade and free market policy being implemented to achieve greater international competitiveness shows a definite trend to further open the economy, with no restrictions for the foreign investor or trade.

No special incentives are granted to, nor are restrictions placed on, foreign investment

Argentina has traditionally welcomed foreign capital and expertise. Exceptions to this policy have been rare. The present government has stated its firm conviction that foreign capital and expertise are essential to Argentina's development, and that it is its intention to establish and maintain conditions attractive to foreign investors. In this respect, Law No. 21382, enacted in 1976, was amended in 1989 so that new foreign investments do not require approval from the authorities (even in areas that previously needed such prior approval). The current legal framework for foreign investment in the Argentine capital markets is extremely liberal. There are generally no restrictions on the participation of foreign investors in the capital of local corporations, nor are there restrictions on the entry of foreign capital or the repatriation of capital and profits. Other specific legislation still contains some conditions to be fulfilled by foreign investors, such as in the cases of some financial enterprises, insurance companies, and communication entities like television and radio stations.

The present government has stated its firm conviction that foreign capital and expertise are essential to Argentina's development

For the most part, 100% foreign ownership of businesses is permitted. Only in exceptional cases is a local partner required or encouraged (as in the case of privatization of some state enterprises).

There are no restrictions on the entry of foreign capital or the repatriation of capital and profits

3.2 Tax Issues

The tax rate on net taxable business profits from Argentine sources is 20%. Corporate residence is determined on the basis of centers of activity and is unaffected by place of incorporation or management. Centers of activity in Argentina of non-Argentine corporations are treated as branch activities. Depreciation is generally computed on a straight-line basis over the technically estimated useful life of the assets or over their standard useful lives.

100% foreign ownership of businesses is permitted

There are relatively few relevant tax incentives in operation in Argentina. Industrial development incentives are granted with respect to each specific investment project according to geographical area. However, few of these incentives have been granted since October 1988. A new legal framework for the granting of incentives is expected; until then, no preferential treatment of an inward investment should be expected.

There are no special provisions in Argentine tax legislation that particularly favor foreign investment. The declared policy is for foreign investment to be on an equal footing with local investment. A new income tax system was approved by the Congress on April 2, 1992, that initiated an income tax of 30% for both domestic and foreign businesses, eliminated the 20% dividend tax paid by foreign businesses, and limited the tax rate for royalty and interest payments. Previously, the income tax rate was 20% with a 20% dividend tax for foreign companies, producing an effective tax rate of 36% on foreign companies. This new tax legislation both simplifies the tax system and lowers the effective tax rates.

New tax legislation both simplifies the tax system and lowers the effective tax rates

Along with this tax simplification, as of February 28, 1992, the federal government began levying an 18% value-added tax. Other than this tax, businesses will only need to pay a corporate income tax, and whatever local tax the provinces require. The latter item has been a problem in the past, with the provincial governments able to levy taxes as a short-term

revenue raiser without any limitation or need for justification. Provincial utilities have the right to impose local taxes on electricity consumers; often these are used to finance local public works projects and to subsidize residential electricity customers at the expense of industrial and commercial customers.

3.3 Other Related Issues

As a result of a policy adopted some years ago of discouraging further increases in already existing large industrial concentrations and to encourage the installation of industrial enterprises in less-developed but otherwise suitable locations, national legislation divides Argentina into geographical zones and lists a wide range of industries considered particularly desirable or suitable to those areas. Related incentives and benefits are generally available to foreign investors.

The incentives vary between zones, but consist, in general, of tax concessions and other operational benefits, such as loans, securing of supplies, and sale of available state land. *Law No. 21608* provides for facilities for the purchase or rental of state-owned assets.

4. INSTITUTIONAL CONDITIONS FOR COGENERATION DEVELOPMENT

4.1 Electric Power Regulation

The electric power supply has traditionally been regulated at the federal level by the Secretariat of Energy, an agency of the Ministry of Economy. The Secretariat of Energy is ultimately responsible for electricity planning, rate-making and granting and administering the concessions for the government-owned companies providing hydro-electric generation or rendering distribution service. It also oversees the development and planning of oil, natural gas and coal production, and works with the Federal Nuclear Commission (CNEA) to integrate nuclear power into the electric supply system.

Recent regulatory initiatives have primarily been focusing on achieving the privatization scheme in an orderly manner. Among them are initiatives for improving the reliability of operation at the generation level.

Recent regulatory initiatives focus on achieving the privatization scheme in an orderly manner

Currently, President Menem's government, under the authority of the Minister of the Economy, is restructuring the regulatory oversight functions at the federal level for the energy sector under *Law 24065, Chapter XII*, which provides for the new electricity sector framework. The law contains the following provisions:

"ARTICLE 54.- The National Electric Power Regulatory Agency is created within the scope of the Secretariat of Energy of the Ministry of Economy and Public Works and Services; it shall carry out whatever is necessary to comply with the objectives indicated in Article 2 of this law."

The National Electric Power Regulatory Agency, to be fully developed by January 1, 1993, will be composed of a Secretary of Electric Energy and a Secretary of Fossil Fuels. Argentina is in the process of setting up the guidance and structure for the newly established electric Agency which will regulate the electric sector. Although most of the regulatory emphasis will be on the distribution sector, since it is a natural monopoly, the new Agency will address the system as a whole. The Agency's jurisdiction will include formulation of a rate-making basis and procedure; quality of service and safety standards; technical areas such as voltage levels, frequency levels, investigations of power outages; right-of-way authorization; and customer and environmental advocacy.

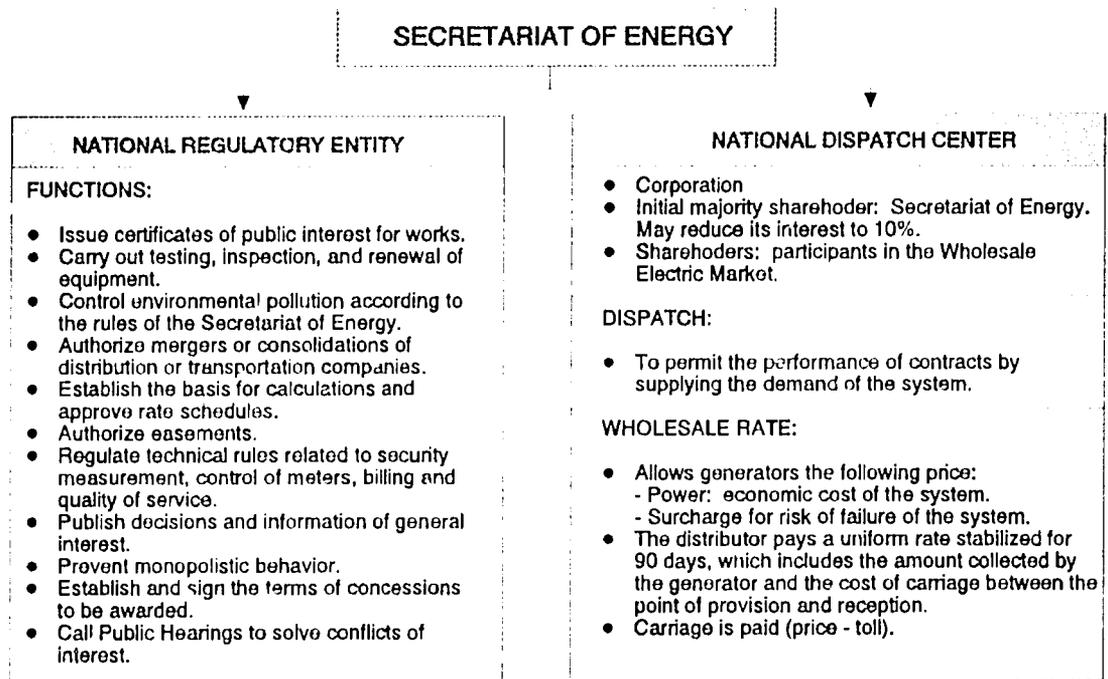
The National Electric Power Regulatory Agency is to be fully developed by January 1, 1993

In addition, to oversee the electric system after the federal utilities have sold their generating, distribution and transmission assets, a new federal commission is being set up. The commission will consist of five commissioners, appointed by the president, who will serve five-year terms. The vice president of the commission must be an economist; other members will include a least one lawyer and one engineer. The commission is charged with implementing safety, rate-making and technical procedures; preventing monopolistic behavior; setting the basis for determining how rates will be calculated; overseeing rights-of-way; and organizing public ratepayer and environmental advocacy roles for public representation before the commission.

Also, in some situations, there are binational regulations in place. This occurs mostly with hydro projects that are located on rivers shared by two countries, such as the Salto Grande plant on the Uruguayan border.

Figure 4

New Regulatory Framework for Electric Power



SOURCE: *Description of the Electric Sector*, Ministry of Economy & Public Works & Services, Secretariat of Energy, Argentina, November 1991.

4.2 Structure of the Electricity Sector

The installed utility generating capacity in Argentina in 1990 was 13,210 megawatts

Electricity sales in Argentina in 1990 totalled 39,500 GWh

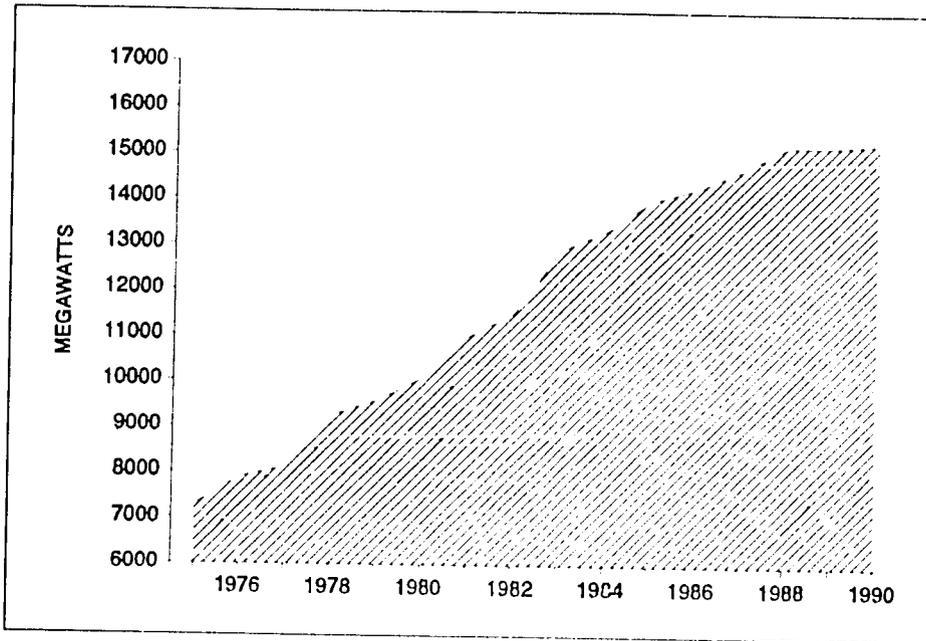
An Argentine government estimate of the installed utility generating capacity in 1990 was 13,210 megawatts (MW) (variations exist in estimates of Argentina's capacity, largely due to differences in the way reliability is factored in; for example, another estimate of capacity in 1989 was 15,251 MW).

Electricity sales in Argentina in 1990 totalled 39,500 GWh. Argentina's reserve margin in 1990, during a period of slow economic growth and plentiful rainfall, was between 10% and 13%. It was possible to maintain this reserve margin because sluggish economic growth limited growth of electricity demand. In September 1991, for the first time in about 10 years, there was an increase in the rate of growth of electric demand. A demand increase occurred again in January 1992. These indicate that, after years of low demand growth, a new trend of more sustained increases in demand may be beginning.

The following graph shows the recent and expected growth of capacity in Argentina:

Figure 5

Growth in Installed Capacity in Argentina, 1975-1990, in MW

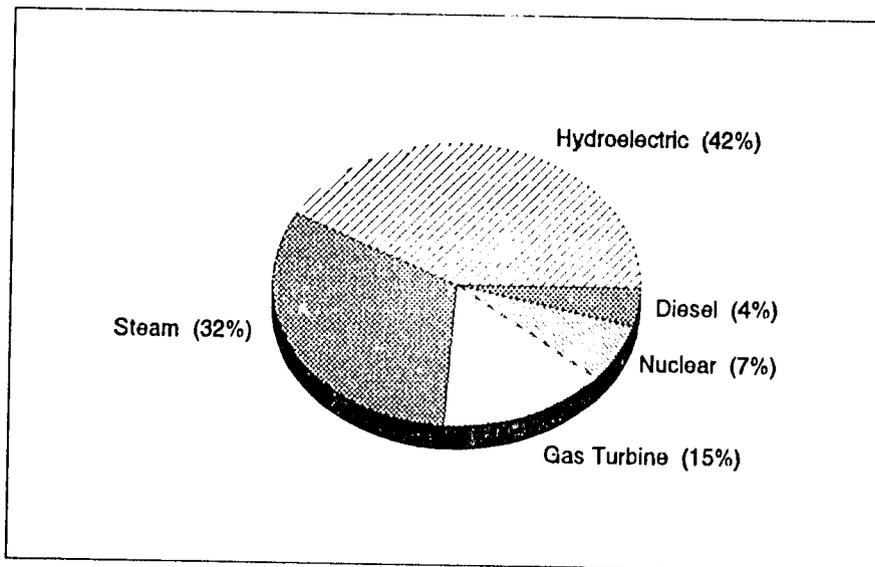


SOURCE: *Sector Eléctrico Argentino, Secretaria de Energia, Argentina, September 1991.*

Past, present and projected installed capacity is portrayed in the next two exhibits:

Figure 6

Installed Generating Power in Argentina, 1991



SOURCE: *Description of the Electric Sector, Secretary of Energy, Argentina, November 1991.*

Table 4

Electric Energy Produced by Fuel Source

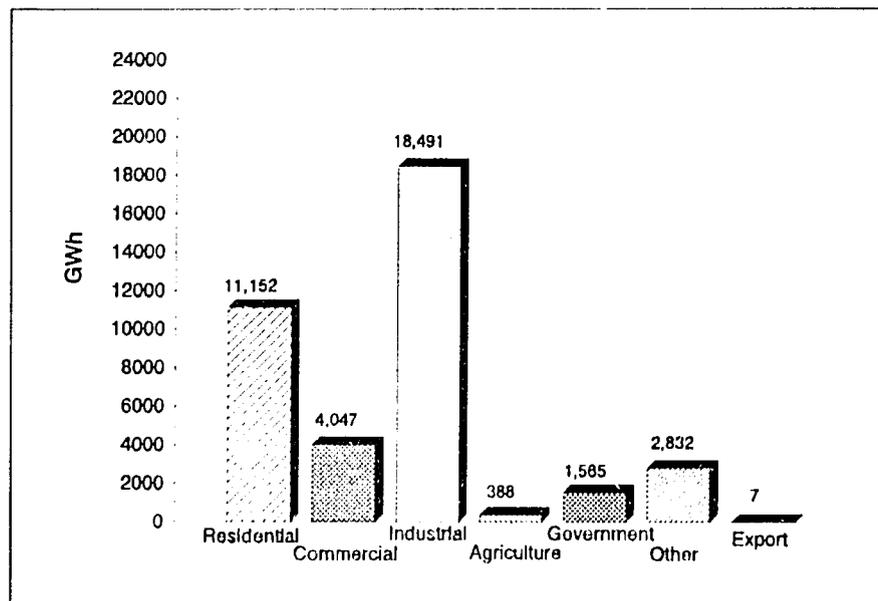
Source	1970	1988	1995 (projected)
Hydro (%)	9	33	38
Natural Gas (%)	3	39	27
Fuel Oil (%)	84	19	21
Uranium (%)	--	8	13
Coal (%)	4	1	1

SOURCE: *Sector Eléctrico Argentino*, Secretaria de Energía, Republic of Argentina, September 1991.

Electricity sales in Argentina are as follows:

Figure 7

Electricity Sales in Argentina, 1988, in GWh



SOURCE: *Summary 1988 Power Data Sheets for 100 Developing Countries*, The World Bank, August 1991.

Generation

Until privatization began in early 1992, the electric power sector in Argentina consisted solely of federal and provincial government-owned enterprises. The main companies providing electric service through 1991 were the following:

- AYEE (Agua y Energía Eléctrica), a federal utility responsible for about one-third of the generating capacity and a considerable share of the national transmission system. AYEE

provided power for other federal and provincially- and municipally-owned utilities, and only administered very small distribution systems in some of the more isolated areas.

- **SEGBA** (Servicios Eléctricos del Gran Buenos Aires S.A.), a federal utility responsible for the electricity supply in Buenos Aires and 31 districts in the Greater Buenos Aires area. SEGBA owns and operates three power stations Puerto Nuevo, Nuevo Puerto and Costanera, with a combined installed capacity of 2,680 MW but must import up to 60% of its capacity requirements from other utilities in Argentina.
- **HIDRONOR** (Hidroeléctrica Norpatagonica S.A.), a federal utility responsible for the development and operation of the hydroelectric facilities in Northern Patagonia, including transmission of the generated energy to the National Interconnected System.
- **EPEC** (Empresa Provincial de Energía de Córdoba), a provincial utility responsible for generation, transmission, and distribution in most of the Córdoba province.
- **ESEBA** (Empresa Social de Energía de Buenos Aires), one of the main provincial electric utilities, in charge of generation, transmission, and distribution in most of the populous Province of Buenos Aires territory, excluding the metropolitan area of the federal capital of Buenos Aires.
- **CTMSG** (Comision Tecnica Mixta de Salto Grande), an Argentine-Uruguayan binational agency in charge of the operation of the Salto Grande hydroelectric power station, built in 1979.
- **CNEA** (Comision Nacional de Energía Atomica), responsible for the design, construction, and operation of nuclear facilities.

The following table shows the amount of generating capacity per fuel source for each of these utilities:

Table 5
Installed Capacity, in MW

Utility	Thermal	Hydro	Nuclear	Total
SEGBA	2,680	--	--	2,680
AYEE	2,340	1,600	--	3,940
HIDRONOR	--	2,720	--	2,720
CNEA	--	--	1,020	1,020
CTMSG (Salto Grande)	--	1,260	--	1,260
Others	1,350	240	--	1,590
Total	6,370	5,820	1,020	13,210

SOURCE: Sector Eléctrico Argentino, *Secretaria de Energía*, Republic of Argentina, September 1991.

Prior to the establishment of the privatization framework, the activities of AYEE, SEGBA, and HIDRONOR were controlled by the National Secretariat of Energy. CNEA remains under the direct control of the President's office. Provincial governments which must follow federal laws, regulations, pricing and other standards own and are responsible for the operation of the

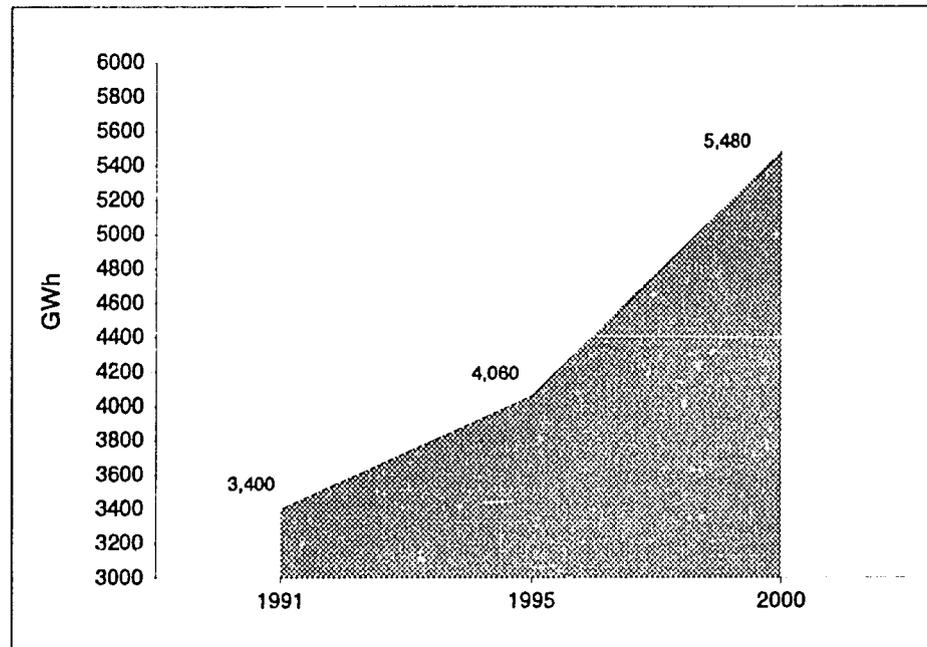
provincial utilities and cooperatives. The few municipal utilities, subject to rules set by the federal government, are generally in isolated areas. They take care of distribution, and their power requirements are met by federal utilities.

Self-generation, including cogeneration, also plays an important role in Argentina's generation scenario

Self-generation, including cogeneration, also plays an important role in Argentina's generation scenario. Projections for industrial self-generation are as follows:

Figure 8

Projected Growth in Self-Generation in Argentina, in GWh



SOURCE: *Description of the Electric Sector, Secretary of Energy, Argentina, November 1991.*

Some private industrial companies have developed generating capacity on their plant sites over the past several decades. Much of this capacity is older, predating the coordinated development of the public electric sector. Rising electric tariffs and local taxes became a significant cost factor which, along with the deteriorating quality of service of public power, drove many large, industrial electricity users to build or expand their own powerplants and interconnecting lines with the local utility system. Such self-generators, including some cogenerators, exist in the pulp and paper, sugar and alcohol, textiles, petrochemical and steel industries.

However, self-generation has become increasingly important, not only in terms of insuring companies' own production capability when public utilities failed to provide adequate power, but also to provide generating capacity to the grid during power shortages and emergencies. Large industrial users had contracts with the local utility for the price at which they bought from and provided power to the grid. Fuel sources for these units were fuel and diesel oil, natural gas (near gas fields where costs were not prohibitive), and bagasse.

Reliability Issues. Historically, the Argentine electricity sector has been inefficient and unreliable (the average generating cost in Argentina runs between 40 and 50 mills/kWh, whereas in the U.S. generating costs run as low as 10 mills/kWh up to about 50 mills, including fuel costs). For this reason, until the late 1970s, many Argentine industries built their own generating systems for their internal use or back-up. From the late 1970s to the mid-1980s, an ambitious power development program, combined with a sporadic economic growth pattern, resulted in a high reserve margin in 1977, it was 58% of the peak demand, and in 1986

it was 69%. As a result of this excess supply, the 1986-2000 national electricity investment plan called for a reduction in the reserve margin through increased use of existing capacity rather than investment in new generating sources. This was partly a result of the federal government's growing budget deficit and lack of investment capital.

However, in 1988 there was a severe drought, causing the role of thermal power to increase relative to hydropower. During that crisis, the unavailability of thermal equipment due primarily to a lack of investment in good maintenance programs was so extensive that the energy shortfall caused by the drop in hydroelectric generation could not be compensated for, despite the previously large reserve margin. Even with the low demand growth at the time, serious power cuts were necessary in the summers of 1988 and 1989 in most of the country. Public awareness of these problems increased due to stringent rationing and rolling black-outs (often lasting several hours every day), especially in the metropolitan area of Buenos Aires.

Generally, these problems with generating deficits were addressed by the government utilities with short-term emergency measures even requiring private generators to provide power to the grid from their own generating and system back-up sources and a decline in the quality of service. The system's inadequacy was partially offset because the growth of demand was actually less than expected. Had economic circumstances been better, demand would have been higher at this point, and the electricity sector would have experienced a more severe deficit of power with potentially crippling effects on the industrial base. As it is, the current system now lacks government investment funds for construction of new generating facilities, and has cost the treasury an operating loss of \$50 million per month. Argentina's electric system now has a very low reserve margin by OECD country standards. The margin needs to be increased in order to provide greater reliability for the system.

The current system now lacks government investment funds for construction of new generating facilities

In the last few years, rainfall has been plentiful, enabling greater utilization of hydropower generation once again. This has reduced dependence on the less reliable, poorly maintained thermal generation. However, with Argentina's present economic restructuring, it is expected that strong GNP growth will occur, accompanied by a growth in electricity demand and a heightened need for greater reliability and new generating sources. Thus, the Argentine government, recognizing that financial input beyond its capabilities is needed in order to avoid a collapse of the electricity sector, arrived at the present policies of restructuring, privatization, and deregulation of the entire sector.

Argentina's electric system now has a very low reserve margin

Transmission

The transmission systems of all of the utilities are almost totally integrated in the National Interconnected System (NIS), operated by the federal government. The transmission system consists of 6,239 kilometers of 500-kV lines, with trunk networks of 220-kV and 132-kV lines. The NIS network was completely interconnected as of 1988, when the Norpatagonica region was tied into the 500-kV network. It is expected that the 500-kV network will total 18,000 km by 1995. The Unified Load Dispatch is in charge of the operation of NIS.

The transmission systems of all the utilities are almost totally integrated

Most of the transmission energy flows run from the North to the South, or from the South to the North to the metropolitan Buenos Aires district. There is a 500-kV transmission ring around the Federal Capital district, which feeds into the district at the 220-kV level. This is largely controlled by AYEE. All of the distributing utilities interconnected to this 500-kV ring around the city of Buenos Aires contribute to the maintenance of this system.

SEGBA itself has relatively little of the transmission network in its system, and is primarily a distributing service utility with less than half of its own generating capacity. AYEE, on the other hand, owns a large portion of the transmission grid which provides electricity to buyers on a wholesale basis, but has very little distribution business. Other major connections to the transmission system are HIDRONOR, the bi-national Salto Grande hydropower project,

the Atucha nuclear plant run by CNEA, and depending on the extent of their service territories, the provincial utilities.

To a lesser extent than the generating system, there is a need for investment in the national transmission grid to upgrade and improve the reliability of the system

To a lesser extent than the generating system, there is a need for investment in the national transmission grid to upgrade and improve the reliability of the system. Until the present time, there has been no wheeling of private power at any level over utility transmission lines.

Distribution

SEGBA is by far the largest of the distribution service utilities, serving 12 million customers in the greater Buenos Aires region. The other federal-level utilities do not have major distribution systems; primarily, distribution services are in the hands of provincial utilities like ESEBA (Buenos Aires) and EPEC (Cordoba). ESEBA and EPEC serve major areas outside of the Federal Capital district, and ESEBA in particular is host to many petroleum-based and large industry complexes.

Primarily, distribution services are in the hands of the provincial utilities

The provincial utilities do not have much autonomy from federal utility regulation, and have to adhere to the average energy price base set by the federal system. For distribution, provincial utilities rely on financial support from the generally poor provincial banks, which are in turn strictly regulated by the Central Bank of Argentina. These utilities have historically lacked the means to insure the reliability of their generating or transmission line systems, and industrial customers often had to finance, build and operate interconnection lines as large as 132 kV from their plants to the utility grid.

From the average generating cost of 40-50 mils/kWh in Argentina, the price of electricity is increased because of transmission and distribution costs by a 3 mil/kWh fee for a national fund for development purposes, and by more than an additional 50% in provincial, municipal and value-added taxes. The residential end-user's purchase price of electricity averages around 100 mils/kWh (though some pay more) while large industrial consumers pay an average 55-65 mils/kWh.

4.3 Current Policy Directions

Private Sector Participation: Existing and New Asset Ownership

On April 12, 1991, Argentina issued a decree to privatize the generation, transmission, and distribution of electricity by January 1, 1993

Privatizing Existing Assets. As a result of *State Reform Law 23696*, Argentina's Executive Branch issued *Decree 634/91* on April 12, 1991, to privatize the generation, transmission, and distribution of electricity, to be completed by January 1, 1993. The new regulatory framework for privatization and regulation of the electricity industry was issued by the Congress under *Law No. 24065*.

A private business entity will be created to manage bulk power transfers and contract requirements between generators and distributors and between generators and end-users

The decree includes technical, financial, and legal provisions concerning the reorganization, operation, and development of the electricity industry, and provides for a five-member regulatory commission to regulate prices, assure competitive access, and oversee other related functions. The bill and the decree specify that, after January 1, 1993, both wholesale and retail prices are to be set by market mechanisms rather than government determination.

The privatization underway in 1992 has three stages at the federal level: the selling of generating business units (which may include more than one generating plant as a unit); the selling of distribution system business units; and the selling of the national transmission grid and its facilities as one enterprise. The new operators of the generation, distribution and transmission business units are prohibited from majority ownership in or operation of more than one of the three areas (generation, transmission, or distribution). This is to prevent monopolistic practices. Shareholders may, however, own stock in any or all of these sectors.

In general, 10% of the capital assets will be allocated to utility employees; between 51 and 61% of the utility generating, distribution, or transmission assets will be sold in a non-

discriminatory public bidding process, open to foreign and domestic entities (Argentina's prior experience with foreign electric equipment vendors has been positive overall, which supports the government's willingness to allow foreign participants in the bidding process). The remaining shares will be the basis for a public offering, or, in some cases where water authority or distribution issues make it appropriate, these shares will be turned over to the local provincial government. Varying shares of AYEE's plant assets will be sold to the bidding entities, public shareholders, or turned over to the provinces.

Provincial governments have a vital interest in the management of their own water resources, and thus will have a unique role in the privatization process. In selling concessions for hydroelectric projects, the provinces' interests will be considered. Thus, sale terms may leave operation of hydroelectric facilities in the hands of the provinces, or an outright transfer to the provincial governments may occur. Provincial governments are expected to uphold the basic electric reforms fostered by the central government, and to initiate their own round of privatizations in the near future.

A fourth private business entity will be granted a concession for the management of bulk power transfers and contract requirements between generators and distributors, and between generators and end-users. This Central Dispatch Unit (CDU) has the responsibility for technical coordination of contractual and economic power transfers, system cost calculation, remuneration, penalties, and other pricing reconciliation between all participating parties. The CDU will receive a fee from the related parties for its services.

The following is the procedure for the transfer to the private sector of the existing power plants of SEGBA and AYEE through a two-part bidding process (Hydro Quebec and First Boston Corporation provided the primary consulting work on the technical and financial aspects of the sale and distribution of electricity in the Greater Buenos Aires area):

- The first envelope contains documentation to demonstrate to the bidding committee overseeing the transfer of assets that the bidding parties meet all the technical and financial qualifications required in order to participate in the bidding process. The bidding committee's members include the Secretary of Energy and his Undersecretary for Electric Energy, and reports to the Minister of the Economy.
- The second envelope submitted to the Committee, and opened approximately two weeks after the qualifications envelope is turned in, simply contains the bidding price offer. There is a pre-established floor price for each concession, based on the value of the power facility and related to its estimated capacity to operate at a profit over their useful lives. Upon the opening of the second envelope, the bidder with the highest bid is awarded the concession for that business unit.

During the first stage of privatization, large central power stations and several smaller generating units operated by the federally-owned SEGBA, AYEE and HIDRONOR utilities are scheduled to be sold off by mid-summer 1992. AYEE's few distribution assets, SEGBA's distribution concession, and 45% of HIDORNOR's existing hydroelectric plants and hydropower units under construction are scheduled for sale by late summer 1992.

Sale of Puerto Nuevo and Nuevo Puerto plants. After qualifying in the initial bidding envelope opened on March 4, followed by the opening of the second envelope on March 19, SEGBA's Puerto Nuevo and Nuevo Puerto stations were sold as one business unit for 92.16 million Pesos to a consortium of two Chilean electric utilities, Chilgener S.A. and Chilectra Quinta Region S.A.

The following table lists companies that purchased the right to bid on the Puerto Nuevo and Nuevo Puerto units:

Table 6

**Public Bid 1-21-91 Opening of Bids: 2-17-92
Price of Bid documents: US \$ 15,000**

**Firms Purchasing the Bid Documents of the Privatization
of the Firm Central Puerto S.A.
(NEW PORT)
1992**

Date	Name	Address	Telephone
1-21-92	CHILGENER S.A.	C. PELLEGRINI 887 - 3er. Piso CAPITAL	322-8336/8796
1-21-92	BENITO ROGGIC E HIJOS S.A.	L.N. ALEM 1050 - CAPITAL	313-8182/8154
1-21-92	EMPRESA NACIONAL DE ELECTRICIDAD S.A.	AV. SANTA ROSA 76 - SANTIAGO DE CHILE	394-4361
1-21-92	ENRON CO.	25 DE MAYO 195 - 5to. Piso. CAPITAL	313-5228
1-22-92	DOMINION ENERGY	BME. MITRE 226 - 2do. Piso. CAPITAL	343-1163/6642
1-22-92	PESCARMONA INDUSTRIAS METALURGICAS	AV. LIBERTADOR 493 - Piso 27. CAPITAL	325-7468/7525
1-22-92	PEREZ COMPANC. COMPANIA NAVIERA	MAIPU 1 - CAPITAL	334-7122
1-22-92	ASTRA CAPSA	TUCUMAN 774 - CAPITAL	334-0912
1-22-92	ENDESA	CORRIENTES 411 - 2do. Piso. CAPITAL	325-8086
1-23-92	ORMAS S.A.	C. PELLEGRINI 1023 - Piso 11. CAPITAL	322-2544
1-23-92	UNION FENOSA Y OTROS	VIAMONTE 867 - CAPITAL	322-4393
1-24-92	LOUIS DREYFUS Y CIA. LTDA.	25 DE MAYO 401 - CAPITAL	311-4741/9327
1-27-92	BANCO FRANCES	RECONQUISTA 199 - CAPITAL	331-7210 334-0732

The offers were for cash payment, unlike several other Argentine privatizations that allowed payment in Argentine debt paper. The buyers are required to absorb US\$ 50 million of debt associated with the plants. Together the two plants have a 1,000-MW generating capacity, but current output is around half that level. In accordance with the tender terms, the winning group took over the plants on April 1, 1992.

Future power-plant sales. Succeeding this initial privatization step in late March, SEGBA's Costanera station a 1,250-MW gas- and oil-fired plant was publicly offered for sale. Technical bids were taken May 4, 1992, and financial bids from qualifying firms were opened on May 15, 1992. SEGBA has estimated that the plant will sell for between US\$ 85 million and US\$ 100-million. After this, SEGBA's distribution system will be divided into two concessions

(North and South), each roughly equivalent in value, which will share the dispatch control center for SEGBA's service area housed at the Costanera plant.

There will be a uniform transmission price for the whole country

After the sale of the generating and distribution assets, the federal transmission system will be put on the bidding block as a single concession. There will be a uniform transmission price (at the point of delivery) for the whole country, stratified only by units of distance and voltage levels at which power from the transmission grid will be purchased.

Non-discriminatory wheeling including retail wheeling for all parties will be mandatory under the new system, though there may be capacity limitations at times. However, for any party that has contracted for the purchase or sale of power through the grid, the transmission concessionaire must provide wheeling service, adding to the capacity of the system if necessary.

Non-discriminatory wheeling—including retail wheeling—for all parties will be mandatory under the new system

Some provincial utilities are also expected to privatize their electric systems, since the provincial governments also lack the financial capability to invest in the upgrading or quality maintenance of the system, as well the ability to compete with the private sector in the open market (in terms of operating efficiency) unless major modernization and streamlining initiatives are undertaken. The wheeling provisions of the federal law ensure that the provincial utilities can no longer take their industrial or commercial customer base for granted. Likewise, provincial governments would place themselves in political jeopardy if they were forced to allocate high-cost electricity to their captive residential customers.

Some provincial utilities are also expected to privatize their electric systems

New Generating Assets. It is a significant indication of the perceived attractiveness of the Argentine electricity market that all seven qualifying bidders on the first SEGBA offering were foreign-based entities, including U.S. companies Enron, Dominion Energy, Duke Power, Applied Energy Services (AES Central Puerto Nuevo, SA), as well as French, Spanish and other Chilean corporate entities. Some concessions were made to potential U.S. bidders in writing the language of the bid requirements, in order to accommodate the legal restrictions U.S. companies may encounter under the Public Utility Holding Company Act (PUHCA). It is clear that foreign power and financial entities are interested in investment in Argentina's electric sector, and it can be expected that most of the bidding for the remaining generating, distribution and transmission concessions will be done by and awarded to foreign entities. At this point in time, due to lack of capital and easy credit terms, it is difficult for Argentine interests to participate in large-scale investments such as these, unless in partnership with foreign enterprises as minority interests.

Foreign power and financial entities are interested in investment in Argentina's electric sector

The foreign companies which participated, or even explored the opportunity for participating, in the bidding for Argentine electric sector concessions have acquired a base of knowledge and a human resource network that would serve them well in other power business ventures in Argentina. It can be speculated that some of these entities will remain serious about doing business in Argentina in the near future, and may be seeking prospective power projects as independent power producers, serving the grid or particular customers via the build-own-operate (BOO) or contract method. Other entities may simply seek construction projects with or without providing operating and maintenance services to the plant.

There currently appears to be no prohibitive or constraining regulatory requirements—including future environmental restrictions—which could harm the potential for private-sector cogeneration development

Regulatory Issues of Concern to the Private Sector

The government of Argentina is now formulating policies designed to address chronic problems in the electricity sector. Among them is an initiative for improving the operation and maintenance of thermal units, support for self-generators and cogeneration, and the encouragement of competition at the generation level.

Other than the general state of uncertainty about what are the specific requirements for private generators in Argentina, there currently appear to be no prohibitive or constraining regulatory requirements including future environmental restrictions which could harm the potential for private-sector cogeneration development.

In Chapter VII of Law No. 24065, which establishes a framework for privatization and regulation of the electricity industry, provisions are stated to allow the power sales and transfers from self-producers including cogenerators across the system:

“ARTICLE 39.- The National Dispatch Center shall not establish restrictions for self-generators supplying power through contracts freely agreed with the demanding parties, unless there were technically founded reasons, and will channel the surplus selling of this type of generation as long as it is economically acceptable for the system.”

Power developers will be assured of a market if their price is competitive

This section assures that power developers will be assured of a market if their price is competitive, and of transmission access for wheeling purposes to dedicated customers.

Wholesale Power Market System and Pricing

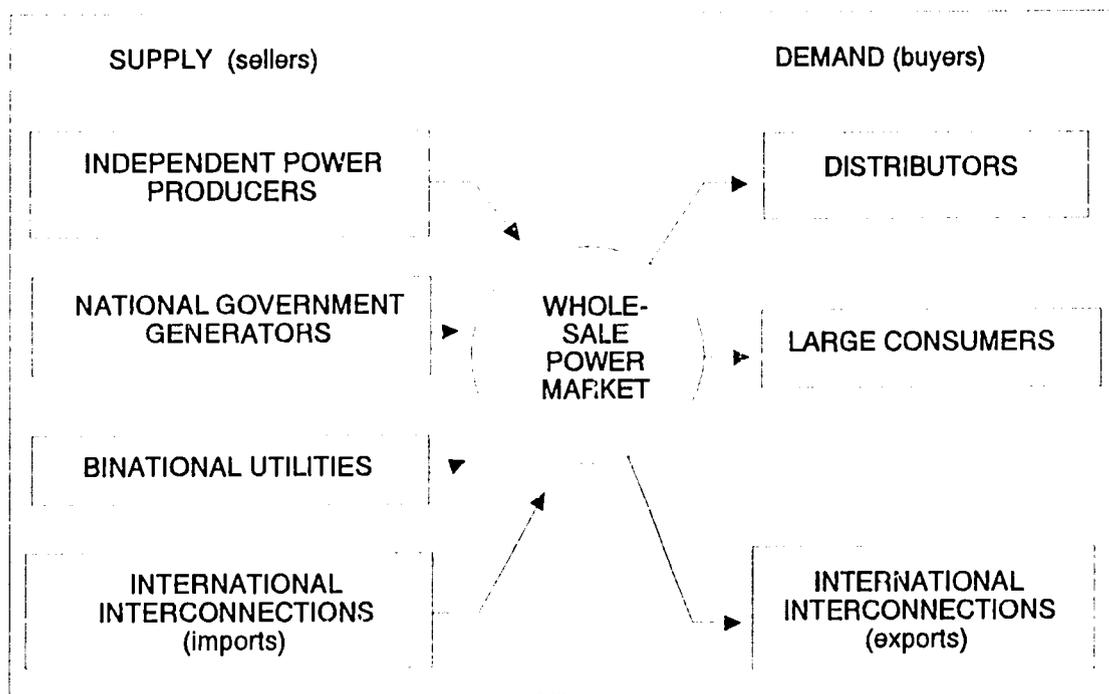
The privatization of the electricity sector will change the nature of the entire electricity market from a monopolistic one to one of competition. As a result, a substantial wholesale power market will emerge, with open access and with greatly increased opportunities for independent producers to sell power to the grid.

Any generating entity will be allowed to compete as a supplier to the grid, or may negotiate individual contracts with any other entity

Under the new electric power system, any generating entity will be allowed to compete as a supplier to the grid, or may negotiate individual contracts with any other entity. In this manner, the Argentine model is expected to promote competition among suppliers and more cost-effective investment and market-based pricing. Although electric rates are initially expected to rise as investments in existing and new generating units are made, the result will be much greater reliability than had the government retained control of this budget-draining sector. The legislation also allows for incentives for efficient operation.

Figure 9

Wholesale Power Market



SOURCE: *Description of the Electric Sector*, Ministry of Economy & Public Works & Services, Secretariat of Energy, November 1991.

Law No. 24065, treating the privatization and regulation of the electricity industry, states the following in Chapter IX:

"ARTICLE 36.- The Secretariat of Energy shall issue a Resolution with the rules of the low-cost dispatch for the transactions of energy and power to be applied by the National Dispatch Center. The above-mentioned rule will indicate that the generators will receive, for the energy sold, a uniform tariff for all of them in every delivery place determined by the National Dispatch Center, on the basis of the economic cost of the system. For its estimate, the cost of what the energy not supplied represents to the community will be taken into consideration."

In the new wholesale power market system, all generating units in the country may make available any portion of their generating output to the grid for system sales. The generator will provide the National Dispatch Unit, the coordinator of the wholesale power market, with information about the amount of capacity available on a firm basis at a marginal cost that is based on the unit's heat rate and fuel costs. Generating entities must act separately, rather than as a group of electricity units, and each must submit its own unit-specific marginal costs. Generators are free to sell all of their capacity to the grid, or to other parties via direct contracts, or a mixture of the two.

All generating units may make available any portion of their generating output to the grid for system sales

After calculating the amount of capacity available, the demand for both firm and non-firm power, and the adequacy of the reserve margin, the National Dispatch Unit may issue a call for bids for additional supply to the system if it perceives a deficit. In this case, generators may submit bids for additional power which they may make available to the grid at a specified price. The National Dispatch Center, depending on the supply-demand situation, will extend capacity payments to the units it will keep on stand-by to back up the system, and, if used, these generators will also be paid an energy fee.

When such conditions exist, the marginal cost of the overall supply increases, since the National Dispatch Center takes the most economic power increments before taking more expensive power increments. In this system, however, the most economic units receive a higher return since the marginal cost of the system will be increasingly higher than their own generating marginal costs. If the system has a supply deficit greater than 1% of the demand, it is considered to be in the *failure* mode, and additional remuneration to generators will be paid by the end-users unless the failure was caused by the unavailability of the generating units. This failure payment to generators is expected, but not required, to be reinvested into expanding generating capacity. There is no *obligation to serve* imposed on the generating units, except through their own contractual obligations.

There is no obligation to serve imposed on the generating units, except through their own contractual obligations

If generators do not supply the amount of firm power in the system contracts, they must pay the National Dispatch Unit the penalties provided for in their supply contracts. These are usually considerable penalties, which based on calculations for a unit similar to Puerto Nuevo may amount to \$10 million per month. However, power failures caused by insufficient generating power will be shared among all the generators, since it would be difficult for one unit to shoulder the entire burden in some cases, especially if it is normally a reliable supplier.

To promote the consideration of system and generating unit efficiency in new pricing schemes, the privatization-related *Decree 634/91* sets forth the following regarding rates in Chapter 4 (Economic Dispatching):

"ARTICLE 12.- Producers (generators) who shall sell by means of the dispatching system organization shall each receive a standard rate at each established delivery point. Said rate shall be based on marginal short-term economic cost of the system, starting with a base value that shall include a margin that shall take into account the evolution of the risk of system failure and its cost. Distributors shall pay a power production standard rate plus the correspond-

ing differential payment for transmission to the point of interconnection, to be invoiced by the enterprise carrying out the last operation. Revenues obtained by generating enterprises abiding by the described framework shall be allocated according to their financial needs.”

Except for a price guaranteed to the SEGBA Puerto Nuevo and Nuevo Puerto concessions, investors in electric facilities will not be guaranteed a price or a volume of sales, unless it is through contracts between a generator and distributors or end-users. By law, the central system is required to pay the market-derived price for all generation purchased. Retail power rates will vary from region to region as a function of transmission costs, and possibly due to direct contracts between individual generators and distributors, but the system’s average wholesale rate for the entire country will be determined by the national dispatching authority.

Pricing. As of April 1990, under pressure from multilateral lending institutions such as the World Bank, the government of Argentina committed itself to replacing the old system of electricity pricing, based on accounting costs, with the competitive-market philosophy of pricing based on marginal costs. Since August 1991, the Secretary of Energy has applied a market approximation for establishing tariffs based on generators’ marginal costs, which has roughly averaged out to be 40 mils/kWh.

During the formulation of the bidding process, the Secretary of Energy realized that a temporary price guarantee would have to be given for the output from the Puerto Nuevo and Nuevo Puerto units in order to cap the risk for potential investors/bidders for this concession. Since the level of investment necessary to renovate the plants was so high and other uncertainties were present in the market, the Secretary of Energy conceded, just prior to issuing the bidding tender for these SEGBA units, to guarantee for eight years a purchase price of 40 mils/kWh (\$0.04/kWh) for these units’ electrical output. These units, which have been operating for more than 60 years, are expected to be retired at the end of the eight-year period (2000).

The government is committed to achieving prices equal to the average short-run marginal cost for all contributors to the grid, including self-generators and cogenerators

The government is committed to achieving prices equal to the average short-run marginal cost for all contributors to the grid, including self-generators and cogenerators. Some regional differences in retail prices are expected to persist, but eventually, the distributing entities including provincial utilities should align their retail tariffs based on the wholesale prices.

Current prices for electricity in Argentina are 1.5 times what they are in the U.S.

Current prices for electricity in Argentina are 1.5 times what they are in the U.S. For example, the pulp and paper industry’s industrial energy rates in the Northwest U.S. may start at less than \$0.02/kWh, while Papel Prensa, a paper mill located in ESEBA’s service territory in Buenos Aires Province, pays \$0.06/kWh (of which \$0.04/kWh is the base energy rate and the remainder is a set of various taxes imposed by the federal and provincial government). Normally, there is no discount to industries with large electricity requirements, although SIDERCA steel is ESEBA’s largest customer and its negotiated rate is \$0.0475/kWh, of which \$0.0358 is the basic energy charge.

Wholesale prices are supposed to reflect fair market value based on short-run marginal costs of the system, while at the retail level they will be overseen by the new federal regulatory agency. The aim of fostering competition in the generation sector is to encourage more efficient production, decrease electricity tariffs, provide incentives to attract private investment capital, and optimize the operation of the entire electric system by assuring the widest possible participation of suppliers through nondiscriminatory, cost-based purchases.

The calculation by the National Dispatch Unit of the system’s marginal cost will be done on an hourly basis. The basic high demand operating period for the electric system is 18 hours/day, and does not include weekends or holidays when demand is lower. The wholesale rate will be revised every three months to provide some stability, and accounts will be reconciled retrospectively.

In 1992, generators will receive a capacity payment (based on the amount of power they made available to the system during that period) of \$2.00/kilowatt-month, which will increase to \$4.00/kilowatt-month (equal to 5 mils/kWh) in 1993. In addition, the marginal cost price for the energy sold by the generators, based on the individual generators' heat rate and fuel cost, will be calculated. Whenever the system's marginal cost is below what the contracted sales prices are, the difference is allocated to a compensation fund, which will be used to make-up the difference when the marginal cost of the system is higher than the contracted prices.

Distributors must calculate their estimated firm power purchases from the grid, contract with specific generators for certain amounts if they don't wish to buy from the generic system, and reserve some portion of their demand for spot market purchases. Contract prices are set according to the negotiating parties. As long as there is no power shortage greater than 1%, the distributors have the flexibility to base these assumptions on whatever their own priorities are (taking risks to save money, reassuring stable prices, or a mixture of these). However, should the system have a power deficit, the power purchasers must pay stiff penalties to the generators, amounting to \$0.75/kWh in 1992 and \$1.50/kWh in 1993.

The marginal costs of a well-run generating unit should be around 20 mils/kWh. The current rough estimate for the system's marginal cost is around 40 mils/kWh, which provides a considerable margin of profit incentive for an efficient generating unit.

Fuel Promotion

Since Argentina has such large, but yet untapped, natural gas reserves, there has been a recent push by the federal government to develop more infrastructure so that this potential may be more efficiently utilized. In recent years, there has been a bottleneck in the supply of natural gas at the distribution level. However, the Secretariat of Energy is promoting construction of new gas trunklines for distribution that should significantly increase the supply of natural gas to Buenos Aires and other major cities within five years.

The Secretariat of Energy is promoting construction of new gas trunklines for distribution

The Secretariat of Energy has also promoted increased gas utilization in the private transportation sector. For example, as of 1992, most taxicabs have converted to natural gas as a fuel, and public sector fleets are similarly converted. Natural gas is viewed as the preferred fuel choice for industrial and commercial sector users as well, which consider it a clean, efficient, relatively cheap fuel source. One of the initiatives being promoted by the federal government is a program to research the potential of cogeneration utilizing natural gas.

The price of gas in Argentina is relatively low

The price of gas in Argentina is relatively low, which, combined with its clean-burning qualities, make it an attractive fuel for power plants. However, the existing distribution system bottleneck makes natural gas supply unreliable most industries find it unavailable for three months out of the year during the high-demand peak season. To promote the gas sector, natural gas exploration, production and distribution enterprises are being privatized. The privatization is expected to balance market supply and demand, although gas prices currently near the international market price of around \$2.50-2.80/million Btu may rise with the increase in investment before ultimately reaching a lower level again.

There is no particular promotion of oil as a fuel for new generation

There is no particular promotion of oil as a fuel for new generation. However, Argentina's domestic reserves of crude are considerable, and have a low-sulfur content which makes fuel oil a realistic option. The price of fuel oil is around \$210/cubic meter, and diesel is even higher at \$245/cubic meter. These are not low prices. Nonetheless, fuel oil or gas oil usually provides the industrial back up when gas supplies become tight during the peak season.

Fuel oil or gas oil usually provides the industrial back-up for natural gas

Development of some coal reserves in the southern region of Argentina is being promoted by the federal government. Part of the privatization concession associated with AYEE's San Nicolas station is the development of a mine in the south, either for export from western ports belonging to Chile, or as a fuel source for a power plant to be constructed near the mine or

Development of some coal reserves is being promoted by the government

near some load center in that region. Other than this, the desire to use coal as a fuel source for powerplants is relatively minor.

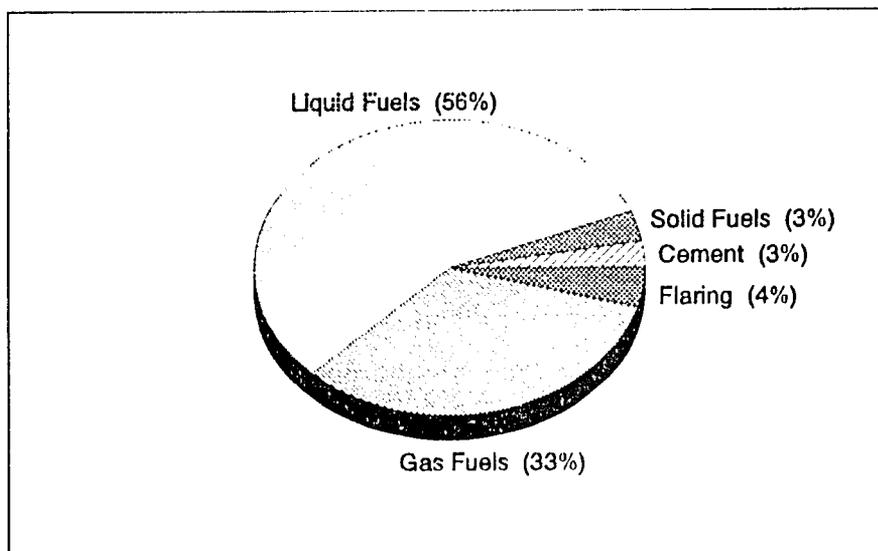
Environmental Issues

Argentina is among the top fifty nations in terms of greenhouse gas emissions

In 1987, Argentina ranked 31st in the world in terms of greenhouse gas net emissions. The sources of Argentina's CO₂ emissions can be broken down as follows:

Figure 10

Percentage Contributions to Carbon Dioxide Emissions in Argentina, 1987



SOURCE: *World Resources 1990-91*, World Resources Institute, 1990.

Argentina's total CO₂ emissions are 13,000,000 tons of carbon.

The Menem Government has expressed its commitment to further enforce pollution controls and ecological preservation

Recently the Menem Government has expressed its commitment to further enforce pollution controls and ecological preservation. In late 1991, President Menem created a new Secretariat for the Environment under the auspices of the Ministry of Economy and Public Works and Services.

New environmental regulations are expected to evolve and be enforced after the conclusion of the privatization scheme

New environmental regulations are expected to evolve soon after the conclusion of the privatization scheme. The new Secretary of the Environment worked with the Secretariat of Energy in formulating the requirements for concessions of the federal utilities. These requirements were relatively light, and included upgrades and refurbishment of equipment and systems, and some fuel limitations (based on sulfur content, for example). These limitations are expected to have a net positive effect on environmental emissions in general.

Decree 634/91, providing for the privatization of the electric power sector, establishes the following regarding the environment:

“...the development of the energy sector must be consistent with the use of alternative energy sources and norms must be established for environmental protection and the rational use for the above mentioned resources.”

Also, *Law No. 24065*, establishing a framework for privatization and regulation of the electricity industry, states the following intention to elevate environmental issues in *Chapter V*:

"ARTICLE 17.- The physical infrastructure, the facilities, and the operation of the equipment associated with the generation, transmission, and distribution of electric energy must be in keeping with measures designed to protect the water basins and the ecological systems involved. Likewise, they must meet the pollution standards in force and those to be established in the future, both in the national and provincial levels, which under no circumstances may exceed those set forth by the Environmental Protection Agency (EPA) of the United States of America."

When the SEGBA plants were privatized, provisions had been made to include air quality control. For example, in the recently-privatized Puerto Nuevo and Nuevo Puerto plants, the required investment for upgrading the facility is around US\$ 100 million. Of this, US\$ 30 million is expected to be refurbishment for environmental purposes, specifically to meet clean air requirements.

Specific elements in the air regulations for the privatization of SEGBA plants include directions to:

- perform a study of actual and potential environmental impacts within six months of taking possession of the units, in order to evaluate the previous operations;
- adopt all the technical means necessary to comply with emission limits;
- install, within six months, continuous emissions-monitoring devices, with graphic readouts, for SO₂, oxides of nitrogen, and particulate matter;
- identify disposal plans for effluent liquids, indicating their chemical and biochemical characteristics within 3 months of taking possession. It will be forbidden to dispose of such liquids in any way other than as declared;
- install water treatment equipment and monitor pH continuously;
- for installations using fuel oil, limit emissions to no more than 1,700 mg/Nm³ for SO₂ and 140 mg/Nm³ for particulates; and,
- adhere to all other environmental laws.

These standards for the most part do not set specific numbers, but rather require the operator to adhere to existing standards, which are fairly lax. Right now, these standards are specific to the sale of SEGBA's Central Puerto plant. However, these rules will be applied uniformly to the privatization of all plants.

However, it is expected that after allowing a short period for the new concessionaires to fulfill their investment obligations and settle into a new operating mode, a new set of specific environmental regulations will be passed by law. These will impose strict environmental standards that are foreseen to be comparable to those of the industrialized democracies, and, more importantly, they will be enforced.

The latter point is relevant because Argentina has relatively strict environmental emissions standards already in place. However, the government has never provided adequate political power or funding for any enforcement activities or monitoring programs for power plants or other industrial facilities.

Contributing to the low priority placed on environmental regulation is the fact that Argentina's crude reserves have a very low sulfur content, and another primary fuel in Argentina, natural gas, also has low sulfur emissions. There are very few coal-burning power plants in the country. This fact may have delayed public concern about the issue of major air pollutants such as sulfur and carbon dioxide emissions.

There are pollution control regulations with severe penalties at the municipal and provincial levels

Since cogeneration is a relatively clean technology, environmental regulations often encourage, rather than discourage, its use

Furthermore, Argentina is located in an area where winds and a basically flat topography partly encircled by ocean prevents any emissions or smog to settle near the land surface. Thus, there has been relatively little attention paid to environmental pollution issues until recently, with the public focus on toxic land and water contamination, and the international focus on the global climate change phenomenon.

To prevent or reduce water and land contamination, which has become a serious problem in the most industrialized areas, there are pollution control regulations at municipal and provincial levels concerning sewage, treatment of industrial residues, disposal of garbage, and other areas. If uncovered, penalties for infringement of industrial pollution control are generally severe.

5. MARKET CONDITIONS FOR COGENERATION DEVELOPMENT

5.1 Brief Overview

Because of ambitious privatization programs in Argentina and the need to improve energy reliability for Argentina's industrial companies, market conditions are expected to bring about a proliferation of cogeneration project opportunities. Both projects built on industrial sites and those built, owned, and operated by independent or third-party developers are anticipated.

Both projects built on industrial sites and those built, owned, and operated by third-party developers are anticipated

Due to the increasing competitive pressures of the domestic and international marketplace and growing concern for the environment, both electric and manufacturing industries in Argentina are being encouraged to improve the overall energy efficiency of their production facilities.

Cogeneration technology offers a way for industries to conserve fossil fuels by improving overall fuel efficiency. An increasing portion of electricity is expected to be generated in the industrial sector with the privatization of the electric sector, the establishment of a wholesale power market with market-based pricing, the allowance for retail wheeling, the persistent lack of reliability in the existing electric supply system, and the expectation of considerable economic growth.

Cogeneration technology offers a way for industries to conserve fossil fuels by improving overall fuel efficiency

With the privatization of the federally-owned electric companies, and the opening of the wholesale power market to all generators private and public it is anticipated that most of the thermal power generating facilities will be in the private hands in the near future. Only a small share of the total generating capacity in Argentina will be owned by provincial utilities, municipal generators and rural cooperatives. It is expected that large, independent generators will supply the bulk of power to the grid, or directly to major distributors and large end-users. There is also likely to be an increasing role for system and contractual sales by industrial self-generators and cogenerators.

Major industries in Argentina include pulp and paper, sugar and alcohol, steel, oil refinery and petrochemicals, cement, food processing and textiles. The market conditions are such that pulp and paper, sugar and alcohol, and the refinery and petrochemicals industries offer the greatest possibilities for cogeneration development in Argentina.

Pulp and paper, sugar and alcohol, and the refinery and petrochemicals industries offer the greatest possibilities for cogeneration development in Argentina

There are a significant number of natural gas offshore reserves in Argentina which offer a relatively cheap, clean fuel source for future cogeneration systems. As more natural gas becomes available, there is greater incentive for gas turbine use and production of electric power through cogeneration.

In considering the overall potential for cogeneration in Argentina, it should be noted that a number of industrial facilities in the pulp and paper and sugar and alcohol sectors are already producing electric power through cogeneration. These cogeneration systems were captive, and were developed to increase the reliability of the user's electric power supply in the face of a deteriorating public utility system, and lower the user's electricity costs especially by reducing the tax burden paid on electricity purchases from the system. Electricity rate subsidization policies and high capital and fuel costs combined to dampen industrial enthusiasm in the past for utilization of cogeneration, particularly when there was no opportunity to sell power to the grid at a fair price, or to wheel to other users over the public system.

The majority of industrial facilities in the pulp and paper, sugar and alcohol and textiles sectors are located in Buenos Aires Province. The refining and petrochemicals sectors are distributed between Buenos Aires Province and the east coast of Argentina.

5.2 Market Aspects

In addition to opening the opportunity for private power competition in supplying electricity to the grid, the new wheeling provision likewise encourages independent energy developers, industrials and even the commercial sector to build their own generating capacity on- or off-site, wheel it from one of their sites to another through the grid, or to enter agreements to purchase electricity from third-party developers. Such possibilities are being openly discussed by such companies as Altecnica, IPAKO, Papel Prensa, Petroquímica Río Tercero, who are interested in any or all of these options.

Many foreign corporations are active in the promotion of power projects by the private sector

Many foreign corporations are active in the promotion of power projects by the private sector, including combined-cycle, cogeneration, and waste-to-energy systems at industrial sites. The foreign corporations include equipment vendors, engineering firms, technical consulting groups, and large consortia from Japan, Finland, Sweden, Spain, Italy, France, Belgium, and Germany. The projects these corporations are marketing range from technical feasibility studies to full power plant design, engineering, construction, and operation and maintenance packages. Least represented, and sometimes criticized by the Argentine industrialists (including at least one pulp and paper plant) for their lack of presence, are U.S. firms, though the quality of U.S. equipment is held in very high regard.

However, potential industrial generators are cautious about immediate investment in generating plant or equipment, since, if the new system works properly as envisioned, the prices of electricity and the reliability of the supply may benefit these users. Thus, many of these potential industrial generators and cogenerators are waiting to see if the new framework can resolve the pricing and reliability issues that would otherwise push them to build their own power base especially if they can sell to the grid or contracted parties at a fair price or wheel their self-generated or cogenerated power over the system to affiliated companies. Another minor issue of concern relates to the availability of natural gas in the peak (winter) season, although the ongoing expansion of the gas industry infrastructure should shortly (within a few years) resolve this problem.

There is a positive trend for the expansion of industrial self-generation, particularly for those industries which have a need for thermal or steam generation as well as electricity. Factors which are encouraging these companies to at least explore the cogeneration and generation option are the competitive international and domestic market pressures that force manufacturers to look closely at the efficiency of their operations; the expansion of the natural gas market and availability; and the prospects of an economic expansion in Argentina to stimulate production and consumption on all levels.

5.3 Key Industries for Cogeneration

The following industries use process steam and electric power, and offer the most potential for cogeneration development in Argentina:

- Pulp and paper
- Sugar and alcohol
- Oil refinery and petrochemicals
- Textiles

Overall estimated cogeneration potential from these sectors is 1,415 MWe (this figure does not include the sugar and alcohol and textile sectors):

Overall estimated cogeneration potential is 1,415 MWe, not including the sugar and alcohol and textile sectors

Table 7
Argentina
Overall Cogeneration Potential

Industry	Estimated Cogeneration Potential (MWe)
Pulp and Paper	1310
Petrochemical & Refineries	104
Sugar & Alcohol	N/A
Textiles	N/A
Cement	N/A
Iron & Steel & Metals	N/A
Total	1414.5

SOURCE: *Global Climate Change Mitigation Through Cogeneration: A Market Assessment of Cogeneration Project Opportunities in Key Developing Countries*, Office of Energy and Infrastructure, Bureau of Research and Development, U.S. Agency for International Development, June 1992.

Again, with its large natural gas reserves, significant industrial base, and newly opened market opportunities, Argentina currently has one of the greatest potentials in the world for cogeneration project possibilities.

The pulp and paper industry offers perhaps the best opportunities for developing private-sector cogeneration plants

Pulp and Paper

The pulp and paper industry, despite some potential obstacles, offers perhaps the most potential in Argentina for development of private-sector cogeneration power plants with capacities that could attract financial backing from such institutions as the International Finance Corporation (IFC). Depending on equipment configuration, the estimated total installed cogeneration potential varies between 442 MW and 1,421 MW. In this industry, possibilities exist for several projects with a potential capacity in excess of 200 MW each.

Estimated total cogeneration potential in pulp and paper varies between 442 MW and 1,412 MW

General Assessment. Pulp and paper plants use large amounts of steam and electricity in their processing operations, and have large amounts of fuel value from their production waste materials, such as bark, wood chips, and paper liquor. However, a majority of plants in Argentina use natural gas and/or oil for process steam generation. The following table shows typical quantities of energy consumption:

Table 8
Argentina
Energy Data for Pulp and Paper Mills

Total Electricity Company	Power Boiler mT/y	tons/h	Steam Fuel	Purchased MW	MWh/day
Alto Parana	220000	120	Wood	40	
Arcor Saic	12000	65	Oil		
Argentina SA.	141000	140	Gas		63.1
	221000	240	Gas	68	264
	110000	160	Gas	13.5	6.3
	15000	14	Oil	0.5	37
	36000	52	Wood+Oil	6.4	
Jujuy, SA.	85000	30	Gas	0.5	40
	30000	12	Oil		
Ledesma Saai	93000		Bagasse		
Massuh SA.	110730	40	Gas	4.5	3.2
Misionero Saicf	172100	65	Oil	9.5	5
Pedotti SA.	14500	24	Gas		24
Prensa SA.	255000	60	Gas+Oil		760
Puerto Piray SA.	224000	170	Wood (?)	48.8	
San Jorge Saicf	16800	15	Gas		
Sur SA.	40000	20	Gas		96
Tucuman SA.	190000	140	Gas	14	
Total	1986130	1367		205.7	1298.6

SOURCE: *Global Climate Change Mitigation Through Cogeneration: A Market Assessment of Cogeneration Project Opportunities in Key Developing Countries*, Office of Energy and Infrastructure, Bureau of Research and Development, U.S. Agency for International Development, June 1992.

Approximately 2% of the total pulp and paper mills in the world are located in Argentina. In 1989, Argentina ranked 30th in the world in production of paper and board.

Generally, each large pulp and paper facility is a potential candidate for a cogeneration project. Based on the steam generation rate, the three columns in the following table correspond to the following power plant configurations:

Generally, each large pulp and paper facility is a potential candidate for a cogeneration project

- Column 1 System with a Gas Turbine (GT) and an unfired Heat Recovery Steam Generator (HRSG).
- Column 2 System with a GT, an unfired single-pressure HRSG, and a non-condensing steam turbine.
- Column 3 System with a GT, an unfired single-pressure HRSG, and a condensing steam turbine with a controlled extraction pressure.

It is assumed in the estimate that the process steam, in all cases presented, is 150 psig. Also, it is assumed that condensing steam turbines exhaust steam into a condenser at 38.1 mm Hg Abs.

Table 9
Argentina
Pulp and Paper Mills
Estimated Cogeneration Potential

Company	Process Steam tons/h	Fuel	GT+HRSG (1)	GT+HRSG +NCT(2)	GT+HRSG +CT(3)	Turbines MW	
Alto Parana	120	Wood	—	—	—	40	0
Arcor Saic	65	Oil	31	40	90	90	—
Argentina SA.	140	Gas	60	93	206	206	—
	240	Gas	120	172	312	68	244
	160	Gas	90	132	206	13.5	192.5
	14	Oil	—	—	24	0.5	23.5
	52	Wood+Oil	—	—	—	6.4	0
Jujuy, SA	30	Gas	—	23	40	0.5	39.5
	12	Oil	—	—	—	20	20
Ledesma Saai		Bagasse	—	—	—	—	0
Massuh SA	40	Gas	20	30	48	4.5	43.5
Misionero Saic	65	Oil	31	40	90	9.5	80.5
Pedotti SA	24	Gas	—	—	—	35	35
Prensa SA.	60	Gas+Oil	30	46	90	—	90
Puerto Piray SA.	170	Wood	—	—	—	48.8	0
San Jorge Saic	15	Gas	—	—	24	24	—
Sur SA.	20	Gas	—	—	30	30	—
Tucuman SA.	140	Gas	60	93	206	14	192
Total MW		442	669	1421	205.7	1310.5	

(1) Gas Turbine with Heat Recovery Steam Generator

(2) Gas Turbine with Heat Recovery Steam Generator and Non Condensing Steam Turbine

(3) Gas Turbine with Heat Recovery Steam Generator and Condensing Steam Turbine

Case Study: Papel Prensa

One company in the pulp and paper industry, Papel Prensa S.A., located in Buenos Aires, was specifically identified as having an immediate and real potential for a cogeneration project. As of March 1992, some 25% of the newsprint production industry still belongs to the federal government. Papel Prensa, a private company, started its operation in 1978, in Buenos Aires province. It produces a standard newsprint paper at the rate of 140,000 metric tons/year, and about 120,000 metric tons/year of pulp. The main problem of this internally very efficient company is the high cost of purchased electricity, compared to the electricity cost of its international competitors. The high-priced electricity, purchased in large quantities from Empresa Social de Energía de Buenos Aires (ESEBA), a provincially-owned utility, contributes to its rather expensive final product cost.

Plant data presented in Table 8 show its cogeneration potential, significantly noting that Papel Prensa purchases large amounts of electricity at a high cost, already uses gas and oil as fuels, yet does not generate any electricity within the plant (it has no steam turbines).

The plant uses 760 MWh/day electricity and 60 metric tons/hour of steam. Steam at a pressure of 12 bar is generated in a gas/oil fired steam boiler, and then its pressure is reduced to 3.5 bar as required by the process. Natural gas, at the price of \$11.20/million Kcal, is used for 9 months of the year. During the remaining three winter months, when there is a shortage of natural gas supplies due to the high peak demand and distribution transportation bottlenecks, a low-sulfur oil (which costs around \$245/m³) is fired. Production is continuous for 360 days/year (allowance is made for three holidays and two days for maintenance per annum). Oil is delivered from nearby Exxon by barges and stored near Papel Prensa's mill on the Rio Plata.

To improve its energy efficiency and cut production costs, the company is considering installing two gas turbines, 12-14 MWe each, with heat recovery steam generators supplying steam for process uses and for the control of nitrogen oxides (NO_x) emissions (the company prides itself on strictly observing air emissions and other environmental standards).

Papel Prensa's management has already had some discussions with turbine vendors from Italy (Ansaldo), Sweden (AIBB), Germany, France, Japan (Mitsubishi), and the United States (Solar). Reportedly, it is very interested in the U.S. equipment, which is considered very reliable, and in U.S. financing. One major issue for the company is to have a local representative of any U.S. bidder for project development in the local area.

Within a few months, Papel Prensa wants to make its final determination on the subject of purchasing gas turbines and heat recovery steam generators (HRSG), but is still willing to consider new offers. The company continues to consider the question of how to attain the optimization of the steam pressure from the HRSG (High Pressure HRSG vs. Low Pressure HRSG), with an eventual application in a steam turbine.

Sugar and Alcohol

The sugar industry, because of the seasonal nature of its operations, may not be able to justify the capital requirements to install cogeneration plants. This industry may be able to utilize a power plant built to use bagasse as fuel, operating in the cogeneration mode during the sugar season, and in a stand-alone mode during the off-season.

General Assessment. Sugar and alcohol production capacities in Argentina are not currently available. There are plants that produce either sugar alone, or both sugar and alcohol. Each type of plant has a potential of producing electric power through cogeneration. A plant that produces both sugar and alcohol has larger potential than one producing sugar alone.

The sugar industry, because of the seasonal nature of its operations, may not be able to justify the capital requirements to install cogeneration plants

Bagasse, produced as a by-product in the sugar industry, can be used as a fuel to produce steam

Bagasse produced as a by-product (waste material) in the sugar industry can be either used as a fuel to produce steam or is a good source of raw material in the manufacture of paper. Ledesma, a leading sugar producer in Argentina, also produces alcohol from molasses and paper from bagasse. This facility has an existing cogeneration plant which supplies all of its electricity needs.

Similarly, other sugar and alcohol plants are expected to have cogeneration plants, although on a more limited generating scale. As electricity prices rise in the free market economy, there will be a greater incentive to expand the cogeneration potential from these plants and also to produce electricity on a year round basis.

The sugar and alcohol industry is a seasonal one, operating during the six-month crop season. In the off-season, production of electric power for other on-site processing facilities may have to be done through the use of condensing turbines.

Refinery, Petrochemicals and Chemicals

The estimated cogeneration potential in the refineries, petrochemicals, and chemicals industries is 104 MW

The petrochemical and refinery industries produce gas-turbine quality fuel gas and use large amounts of process steam throughout the year. The estimated cogeneration potential in this sector is 104 MW. Several off-the-shelf technologies also exist for such applications in these industries as well.

General Assessment. [Data on refinery and petrochemical plants are presented in Attachment 6.] The capacities of these plants and type of utility facilities vary significantly. The energy data for the plants presented in the table are not available, but estimates of energy consumption were made based on generic knowledge on the product.

Each refinery and petrochemical plant offers opportunity for cogeneration

Process steam requirements in refinery and petrochemical plants depend upon the feed and product slates, and downstream processing units. These facilities also produce large amounts of light hydrocarbon gases, which are used as fuel for process heaters or for steam production in utility boilers. Every refinery and petrochemical plant has a significant potential for cogeneration applications, and especially so if there are other adjacent industrial complexes with steam or electric requirements, which is often the case.

As can be seen in the following table, overall cogeneration potential in this sector is estimated to be at least 104 MWe for the petrochemical and chemical plants. These facilities have various process steam users and also require large quantities of electric energy for operations like chlorine production by electrolysis.

Table 10

Argentina
Petrochemicals and Refineries
Estimated Cogeneration Potential

Enterprise and Facility	Capacity Product Description	Estimated Steam Use MT/Y	Estimated Cogeneration Potential KG/HR	KW(1)
Atanor S. A.				
Rio Tercero Plant	Acetic Acid Methanol	4,800 14,000	3,832	474
Baradero Plant	Acetic Acid Acetic Anhydride	11,000 2,400	9,485	1,175
Duperial S.A.I.C.				
San Lorenzo Plant	Ethylene Also Plastics, Films, Dyes, Ammunition, Agricultural and Pharmaceutical Prod	22,000	3808	471
Fabrica Rio Tercero				
	Acetic Acid Methanol	4,800 12,880	3797	470
Instituto Petroquimico Argentino				
Ensenada Plant	Ethylene Low Density Pe	15,000 14,000	4,339	537
Ipaco S.A				
Ensenada Plant Polyethylene	Ethylene	15,000 14,000	4,339	537
Pasa Petroquimica Argentina S.A.				
	Ethylene	23,000		
Petro Quimica Bahia Blanca S.A.I.C.				
Bahia Blanca Plant	Ethylene	245,000	42,407	60,568
Polysur S.M.				
Bahia Blanca Plant	Polyethylene	210,000	26,143	39,363
Total Cogen Capacity, KW				103,599

Estimate based on gas turbine with heat recovery boiler and condensing turbine

*In the absence of any direct input from the operating companies, it is assumed that the fuel type is natural gas.

SOURCE: *Global Climate Change Mitigation Through Cogeneration: A Market Assessment of Cogeneration Project Opportunities in Key Developing Countries*, Office of Energy and Infrastructure, Bureau of Research and Development, U.S. Agency for International Development, June 1992.

Market Conditions for Cogeneration Development. As mentioned above, each refinery and petrochemical plant offers opportunity for cogeneration. One petrochemical company, IPAKO, confirmed that there is interest in this industry to utilize cogeneration and gas-fired combined-cycle systems to produce power and steam for industrial complexes, and eventually

when the new electric industry structure is fully implemented in Argentina in 1993 for sale to the grid or to wheel to affiliated companies over the system.

Textile Industry

Total cogeneration potential in the textiles sector is expected to be substantial

General Assessment. The textile industry in Argentina is very significant and export-oriented. This industry uses steam as well as electric power and therefore, there is a great incentive for cogeneration. Total cogeneration potential in this sector is expected to be substantial, but could not be calculated more precisely due to the limited data available which is necessary for such calculations.

Case Study: ALPARGATAS

ALPARGATAS S.A.I.C., a group of companies within the textile industry, was identified as having a good potential for at least one cogeneration project. This large company, the products of which serve both domestic and international markets, is composed of the following major production divisions: textiles, footwear, fishing and fish processing.

ALPARGATAS owns many plants located not only in Argentina, but also in neighboring Uruguay and Brazil. Textiles like heavy denim indigo fabrics for jeans, quilted bed covers, bath robes, towels, industrial textiles for weather protection clothes, and casual footwear are exported predominantly to markets in the United States and Germany. Its fishing business operates five fishing vessels, which provide fish for processed products exported to Australia, United States, Germany, Italy, and England.

The ALPARGATAS Board of Directors believes that only by manufacturing exclusive products of a high enough quality to meet international market standards, increasing global productivity of the group of member companies, and placing emphasis on efficient operation, will ALPARGATAS remain competitive in the new framework of a complex business environment.

ALPARGATAS is interested in cogeneration facilities for two of its plants in particular. One plant is located in Buenos Aires metropolitan area, and the second one in Bella Vista. These plants operate 250 days/year, 24 hours a day. Some lower load operation occurs during the weekends. Also, the dye and shoe plants, which have the highest process steam requirement, have seasonal ups and downs in their production pattern.

Currently, ALPARGATAS purchases all of its electricity an average 1.4 million kWh per month per plant for all of its ten Argentine plants from the local electric utility. At its Buenos Aires plant, served by SEGBA, it pays 65 mills/kWh, not including the 18% value-added tax, for its electricity.

Because of the poor reliability of the electric system in the Buenos Aires area, the company installed diesel motors over thirty years ago. These engines, however, are small and costly to run, since diesel oil is quite expensive (about \$245/m³) and they are mainly used as emergency back-up power. Indeed, SEGBA itself has required the company to run this power source during periods in which it was experiencing capacity shortages. Process steam for the plant is generated in a natural gas-fired boiler.

The characteristics of a cogeneration system desired by ALPARGATAS for use at one of its plants are:

Electric generation: 4,000 kW

Process steam demand: 25 - 30 metric tons/hour

Process steam pressure: 10 - 12 bar at turbine extraction/exhaust

Fuel available: natural gas, and, for 3 winter months, oil (reliability of gas supply in winter is not satisfactory)

Since this plant is within the Buenos Aires city limits, the cogeneration plant based on a combined-cycle system may not be feasible because of space availability and a high level of noise. ALPARGATAS would consider building a cogeneration plant outside the city limits, and wheeling electricity from this location to several of its plants located in the vicinity. The company would favorably view a third-party cogeneration plant, with third-party operation and maintenance contracts, if the energy prices and reliability of such a project are acceptable. The company considers itself a textile specialist, not an energy producer, and is not interested in electric generation other than as a production input, and would thus actually prefer others to handle such business.

Fertilizer

General Assessment. The fertilizer industry uses steam as well as electric power and is one of the sectors suitable for cogeneration projects. However, this sector in Argentina is relatively small overall, and prospects for cogeneration projects in this sector are limited.

Food Processing

General Assessment. There are many small food processing plants in Argentina, but the details necessary for analysis of cogeneration potential were not available. In general, this industry utilizes both steam, hot water and electric power. This industry is fragmented in small production operations throughout the country. Therefore, it is difficult to estimate overall cogeneration potential.

Steel

General Assessment. Steel-making plants are large users of electricity, but have no substantial use for steam. As such, these facilities of themselves do not offer any opportunities for cogeneration projects. However, if there are other industrial users in the proximity of the steel plants which require process steam, it would be economic and profitable for the steel-maker to build a cogeneration system on its site and sell the steam to the neighboring user.

Market Conditions for Cogeneration Development. SIDERCA, a Buenos Aires-based steel company, is encouraging private enterprises to build a natural gas fired power plant to supply electricity to their electric steel furnaces. This plant may have the potential for thermal integration with the steel facility to increase the thermal efficiency of the proposed power plant.

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ACRONYMS

AEA	Advanced Engineering Associates
AYEE	Agua y Energía Eléctrica
bbl	Barrels
BLT	Build-lease-transfer
boe	Barrels of oil equivalent
BOO	Build-own-operate
Btu	British thermal unit
CDU	Central Dispatch Unit
CTMSG	Comision Tecnica Mixta de Salto Grande
CNEA	Comision Nacional de Energía Atomica (Federal Nuclear Commission)
CO ₂	Carbon dioxide
DHC	District heating and cooling
EIR	Environmental impact report
EIS	Environmental impact statement
EPA	Environmental Protection Agency
ESEBA	Empresa Social de Energía de Buenos Aires
EX-IM Bank	U.S. Export-Import Bank
GDP	Gross domestic product
GNP	Gross national product
GT	Gas turbine
GW	Gigawatt
GWh	Gigawatt hours
HIIDRONOR	Hidroeléctrica Norpatagonica SA
HRSG	Heat recovery steam generator
IBRD	International Bank for Reconstruction and Development
IDB	Inter-American Development Bank
IFC	International Finance Company

IMF	International Monetary Fund
kV	Kilovolt
kWh	Kilowatt hours
MERCOSUR	Southern Cone Common Market
mm Hg Abs	Millimeters of mercury (pressure)
M metric tons	Million metric tons
Mft ³	Million cubic feet
MW	Megawatt
MWe	Megawatt electricity
NIS	National Interconnected System
psig	Pounds per square inch gauge
SEGBA	Servicios Eléctricos del Gran Buenos Aires S.A.
ST	Steam turbine
STAG	General Electric acronym for steam and gas turbine
TPA	Tonnes per annum
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
U.S. AID	United States Agency for International Development
WIEG	Washington International Energy Group
YPF	Yacimientos Carboníferos Fiscales

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