



LATIN AMERICAN ENERGY ORGANIZATION

LATIN AMERICA AND THE CARIBBEAN
ENERGY-ECONOMIC EFFICIENCY AND
PRIVATE-SECTOR PARTICIPATION: A KEY ELEMENT
IN POWER SECTOR RECOVERY



Quito, August 1993



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PRESENTATION

The Permanent Secretariat of OLADE, as part of its basic activities, has been focusing on the electric power sector in order to identify major problems and propose solutions so that this sector can continue to support the Region's economic and social development.

One of the major problems is investment financing over the next few years. Studies conducted by OLADE indicate that there is no single solution to resolve this difficulty. The coordinated participation of all agents involved in the sector is required. Any proposal would therefore have to include the search for economic and energy efficiency, the broader participation of the private sector, and a new role for the State in the sector's management. Likewise, greater contribution by multilateral banks would have to be considered.

The importance of energy-economic efficiency lies in the fact that it will enable a greater net internal generation of funds and the displacement of investment requirements, so that the sector can become more competitive and provide services that generate returns.

INTRODUCTION

The Latin American and Caribbean (LAC) power sector made significant progress during the seventies and eighties; in fact, it increased the level of electrification from 40% in 1970 to 70% in 1989. However, a variety of problems related to the lack of sound business management, low energy-use efficiency and other economic, institutional and environmental aspects, have created difficulties not only for the provision of suitable services but also --and even more importantly-- for the sector's own development. Consequently, the LAC power sector finds itself in a difficult situation, since it must overcome technical and institutional problems affecting its service while financial constraints prevent it from undertaking the large investments needed to meet the electricity requirements of the Region's economic and social development efforts to the end of this decade.

If the same power system development policies of the past continue to be applied in the Region, in coming years it will be necessary to invest nearly US\$19 billion annually, in which case a financing deficit on the order of US\$13 billion annually would be anticipated. This would prove to be totally unmanageable for the LAC countries. OLADE therefore considers it imperative to analyze alternative solutions to this problem. One of these could well be to promote a strategy combining economic- and energy-efficiency aspects. Alongside this strategy, increased private-sector participation would be required, as well as the search for alternative sources of financing and redefinition of the State's role in the sector.

The combined effect of economic- and energy-efficiency actions would, on the one hand, be the internal generation of larger amounts of funds and, on the other hand, deferment of investments. In any case, these actions by themselves will not solve the sector's financing deficit problem; private-sector involvement and greater support from multilateral banks are also needed.

This paper examines the main problems facing the sector, presents forecasts for demand, supply and investment requirements and identifies and analyzes the principal options for a strategy that could contribute to solving investment financing problems and, thereby, to ensuring electricity supplies at the regional level.

1. MAIN PROBLEMS

1.1 Institutional Problems

1.1.1 In most LAC countries, the power sector operates under laws and regulations whereby the State has adopted as its principal roles those of central planner and direct owner of public-service power utilities. In many cases, this model was adequate during the formative stages: economies of scale were achieved in small systems, funding was provided through the taxation system when capital markets were not suitable, and scarce administrative and technical resources were tapped. As time passed, the power sectors and the economies within which they operated grew larger and more complex, and the disadvantages became more evident. One consequence has been that, in many countries, the sector's main objective of providing reliable, efficient service has been compromised for political reasons. Thus, for example, large projects have been built without duly considering their economic costs and benefits; the utilities have been used to generate employment; and prices have been set below economic costs. In some cases, the power sector has also been used as a means of obtaining foreign currency loans which have been earmarked for other economic activities. Even in those cases in which there have been rules preventing such actions, they have not always been consistently enforced.

1.1.2 The main problems affecting the power sector in many LAC countries largely reflect the lack of a modern view of the sector's role and of legal and institutional structures suitable for spurring its development. The State's dual functions as regulator and shareholder have led it to intervene in management decisions that should ordinarily be in the hands of autonomous company boards of directors and administrators. Furthermore, regulatory practices have been scant, and usually poor, and have thus hampered the performance of the public and private agents involved in the sector, through excessive, unnecessary controls and little effective regulation. The overall legal and institutional framework has not been sufficient to foster efficient company performance in the power sector. Sometimes it has been rigid in adapting to varying circumstances in the global and sectoral economic environments; at other times, when relatively appropriate, it has not been duly applied.

1.1.3 Several LAC countries have begun to formulate improvements in their regulatory frameworks in order to better manage their respective power sectors. The initial focus is on greater transparency and public accountability in managing power sector institutions. Since relations between government institutions, utilities, associates and customers are heavily influenced by regulations, it is necessary to reform these so that the governments can demonstrate their political and legislative leadership and a strong commitment to regulatory and institutional change. The regulatory framework, rather than being merely a means of control, should ensure an environment of competition that promotes economic and energy efficiency.

1.2 Lack of Sound Business Management

1.2.1 In the 1980s the power sector was characterized by a loss of management autonomy, due to the sometimes excessive increase in the State apparatus and growing political interference in utility management, even in tariff-setting. Furthermore, these companies have often been managed without applying the concept of management accountability and have thus been increasingly removed from customary business practices. This situation has created difficulties for attracting capital to expand the system, beyond traditional funding sources, due to the sector's low level of profitability and credibility. Underestimating the complexity of

unsuitable operation and maintenance of hydro-thermal systems has also had a bearing on poor business practices, as have the privileges granted to workers, e.g., labor conditions and salaries alien to the local job market and excessive employment stability. Below are listed some of the indicators that reflect the management problems in the LAC power sector and that have affected the cost and quality of service:

- ♦ Financial deficits in most utilities.
- ♦ A 20% decline in the available thermoelectric park over the past decades ⁽¹⁾.
- ♦ Thermoelectric generation efficiencies of less than 30% on average. ⁽²⁾
- ♦ Electricity losses averaging 17% in the Region, but in some cases exceeding 30% of total generation ⁽³⁾.
- ♦ In some countries, collection periods longer than three months, which represents more than three times the optimal level ⁽³⁾.
- ♦ Surplus generating capacity in some countries, motivated by the emphasis on supply policies and the interests of builders and equipment suppliers.

1.2.2 The operation of the LAC power sector companies should be evaluated according to results obtained, for which their management should be made responsible and accountable. To do this, it is necessary to work with a set of goals related to administrative, technical and financial aspects. Performance should be measured as a function of the degree of compliance with these indicators, established on a comparative basis according to the characteristics of the company's activities and the power system that it operates.

1.3 Growth in Demand Unaccompanied by Efficient Electricity Use

1.3.1 Although it is true that the growth in electricity demand could be a positive indicator, in the case of the Region's power sector the high energy consumption recorded during the last two decades mainly responded to greater expansion of service coverage and inefficient energy use. The policies undertaken by the LAC countries to increase electrification rates and provide electricity to most of the population made it possible to expand service coverage from 40% in 1970 to 70% in 1989. However, these policies were not complemented by programs for efficient energy use ⁽³⁾. This strategy resulted in an electricity consumption growth rate of 7.2% annually over the past two decades, as opposed to the 3.5% growth rate of the Gross Domestic Product ⁽⁴⁾, and in the doubling of energy intensity during that period. (See Table 1.)

1.3.2 Consequently, LAC electricity consumption has been characterized by a high degree of elasticity in growth of demand with respect to Gross Domestic Product, steady growth in per capita consumption, and a rapid increase in access to electricity, without any major controls on efficient energy use. If the same consumption patterns continue, this situation will be maintained in the Region in coming years, and this will call for more capital resources to meet electricity demand. From a financial standpoint, this situation seems unsustainable in any light.

1.4 Deterioration of Infrastructure

1.4.1 It is estimated that the deterioration in the LAC electric power infrastructure has led to a cost increase of over US\$10 billion annually ⁽¹⁾, due to the rise in generating costs, the increase in power losses, and the negative economic impacts derived from electricity rationing. Even though the LAC power sector's generating capacity has grown rapidly since 1970, the effective availability of this capacity has decreased over the same period, mainly due

to the unsuitable system operating practices and almost total abandonment of facility maintenance. According to World Bank estimates, the availability of installed thermoelectricity generating capacity has declined by 20% over the past decade ⁽⁴⁾.

1.4.2 The lack of suitable maintenance has led to deterioration in the generating capacity of the power systems of most of the Region's countries. The immediate consequences have been more service interruptions, higher fuel costs and lower levels of reserve generating capacity. In some countries, despite the theoretical surplus capacity, it has not been possible to cope with dry periods and has been necessary to ration electricity supplies, with high losses for the countries' economies and deterioration in the population's well-being.

1.4.3 Furthermore, as a consequence of power service disruptions, in LAC between 2% and 5% of the potential electricity demand has not been met, and this has meant revenue losses of some US\$500 million to US\$1.2 billion for the utilities and some 10 times this amount of losses for the broader economies ⁽³⁾. This deterioration in the power facilities has also led to heavy investment by the productive sectors, to protect themselves from the lack of power service reliability.

1.5 Low Level of Efficiency of Electricity Production and Use and High Levels of Losses

1.5.1 Underestimation of the complexity of hydrothermal system operation. Many LAC power systems have been affected by underestimation of the complexity of operations and unsuitable maintenance of their hydrothermal capacity, which has caused a notable deterioration in service reliability and utility finances. Within these problems special mention should be made of the inadequate appreciation of hydropower availability in some countries, which has been worsened by drought problems and by the low effective capacity and low efficiency of the thermoelectric generating park. In many systems, the latter is below 30%, including cases of generation based on gas turbines operating at even lower levels ⁽²⁾. This should lead to the introduction of new methods for analyzing and managing hydrological risk, to the recovery of power capacity, and even to the decommissioning of obsolete units in order to make room for new plants applying recent technological advances (for example, combined cycles, fluidized beds, and steam injection in gas turbines). These initiatives require more suitable training for technical personnel from the utilities.

1.5.2 Low levels of efficiency in the use of electricity. The Region displays low levels of efficiency in electricity use due to: the fact that the residential, commercial and services sectors employ end-use equipment having high levels of specific energy consumption; the obsolete industrial park; and the behavior of consumers, whose energy-use practices are not optimal from an efficiency standpoint. Thus, there is a sizable potential for savings, which, according to OLADE estimates, could be as much as 10% to 15% of current consumption.

1.5.3 High levels of losses. The values for electricity losses in LAC have reached alarming levels, in some cases close to 30% of total generation, with a regional average of 17%. This situation has been caused mainly by low investments in the area of distribution, with respect to those in generation and transmission, and by organizational and administrative deficiencies in the power companies ⁽³⁾. In an efficient system, the level of technical transmission and distribution losses fluctuates between 7% and 10%. Non-technical losses include the electricity consumed but not billed due to illegal or incorrect connections, metering errors or poor billing procedures. To keep technical losses low, suitable investments are required in distribution and, in some cases, transmission systems, as well as sound operating schemes.

Keeping non-technical losses at reasonably low levels calls for appropriate business practices and a legal framework that works and that includes sanctions. Reduction of these losses can give rise to important investment savings and significantly larger revenues for the utilities.

1.6 Economic and Financial Crisis

1.6.1 If measures are not taken to improve economic and energy efficiency, the LAC energy sector will face a difficult decade because of the large volume of investments that must be made. Calculated as US\$ 19 billion per year, these would lead to an annual funding deficit of US\$13 billion, which is considered unmanageable for the Region. Meanwhile, external debt servicing, estimated at US\$50 billion, will also constitute a heavy financial burden for the Region's power sector ⁽³⁾.

1.6.2 Generally speaking, the power sector's economic performance has been moving increasingly farther away from optimal efficiency levels, especially in the 1980s. Pricing, fiscal and exchange-rate policies, investment decision-making, and institutional management have not fostered economic and energy efficiency. In many cases, electricity prices have shown a strong tendency to deteriorate in real terms, remaining below their efficiency levels and sometimes recurring to highly inadvisable cross-subsidies. This has given incorrect signals to consumers and thus promoted inefficient energy use and caused the companies serious financial problems.

1.6.3 Several factors have influenced the financial crisis in the LAC power sector. Some of these have been exogenous to the sector, e.g. the oil crises of the 1970s, which substantially increased the costs of goods and services and production costs. This situation also led the countries of the Region to adopt energy self-sufficiency policies that resulted in the large-scale development of hydropower, for which financing was obtained with relative ease in the early 1970s due to the surplus of money on capital markets. However, in the late 1970s and early 1980s, these sources began to become depleted; amounts were restricted and more stringent conditions were implemented for the granting of new financing to the power sector. At the same time, devaluations caused by balance-of-payments problems, alongside the governments' efforts to curb inflation through strict control over public sector prices, resulted in an erosion in electricity tariffs in real terms. Between 1972 and 1988, these fell by 22%, whereas operating costs rose by 14% over the same period⁽³⁾. Following the drastic reduction in credit in the early 1980s, the LAC countries found it difficult to obtain fiscal resources and many power utilities found it impossible to service their debt, which was aggravated by high financing costs, due to monetary evaluations, both internal and external; by lags in project implementation periods; and by losses in the creditworthiness of the countries of the Region. This resulted in a large increase in interest rates. The proportion of the debt service with respect to the total use of funds available to the sector grew steadily from 24% in the early 1970s to 59% in the late 1980s, and the debt service coverage coefficient dropped from 1.4 to 0.5 over the same period⁽³⁾. These factors meant that at the end of the 1980s the power sectors of the Region found themselves in a deteriorated financial situation that constituted a heavy burden for national economies.

1.7 Environmental Constraints

1.7.1 Society's new level of awareness about environmental protection and multilateral banks' and technical assistance agencies' new policies in the area of environment are of capital importance, for they increase the degree of complexity of the challenges that LAC power sector development must face-- to such a degree that many countries of the Region interpret

the environmental factor as a new constraint. Parallely, there is the conviction that the best environmental plan for developing countries is the one that eliminates poverty, which is the main source of environmental deterioration. To do this, it is indispensable to increase the production of energy in all of its forms and to use it more efficiently.

1.7.2 This new reality is primarily affecting the development of large-scale hydropower projects, whose associated socioenvironmental costs can increase the originally estimated investments between 5% and 50% and thereby reduce or eliminate the projects' economic attractiveness. The lack of a suitable environmental policy for the management of this type of project in the past, at both the levels of countries and development financing agencies, has led to resistance from the local populations affected by the projects, who are usually advised by international groups.

1.7.3 Financial restrictions and oil price stability favor less capital-intensive investments and, therefore, power system expansion plans based on thermoelectric plants. In the short term, these will increase the levels of atmospheric pollution, which are already critical in the Region's major urban and industrial centers. This will in turn lead to reactions from the public at large and make it necessary to install costly anti-pollution systems, thus eliminating some of the attractive points of thermoelectric plants over hydroelectric ones. However, some countries would have the option of using natural gas to overcome these difficulties.

1.7.4 An important environmental element worthy of mention, and still undervalued in LAC power sector development, is the significant contribution of hydropower to the reduction of greenhouse gases, mainly carbon dioxide. In 1990, every kWh generated in the Region produced 30% less CO₂ than in 1970⁽²⁾.

1.7.5 Nowadays, society (and that includes most power utilities and countries in the Region) is beginning to understand that "extra" environmental costs form an integral part of investment projects and that in the past these were simply covered by some sector of society. Therefore, they are not "new" costs. To this must be added the existence of a more open, better informed and, consequently, more participatory society, which makes it unthinkable that an electricity generation project today can be built with the same environmental criteria of only ten years ago. Society has also come to understand that environmental programs, previously considered "external" to the project, actually guarantee the sustainability of the investment (programs of basin management, reforestation, etc.) and are thus just as important as the dam or the electromechanical equipment.

2. FORECASTS OF DEMAND, SUPPLY AND INVESTMENT REQUIREMENTS

2.1 Methodology

2.1.1 Electricity supply and demand forecasts come from the energy forecasting study that OLADE is conducting with support from the Commission of the European Communities. The forecasting methodology makes it possible to carry out analyses at the country level; and the regional results obtained are, therefore, derived by aggregating figures for the 26 OLADE Member Countries. The countries' expansion plans have been used as the basis for analyzing electricity supply and have been adjusted to demand using a simulation model. In those cases in which such plans were not available, information on the existing power park and on the most likely projects was used. This has made it possible to make assumptions regarding future supply.

2.2 Demand Forecasts

2.2.1 According to OLADE estimates, the growth in LAC's electricity demand will reach an average rate of 4.4% in the 1990-2000 period, which is slightly lower than the Region's growth rate in the 1978-1990 period (5.8%). This evolution of demand is based on an average growth rate of 2.9% for the Region's Gross Domestic Product over the same period, and it considers past trends for the different energy sources' substitution and penetration processes. As a function of these trends, the results obtained show a reduction in energy intensity and an increase in per capita consumption. Under these conditions, total energy consumption will reach an average growth rate of 2.7% in the period, and electricity will continue to increase its share in total final consumption. (See Table 1.)

2.2.2 The application of policies for efficient energy use and for energy substitution will make it possible to reduce electricity consumption growth rates and, therefore, the requirements for installed capacity. It is estimated that, if electricity consumption savings and substitution of 5.9% can be achieved by the year 2000, the annual consumption growth rate would decline by 3.7%.

2.3 Forecasts of Supply and Investment Requirements

2.3.1 Without considering the application of energy conservation policies, the power capacity that would have to be added in the 1990-2000 period in order to satisfy the increase in demand would amount to 65 GW, of which approximately 63% would correspond to hydropower stations, 18.5% to stations using oil and natural gas, 14.5% to coal-fired plants, and the rest to geothermal and nuclear power plants under construction. (See Table 3.) By applying programs for efficient energy use, energy substitution, power capacity recovery and power loss reduction, supply requirements could decline by some 2.0%, with the consequent benefits for the Region's economies.

2.3.2 Considering current consumption patterns and trends, during the 1990-2000 decade investment requirements in the power sector (for generation, distribution and transmission) would be approximately US\$19 billion annually. It is worthwhile to note that 88% of this investment would be concentrated in six countries of the Region: Argentina, Brazil, Chile, Colombia, Mexico and Venezuela.

3. MAJOR OPTIONS

3.1 No Single Solution

3.1.1. Considering the amount of funds generated by the power sector's average tariffs, the management schemes in force, and contributions from customers, the investment financing mentioned in the preceding section would lead to a deficit on the order of US\$13 billion annually. (See Table 4.) This would be unmanageable for the countries of the Region. A strategy that only takes into account the application of tariffs at long-run marginal costs and the reduction of costs would not be sufficient to meet the sector's investment requirements either, largely because of the heavy burden of servicing external debts. In this case, if contributions from customers are considered, the deficit would be US\$4.7 billion. (See Table 5.) It is therefore indispensable to analyze alternative solutions to this problem. A suitable strategy might be one that, in addition to considering economic efficiency aspects,

takes into account other options such as promotion of energy conservation and power interconnections, increased participation by the private sector, the search for alternative forms of financing, and the redefinition of the State's role in the sector.

3.1.2 The combined effect of economic- and energy-efficiency actions will, on the one hand, be the internal generation of a larger amount of funds, obtained by reducing operating costs and applying tariffs at marginal costs and, on the other hand, deferment of investments due to energy savings, energy substitution and recovery of generating capacity. In any case, these actions alone will not solve the problem of the sector's investment financing deficit. It will thus be necessary to have private sector involvement and greater support from multilateral banks. This strategy would also lead to a reduction in environmental impacts, due to less need for the addition of new equipment and lower fuel use in plants already operating and those to be commissioned.

3.1.3 Consequently, the solution to the sector's investment financing needs calls for contributions from a group of options that should be handled comprehensively. One possible investment financing scheme for the sector is shown in Table 6. The total volume of investments would be reduced to US\$17 billion, due to the reduction in installed capacity requirements resulting from the application of energy conservation measures. The application of long-run marginal cost tariffs and the reduction of costs would make it possible to cover debt servicing and to have available a net internal generation on the order of US\$11.4 billion. Under these conditions, the annual financing deficit, including contributions from customers (for extensions of lines, grids, connections and meters) would be US\$3 billion. If the multilateral banks' contribution were US\$1.4 billion, the balance of US\$1.6 billion would have to be covered by contributions from internal and external savings. However, if it is considered that the increase in electricity prices to marginal-cost levels could lead to a contraction in demand, due to price-elasticity effects, the net income from the utilities' energy sales would decline by an estimated US\$1 billion, and the deficit would increase proportionately. In the long term, this effect would tend to be offset by a reduction in investments.

3.1.4 The traditional financing scheme has been exhausted. As a result, power sector companies should effectively act as businesses and seek to domestic and foreign capital markets. The development of internal capital markets is essential for an economy with greater participation by market forces. However, the capture of resources on the internal market calls for national efforts to encourage the financial recovery of power sector companies, continuation of the stabilization process already under way, and sustained economic growth. Given that the resources of domestic capital markets will not be sufficient, the sector will have to recur to international capital markets, but cautiously, due to exchange rate risks and the high degree of competition, which restricts access to those resources. It is worthwhile to point out that the cost of capital for the power sector will depend to a great extent on institutional soundness, the application of clear and stable rules, utility recovery, and the governments' macroeconomic goals.

3.2 Improvements in Power Sector Management

3.2.1 Improved business practices, regardless of the ownership system (public, private or mixed), will lead to a reduction in investments and operating costs; and if they are accompanied by adjustments in tariffs to economic levels, it would be possible to generate internal resources that could contribute, in part, to financing the sector's investments.

3.2.2 If only one fourth of the thermoelectric generating capacity requiring rehabilitation could be recovered, the Region could increase its supply by 3,000 MW, at a cost of approximately US\$1.2 billion, i.e., US\$400/kW, which is an amount much lower than that required to install new power stations offering the same capacity. (See Table 7.) Other advantages would be improved generating efficiency and a notable decrease in fuel consumption.

3.2.3 The reduction of power losses could also lead to considerable savings. If losses estimated by the year 2000 could be reduced by 1.7%, this would mean an annual generation of 13,300 GWh less and a capacity of some 3,000 MW less. The costs entailed in this reduction would be on the order of US\$900 million (US\$300/kW), a figure much smaller than that required to expand generating capacity in an equivalent amount. (See Table 7.) Furthermore, that reduction would lead to lower operating costs.

3.2.4 The reduction of the LAC power utilities' 1988 average collection period of 111 days to 45 days would make it possible to obtain US\$3.1 billion in additional liquidity ⁽³⁾, without taking into account the reduction in financial costs and the benefits due to inflation's erosion of the buying power of the sums collected. To achieve these goals, in some cases it would be expedient to modify laws and to improve administrative procedures for billing, collecting and disconnecting service.

3.2.5 In order to overcome efficiency problems and improve resource allocation, it is also necessary to establish and consolidate integrated analysis methods for the energy sector and to prepare a general framework for orienting investment decisions to be made by the economic agents involved in the sector. The methodologies for selecting investments for power system expansion should go beyond the search for the economic optimum defined by overall least cost; in general, the concept of flexibility in planning should be introduced, incorporating, among other aspects, demand-side management and energy conservation, financial constraints and uncertainties associated with demand, fuel costs, and project implementation schedules and costs. In this regard, OLADE, together with the Inter-American Development Bank (IDB), has been developing the SUPER/OLADE-BID Model, which is a tool that makes it possible to define and analyze generation and transmission investment strategies that incorporate the above-mentioned aspects.

3.3 Electricity Conservation Possibilities

3.3.1 If savings on the order of 5.0% were achieved in electricity consumption by the year 2000, this would represent a decrease of approximately 36,200 GWh in consumption for that year and a decrease of 6,000 MW in installed power capacity requirements, which would have called for an annual cost of some US\$1.4 billion (US\$0.04/kWh). To attain this level of energy savings, it will be necessary to promote a group of policies and actions in the field of demand-side management and efficient use of electricity. Demand could be moderated through technical and economic measures, and consumption could be reduced through the introduction of more efficient end-use technologies and practices, with the consequent deferment of investments. This significant savings could be achieved without altering service quality. (See Table 7.)

3.3.2 The application of energy substitution policies would enable an electricity consumption decrease due to the penetration of other energy sources such as natural gas, liquid gas and solar energy. It is estimated that this could mean a reduction of approximately 1,000 MW in installed power capacity requirements. (See Table 7.)

3.4 Private Investment

3.4.1 To contribute to improving the situation of the LAC power sector requires significant reforms in the State's role in this area. This should consider greater participation by the private sector, both in electricity generation and in transmission and distribution-- all of this within an overall trend towards openness to more competitive markets, where it will be fundamental to implement in public enterprises the business practices typical of the private sector, without discounting the possibility of commercial agreements between the leading players in the power sector (electricity customers, the utilities themselves and suppliers of goods and services). These agreements would make it possible to achieve greater dynamism in the power sector and for the resulting benefits to be shared. Thus, there is significant room for private-sector participation in the power sector, but this does not necessarily imply the full privatization of all the assets currently in the hands of the State.

3.4.2 The private sector can make a significant contribution of capital and technology in various areas of power sector activity, thus freeing up resources that the government would allocate to pressing social needs. The features and scope of private-sector participation should be viewed case by case, as a function of prevailing economic and financial conditions and political and social considerations. These improvements would not result solely from the additional financial contribution that the private sector could bring to the power sector, but also from the advantages derived from better, faster decision-making and the application of more effective management practices, in the pursuit of greater efficiency in the use of the power sector's technical, economic and financial resources, with ample benefits for the sector itself and for the countries. In any case, the participation of private investment in the LAC power utilities will take some time, since it will be necessary to make a great deal of additional effort in the areas of tariff changes, guarantees, regulations and suitable legislation and, above all, to provide a climate of security in order to attract larger amounts of private-sector capital to the sector.

3.4.3 As a contribution to the issue of financing power sector expansion, OLADE, with the aid of international experts, has been analyzing capital-market opportunities and typical access mechanisms. A series of constraints have been identified, and these must be overcome by the countries in order to achieve private investment participation. These constraints arise on the side of funding recipients (countries, power sectors and utilities), and on the side of potential funds-supplying markets.

Constraints at the Country Level

3.4.4 At the country level, political constraints must be considered because they affect the image of stability, and so must economic and financial reforms that favor sustainable growth and reduce political risks, which in turn facilitates the utilities' access to capital markets. These political, economic and financial constraints are as follows:

Political

- ♦ Political instability has always been a serious constraint for capital flows to a country, and it can be inferred that it would be difficult for a country with high political risks to gain access to capital markets and to attract development funding. Such political instability can be the outgrowth of sudden changes in government or in economic and social policies.

Macroeconomic

- ◆ The lack of policies or the maintenance of erratic or unstable policies in the macroeconomic aspects indicated below would hinder possibilities for funds from capital markets and would restrict these to the so-called "project financing," which is increasingly scarce:
 - Currency convertibility, which facilitates transactions of all kinds in company operations and makes the company's shareholders or bondholders defend its viability.
 - Interest rates that support the massive capture of local funds. Nearly 60% of the funds that the Region will need in this decade will be in local currency.
 - Low levels of inflation or inflation with a definite downward trend. A one-digit annual inflation rate would be preferable.
 - Exchange rates that are competitive for tradable goods in the economy.
 - Stable and growing international reserves levels, to allay investors' concerns about the need to make certain transactions required in the power industry using foreign exchange.
 - Repatriation of dividends and debt servicing, to attract international institutional investors or foreign investors. The difficulty in repatriating dividends could be dealt with in part through the participation of investment-guaranteeing institutions such as the Overseas Private Investment Corporation (OPIC) of the United States or the Multilateral Investment Guarantee Agency (MIGA) of the World Bank.
 - Freeing of capital accounts, i.e., admissibility of capital entry and exit. In a power company, a controlled policy of openness to capital flows facilitates the participation of foreign investors of all kinds in the capital markets. This would have to occur once the current account has been successfully opened up.
 - Surplus in the balance of payments, which ensures the country's adequate involvement in the area of international trade.

Financial

- ◆ Institutions that provide liquidity to the system should be managed efficiently and be kept removed from the distortions created by State management.
- ◆ It is expected that there will be an appropriate, modern regulatory framework permitting the influx of large amounts of stocks and liquidity in the system.
- ◆ Privatization of State companies is the mechanism for massively providing stocks for the market. When there is no privatization program in a country that is re-entering the market through its State enterprises, shares floating on the market are scarce.
- ◆ Privatization processes and reforms in the management of funds that provide liquidity to the capital markets of the Region's countries have to be well-balanced and suitably programmed by the State.
- ◆ Credit must be given to those governments and specialized institutions in the Region's market that, with greater or lesser speed, are making the pertinent decisions, especially on improvement of the economic, legal and institutional environment favoring the development of capital markets.
- ◆ The highly indebted countries, which have found it difficult to meet their debt servicing payments and cannot take care of their external debt on the basis of market mechanisms, would see their entry onto the international capital markets seriously affected.

- ♦ High levels of debt are detrimental to the country and also to the market players that do not perceive that a country with problems for making payments on its external front may have a rating unsuitable for market access.
- ♦ If a country is incapable of covering its short-term trade financing debt, the situation of perceived risks and the impossibility of access to capital markets are more evident.
- ♦ When a country has not established a record of regularly servicing its short-term debts, it becomes almost impossible for its companies to access capital markets.
- ♦ A country that can offer institutional tradition and practices that regulate its business practices and development is attractive to investors; one that cannot is faced with restrictive barriers.
- ♦ Institutional investors initially seek emerging markets such as those of the Region, where capital gains and the lack of dividend-sharing are attractive. The Price/Earning ratio, i.e., the price that is paid for each share in relation to the gains that are distributed is a key element in an equity investment decision. In emerging markets where shares are usually undervalued, the Price/Earning ratio is low. If there are no possibilities for increases in the Price/Earning ratio, as a function of growth in the national economy and improvements in the companies, investors will perceive this as an unfavorable investment environment.
- ♦ A country that has not developed a clear regulatory system for the stock market will not be able to provide suitable stock-investment rules, and this is a significant constraint.

Constraints at the Sectoral Level

3.4.5 In the power sector, tariff restrictions must be taken into account, as well as access to inputs, fuels and subsidies. Likewise, it is necessary that there be regulatory agencies for the sector and for the stock market. Other restrictions to be kept in mind are the lack of government targets for industry, centralized decision-making, operating difficulties, and ownership of the utilities due to the existence of laws that hinder access to capital markets.

3.4.6 In international capital-market circles interested in financing the power sector, the tariff system is the first barrier to be overcome. This restriction arises when tariffs are not based on marginal costs, but rather on political criteria; when there are uniform national tariff sheets that do not reflect differences in generation, transmission and system operation costs in the various regions of the country; and when tariffs do not favor an internal generation of funds sufficient to underwrite minimum programs of utility development.

3.4.7 Uncertainty regarding access to fuels, their costs and major inputs controlled by the State. This restriction is also critical, since the operational viability of some countries' power systems depends on it. If a given fuel is scarce or costly or if water is competing with other uses in one same area, the governments must clearly establish policies for accessing each major input under its control.

3.4.8 Non-transparent subsidies. A subsidy policy that disguises the benefits that the government wants to grant to certain sectors of the community is not beneficial for the community nor for investors, because, just as the subsidies were easily created, they can easily be rescinded. However, a policy that is transparent in terms of level, duration and target population is healthy from the standpoints of its creation and management.

3.4.9 Weak or non-existent regulatory agencies in the power sector. The presence of a regulatory agency in the power sector is key to the commercial development of the power industry. Such agencies regulate not only technical and operational aspects but also the

critical tariff regime, and they supervise the financial results of operations. The absence of this type of agency gives the executive branch of the country (and sometimes the legislative branch as well) too much influence on policy, which constitutes a stumbling-block for local and foreign investment decision-making.

3.4.10 Excessive political influence from the sector's directing agency. When there is no regulating agency for the power sector, it is replaced by agencies that direct sector development. They plan, design, build, operate and even regulate the sector, but traditionally they are subject to political influences on decisions of all kinds, some of which bring with them the consequence of high operating costs for the agencies overall and for the units they manage. The directing agencies that do not have clearly defined roles can have negative effects on private investment or on access to capital markets.

3.4.11 The decision-making process is centralized and bogged down. If the decision-making process for critical aspects of the power sector is centralized and bogged down, it does not provide incentives for adopting least-cost investments and it impedes suitable demand-side management or energy conservation.

3.4.12 Lack of sectoral objectives. If the directing agency or the government lacks clear objectives for decentralization, economic efficiency, competition and the attraction of private investment, it is perceived to be weak in the external context, and this hampers access to developed capital markets.

3.4.13 Laws that restrict the operation and/or ownership of power sector companies. This is a constraint for the participation of entities other than the traditional ones in sector development, and it therefore creates a monopoly in the sector and limits the government. Unless there is a government policy or a federal law to limit power sector ownership to the State, access to capital markets will be very restricted.

3.4.14 Long construction periods in developing countries. The power sector is characterized by projects having lengthy construction periods, due to problems with external supplies, customs clearance, flows of funds during construction, etc. The danger here lies in the fact that these periods can coincide with those of political or economic instability. This can also influence access to funds from capital markets.

3.4.15 High project costs. Power sector investments are intrinsically high. If to this is added the cost of the project site, extra costs, price escalation, delays and contingencies, the situation becomes even more dramatic, since the funding supplier will think twice before investing its money in high-cost projects.

Constraints at the Company Level

3.4.16 As for the companies themselves, the most relevant restrictions are inadequate standards for financial, operational and service performance; the absence of acceptable, periodical financial statements; the lack of a tradition of sound business management based on results; and the absence of a self-sustaining financial structure.

3.4.17 Lack of minimal standards for financial, operational and service performance. This is perceived directly in the lack of potential for growth in the utilities' earnings, since they do not lead or figure among the leaders in the power sector market. This constraint is also related to the facts that the power industry does not grow at the same rate as, or a higher rate than, the

Gross Domestic Product and that its operational and service results do not meet customers' demands.

3.4.18 Lack of acceptable, periodical financial statements. This is a logical restriction in the sense that, without this minimal information, it is difficult to discern the utilities' actual situation. Sometimes in the case of power companies, even though financial statements do exist, they do not apply internationally accepted accounting standards.

3.4.19 Poor financial history. The historical financial performance of the utilities entails the additional complication that the utilities are viewed by their markets as poor or unattractive enterprises. If their markets, which are usually captive, appraise them poorly --and this situation has held true historically-- it will be very difficult for the companies to gain access to capital markets unless they can develop an attractive performance record. Governments, especially, seldom consider it necessary for performance results to be attractive; they are content with not having the companies be major contributors to the fiscal deficit.

3.4.20 Lack of a management tradition based on results. Production and service quality results are contingent on technical factors and business practices, but the latter in turn are a function of the lack of an adequate organizational structure, an inappropriate system of planning and performance control and, furthermore, the lack of a clearly defined participatory, modern management style involving the entire organization. Customers naturally relate their payment for electric power services to power quality and production. Obsolete management without clear direction based on results leads to a poor image for utilities.

3.4.21 Utilities are not stock companies. In other words, they are companies or enterprises created by law and their assets do not take the form of shares. These companies could only issue bonds with a government guarantee, but not shares; this impedes stock transactions among investors. Therefore, for partial or total privatization processes to take place, it would first be necessary to convert them into stock companies.

3.4.22 Lack of a self-sustaining financial structure. This restriction is becoming critical, because the companies must create a financial structure allowing them to develop in the face of growing competition on their markets. This is a responsibility that cannot be shirked by either private or public sector owners. In developed markets, it is supervised by the regulating agency, so that the utilities will take the necessary actions to strengthen their financial structures and be able to grow.

Constraints at the Market Level

3.4.23 As for potential funding supplier markets, constraints come from the future limitations that the multilateral banks will have in supporting innovations that imply working with the private sector in developing the power industry. It is also necessary to take into account the difficulties of receptivity to risk that certain industrialized countries have not yet resolved, and that would favor the Region's utilities. Finally, the industrialized countries' limits on debt exposure could also constitute barriers to the utilities' access to developed capital markets.

3.4.24 Multilateral banks, private banks and state owned and operated banks. It is clear that the institutions that have traditionally financed power projects (the World Bank, the IDB and Eximbank) are finding it more difficult to be able to do so because the member governments and major capital contributors have increasingly more budget difficulties in sustaining these programs. International private banks have taken on another role in the capital markets: that

capital markets: that of ensuring debt servicing through innumerable elements that will create restrictions on companies or countries from the developing world. This situation is an outgrowth of experiences during the debt crisis of the 1980s.

3.4.25 The World Bank and the IDB. These institutions have not yet decided whether they are ready to incorporate innovations that imply working directly with the private sector, although some statements have been made in that regard. This hinders these institutions' assuming more active roles in support of the power companies' entry into the capital markets or other services, one of which could be the underwriting of bonds issues for utilities on the capital markets.

3.4.26 Certain markets which could potentially be targets for the placement of bonds and stocks for companies from developing countries still maintain eligibility standards that are unattainable for companies from the Region. Just as these standards were eased in the United States, Canada (especially Ontario), Switzerland and Japan, it is necessary for them to be eased on other markets, in order to allow access by LAC companies.

3.4.27 The difficulty of issuing bonds that can be converted into stocks and that can be placed on developed markets is a constraint, since this type of issues is a key element for construction financing.

3.4.28 Industrialized countries' receptivity to risk. Recently, the United States and Germany have been the largest target markets for bonds issues and American Depositary Receipts (ADRs). The availability of information on borrowers and institutional differences --among other aspects-- explain the receptivity of these markets. However, from the standpoint of the markets, the fact that certain instruments have been accompanied by due experience with high-yield stocks has been influential, since there is suitable appreciation of these by credit-rating companies. There has also been a sufficiently broad network of banks from around the world which have provided the market with *de facto* credit ratings for certain investment instruments. The United States is an example of the former, and Germany of the latter. If these requirements are not suitably developed in other markets, access by the Region's utilities will be limited.

3.4.29 Limits for each developing country's exposure within the industrialized countries' capital markets. Since the debt crisis, through direct or indirect signals to the market, public institutions that are regulators of financial markets, private institutions that are raters, and specialized magazines have forced financial institutions to define debt exposure limits for each country and its companies. These exposure limits will become serious obstacles for the utilities' access to the capital markets.

3.5 Alternative Financing Arrangements

3.5.1 In addition to traditional power sector funding sources, the LAC countries have a group of options for mobilizing financial resources for new investments in the sector. Among these options are the use of local capital markets, including the placement of bonds on the market or developing these if they do not exist; leasing of new equipment or facilities, involving local or foreign financial agents; promotion of joint ventures between existing power companies and private investors; promotion of the purchase of energy generated by independent power producers and cogenerators; promotion of demand-side management and rational use of electricity projects; arrangement of schemes to swap external debt for new investments; increased financial involvement of new customers in system expansion; sale of

part of the utilities' assets; creation of conditions for the operation of the so-called energy service companies; and promotion of larger employee shares in the utilities' capital.

3.6 The State's Role in the Transitional Stage

3.6.1 The LAC power sector in general requires profound structural reforms that imply a review of the State's role and more room for private-sector participation. In any case, given the features of the electric power industry, the State should continue performing important functions that are vital in ensuring efficient service provision. The State will maintain certain responsibilities that naturally correspond to it in the power sector (e.g., regulation and indicative planning), regardless of the model adopted for restructuring the electric power industry. Likewise, for various political, social, economic or financial reasons, it will have a space as an owner (but not necessarily an operator) of power sector companies.

3.6.2 The State's role as a regulator is unquestionable in a sector having the economic characteristics of the electric power industry. The need for regulation of public power services is present in any economic model established, whether strictly monopolistic, open or intermediate. Furthermore, it is independent of the ownership regime, since State ownership does not eliminate the need for regulation, which is a key factor in making public power services efficient. The presence or absence of market-access barriers, tariff systems, the subjection of public or private companies to commercial laws, the rules for optimal power system operation, and the protection of captive consumers are, among others, important regulatory factors which define the sector's economic efficiency.

3.6.3 The State may continue to participate in the ownership of power companies in LAC. In those cases where competitive systems can be implemented, if public enterprises are subject to a commercial regime and follow standard business practices, in principle they can operate as efficiently as any other market agency (and otherwise should withdraw). If for strategic or economic reasons certain companies remain in the hands of the State, they should operate under competitive conditions.

3.6.4 Another important role of the State is strategic planning, which will only be indicative in order to orient the investment decisions of public and private players on the market. In monopolistic, State-owned schemes, this planning will be the responsibility of the company in charge of power system development. Of course, each company will have its own commercial strategy and there will be the risk of unnecessary, uneconomic multiplication of investments. Likewise, as part of this strategy, some companies could come to raise artificial market-entry barriers when the market is open, to protect their investments. This reinforces the need for orientational planning by the State. In open systems, indicative planning leads the State to play a subsidiary role, since if there are no interested private parties (due to logical variations on the capital markets), in certain cases the government must make those investments.

3.7 Viability of Environmentally Sound, Sustainable Management

3.7.1 Experience shows that local environmental problems related to electricity generation and transmission can be fully controlled so as to make them acceptable to society at large. There are methodological tools and technologies available to assess and mitigate the environmental components of power projects, and society at large has the legal and participatory means of intervening in decision-making and in maximizing benefits. The environmental project costs, which are now considered as additional or "new" are not really so; in the past they were simply absorbed by some sector of society.

3.7.2 Measures to control and mitigate environmental impacts of thermoelectric generation are well-known and fully quantifiable from an economic standpoint. Options may vary from the use of cleaner fuels to the installation of gas scrubbers. In this regard, the development of natural gas for electricity generation, in those countries where this is possible, offers great advantages over other forms of power generation.

3.7.3 In the case of hydropower projects, despite their greater complexity, experience shows that suitable environmental management is possible. The main problem lies in the need for companies and international organizations to assimilate the concept that hydropower projects are much more than electricity generation projects and that they offer other benefits such as flood control, irrigation, regional development, etc. The power sector should necessarily adapt its institutional structure to take into consideration new, multipurpose projects.

3.7.4 One way to reduce the environmental risks of hydropower projects is to reduce their scale. This offers additional economic and strategic advantages (better alignment with demand, lower financial risks, better spatial distribution of sources, greater operating flexibility, etc.), but requires better business management and better inter-institutional and investment-planning coordination.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 A joint effort is required to make the power sector economically efficient. The power sector's current problems, aggravated by the great demand on capital resources needed to underwrite its expansion, calls for the involvement of the State, the companies themselves, the private sector, and customers. It will also be necessary to consider all forms of company organization: public, private and mixed. The need for a transitional period must be accepted a priori, as well as the need for the State to have a well-defined role allowing it to establish clear rules, be an effective regulator, foster competition, and ensure power sector development.

4.2 Tariff systems and business management efforts must be efficient. Tariffs must reflect economic costs and encourage efficient energy production and use. For this, it will be necessary to have effective regulation of power service supply in the areas where there are natural monopoly conditions. Furthermore, improved management should be one of the top-priority objectives to be attained by utilities in all of the countries of the Region. In this regard, it is necessary to rehabilitate the generating park, mainly the thermoelectric plants that, in many countries, have been practically abandoned due to the hydropower surpluses of previous decades, following start-up of large-scale hydropower projects. It will also be necessary to achieve a significant reduction in electric power losses, both technical and non-technical, and to have strict control over technical and financial management indicators.

4.3 Energy conservation: a fundamental strategy for economic efficiency. The implementation of energy conservation programs will make a significant contribution to reducing operating costs and investment requirements. For this, it will be necessary to have political decision and commitment on the part of the governments, and technical, economic and financial assistance from international institutions. It is important for the latter to substantially increase the amount of funds made available to finance conservation programs at the national and regional level.

4.4 Development and access to capital markets: the role of multilateral banks. The traditional funding scheme has been exhausted; it is necessary to develop another one in which the private sector will be more relevant and there will be greater access to internal and external capital markets. The procurement of resources from the internal market calls for the countries to make an effort to foster financial recovery of the power sector companies, as well as to continue the process to achieve stabilization and sustained economic growth. Other restrictions that hinder access to resources must be overcome within the sector itself, in the companies, and in the funds-supplying markets. Actions on international capital markets must take into account exchange-rate risks and competing demands that hamper access to these resources. In addition, there is a disturbing tendency in the involvement of multilateral banks, particularly the World Bank, whose financial support to the Region's power sector is decreasing.

4.5 Environmental protection. There are ways to fully incorporate socioenvironmental considerations into electricity generation and transmission projects, so that these will be acceptable for society as a whole and for the physical-biotic environment. However, the internalization of "environmental costs" in new projects will require additional efforts in the allocation of the scarce financial resources available; these must be kept in mind by the multilateral banks. Increased electricity production and its efficient use in the Region is a necessary condition for guaranteeing sustainable development.

(1) "Maintenance Neglect in the Power Sector: The Cost and Options to Overcome It," The World Bank, October 15, 1991.

(2) Energy Situation of Latin America and the Caribbean: Transition to the 21st Century, OLADE, 1991.

(3) Evolution, Situation and Prospects of the Electric Power Sector in the Latin American and Caribbean Countries, OLADE/World Bank, Spanish version, December 1991.

(4) OLADE, Energy-Economic Information System (SIEE).

**LATIN AMERICA AND THE CARIBBEAN
POWER SECTOR
EVOLUTION OF SOME INDICATORS**

Table 1

INDICATORS	UNITS	Y E A R S			ANNUAL RATE (%)	
		1970	1980	1990	1970/1980	1980/1990
TOTAL INSTALLED CAPACITY	GW	39.2	92.5	161.5	9.0	5.7
HYDROPOWER / TOTAL POWER	%	47.6	52.7	58.5		
ELECTRICITY PRODUCTION	TWh	145.1	357.2	597.7	9.4	5.3
HYDROPOWER PROD. / TOTAL PRODUCT	%	53.5	60.1	65.8		
ELECTRICITY CONSUMPTION	TWh	120.9	297.8	486.2	9.4	5.0
RES + COMM + SERV	%	42.8	42.3	43.3		
INDUSTRIAL	%	51.0	52.1	50.8		
TRANSPORTATION	%	1.2	0.6	0.6		
CONSTRC + AGRIC + OTHERS	%	5.0	5.0	5.3		
ELECTRIFICATION LEVEL	%	42(1)		70(2)		
PER CAPITA CONSUMPTION	kWh/inhab.	430	832	1,097	6.8	2.8
ENERGY INTENSITY	kWh/1000 US\$	295	418	599	3.5	3.7
POPULATION	10 ⁶ inhab.	281.2	357.8	443.4	2.4	2.2
GROSS DOMESTIC PRODUCT	10 ⁹ US\$ 1980	409.7	711.8	811.7	5.7	1.3

(1) CORRESPONDS TO 1971

(2) CORRESPONDS TO 1989

SOURCES: OLADE, ENERGY-ECONOMIC INFORMATION SYSTEM (SIEE)
ECLAC, STATISTICAL YEARBOOK ON LATIN AMERICA AND THE CARIBBEAN - 1991

Table 2

LATIN AMERICA AND THE CARIBBEAN
SOCIOECONOMIC VARIABLES AND DEMAND
SCENARIO WITHOUT ENERGY CONSERVATION

	UNITS	Y E A R S		
		1978	1990	2000
POPULATION	10 ⁶ inhab.	341.9	443.4	540.8
GROWTH RATE	%		2.2	2.0
TOTAL GROSS DOMESTIC PRODUCT	10 ⁹ US\$ 1980	638.5	811.7	1,076.3
GROWTH RATE	%		2.0	2.9
TOTAL ENERGY DEMAND	10 ⁶ BOE	1,908.4	2,468.0	3,236.0
GROWTH RATE	%		2.2	2.7
ELECTRICITY CONSUMPTION	10 ⁶ BOE	152.4	301.3	462.0
GROWTH RATE	%		5.8	4.4
ELECTRICITY CONSUMPTION BY SECTORS				
RESIDENTIAL + COMMERCIAL + SERVICES	TWh	120.0	210.7	312.1
	%	48.8	43.3	41.9
INDUSTRIAL	TWh	111.0	247.1	394.1
	%	45.1	50.8	52.9
TRANSPORTATION	TWh	1.2	2.7	4.1
	%	0.5	0.6	0.5
CONSTRC + AGRIC + OTHERS	TWh	13.8	25.7	35.3
	%	5.6	5.3	4.7
TOTAL	TWh	246.0	486.2	745.7

SOURCE: OLADE/CEC, ENERGY FORECASTING PROJECT - PHASE II

Table 3

LATIN AMERICA AND THE CARIBBEAN
POWER SECTOR OUTFITTING FORECASTS
SCENARIO WITHOUT ENERGY CONSERVATION

	Y E A R S		ADDITIONS
	1990	2000	1990 – 2000
INSTALLED CAPACITY – GW			
HYDRO	94.5	135.4	40.9
GEOTHERMAL	0.9	2.1	1.2
NUCLEAR	2.3	3.6	1.3
COAL-FIRED THERMAL	4.6	14.0	9.4
OIL-FIRED THERMAL (*)	59.2	71.2	12.0
TOTAL	161.5	226.4	64.9

(*) INCLUDES NATURAL GAS

SOURCE: OLADE/CEC, ENERGY FORECASTING PROJECT – PHASE II

**FINANCING OF POWER SECTOR INVESTMENTS
IN LATIN AMERICA AND THE CARIBBEAN**

Table 4

With countries' average tariffs *
(Billions of 1989 US\$)

YEAR	Investments	Gross Internal Generation of Funds	Debt Servicing	Internal Contribution to Investments	Deficit with – out Customer Contributions	Customer Contributions**	Deficit with Customer Contributions
	(A)	(B)	(C)	(D=B–C)	(E=A–D)	(F)	(G=E–F)
1990	13.096	9.748	9.501	0.247	12.849	2.655	10.194
1991	16.086	10.259	8.817	1.442	14.644	2.916	11.728
1992	17.944	11.768	8.664	3.104	14.840	3.089	11.751
1993	18.911	12.621	9.055	3.566	15.345	2.787	12.558
1994	20.322	13.902	9.384	4.518	15.804	2.355	13.449
1995	22.411	14.699	9.458	5.241	17.170	2.307	14.863
1996	23.911	15.858	9.850	6.008	17.903	2.182	15.721
TOTAL	132.681	88.855	64.729	24.126	108.555	18.291	90.264
Annual Avg.	18.954	12.694	9.247	3.447	15.508	2.613	12.895

NOTES : * For average annual sales of 572.8 TWh and an average rate of 5.4 cents of a US\$ per kWh, que
which corresponds to average tariffs to be applied in the 1990–1996 period, according to the countries' estimates.

 ** Corresponds to contributions for extensions of lines, grids, connections and meters.

SOURCE : The Evolution, Situation, and Prospects of the Electric Power Sector in the Latin American
and Caribbean Countries, Volume I, The World Bank and OLADE, August 1991.

**FINANCING OF POWER SECTOR INVESTMENTS
IN LATIN AMERICA AND THE CARIBBEAN**

Table 5

With LRMC tariffs *
(Billions of 1989 US\$)

YEAR	Investments	Gross Internal Generation of Funds	Debt Servicing	Internal Contribution to Investments	Deficit with – out Customer Contributions	Customer Contributions**	Deficit with Customer Contributions
	(A)	(B)	(C)	(D=B – C)	(E=A – D)	(F)	(G=E – F)
1990	13.096	18.347	9.501	8.846	4.250	2.655	1.595
1991	16.086	18.246	8.817	9.429	6.657	2.916	3.741
1992	17.944	19.486	8.664	10.822	7.122	3.089	4.033
1993	18.911	20.354	9.055	11.299	7.612	2.787	4.825
1994	20.322	21.697	9.384	12.313	8.009	2.355	5.654
1995	22.411	23.343	9.458	13.885	8.526	2.307	6.219
1996	23.911	24.787	9.850	14.937	8.974	2.182	6.792
TOTAL	132.681	146.260	64.729	81.531	51.150	18.291	32.859
Annual Avg.	18.954	20.894	9.247	11.647	7.307	2.613	4.694

NOTES : * For average annual sales of 572.8 TWh and an average rate of 6.8 cents of a US\$ per kWh, which corresponds to 100% of the LRMC tariff and represents an increase of approximately US\$8 billion annually in earnings.
 LRMC : Long – Run Marginal Costs

 ** Corresponds to contributions for extensions of lines, grids, connections and meters.

SOURCE : The Evolution, Situation, and Prospects of the Electric Power Sector in the Latin American and Caribbean Countries, Volume I, The World Bank and OLADE, August 1991.

Table 6

**FINANCING OF POWER SECTOR INVESTMENTS
IN LATIN AMERICA AND THE CARIBBEAN**
Billions of US\$ per Year

ITEM	According to Cocoyoc document(a)		With energy conservation programs*
	With countries' average tariffs	With tariffs at LRMC**	
Investments	19.000	19.000	19.000
Reduction due to energy conservation			2.000
Investments with energy conservation	19.000	19.000	17.000
Gross internal generation of funds	12.700	20.900	20.600
Less debt servicing	9.200	9.200	9.200
Net internal generation of funds	3.500	11.700	11.400
Customer contributions	2.600	2.600	2.600
Deficit	12.900	4.700	3.000
Contrib. from multilateral banks	2.400	2.400	1.400
Deficit to be financed	10.500	2.300	1.600

NOTES:

* With energy conservation programs, demand decreases, thereby reducing net earnings by US\$300 million annually.

** LRMC: Long-Run Marginal Costs

SOURCE:

(a) The Evolution, Situation, and Prospects of the Electric Power Sector in the Latin American and Caribbean Countries, Volume I, The World Bank and OLADE, August 1991.

Table 7

LATIN AMERICA AND THE CARIBBEAN
IMPACT OF ELECTRICITY CONSERVATION MEASURES
(ENERGY SAVINGS AND DEFERRED INSTALLED CAPACITY REQUIREMENTS)

MEASURES	GWh/YEAR	MW	COST MILLIONS OF US\$
RECOVERY OF POWER CAPACITY IN THERMOELECTRIC PLANTS		3,000	1,200 (1)
REDUCTION OF TECHNICAL LOSSES	13,300	3,000	900 (2)
ENERGY SAVINGS	36,200	6,000	1,400 (3, 4)
ENERGY SUBSTITUTION		1,000	
TOTAL		13,000	
DEFERRED INVESTMENTS (MILLIONS OF US\$) (5)		33,000	

NOTES : (1) COST OF POWER CAPACITY RECOVERY (US\$ 400 / kW)

(2) COST OF REDUCING LOSSES (US\$ 300 / kW)

(3) ANNUAL COSTS

(4) COST OF ENERGY SAVINGS (US\$ 0.04/kWh)

(5) COST OF NEW OUTFITTING (US\$ / kW)

– GENERATION	1,500
– TRANSMISSION	675
– DISTRIBUTION	675



LATIN AMERICAN ENERGY ORGANIZATION