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NON-UTILITY GENERATION OF ELECTRICITY IN THE DOMINICAN REPUBLIC: OPPORTUNITIES, NEEDS AND IMPEDIMENTS

Prepared for:

THE AGENCY FOR INTERNATIONAL DEVELOPMENT
BUREAU FOR LATIN AMREICA AND THE CARIBBEAN

Under the Regional Energy Resource Project
(No. 598-0606)

December 1984

ENERGY/DEVELOPMENT INTERNATIONAL
100 North Country Road
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I. INTRODUCTION

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A. BACKGROUND

In most developing nations expanded electricity supply to both urban and rural areas is a priority. Due to the expansion of their economies and the major influx of people into cities from rural areas, national governments and utilities must meet expanding urban demand. They must expand supply in urban areas to assure delivery of expected minimal levels of service and in rural areas assure that electricity is used to help create conditions which will keep or attract people and economic activity. Utilities are having difficulty in expanding their generation, transmission and distribution capability in light of national economic problems, competing priority areas for government investment, institutional and manpower limitations and their poor financial conditions. In addition, developing country utilities often rely almost entirely on imported oil as fuel. Except for hydro-based generation, other country-held and renewable energy resources have not been used or developed. It is evident that new and creative mechanisms are needed to encourage the utilization of renewable energy resources.

A candidate mechanism which has proven to be a very powerful stimulator of increased electricity generation and supply capacity in the U.S. is PURPA (the Public Utility Regulatory Policy Act of 1978). This legislative and regulatory package was directed at stimulating off-system or non-utility generation of electricity by private and public sector entities using renewable energy resources and technologies. PURPA is recognized as having been very successful in creating new economical and reliable supplies of electricity, especially through private sector investment. In California alone, alternative energy based electricity generating capacity almost quadrupled from 1981 to 1983. In this time period, cogeneration supplies rose from 200MW to almost 800MW and an additional 5,500MW

were being developed. Because of its success in the U.S., it has been identified as a possible model for developing country activities.

B. OBJECTIVE

In the Dominican Republic, the use of private financing of alternative technologies for electricity production can facilitate the planning function of Corporacion Dominicana de Electricidad (CDE) by minimizing the construction of conventional central plants and avoiding some of the problems that have complicated the construction and financing of the conventional generating facilities. Through tax policy, regulatory policy and technical assistance the Dominican Republic Government can promote the development of alternative energy technologies by the private sector. Alternative energy resources, such as low-head hydro electric, bagasse, solar, cogeneration and wind can be developed by the private sectors in the Dominican Republic if a regulatory policy similar to the Public Utility Regulatory Policy Act of 1978 (PURPA) is implemented. In the U.S., PURPA provides incentives for industrial and private electricity production and sale to the utility grids. Under the Act, it also requires utilities to buy electrical output from these plants and pay the producer the "avoided cost" or their marginal cost of producing electricity.

The principal objectives of the study as stated in the Scope of Work are to provide a study for USAID and the Dominican Government that:

- Analyzes the existing electrical system and identifies, policy, legal, regulatory, institutional and technical impediments to private sector generation of electricity for sale to the utility.
- Identifies renewable energy opportunities for the generation of electricity for sale to the national utility grid.

- Provides recommendations to foster private sector renewable energy based electrical generation in the country.

The nature and history of the U.S. Public Utility Regulatory Policies Act of 1978 (PURPA) was used as a principle source of information and comparison in this study. PURPA, an historic piece of U.S. energy legislation, requires that U.S. utilities buy power from private sector generators which primarily use renewable energy sources. It allowed private sector entities to generate and sell electricity under certain specific conditions without having to become a public utility. The selling price was defined as the utilities' avoided cost which is essentially their marginal cost of generation. Implementation of the act was slow due to utility resistance and other problems which were ultimately resolved in court cases. However, the successful resolution of major issues and the major stimulative impact it has had on the development of non-utility renewable energy applications can be instructive. It has been particularly successful in California where the government actively used it to encourage renewable energy development in the utility and private sectors. It has also been shown to provide an economical and reliable additional source of electricity to help utilities meet demands without expansion of their oil-based generating capacity. The goals of PURPA to stimulate the use of renewable energy resources by non-utility generators are also important in other countries and it was felt that an investigation of the potential for PURPA or other types of stimulative arrangements would be valuable in the countries covered by this study.

C. APPROACH AND TEAM

This study is based on a two week visit to Santo Domingo, Dominican Republic, during which a two-person team met with a wide range of professionals from both public and private industries to discuss Off-System Generation (OSG) of electricity and collect information. A list of the major meetings which were held is presented in Appendix B. The team visited those institutions and

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individuals known to be involved in or considering generation and/or sale of electricity. Meetings were pre-arranged by The Comision Nacional de Policita Energetica, local USAID Mission personnel and by team members. Additional meetings were scheduled with others as a result of information gained and contacts made while in-country. The project scope of work was explained and used as the basis of each meeting.

The E/DI Dominican Republic team included Andres Doernberg and Shibu Dhar. The two week visit, though short, was very efficient and was supported by considerable background and relevant experience of team members and of E/DI.

D. REPORT ORGANIZATION

The overall project includes consideration of Off-System Generation (OSG) of electricity and PURPA applicability in three countries. Because of this, three separate country reports have been prepared and the results of visits to each country are covered by the individual reports. However, because there are common elements and findings of interest to all readers the reports contain a number of identical sections. The format and organization of each report is also identical.

The information presented in each report is organized to define the present situation and preview the future with respect to private sector renewable energy based generation of electricity. The use of PURPA and its status in the U.S. provides a benchmark to measure and illuminate opportunities, needs and impediments in each country. Report appendices contain detailed information which may be useful for selected readers or background and backup to portions of the text. The chapter presenting the summary, conclusions and recommendations is specific to the country. A separate volume presents a summary of findings and recommendations of the study as well as background material on PURPA.

II. SUMMARY OF FINDINGS AND RECOMMENDATIONS

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A. INTRODUCTION

In the Dominican Republic as elsewhere in developing countries, the poor financial condition of the electric utility coupled with extraordinary high needs of new electric capacity during the next decade, provides a strong incentive to the government to find ways to finance the growth of the electric system. Steps are being taken in the Dominican Republic that will make other public sector institutions suppliers of significant amounts of power for sale and distribution by the state-owned public utility. This approach, which reverses three decades of total control over generation of electricity by the public utility, could be expanded to include private sector investment, both in eliminating inefficiencies currently existing in the system, and in the production of power from alternative energy sources: agricultural wastes, wood, small hydro and wind energy. A major policy objective for the development of the electricity sector should be to direct both public and private investment to these options.

B. FINDINGS

1. Existing Financial Situation of the Public Utility

The state-owned Corporacion Dominica de Electricidad (CDE) is in critical financial straits, for reasons that are typical of those encountered in many development countries and reasons that are unique to the Dominican Republic's current economic crisis:

- Tariffs are kept low in order to protect the standard of living of the population, 30 percent of which have access to electricity (and a considerably higher fraction in urban areas). CDE's tariffs are fixed by Presidential decrees upon recommendations of the CDE Executive Board, who are Presidential appointees.

- CDE's revenues are threatened by widespread theft of electricity, a situation that is aggravated by tariff increases. Theft also brings about inefficient uses such as electric cooking and high growth rates in electricity demand, which reached 10 percent in 1983. That year, 38 percent of electricity generated was lost in transmission, distribution and theft. By comparison, only 27 percent was lost in 1978.

- In order to keep tariffs low, CDE receives direct and indirect subsidies for fuel oil and gasoil/diesel, via special domestic prices that are 50 percent lower than retail prices and through a preferential rate of exchange that allows CDE to import oil at a rate of RD $1.0 = US $1.0. In 1983, CDE spent RD $87 million in petroleum imports and would have had to spend RD $130.5 million without the preferential rate.

- CDE's financial situation will be aggravated if and when the expected agreement between the International Monetary Fund and the government is signed in December of 1984. Any agreement would call for an immediate cancellation of CDE's fuel subsidies and gradual increases in electricity tariffs. CDE is in no position to absorb an abrupt increase of 50-100 percent in the prices it pays for fuels.

- Electricity demand continues to grow at high rates. The current capacity expansion plan envisions rates of 10.2 - 13.3 percent p.a. for the period 1988-1993. The plan estimates total investment for this period of US $1.4 - 1.5 billion excluding fuel costs. The ability of CDE to obtain funding for all these projects is doubtful.

2. Planned Alternative Energy Projects in the Public Sector

The Dominican Republic is committed to the development of ambitious alternative energy projects within public sector institutions. The most advanced are two projects of the state-owned Consejo Estatal de Azucar (CEA), which is expected to provide insignificant amounts of electricity to the grid by 1987. Other plans call for use by CDE of sugarcane field wastes and fuelwood in power plants and the development of numerous small scale hydro projects by CDE, INDRHI and rural communities with assistance from COENER.

- CEA Optimization and Diversification Project requires an investment of US $90 million in its first phase (2 sugarmills), which will provide to the grid some 54MW of power from cogeneration with bagasse 6 months per year, and some 35MW from bagasse and coal the rest of the year. Subsequent phases envision similar investments in three other sugarmills providing an additional 27MW to the grid during harvest and 23MW during the off season.

- CDE/CEA Sugarcane Wastes and Bagasse Utilization Projects: one project contemplates the generation of 37MW of power by CDE using sugarcane field wastes and coal as fuel, and a second cogeneration system of 36MW run by CEA using bagasse and coal as fuel at the Barahona Sugarmill. CDE is also proposing a 30MW plant using sugarcane field wastes in the area of San Pedro.

- Energy Farm: a 50MW woodfuel generation plant is proposed by CDE's Capacity Expansion Plan for introduction by 1989, at a cost of US $70 million.

- Small Scale Hydro: CDE is planning 15 small hydro projects ranging in size from 500kW to 2MW. In addition, INDRHI is planning 7 projects ranging in size from 300-4100kW. All these projects will be grid connected.

3. Legal Status of CDE and Precedents of Power Purchases from other Institutions

By law, CDE is the only institution in the country able to generate electricity for distribution and sale. There is, however, a long history of sale of electricity to the utility by private and public sugarmills, some of which continue to this day. More recent developments have resulted in CDE entering into contracts to buy power from private and public producers, some of which resemble PURPA-type applications and others that do not.

- Falconbridge generates for CDE up to 70MW of power at its mining facilities. This arrangement is viewed as temporary (until markets for ferronickel improve), but it has been in existence since 1976. A contract signed in 1983 stipulates that CDE pays for the fuel oil used in generation, plus RD 2 1/2 cents per kWh.

- CEA will sell electricity to CDE after its investment is completed (see 2 above) at a price equal to its annualized cost of capital and O+M, plus a return on investment of 18 percent. In addition it will be credited a fuel cost for the bagasse equivalent to the cost of coal to CDE. Currently, CEA is being credited RD 3.0 cents per kWh for the electricity it sells to the grid.

- A private industry has signed a contract to sell 600 kW to the grid at RD 8cents/kWh. Coconut husks will be used as fuel by this agroindustrial processor from a steam generator available since a plant overhaul. It is not a cogenerator.

4. Potential for Grid-Connected Cogeneration and Renewable Resource Power in the Private Sector

The potential for private sector production of electricity for sale to the grid can be found in the areas of agricultural wastes, energy plantations, wood and cogeneration. Private development of small hydro projects is presently hindered by laws giving all water rights in the country to INDRHI. Of the two private sugar producers, only one has a potential to sell excess power, because the LaRomana sugar mill (the largest in the country, until recently owned by Gulf & Western) processes bagasse into furfural and has no excess electricity to sell.

Agricultural Wastes (excluding sugarcane): the most promising potential source of OSG power (from wastes) is rice straw, enough of which is discarded every year to supply an estimated 12.4 MW. Another reason rice straw is mentioned most often is that rice mills are concentrated in two areas of the country and it would be possible to collect most of the rice straw easily. Other large volume wastes are cotton wastes, coconut husks and peanut shells. The last two are widely used by industry as a fuel already.

Private Sector Sugar Industry: the Colon sugarmill of the Vicini Group could have the potential for selling excess power to the grid, but no investment in this direction is envisioned by this private producer. The LaRomana sugarmill does not have excess power to sell to the grid. Sugarcane field wastes from estates in the private sector have a potential to produce significant amounts of power; these have not been evaluated to this date.

Fuelwood Plantations: there are several indications that the private sector is interested in investing in fuelwood plantations to produce charcoal and animal feed. None of these plans envisions generation of electricity as one of the products. The feasibility of power production will be proven by CDE on a large scale, as noted above.

Wind: from data gathered up to this date, there are indications that favorable conditions exist on the North Coast and in the Barahona region of the South West. A program directed by COENER with USAID funding will be carried out, that will provide wind profile data to satisfy the needs of wind turbine feasibility studies. Except for 1.5 kW machines, no private developer has ventured into wind generators, although there is some interest by the burgeoning tourist industry of the North Coast.

Cogeneration: the potential for cogeneration by industry with sale of excess power to the grid appears to be small. The mining sector (ferronickel, gold) does not have the potential to cogenerate, nor do the industries so far audited by the USAID funded energy conservation project. The rum industry is one of the potential candidates for cogeneration.

5. Legal Environment for Application of PURPA-Type Generation and Utility Position

The laws, decrees and regulations currently in place are formidable barriers to implementation of PURPA-type projects. On the

other hand, a combination of existing precedents of power purchases by the utility, coupled to a general consensus that the utility will not be able to provide the nation with the electricity it needs, leads us to conclude that the environment is favorable to an attempt to modify the laws that currently exist. The most important laws/decrees are:

- CDE has exclusive rights to production and distribution of electricity in the country.
- It is the declared national interest for the state to own the electric utilities in the country.
- INDRHI has all rights to the water resources of the nation, thereby preventing any private small scale hydro production. In practice, no example of a prohibition of this kind is known of.

The precedents of purchase of power by CDE (detailed above) have led to contracts between CDE and several public and private sector institutions. These contracts do not carry the weight of a law or a decree and are not permanently valid. On the other hand they are concrete testimony to the CDE's position vis-a-vis power purchases:

- CDE is willing to negotiate with all power producers that have an interest in selling to them.
- CDE agrees on the concept of avoided costs, and would like to obtain methodological procedures to calculate these for the case of small power purchases.
- CDE feels it would be difficult to modify the existing laws to formalize PURPA-type arrangements by law, but feels that the existing precedents make changes in the law unnecessary.

6. Economic Environment and Private Sector Position

The principal impediment to private investment in power systems for sale to the grid, in view of this team, is economic and financial. The system of direct and indirect subsidies to CDE, through preferential fuel prices and preferential exchange rates for imported fuel, yields avoided costs that are unrealistically low, which private

developers of electricity would in most cases not find attractive enough. The current subsidies are to be decreased if and when the agreement between the Government and the IMF is signed; only after the terms of the agreement are released will the new medium-term avoided costs for CDE be known.

A related impediment is the financial situation of CDE, which will probably worsen during the period its tariffs will slowly increase to reflect the sudden cutback in fuel subsidies. CDE's financial position was mentioned most often by the private sector as a factor against private investment in off-systems generators. Any investment with electricity as its primary product will be considered very risky until CDE's financial position is improved.

C. RECOMMENDATIONS

1. Drafting PURPA-Type Laws: we recommend that technical and legal expertise be hired to draft PURPA-type legislation appropriate to the energy situation of the Dominican Republic. A political climate could emerge in the next few years that may lead to passage of PURPA type legislation in the National Congress. One institution suited to prepare a draft for this legislation is the COENER.

2. Clarification of Specific Legal Situations: we recommend that legal expertise be hired to clarify the following concepts:

- CDE-Third Party Power Purchase Agreements: determine the legal statue of these contracts, what risks to private investors these entail, as well as what rights, determine legal standing on contract renewal etc.

- INDRHI Rights over Water Resources: we recommend that legal experts be hired to determine the ramifications of INDRHI's control over water resources. This review should confirm the accepted view that it is not possible for the private sector to exploit hydro resources; it should also recommend what negotiations to pay for water rights or royalties could be undertaken.

3. Assistance in Determining Avoided Costs: the CDE expressed interest in obtaining assistance in the methodological aspects of avoided cost calculations, in particular as it applies to purchases of power from small-scale, intermittent producers such as wind turbines. This assistance also would include the appropriate computer models currently used in the U.S. for this purpose. We recommend that such assistance be provided by AID.

4. Contract Negotiation for Power Producers: it is generally true that potential power producers do not have experience negotiating PURPA-type agreements. For example Falconbridge (a mining company) hired a consultant to assist them in their negotiations with CDE. CEA expressed interest in having our team review critically the agreement on power sales it recently signed with CDE. We recommend that technical assistance be provided to a professional institution in the Dominican Republic that can assist private and public sector parties in similar negotiations in the future. In the absence of a body with the functions of a Public Utilities Commission, we suggest that this expertise be developed in the COENER.

5. Develop Information of Potential Resources: of all potential PURPA-type applications in the Dominican Republic, wind turbines emerge as the most promising application for which not enough reliable information is available. COENER is currently starting an activity with USAID funding to determine wind profiles at several promising sites in the country. We recommend that this activity be started as soon as possible, and that a study be designed to move forward the date of implementation of a wind energy demonstration project. The policy, economic and institutional aspects of the sale of electricity to CDE should be included as an integral part of that project.

III. STATUS IN THE DOMINICAN REPUBLIC

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A. ELECTRIC UTILITY STATUS

1. Background

The Corporacion Dominicana de Electricidad (CDE) is the main producer and sole distributor of electricity in the country. All electric power is supplied by the CDE System with the exception of a few self-generating systems that supply electricity for their own needs. The electric energy use grew at an average rate of 12 percent per year from 1970 to 1982, reaching a total consumption level of 2,849 gWh in 1982.

Table III-1 shows the installed capacity and energy production by each type of generating plant for the year 1982. The generating system of CDE consists of steam, hydro, gas turbine and diesel generating units as well as some generating installations owned by the government (i.e., some of the large hydroelectric projects).

2. Generating System

Existing Plants

The location and size of the existing generating plants and their status are included in Table III-2. It is important to note that even though the CDE system installed capacity is 880 MW, the maximum available capacity is only 640.50 MW. Almost 48.0 MW is presently out of service permanently and additional 82.3 MW is undergoing a thorough rehabilitation program.

Last year's operating history of all thermal generating units is summarized in Table III-3. A total of 4.05 million barrels of residual fuel oil and 0.82 million barrels of gasoil were consumed by CDE.

TABLE III-1

INSTALLED CAPACITY AND ENERGY PRODUCTION
IN THE CDE SYSTEM
YEAR: 1982

Generation Type	Total Installed Capacity MW	Gross Energy Production gWh
Steam (fuel oil)	443.0	1777.50
Gas Turbine	186.0	280.05
Diesel	17.0	6.36
Hydro	186.0	317.07
Purchased* (Falconbridge)	78.0	468.08
TOTAL	910.0	2849.10

Source: CDE

* Steam generation (fuel oil) for the grid utilizing equipment at the Falconbridge mine. See section IV.E for details on this arrangement.

TABLE III-2

EXISTING GENERATING PLANTS
OCTOBER 31, 1984

Name of Plants	Name Plate Rating, MW	Average Dependable Capacity in MW
Gas Turbine		
Timbeque No. 1	21.1	Out of Service
Timbeque No. 2	21.1	18.0
Los Mina No. 1	35.6	27.0
Los Mina No. 2	35.6	27.0
San Pedro	28.3	23.0
Barahona	28.3	Under Rehabilitation
Flotante No. 4	8.4	Under Maintenance
Flotante No. 5	8.4	5.6
Steam		
Haina No. 1	54.0	Under Rehabilitation
Haina No. 2	54.0	23.0
Haina No. 3	84.9	40.0
Haina No. 4	84.9	70.0
Haina No. 5	84.9	47.0
Santo Domingo No. 5	12.6	7.0
Santo Domingo No. 6	12.6	9.0
Santo Domingo No. 7	12.6	9.0
Santo Domingo No. 8	26.5	Out of Service
Puerto Plata No. 1	27.0	25.0
Puerto Plata No. 2	36.0	27.0
Itabo	90.0	90.0
Diesel		
Flotante No. 1	1.6	Under Maintenance
Flotante No. 3	1.6	1.0
Diesel Santiago	12.0	2.0
Hydroelectric		
Tavera No. 1	40.1	35.0
Tavera No. 2	40.1	40.0
Rincon	10.1	9.0
Hatillo	8.0	6.8
Jimenoa	8.4	Under Maintenance
Valdesia No. 1	27.0	22.0
Valdesia No. 2	27.0	22.0
Sabana Yegua	13.0	11.0
Sabaneta	6.3	5.5
Las Damas	7.5	2.4
Los Ranchitos	0.8	Out of Service

Source: CDE

TABLE III-3

CURRENT OPERATING EFFICIENCY, CDE THERMAL PLANTS

(1983)

	No of Units in Operation	Generation (gWh)	Fuel Consumption Barrels	Efficiency kWh/gal
Steam (fuel oil)	10	1980.26	4,049,894	11.64
Diesel (gasoil)	5	10.73	26,751	10.37
Gas Turbines (gasoil)	5	279.19	792,289	8.39

Source: CDE

Future Plans

One scenario of the present CDE expansion plan for the next fifteen years is shown in Table III-4. According to this plan (which presents several possible programs or scenarios) a total of 1914 MW will be added to the present system of 857 MW. The major energy projects for the 1988-1993 period include electricity generation by bagasse (CEA) and an energy farm, as well as hydro and coal:

1988: CEA Projects Phase I: Rio Haina, Boca Chica

1989: Manabao - Bejucal; Energy Farm 50 MW (woodfuel);
CEA Projects
Phase II: Consuelo, Ozama and Quisqueya

1990: Manabao-Bejucal + Bejucal - Tavera; Sabaneta - Bao; San Pedro; Los Veganos (are all hydro)

1991: Los Negros - Sabaneta + Sabaneta - Bao; Alto Yuna (Piedra Gorda), Jiguey (all are hydro)

1992: Redondo - El Salto; La Hilguera; Las Avispas; Fondo Negro; La Diferencia; Mao; Aguacate (are all hydro)

1993: Future Coal plants (200 MW)

According to the proposed CDE expansion plans, hydro projects to be completed by the end of 1992 will increase this resource by six-fold (118 MW to 756 MW). Similarly, coal based generation will increase from 80 MW to 971 MW by 1998. Whether this ambitious expansion plan can, in fact, be realized, depends primarily on the availability of financing and also investment requirements for the watershed protection. Failure to protect the watershed can have a very negative impact on the ultimate feasibility of the hydroelectric resource development in the Dominican Republic.

In Table III-5, the CDE estimated energy production requirements from the various sources are included: It is interesting to note that the CDE is planning to produce almost 96 percent of its energy requirements from coal and hydro plants by 1990. At present (1984) the total energy production from the coal and hydro based plants are

TABLE III-4

FUTURE GENERATION EXPANSION PROGRAMS

	Available Capacity in MW						
Year	Hydro	Coal	Oil	Gas Turbine	Non-Conventional	Total	Gross Installed Capacity in MW
1984	118	80	413	9	--	620	857
1985	174	80	329	87	--	670	830
1986	190	80	337	97	20	724	875
1987	222	163	326	31	40	782	1036
1988	231	163	326	75	77	872	1200
1989	282	163	326	71	130	972	1321
1990	449	163	326	16	130	1084	1505
1991	602	163	311	2	130	1208	1673
1992	756	163	240	58	130	1347	1636
1993	756	285	240	53	130	1502	1811
1994	756	507	240	53	130	1586	1986
1995	756	529	250	53	130	1708	2161
1996	756	651	240	53	130	1830	2336
1997	756	811	240	53	130	1990	2504
1998	789	891	240	--	130	2050	2655
1999	789	971	240	--	130	2130	2771
2000	789	971	240	--	130	2130	2771

Source: CDE: Actualizacion Plan de Expansion del Sistema Electrico de la CDE. Volumen I. Sofrelec, Octubre 1983.

TABLE III-5

PROJECTED GROWTH IN ENERGY PRODUCTION

1985 - 1990 (gWh)

	1985	1986	1987	1988	1989	1990
Capacity Type:						
Oil	1942.00	1772.00	1049.00	765.00	457.00	0.00
Gas Turbine	50.00	50.00	50.00	74.00	60.00	60.00
Diesel	6.00	4.00	2.00	--	--	--
Coal	654.00	654.00	1300.00	1300.00	1300.00	1920.00
Hydro	554.00	806.00	940.00	1392.00	2079.00	2326.00
Nonconventional Sources	--	--	60.00	120.00	120.00	120.00
Purchases	--	--	--	--	--	--
TOTAL	3206.00	3285.00	3401.00	3651.00	4016.00	4426.00

Source: CDE, Departamento De Estadisticas

less than 30 percent of the total energy output of the CDE system. By 1990, the coal plants will provide the energy requirements for the base load demand, thereby substituting for the present oil-fired thermal capacity. Also, the role of hydro will be extended to cover more periods of intermediate periods substituting for the present reliance on purchased oil-fired capacity and for some phased-out gas-turbine and diesel capacity.

3. Transmission and Distribution

Figure 1 shows the present transmission networks between different load centers within the CDE service area. The total transmission and distribution network are distributed as follows by voltage levels:

Voltage Level (KV)	Lengths in KM
138.0	250.0
69.0	1200.0
34.5	607.0

Some of the 138 KV transmission lines are operating at present at 69 KV level and it is expected that operation at 138 KV level will begin by the end of 1984.

In recent years, transmission and distribution losses in the CDE system grew at an annual rate of 12.9 present (1977 - 1982). In 1983, the losses are reported to have climbed to 38 percent of generation, while the figure cited for 1984 is an average of 32 percent. The following table shows the system losses as a percent of net generation for the CDE system:

Year	Losses gWh	Net Generation gWh	% of losses
1977	523.30	2058.70	25.4
1978	626.30	2300.30	27.2
1979	545.30	2252.10	24.2
1980	716.20	2629.80	27.2
1981	702.20	2787.80	25.2
1982	959.80	2849.10	33.6

There appears to be two major causes for these losses. One is the theft of power due to inadequate meter reading, billing and poor monitoring of consumption. The other cause, technical losses, are due to under-rated distribution system conductors, and poor power factors at the consumer level at which various electrical equipment operates. The power factor of the Santo Domingo System is very low averaging between 0.65 to 0.75. The resulting high reactive currents contribute significantly to the overall system losses.

System Reliability:

The level of reliability of power supply in Dominican Republic, particularly in Santo Domingo, has been unsatisfactory for a number of years. The prime cause has been problems in the generating stations particularly with the old steam and diesel units. A program of rehabilitation has been developed and implementation begun.

Problems are also experienced on the distribution system. In many cases the voltage cannot be maintained within the statutory limits of rated voltage and premature failure of transformers in service is a cause of concern to the system's reliability.

Many of the problems now facing CDE result directly from the financial constraints under which the corporation has had to operate in the last 10-15 years. A World Bank loan to assist CDE is under consideration to reduce system losses; US $13.0 million in the loan will be devoted to improve metering systems.

4. Electricity Demand - Past and Prospective

The energy and capacity forecasts presented in this section are prepared by the CDE based on the regression analysis (historical trend) and major industrial and rural electrification programs. In Table III-6, the capacity and energy forecasts for the high, low and medium scenarios are included. If it is important to note that the peak demand for the system is estimated by CDE to increase by three-

TABLE III-6

ELECTRICITY ENERGY AND DEMAND FORECASTS

	HIGH SCENARIO 1		LOW SCENARIO 2		MEDIUM SCENARIO 3	
Year	Peak MW	Energy gWh	Peak MW	Energy gWh	Peak MW	Energy gWh
1984	657*	3,571	600*	3,338	601*	3,370
1985	736	4,000	658	3,572	670	3,639
1986	825	4,480	704	3,822	724	3,930
1987	924	5,017	753	4,090	782	4,245
1988	1,035	5,622	832	4,519	871	4,733
1989	1,159	6,294	920	4,994	972	5,277
1990	1,298	7,051	1,016	5,518	1,083	5,884
1991	1,454	7,899	1,123	6,098	1,208	6,561
1992	1,628	8,842	1,241	6,738	1,347	7,316
1993	1,824	9,904	1,371	7,445	1,502	8,157

* Actual peak demand in 1984 was lower than 600 MW.

Source: CDE/Sofrelec

folds even for the medium load forecast. Similarly, demand for electricity for the same period would increase by 2.5 times.

In Table III-7, the historical energy demands for the residential, industrial, commercial, government and energy losses in the CDE system are included. It is important to note that almost 33 percent of the present energy production is lost in the system due to technical and non-technical losses. Any improvement for system loss-reduction will reduce the peak demand and energy production requirements significantly in future years.

B. PETROLEUM PRODUCTS IMPORT COSTS AND RETAIL PRICES

Energy Import Bill

The Dominican Republic's imported petroleum bill amounted to US $444.7 million (f.o.b.) in 1983, and through September of 1984 has reached US $396.2 million, which pro-rated to the entire 1984 calendar year could reach US $528 million. The local refinery is producing at capacity at a rate of about 10 million barrels of crude. The needs of Falconbridge's ferronickel mining operation consumed in 1983 2.6 million barrels of reconstituted crude processed at their facilities. To supplement the nation's petroleum products demand, 2.9 million barrels of fuel oil were imported directly by CDE for US $87.8 million (f.o.b.), and about 50 percent of the country's LPG demand are met directly by imports for US $14.1 million (f.o.b., plus freight costs, which are high for LPG).

Table III-8 details the breakdown of the petroleum import bill for 1983 and January to September for 1984. The volume of imports has remained essentially unchanged since the late 1970's, with most variations due to ferronickel's needs which vary with production levels at the mine. An exception is LPG demand, which has grown by 34 percent in 1980-1983 due to a policy of price cross subsidization that has led to large industrial demand and conversion to LPG by numerous

TABLE III-7

HISTORICAL ENERGY DEMANDS BY LOAD SECTORS

(gWh)

Year	Residential	Industrial	Comm'l	Government	System Losses	Gross Generation
1975	450.7	429.5	153.1	137.4	374.6	1545.3
1976	459.4	461.2	150.6	136.5	431.3	1639.2
1977	584.4	577.1	196.7	177.2	523.3	2058.7
1978	639.4	617.5	214.1	203.0	626.3	2300.3
1979	636.0	661.9	214.2	194.7	545.3	2252.9
1980	723.9	719.5	230.6	239.6	716.2	2629.8
1981	817.8	757.9	256.4	252.5	703.2	2787.7
1982	732.2	673.2	228.3	255.6	959.8	2849.1

Source: CDE

TABLE III-8

DOMINICAN REPUBLIC PETROLEUM IMPORTS

	1983		1984 Jan-Sept.
	Barrels (thousands)	US$FOB (millions)	US$FOB (millions)
Crude for Refinery	10,006.6	327.8	298.0
Crude for Falconbridge	2,556.2		
Fuel Oil for CDE(1)	2,946.7	87.8	72.9
LPG	584.8	14.1	6.5
Other Products	NA	14.9	18.7(2)
TOTAL		444.7	396.2

(1) In addition, CDE purchased 1103.2 thousand bbls of fuel oil from the refinery

(2) Of this total, US $16.9 million correspond to diesel imports for CDE

Source: Comision Nacional de Politica Energetica, unpublished data tables.
Totals may not add due to roundoff.

vehicles. Another trend is a recent sharp growth in direct diesel imports, from low levels in 1980 to US$16.9 million (f.o.b.) for the first 9 months of 1984. This growth is due to CDE's needs in their gas turbine and diesel units, which are often being used to meet base loads.

Retail Petroleum Products Prices

Petroleum product prices are fixed by the Ministry of Industry and Commerce through Government Resolutions. This jurisdiction is given to it by Organic Law No. 290 of June 30, 1966 which created the Ministry, and by Decree No. 3366 of February 16, 1969 which empowers the Ministry to control prices of petroleum products.

Table III-9 shows current domestic prices for petroleum products. As can be seen, periodic Ministerial Resolution updates prices in an attempt to balance the financial needs of the Refinery and at the same time protect the poorer segments of the population from increases in cooking fuel (LPG) and electricity (CDE receives special prices). This fine tuning now also includes a special price for fuel oil to cement plants, and LPG to a taxi driver's cooperative.

Prices of petroleum products increased by an average 50 percent in May 1984 after the preferential exchange rate of RD $1.0 = US $1.0 was raised to RD $1.50 = US $1.0. Despite the deep social cost that this increase represented, it is likely that more increases will have to follow, since the shadow rate of exchange is estimated to be much higher, RD $2.50 = US $1.0. The free market rate is in the range of RD $2.80-2.95 = US $1.0. Furthermore, CDE has been exempted from the recent increases: it has especially low prices for domestically refined products (as shown in Table III-9) and in addition is able to use a rate of 1.0:1.0 for its considerable direct imports of fuel oil and diesel. In all its cost calculations related to purchase of electricity from third parties, CDE uses the preferential rate of exchange for its fuel costs (including coal) of a peso: dollar parity. This access to unrealistically inexpensive foreign exchange has

TABLE III-9

PETROLEUM PRODUCTS
RETAIL PRICES, 1984

	Aug. 1	Sept. 10	Nov. 1
LPG RD$/Tonne			
Domestic	437.07	463.00	430.00
Industry/Commercial	861.00	904.80	904.80
Cooperativa de Choferes	861.00	861.00	735.00
LPG retail, RD$			
100 lbs	28.00	28.00	28.00
50 lbs	14.55	14.55	14.55
30 lbs	8.75	8.75	8.75
25 lbs	7.25	7.25	7.25
CDE, Gasoil RD$/gal	1.0304	1.0304	1.0304
Fuel Oil RD$/bbl	23.1868	23.1868	23.1868
Gasoline RD$/gal	2.95	2.95	2.95
Gasoil RD$/gal	2.25	2.25	2.25
Kerosene RD$/gal	2.00	2.00	2.00
Fuel Oil RD$/gal ex-refinery	1.20	1.20	1.20

Note: Retail prices are for Santo Domingo and Zones 1 and 2. Prices of gasoil and gasoline are RD $0.03 higher in the most remote zone 5. For LPG, inland prices are higher by RD $0.02 per pound of LPG.

Conversion Rates: Preferential Rate for Petroleum RD $1.50 = US $1.0
Parallel Free Market Rate (Nov. 1984) RD $2.84-2.90 = US $1.0 CDE Direct Fuel Oil imports RD $1.00 = US $1.0

significant implications for potential small power producers requiring realistic prices for their electricity. CDE's tariffs, detailed in the following section reflect the subsidized fuel prices. When converted to US cents per kWh at the shadow price rate of foreign exchange, the rates are no more than US 6-8 cents per kWhr.

The indirect subsidy to CDE can be measured approximately by calculating the additional pesos CDE would have had to raise to pay for its fuel inputs assuming a rate of exchange of RD $1.50 = US $1.0 as shown in Table III-10. In 1983, it amounted to RD 74.4 million for fuel oil and diesel purchased locally and imported directly, or RD 3.3 cents per kWh generated by petroleum fuels.

TABLE III-10

ESTIMATED CDE INDIRECT SUBSIDY, 1983

	Actual Disbursement (RD$ million)	Amount of Indirect Subsidy assuming RD $1.50 = US $10 (RD$ million)
Fuel Oil, from Refinery	25.6	12.8
Fuel Oil, direct Imports	87.8	43.9
Diesel Oil, from Refinery Diesel Oil, direct Imports	35.4	17.7

Note: Calculated at RD $23.19/bbl for fuel oil from refinery, from refinery, RD $1.03/gal for diesel oil

C. ELECTRICITY TARIFFS

General Rules and Electricity Tariffs

The tariffs of the CDE are promulgated by the Presidency, exercising its authority conferred by article 55 of the Constitution. Currently in force is Decree No. 2217, General Rules Directing the Contractual Relationship Between the CDE and Consumers. Article 1 states that the tariffs are determined by vote of the Board of Directors (Consejo Directivo) of the CDE for approval by the Executive Branch.

Among other stipulations the General Rules prohibits resale of electricity, including servicing via one CDE meter an adjacent property, even if the property is of the same ownership as the property where the meter is located. It also establishes that if in mixed residential/commercial uses in one property, non-residential uses exceed 25 percent of consumption, special meters have to be installed. In cases where transformers are installed which are owned by the consumer, CDE has the right to meter both the primary and secondary sides of the consumer's transformer. CDE also has the right to install its own transformers and other equipment in the property of the consumer, and have access to it by its technicians.

Article 22 rules that power fluctuations and low power factors should be minimized. Sufficient capacitors supplied by the consumer should be installed to maintain a minimum power factor of 85 percent. It states that CDE can refuse or suspend service to users that do not comply (in practice, this rule is not being enforced).

The second part of the General Rule establishes electric rates. The current rates are dated August 1, 1984. These are detailed in Table III-11. Residential rates are progressive, increasing by 30 percent per kWhr after 200 kWh per month. Below that level, rates are RD 7-8 cents/kWh plus fuel adjustment; higher consumption is charged at RD 10-14 cents/kWhr (plus fuel adjustment). Commercial, government

TABLE III-11

ELECTRICITY TARIFFS, DEMAND AND ENERGY CHARGES

VALID NOVEMBER 1984

Residential (R-1)

0-15 kWhr	RD$ 1.373
Next 35 kWhr	RD$ 0.082/kWhr
Next 250 kWhr	RD$ 0.069/kWhr
Next 500 kWhr	RD$ 0.082/kWhr
Next 400 kWhr	RD$ 0.096/kWhr
Next 1300 kWhr	RD$ 0.144/kWhr
Next 2500 kWhr	RD$ 0.151/kWhr

General Power (I-4, G-4)

Demand Charge	
0-25 KVA	RD $68.64
Over 25 KVA	RD $2.471/KVA
Energy Charge	
All consumption	RD $0.12355/kWhr

Maximum Demand: measured on 15 minute interval readings per month, never less than 75% of highest load in the previous 11 months.

Commercial (C-2)

0-15 kWhr	RD $4.846
Next 85 kWhr	RD $0.144/kWhr
Next 100 kWhr	RD $0.145/kWhr
Next 300 kWhr	RD $0.147/kWhr
Next 500 kWhr	RD $0.148/kWhr
Next 2000 kWhr	RD $0.150/kWhr
Next 7000 kWh	RD $0.151/kWhr
Next 10,000 kWh	RD $0.152/kWhr

Government and Municipal (G-2)

Similar to C-2

Note: The value tabulated here includes a 2% per month increase applied for 16 months that has been instituted.

and large power consumers have essentially flat charges for energy, with at most increases of a tenth of a cent progressive with higher consumption. Demand charges are applied to large power consumers only (I4 and G4).

The published tariff schedule contains tabulated rates that are superceded by a footnote (Article 2) that states that the rates are being increased by 2 percent per month for 16 months. This period is now over. The prices contained in Table III-11 incorporate the increase, and correspond to actual billings now enforced.

Fuel charges are based on a formula shown in Table III-12. They have meant additional charges of RD 1.9-2.2 cents per kWh through April 1984. Since then, fuel oil prices have actually decreased to RD $0.552/gallon from the RD $0.630 established in the formula, but gasoil is higher at RD $1.0304 versus RD $0.947 per gallon. The reference price for coal in the formula is RD $51.66 per ton, presumably the price at which CDE expects to obtain the fuel in the future.

D. POWER PRODUCTION FROM ALTERNATIVE SOURCES

The potential for production of electricity from alternative sources in the Dominican Republic is large, a fact that has been amply recognized in the country. There are two aspects that make the situation unique. The first is that planned electric generation from alternative sources will be of a scale that falls outside "small power" in the context of the Dominican Republic; the second is that the large-scale alternative resource projects planned are within the public sector, specifically CDE and the state owned Corporacion Estatal de Azucar (CEA). It is clear, however, that beyond these alternative resource projects planned, there is an additional potential for small power that in most cases could be implemented by the private sector. In this section, we present a description of this potential from alternative sources, large-scale as well as small

TABLE III-12

FUEL ADJUSTMENT FORMULA AND
RECENT FUEL ADJUSTMENT CHARGES

AC: Fuel Adjustment

EV: kWhr sold

GF: Gallons of fuel oil consumed by CDE in month, PF: price

GG: Gallons of gas oil consumed by CDE in month, PG: price

GD: Gallons of diesel oil consumed by CDE in month, PD: price

TC: Tons of coal consumed by CDE in month, PC: price

$$AC = AC_o + \frac{GF\ (PF-PF_o) + GG(PG-PG_o) + GD(PD-PD_o) + TD(PC-PC_o)}{0.95\ EV}$$

Where the o subscript denotes values for April 1984:

AC = RD \$0.022762

PF = RD \$0.630385/gal of fuel oil

PG = RD \$0.947180/gal of gas oil

PD = RD \$1.106239/gal of diesel

PC = RD \$51.66/ton of coal

Date	AC (RD\$/kWhr)
Oct 1983	0.02243
Nov 1983	0.02163
Dec 1983	0.01933
Jan 1984	0.01933
Feb 1984	0.02155
Mar 1984	0.02047
Apr 1984	0.02154

scale, with the exception of the projects discussed elsewhere in this report.

a. Sugarcase Field and Processing Wastes

The sugar industry in the Dominican Republic is partly in the public sector and partly in the private sector. The state-owned Corporacion Estatal de Azucar (CEA) has 12 sugarmills (one of which is also a sugar refinery) and produces about 70 percent of the country's sugarcase; the private sector consists of the two companies, Gulf & Westerns' Central Romana (the largest sugarcane mill in the world), and the Vicini Group which currently operates only one of their three sugar estates. Table III-13 shows total land under sugarcane cultivation, sugarcane production and milling capacity for each mill.

Field wastes are the tops and bottoms of the cane plant, including leaves, that are usually discarded during harvesting and left in the fields. They amount to an estimated 27 percent of the harvested sugarcane crop weight, or some 3.0 million tons per year equivalent to 4.0-6.2 million barrels of oil. Bagasse amounts to 35 percent of the sugarcane crop weight, or 3.9 million tons per year equivalent to 5.2-8.1 million barrels of oil (depending on moisture content).

A very small fraction of the energy in the bagasse is currently available as a source of energy outside the sugarmills. CEA produces little surplus bagasse; and at Central Romana, bagasse is used as raw material for the production of furfural, a product used as a solvent and in the manufacture of dyes and plastics. The Colon sugarmill of the Vicini Group has the potential to sell excess electricity and feasibility studies to this effect were prepared two years ago. They proposed wheeling of power from the sugarmill to a nearby cement factory, but CDE refused to wheel power. Except for CEA, no electricity from sugarmills is sold to CDE at present.

TABLE III-13

SUGARCANE PRODUCTION

	Cultivated Land (hectares)	Capacity Tons/day	Sugarcane Milled Tons
I. CEA			
Amistad	1548	500	73,308
Barahona	11181	5000	901,384
Boca Chica	10670	3800	738,535
Catarey	6095	2200	313,613
Consuelo	16375	4500	937,570
Esperanza	2224	1500	131,248
Monte Llano	6328	2200	2,109,482
Haina	49173	12500	330,922
Ozama	20820	3600	662,300
Quisqueya	12090	2400	496,242
Provenir	9971	3000	579,249
Santa Fe	8438	3000	439,429
II. GRUPO VICINI			
Angelina	6604	2000	215,000
Cristobal Colon	13659	3000	500,000
Caei	4906	2500	200,000
III. CENTRAL ROMANA	74569	7000	2,548,313
TOTALS	254,651	65700	11,176,595

Note: Production is for the 1977 season

Source:

CNPE: Cuantificacion de Desechos Agricolas en la Republica Dominicana (1980).

In the future, CEA is projected to become a major supplier of electricity to the grid, as noted elsewhere in this report. An ambitious program is being proposed that calls for the diversification of the state-owned sugar industry, specifically to transform itself from its precarious financial situation as a sugar producer, to a producer of sugar and electricity. The sales of electricity would restore the industry to financial health, in light of the dim outlook of the sugar market in the future. The long range plans also contemplate closing down three sugarmills in the North Coast, where the real estate has a potential for agriculture and tourism.

Two projects have been prepared involving three sugar mills. The first, prepared by John Payne of Hawaii, proposes to install 60 MW in Rio Haina, of which 42 MW are available to export to the grid during the 6 month harvesting season, and 17 MW in Boca Chica, with 12 MW available for the grid during harvest. The power supplied would be base load, and in the off-season (in which most of the installed capacity is available for the grid) the fuel used would be stored bagasse with imported coal as backup. This project has been submitted to the IADB, and if their funding is approved, will be ready for competitive bidding by mid-1985. The new plants, which proposes using boilers at 850 psi, or possibly 1250 psi, would be completed by 1987.

The second project is in Barahona, where two power plants are contemplated. CEA would cogenerate 36 MW to run the sugarmill and sell excess power in one plant using bagasse as fuel with coal as backup. A second 37 MW plant would be operated by CDE, using can wastes as primary fuel, with coal as backup. The rationale is that Barahona is the largest sugar estate with artificial irrigation, and therefore has a high productivity of cane foliage and cane field wastes; the removal of foliage actually enhances overall productivity. Funding for this project is being sought from the West German government.

Total estimated cost for the three projects is about US $130 million, as shown in Table III-14.

TABLE III-14

CEA DIVERSIFICATION PROJECT

Location	Power Plant	Power for Grid 6-mos	Fuel	Investment
Rio Haina	60 MW	42 MW	Bagasse, coal backup	US $70 million
Boco Chica	17 MW	12 MW	Bagasse, coal backup	US $20 million
Barahona				
CEA	36 MW	NA	Bagasse, coal backup	US $40 million
CDE	37 MW	37 MW	cane wastes, coal backup	NA
	150 MW			US $130 million

Source: CEA, meeting with General Manager

Later phases will include three other CEA sugarmills. Excess power available to the grid from these mills during harvest season totals 27.8 MW.

b. Fuelwood Plantations

The concept of energy plantations in the Dominican Republic has extensive support both in the private and the public sectors. A demonstration project is being carried out with USAID funding by the Instituto Superior de Agricultura (ISA) with support from COENER; CDE includes an energy plantation in its long term expansion plan that would fuel a 50 MW plant by 1989. According to a MITRE Corp study, nearly 60,000 hectares would be needed to supply fuel for a 50 MW plant. The same study estimates that about 525,000 hectares are suitable for energy plantations nationwide, including land currently forested. The CDE plant would therefore require a significant fraction of suitable lands.

In the private sector, there are several energy farm proposals under consideration, none of which contemplate production of electricity. The Overseas Private Investment Corp (OPIC) has recently funded a feasibility study involving US and Dominican investors. The results of this study are not available yet. The Vicini Group has been investigating the possible uses of the 11,500 hectares it owns at the two sugar estates that have ceased operating, and has been recommended that 235 hectares (100 acres) be put to use as energy plantations. Charcoal would be the primary output.

c. Agricultural/Agroindustrial Wastes

Industries that process agricultural products generate large volumes of wastes that can be used as fuel for electricity. At the same time, these industries are large consumers of electric power; they have the potential, therefore, to generate electricity for their own needs as well as sell excess power to CDE. Besides the sugar industry, there are the rice mills, coconut processing industries,

peanut oil, coffee, maize (corn) and cotton processors that have the potential to use byproduct (wastes) as fuel for electricity generation by direct combustion or by first converting to combustible gases via biodigestors or gasifiers.

The staff of the Division of Energy Resources of the COENER has evaluated this potential as shown in Table III-15. A total 167 gWh could be generated from collected wastes of rice, cotton and coconut and peanut shells.

A part of this resource is used already in boilers. The Industria Manicera, a peanut oil processor, pelletizes peanut shells to use as boiler fuel. The coconut industry is generally able to consume coconut husks as boiler fuel; at one time, Alfareria Dominica, a brickmaker located in Santo Domingo, fired its kilns with coconut husks but presently claims that none is available. Coconut husks also fire the boiler at Productos del Tropico with which it will generate 800 kW, 600 kW for sale to CDE (see section IV-E).

Rice straw is a promising resource because rice mills are closely concentrated at two sites in central Dominican Republic. At present, rice straw is used in the mills as boiler fuel, but about one half has to be disposed of. Rice mills are worth studying further as one potential project for cogeneration with sale of excess power to the grid.

d. Small-Scale Hydro

The potential for small-scale hydroelectric production in the Dominican Republic is significant in relation to current peak demand. Several studies to develop small scale hydro by public sector institutions are underway. The private sector, on the other hand, is barred from exploiting the resource by the law that gives INDRHI, the Water Resources Insititute, the rights for all underground and above ground water resources in the country. This restriction includes any facility even if it is on private property.

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TABLE III-15

POTENTIAL ELECTRICITY PRODUCTION FROM AGRO/INDUSTRIAL WASTES

	Yearly Production Million lbs	Heat Content Btu/lb	Electricity Potential[1] gWh	Potential Installed Capacity kW[2]
Rice Straw	120.0	6200	62	12,400
Coconut Husks	31.4	8500	22	4,400
Peanut Shells	29.6	8500	21	4,200
Cotton Wastes	149.2	5000	62	12,400
			167	

(1) Using 12000 Btu/kWh

(2) Assuming 5000 hours/year

Source: COENER, Division de Recursos Energeticos

In practice, CDE exploits hydroelectricity at several sites despite INDRHI's control over water resources, with the exception of the Tavera Dam, for which a special law was passed in congress to legitimize its rights to the resource. INDRHI considers CDE as an upsurper of its rights to develop hydroelectric projects, and is currently attempting to negotiate a contract with CDE to obtain royalty payments or a similar arrangement for the sale of the water rights. It is therefore plausible that private sector hydro developers could negotiate similar arrangements with INDRHI.

The concept of small-scale hydro requires clarification in the context of the Dominican Republic. The CDE system, for example, operates small plants of 7.5 MW at Jimenoa and Las Damas, and an even smaller facility of 250 kW at Constanza. It is completing 7 small plants totalling 9 MW. In addition, it purchases electricity from the INDRHI owned Los Ranchitos plant that has a capacity of 680 kW. There is, therefore, some overlap between what could be considered small-scale hydro, and plants that in the Dominican Republic belong to "conventional" hydroelectric development of the public utility.

Total hydroelectric potential for the Dominican Republic has been estimated at as much as 8,000 gWhr. Because of the definitional ambiguities indicated above, it is not possible to separate the fraction of the total that corresponds to "small-scale" hydro. Several projects in the public sector are underway that give an indication that a significant potential exists.

CNPE Project: the CNPE, with collaboration of INDRHI and CDE, with AID funding and technical assistance of Harza Engineering Co is carrying out a project that in its first phase included a reconnaissance of numerous potential sites. The sites were limited to a range of 100-1500 kW; a list furnished by INDRHI included more than 50 sites in this range. All indications are that many more sites of this magnitude exist.

The project evaluated 44 of these sites, with a total potential capacity of 20.8 MW, as shown in Table III-16. Costs range widely, but are generally very high, from a low of RD $2,000 per kW to RD $15,000 per kW. High costs are due in part to the need to build canals several kilometers long to attain the necessary head for the low volumes of water ($0.5m^3/s$ - $0.75m^3/s$) involved. The CNPE project plans to undertake the development of a 470 kW plant for a cost of US $1.3 million plus RD $2.0 million.

CDE Projects: small scale hydroelectric projects are not explicitly incorporated in the current capacity expansion for 1988-1993 of CDE. The utility, however, has a long list of some of the most promising sites in the country.

CDE has studied sites in the 500-2000 kW range; it has recently signed an agreement with the Taiwan government for funding 15 such sites totalling some 15 MW.

INDRHI Projects: INDRHI has the potential to exploit the potential energy of gradients in their existing irrigation canals. The largest of these irrigation canals has a potential to generate 10 MW at 3 sites, for a cost estimated at RD $2.5 million. The budgetary restrictions of this institution, and their admitted lack of technical capabilities to carry out hydro projects successfully, makes it unlikely that this potential will be developed in the near future, despite the promising economics relative to all other small scale hydro projects evaluated.

e. Wind

Information of wind regimes available currently in the Dominican Republic is insufficient to evaluate the potential of this resource to grid-connected power generation. Several steps to overcome this situation are being taken by the COENER, in which adequate instrumentations and measurements will be made in the most promising areas of the country. These have been identified in a recent COENER

TABLE III-16

SMALL SCALE HYDRO SITED
INVESTIGATED BY CNPE

Size	No of Sites	Total Capacity
100-500 kW	29	7,767 kW
500-1000 kW	10	7,062 kW
1000-1500kW	5	5,970 kW
	44	20,799 kW

report (7) in the North Coast (Cabrera), the North West (Monte Cristi), the South East (Cabo Engano) and the South West (Barahona). Some average data available for these sites is shown in Table III-17. This data was collected in meterological stations for other purposes, in flat terrains with sensors too close to ground level and these are considered to greatly underestimate the potential resource. For instance, none are located in mountain passes or mountain peaks.

It is not possible to draw conclusions at this point, except to point out that certain locations appear to have promise. Of special interest is the North Coast, center of a fast-growing tourism industry. Entrepreneurs in this sector may be willing to assume certain risks by selfgenerating part of their electricity needs with wind turbines; inquiries have in fact been made to the COENER for technical assistance by a developer.

TABLE III-17

PROMISING WIND SITES, PRELIMINARY DATA

	Annual Mean Wind Velocity	Total Annual Median Power Density
Cabrera	5 m/sec	150 watts
Cabo Engano	4 m/sec	70 watts
Barahone	3 m/sec	60 watts
Monte Cristi	3 m/sec	60 watts

Source: COENER: Evaluacion de los Recursos Solar y Eolico en la Republica Dominicana.

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f. Cogeneration

The potential for cogeneration within industrial facilities in the Dominican Republic is probably small with the exception of the cogeneration that is already in place in the sugar industry. Most large industrial consumers have been audited or otherwise surveyed:

- Ferronickel: fuels are used as chemical feedstocks and in electric generation; large energy savings per unit of output (25%) have been achieved recently. Thermal demands are low; cogeneration is not an option.

- Ferrous Metals: Metaldom, a large manufacturer of laminated metal products (reinforced bars, wire rod, angles, etc), has large peak demand for power (18 MW, for its electric furnaces, supplied by CDE) but a relatively small thermal load (heating billets in laminating plants). It has been studying several options to self generate; marine diesel units consuming imported fuels the most likely choice, due to technical reasons (electric load varies greatly in the course of the day). This industry, which has plans to expand that would raise its peak demand to 45 MW, could be viewed as a potential sporadic supplier of electricity (without cogeneration), because market conditions for its products may create future conditions of excess installed capacity in electric plants.

- Non-ferrous Metals and Glass: The country has three cement plants, one of which is in the process of substituting fuel oil for coal and several brickmakers, ceramic tile factories etc. None of these represent a potential for cogeneration.

- Textile: Information collected a COENER in surveys and in energy audits has yielded no opportunities of true cogeneration in this sector.

- Food and Beverages: of all firms in this sector analyzed by the COENER Energy Conservation Program, the best opportunities for cogeneration were found in the rum industry. Opportunities to substitute petroleum for other fuels as boiler fuel, on the other hand, have been more successful: peanut shells briquettes, coconut husks and rice straw are being used within industries or sold to other users as boiler fuel or in kilns.

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Industrial Parks: It is possible to find cogeneration applications in the case of adjacent industries that, without having balanced thermal and electric loads by themselves, could achieve such a balance as a group. No such opportunities have been identified, however. Current CDE regulations forbid direct sale of electricity from one industry to another; no such barriers appear to exist for the sale of low grade heat between industries.

IV. PURPA APPLICABILITY

IV. PURPA APPLICABILITY

A. INTRODUCTION

The history of PURPA in the U.S. included legislative, legal/regulatory and operation/administration phases. The process started with legislation being passed at a national level. This was followed by a period of information development, creation of the apparatus to implement and monitor the act, court and legal clarification of the law, and negotiations between regulators, utilities and off-system generators. Finally, arrangements were completed and actual generation and purchases have resulted. A short description of this process can be instructive to the consideration of the utility and applicability of a PURPA-type process outside the U.S. The following paragraphs summarize the nature and development process of PURPA in the U.S.

B. PURPA LEGISLATION

PURPA, enacted in 1978, was a part of a major legislative energy package presented to the U.S. Congress by the Carter administration. It was targeted at stimulating conservation and the use of renewable energy resources t generate electricity. The legislation ordered all state Public Utility Commissions (PUC's) to "consider" by the end of 1981 the implementation of standards to promote "conservation, efficiency, and equity" in utility policies through voluntary changes in rate structure and other practices. Utilities were directed to publish detailed statistics on their cost of providing electricity, a requirement essential for determining their marginal costs for providing additional energy. The portions of the act which have been the most controversial and which have been the subject of most problems are Sections 201 and 210. These sections require public and private utilities to buy power from qualified small power producers using renewable energy resources and to sell them auxiliary power at

non-discriminatory rates. These sections also stimulated cogeneration by non-utility entities as a means of improving the overall utility efficiency. The Act further:

- Required PUC's to address existing constraints and establish requirements under which any qualifying independent power producer (of less than 80 megawatts) can tie into the utility grid.
- Streamlined the licensing process for cogeneration and renewable energy facilities of less than 30 megawatts.
- Required the Federal Energy Regulatory Commission (FERC) to publish rules governing establishment of "just and reasonable rates" for the buying and selling of power to utilities by qualifying facilities, specifying that, "no such rule...shall provide for a rate which exceeds that incremental cost to the electric utility of alternative electric energy."

C. PURPA IMPLEMENTATION

The time between 1978 enactment and mid-1980 was taken up in rules preparation and publishing by the Federal Energy Regulation Commission (FERC). These rules, published in 1980, created two major problems for the utilities:

- Mandatory interconnection with all qualified independent power producers was stipulated; and
- A payment for purchased power based on "full avoided cost" was required.

These problems and many more led to court proceedings and finally in 1983 the U.S. Supreme Court upheld FERC's 1980 rules. During the time between 1980 and 1983, because of the uncertainty, PURPA applications were still affected.

Following the Supreme Court decision the number of applications increased substantially. California was one of the states which became a leader and innovator in the PURPA process. California's PUC

established a statewide methodology for determining avoided cost and thus eliminated the variance found in other states where utility avoided cost formula proposals are judged and approved separately. The PUC also closely monitors utility compliance and the qualification process. The avoided cost formula in California includes factors covering fuel, maintenance, line losses, administration, transmission and distribution investment, and capacity. This makes the avoided cost calculation more beneficial to off-system generators than if only fuel costs were included. California has also benefited because of the availability of capital, a good renewable energy resource base and excellent investment and other tax benefits.

The stimulation of conservation and renewable energy resources use in California brought about by PURPA and other attributes has been dramatic. As an example, between 1981 and 1983 the amount of on-line supply capacity rose from less than 200MW to over 750MW. In 1984 the increase was similar. In the U.S. a total of 45 million kWh of newly created wind based electricity was produced in the one year between 1982 and 1983. These increases, as mentioned above, were due to many factors but in fact PURPA played a substantial role.

The above summary has identified the process, the key elements and the positive stimulation possible through lesiglative and regulatory programs such as PURPA. With this as a background it is possible to examine the Dominican Republic as well as Jamaica and Barbados and identify opportunities, needs and impediments. In the Dominican Republic there are a number of in-place legal-institutional factors which influence and affect OSG. In addition to the factors brought out by the above discussion there are elements peculiar to non-U.S. and developing country situations. Some of these important factors are noted in Table IV-1.

TABLE IV-1

FACTORS AFFECTING PURPA APPLICABILITY IN CARIBBEAN COUNTRIES

FACTOR	IMPACT
• Government ownership of utility	Allows more direct and rapid influence by Government
• Use of electricity supply by government to promote development and accompanying subsidy in prices	Developing country electricity supply is much more a part of government policy; utility expansion and operation is affected less by economics
• Government uses of electricity are often not paid for	Cash flow position of utility can be poor and expansion of generating capacity is often restricted
• OSG usually based on use of foreign technology	National savings in foreign currency outlay are spread over a long time and immediate impact may be a short-term increase in foreign spending. Cost-benefit analysis requires careful examination of shadow price of foreign exchange
• OSG will not use fossil fuels, or use them very efficiently	This will have a positive long-term impact on foreign exchange spending by diminishing oil purchases
• OSG sometimes involves foreign investors to pay for initial capital requirements	Balance of payments is negatively affected due to need to repatriate profits
• Limited utility technical capability, financial ability, and equipment condition	Any OSG private sector contribution to electricity generation will alleviate these problems
• The small number of opportunities for cogeneration or OSG	The overall impact and economic benefits of OSG may warrant only a case by case approach, in which case legislation may not be necessary
• Risk to private investors	The difficult financial position of public utility makes private investors uneasy on their ability to collect on electricity sales to the utility

D. LAWS GOVERNING CDE

The Corporacion Dominicana de Electricidad has as its principal function "the production, transmission and distribution of electric power, in exclusivity, within the territory of the Dominican Republic", according to the Government Organization Manual published by the Secretariado Tecnico of the Presidency[(a)]. The legal basis is contained in Decree No. 555 of January 16, 1955, which names CDE the enterprise purchased by the State to carry out those functions. The background to these actions is in Law No. 4018 of December 30, 1954, which states in part:

> Article 1: Declares national interest for the State to purchase enterprises that produce, transmit and distribute electricity.
>
> Article 2: In order to ensure ample reliable supply, in urban as well as rural areas; develop hydro resources; offer lowest tariffs consistent with sound financial policies.
>
> Article 3: The assets of each public utility purchased by the State will be managed separately according to sales dictated by the Executive Branch.

CDE is an independent state-owned corporation under the direct control of the Executive Branch, which designates the General Manager and approves tariffs. Besides Law No. 4018 approved by both chambers of the National Congress, most other rules and regulations pertaining to CDE are carried out through Presidential Decrees and Resolutions adopted by its Board of Directors. These are assembled in a document printed by CDE entitled "Leyes, Reglamentos, Resoluciones y Decretos de la CDE" (1983).

(a) Presidencia de la Republica Secretariado Tecnico, Manual de Organizacion del Gobierno, 4a Edicion (1980).

The monopoly enjoyed by CDE in the transmission, distribution and sale of electricity is effective and has withstood many attempts to circumvent it. We can cite the examples of an industrial park which was denied permission to self-generate electricity for distribution among the companies within the park, a proposal to wheel excess power from a sugarmill to a nearby cement plant that was also rejected, and several instances where industries in close proximity to each other would prefer to trade self-generated electricity but are not allowed to install transmission lines. The self-generation of electricity, however, is not prohibited. Moreover, since the late 1970's and due to periodical power failures that continue to this date, self-generation equipment has been exonerated from import duties and in effect encouraged. The institution responsible for exoneration of import duties is the Ministry (Secretaria) of Industry and Commerce. This Ministry, which controls the energy sector more than any other institution of the GDR (its Secretary used to be the head of the Energy Commission until a recent reorganization) and among other functions sets prices for petroleum products, has no influence over the public utility.

In the area of hydro electricity, CDE appears to require the intervention of the National Congress because INDRHI, an institute within the Ministry of Agriculture, has control over underground and above ground water resources throughout the country. The Tavera hydro electric project, for example, required Congressional Law No. 264 to denote that the plant be built, operated and administered for the State through CDE and INDRHI. In the case of other hydro electric projects of the CDE, it is not clear that similar laws exist. INDRHI's conflict with CDE over rights to the water resources is long standing. INDRHI would like to negotiate a contract whereby CDE would pay a royalty for the water it uses in its hydro projects. Because of its lack of technical and managerial capacity to build and operate hydro plants, and its inability as a part of the State bureaucracy to enter into the credit markets on its own, INDRHI is not likely to become an important factor in the development of hydro electric projects. On the other hand, its control over all national water

resources, including those on private lands, can be a serious impediment to the development of small scale hydro projects for private use or for sale to the grid.

E. CDE POSITION

The CDE has a long tradition of purchasing power from other producers, and new agreements are being made with private and state-owned companies. This position was stated by the head of CDE, Marcelo Jorge, during a lengthy meeting with our team. The salient points are that:

- Despite the fact that there are no laws specifying power purchases there are several procedures that are well established.
- There would be no problem in making public the prices being paid to the private small power producers with which agreements exist, in order for other producers to receive similar prices.
- The procedures are different for large producers (CEA, Falconbridge) than for small ones. The existing procedures are detailed below.
- Changing the laws in order to institutionalize these procedures would be difficult and the contracts/agreements reached have the same protection of legislated procedures. Legislation could follow after execution of agreements.
- All procedures used in reaching purchase price for electricity from private producers use an exchange rate for avoided fuel costs of RD $1.0 = US $1.0. This is the rate at which CDE currently pays for oil.
- Although the letter of law would appear to allow CDE to expropriate any private generator, the long history of co-existence of private generation (i.e. Falconbridge, sugar industry) makes it unlikely.
- CDE is interested in learning about the methodologies used in the U.S. under PURPA to calculate avoided costs. The WASP-3 model currently at CDE is only adequate for large projects, and cannot take into account the seasonal and daily variations of small generators such as solar and wind.

There are currently three procedures to calculate purchase price of electricity in as many contracts or agreements that are in effect.

a) Falconbridge

A contract between CDE and Falconbridge was signed in 1983 whereby CDE pays RD $0.025 per kWhr generated at Falconbridge. This agreement was reached after several years in which CDE was able to generate some 60 MW idle at the Falconbridge mine (where production has been below capacity due to nickel market conditions). The arrangement started in 1976 to assist CDE in an emergency, at no cost to CDE except for the fuel oil used in the plant. The arrangement was made more permanent with a contract in 1983, in which the concept of avoided cost was applied: in the absence of the steam generators at the mine, CDE would have to operate their gas turbine at a cost of diesel in excess of the cost of fuel oil of RD $0.05/kWhr. The price of RD $0.025 was arrived by splitting the difference.

b) CEA

The contract reached with CEA to be implemented in their rehabilitated plants (54 MW available for sale to CDE in the first two sugar mills, with more to follow) is based on a CEA investment and O+M cost plus reasonable (18%) rate of return basis, with the value of bagasse computed at the heat equivalent of coal. In other words, CEA electricity will be priced like is commonly done at utilities, with an elements of avoided costs (credit for bagasse at the avoided costs of coal) added. CDE does not know what the purchase price will be. The details of the agreement are contained in article 5 of the contract (see Appendix A).

The contract appears to commit CDE to purchase the power, which hypothetically at least could exceed CDE's long range marginal costs although it can be changed from year to year. The procedure established with CEA is the one favored the most by the head of CDE.

c) Productos del Tropico CXA

This private industry is a coconut cream producer that will have 600-800 kW available for sale to CDE from combustion of coconut husks. An "avoided costs" procedure yielded a price of RD $0.08/kWhr (using a rate of exchange of RD $1.0 = US $1.0 for avoided fuel costs). CDE is about to sign a contract to purchase electricity from Productos del Tropico CXA at this price. The circumstances of the 600 kW available are rather unique, in that a processing redesign at the plant reduced the electric load drastically, leaving some 600 kW of the 800 kW installed available for export to the grid.

d) INDRHI

The current financial arrangement between CDE and INDRHI was not reviewed in detail by the team. According to INDRHI, it receives credit for the electricity it delivers CDE from its Los Ranchitos hydro plant at a rate equivalent to CDE tariffs minus a differential to account for CDE's administrative and other costs (T&D losses etc). Because INDRHI is a net purchaser of CDE electricity, no actual payments are made.

The current arrangement described above should be verified, since it contradicts CDE's preference not to swap electricity on a one-to-one basis (i.e., a meter reading both ways). As INDRHI get more hydroelectric projects on line, the agreement for purchases of power will be modified. The institutional rivalry between INDRHI and CDE (regarding the development of hydroelectric resources of the country and the payments of water rights to INDRHI) complicate the rationalization of any power purchase agreements between these two government organizations.

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F. GOVERNMENT POSITION

As explained earlier in this report, the public utility is part of the government, depending directly from the Executive Branch in the appointment of the General Manager and the Board of Directors, as well as decreeing tariffs and any other decrees pertaining to the utility. On the other hand, laws have to be approved by Congress. The team did not approach the Presidency or Congress on their views regarding changes in the laws to allow PURPA type legislation to be instituted. In this matter, the position of the Executive Branch should be the same as that of CDE, explained in the section above.

The position of the Executive Secretary of the Comision Nacional de Politica Energetica (COENER) is wholly supportive of private sector development of power for sale to the utility, and by implication, of legislative changes to permit it. In a recent speech given in Santo Domingo, he expressed that:

> "...as an alternative emerges the possibility of participation of private capital investment in areas which until recently have been considered fundamentally of interest to the public sector.
>
> ... Within this process [of rationalization of the energy system], the laws and other legal instruments that regulate the energy sector must be continuously adapted to facilitate actions from all participants, according to the tactical and structural needs of the economic development strategy."

Among the specific examples of private sector participation, the Executive Secretary cites the support given to COENER's energy conservation programs by the private sector, and recommends specifically:

"A plan for expansion and of energy efficiency improvements for industry and for CDE could be accelerated with a larger participation of the private sector not only in the financing of projects but also in co-generation of electricity and in the development of the renewable resources of the country."

Laws can be drafted by any government institution in the Dominican Republic, for submission to the National Congress. It is therefore possible for the technical staff of the COENER to draft a PURPA-type legislation and submit it to Congress. It is not likely that COENER could do so without support from other institutions. In the present government structure, COENER is within the Technical Sub-Secretariat of the Presidency, and its head (who has a rank equivalent to a Minister) is automatically the President of the Energy Commission. Because of the last government reorganization that moved COENER from the Ministry of Industry and Commerce to the Technical Sub-Secretariat, its effectiveness seems to have been diminished. In this period, the full Energy Commission has never held a session.

G. PRIVATE SECTOR POSITION

The team met with a large number of private sector individuals representing the National Council of Entrepreneurs (Consejo Nacional de Hombres de Empresa) and the Industrial Association, as well as specific industries that are pursuing alternatives to purchases of electricity from the grid. The position that emerged was virtually a consensus.

- Industrialists are primarily interested in increasing the reliability of electricity supplies, and reducing their costs. The approach pursued is selfgeneration of electricity, with available stand by power from the utility without being penalized for demand charges.

- Alternative fuel sources are being used in several instances (peanut shell briquettes, coconut husks); the possibilities of using small scale hydro in agroindustries of the interior, and of placing wind generation in tourist complexes are investigated sporadically.

- In order to create the conditions PURPA creates in the U.S., laws governing electricity generation would have to be changed.

- The concept of investing for the specific objective of sales of power to the utility was met with skepticism, and invariably the financial straits of CDE were raised as the basis for their skepticism. Currently the utility often needs to raise its credit limit from petroleum distributors; small power producers could not be in a position to carry a large financial burden.

- The single private sector supplier of electricity to CDE is Falconbridge. The mining company is generally satisfied with the arrangements, and invoices are being paid by the utility.

- Besides selfgeneration, the private sector often expressed interest in setting up power plants that serve two or more adjacent industries. One project proposed a diesel generator serving all industries in an industrial park in the outskirts of the capital. CDE did not permit this alternative; it also has refused any proposals to wheel power from one selfgenerator to any third party.

H. LONG-RANGE AVERAGE COSTS

The CDE expansion plan for the 5 year period 1988-1993 is contained in a working document "Actualizacion Plan de Expansion del Sistema Electrico de la CDE" dated October 1983 (incorporating updated computer runs to June 1984) prepared by SOFRELEC. The purpose of this section is to obtain a calculation of average cost per kWhr produced during this period, by obtaining a ratio of total investment fuel and O+M costs to electricity produced from the investment in power plants for that 5 year period.

The long-term plan consists of a series of scenarios that assume different electric demands, fuel prices and somewhat different lists of available plants to select from. No specific scenario has yet been chosen by CDE to be implemented at this date. The one described here uses as a starting point the plan's low electricity demand postulates, one that projects electric production to grow an average 10.07 percent per annum for 1982-1993. The medium and high demand cases are even

less likely to be carried out, considering the financial situation of CDE. The other assumptions of this plan are:

- Price per barrel of Bunker C (cif) of US $23 in 1985, US $27 in 1990, US $33 in 1995 and US $40 in 2000, plus 0.002 US $/kWh for handling (0.8 US $/$10^6$ kcal). Gasoil prices per unit of heat equivalent are 2.0 times higher at the beginning of the period, and 1.42 times higher at the end of the run. Price of coal (cif) per tonne of $59 in 1985, $63 in 1990, $67 in 1995 and $71 in 2000; plus freight to power plant of $7.42/tonne. A heat rate of 6000 kcal/kg (low heat value) is used. Including coal handling at the plant, price per unit of heat equivalent is 73 percent of that of Bunker in the initial year, and 47 percent in the final year of the run.

- The CEA Optimization Projects are carried out in 5 sugar mills for a total supply to the grid of 69 MW during harvest season and 58 MW during idle period, and do not come in until 1989. Bagasse priced at coal equivalent.

- The 50 MW Energy Plantation project is postponed to 1991. Cost of fuel at US $20/ton (4722 kcal/kg).

- The first new 200 MW coal-steam plant starts up in 1993.

- From 1987 on, 69 MW of gas turbines are added.

- The hydro projects add to 359 MW and are the ones listed in Table IV-2. Others are postponed beyond 1993.

- The costs of the joint Energy/Irrigation projects are 70 percent attributable to energy.

The results yield a total cost of US $3,044.7 million, of which US $1,320.0 million is investment plus O+M, and US $1,724.7 million is for fuel. The local costs are converted to US$ at a rate of US $0.57= RD $1.0 (RD $1.75/US $). The plants are expected to produce 3234 gWh/year and for a 20 year life the average production costs therefore are estimated to be about US $0.047/kWhr.

TABLE IV-2

CAPACITY EXPANSION PLAN 1988 - 1993

Run No. 3

	Useful Life	MW	gWh/ year	Year
CEA Projects	(NA)	69-58	551	After 1989
Energy Plantation	(NA)	50	245	1991
Coal Steam	25	200	1104	1993
Gas Turbines	17	69	180 (est)	After 1987
Hydro:				
Manabao-Bejucal		20	73	1989
Bejucal-Tavera		80	217	1990
Sabaneta-Bao		86	326	1990
Los Negros-Sabaneta		36	127	1991
Jiguey		85	202	1991
Aguacate		52	209	1992
			3234	

Source: CDE: Actualizacion Plan de Expansion del Sistema Electrico de la CDE.

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APPENDIX A

APPENDIX A

PURCHASE - SALE CONTRACT

BETWEEN

C.D.E. AND C.E.A.

Salient Points (our underlining)

- CEA's diversification strategy: contract recognizes that CEA is diversifying into electricity production as a means to raise revenue by sales of sugar, molasses and electricity that allows it to recover production costs.

- Articles 1-3: CDE will supply CEA with electricity, principally in the inactive periods and during production as needed. This electricity will be paid by CEA according to the prevailing rates and type of service offered.

- Article 4: CDE will purchase excess power that may be available from CEA at a price 20 percent lower than the generation costs of CDE, calculated as follows:

  Cost of generation will be taken from the General Balance and Supplement of the month prior to the meter reading, regardless of the site of generation. The cost of generation corresponds to the line Total Cost of the Net kWh (or equivalent terminology if statements are modified).

- Article 5: On the other hand, the above method of calculation of purchase price will be modified prior to CEA's Energy Optimization Program, which will provide a significant contribution to the national grid.

  For this purpose, CDE and CEA will sign an agreement that considers new basis, methodology and pricing policies of the sale of electricity to CDE, which will guarantee a minimum return on future investments, with the objective to improve the finances of CEA, in that this constitutes a new productive activity in line with the diversification policy of the National Sugar Industry in the country.

At this time, the price paid by CDE will be calculated:

1) Capital Costs: Capital Recovery Factor applied to total investment attributable to the generation system, 12 percent discount rate and a period equal to the useful life of the capital equipment.

2) Operating Costs: :labor costs attributable to the steam and electricity generation activities, as well as bagasse and coal handling.

3) Maintenance and Repairs: similar to (2).

4) Fuels: Bagasse will be valued at the opportunity cost of coal. The following formula will be applied:

$$\text{Value of bagasse expressed in coal equivalent} = \text{coal cost/ton} \times \text{tons bagasse} \times \frac{\text{bagasse heat value}}{\text{coal heat value}}$$

The heating value of bagasse with 50 percent moisture is 350 Btu/lbs. That of coal corresponds to the coal purchased by CDE. The cost of coal includes FOB price, freight to Dominican ports, insurance and handling/transport cost to CDE stations.

5) Margin: The margin is set to provide an 18 percent rate of return.

Article 9: This contract is valid for five years and is renewable for 1 year periods subsequently.

APPENDIX B

APPENDIX B

PERSONS/INSTITUTIONS CONTACTED

Government Institutions

Comision Nacional de Politica Energetica,
Tel: 595-5090
Jose Ramon Acosta, Secretario Ejecutivo

Division de Estudios Economicos
Bolivar Rosario
Daniel Sanchez, Consultant (IDEA)
Oscar Morales, Consultant (IDEA)

Division de Estadistica e Informatica
Agustin Leon

Division de Recursos Energeticos
Ing. Cesar Gomez
Ing. Luis Abreu
Ing. Alberto Llenas
Robert Gewargis, P.E., Consultant (Harza Eng.)

Division de Alsono y Conservacion
Ing. Ahorro Anaximandro D'Oleo
Eduardo Maal, Consultant (Fluor)

Corporacion Dominicana de Electridad (CDE)
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Ing. Marcelo Jorge, General Manager

Instituto Nacional de Recursos Hidraulicos (INDRHI)
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Ing. Isidro Pazos, Counsel of the Director

Consejo Estatal de Azucar
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Ing. Acosta, Energy Project

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Consejo Nacional de Hombres de Empresa
Dr. Frank Castillo, General Manager
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Silvestre Alba de Moya, Board Member
John J. Saunders, Board Member (Bechtel)
Fernando Periche, Asociacion Bancos Desarrollo
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APPENDIX C

APPENDIX C

List of Abbreviations

COENER	Commision Nacional de Politica Energetica
CDE	Corporacion Dominicana de Electricidad
CEA	Consejo Estatal de Azucar (State Sugar Corporation)
INDRHI	Instituto Nacional de Recursos Hidraulicos (National Institute of Water Resources)
IMF	International Monetary Fund

Currency Conversion Rates (November 1984)

1.	Official rate	RD $1.0 = US $1.0
2.	Rate for Petroleum Imports	RD $1.5 = US $1.0
3.	Rate for Traditional Exports Sector	RD $1.45 = US $1.0
4.	Parallel Market Rate	RD $2.84-2.90 = US $1.0
5.	Shadow Exchange Rate Used in SOFRELEC/CDE	RD $1.75 = US $1.0
6.	Rate for CDE Imports of Petroleum or Coal	RD $1.0 = US $1.0