

Africa Gas Initiative

Gabon

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JOINT UNDP / WORLD BANK
ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

PURPOSE

The Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP) is a special global technical assistance program run as part of the World Bank's Energy, Mining and Telecommunications Department. ESMAP provides advice to governments on sustainable energy development. Established with the support of UNDP and bilateral official donors in 1983, it focuses on the role of energy in the development process with the objective of contributing to poverty alleviation, improving living conditions and preserving the environment in developing countries and transition economies. ESMAP centers its interventions on three priority areas: sector reform and restructuring; access to modern energy for the poorest; and promotion of sustainable energy practices.

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Foreword

The Africa Gas Initiative (AGI) Study is aimed at identifying countries where gas flaring could be reduced, for better utilization in the industrial and commercial sectors of their economies. This study was conducted by Mourad Belguedj, Senior Energy Specialist and Team Leader at the Oil and Gas Division of the World Bank and Henri Beaussant, Gas Economist and consultant.

The focus of the study, aimed initially at select countries on the West Coast of Africa, is of direct relevance to ESMAP's mandate and might be useful to Policy makers, Industry and practitioners in the target countries. The Study is published as part of the ESMAP series of reports and may usefully contribute to Project Identification and to addressing key Policy Issues in these countries, as well as enriching the debate on Energy Sector Reform. The authors wish to express their gratitude to all the colleagues who contributed directly or indirectly, to the review and completion of this work.

Abbreviations and Acronyms

AGI	Africa Gas Initiative (World Bank)
AIC	Average Incremental Cost
API	American Petroleum Institute
CCGT	Combined-Cycle Gas Turbine
CFA	Communauté Financière Africaine
CIF	Cost, Insurance, Freight
ESMAP	Joint World Bank/UNDP Energy Sector Assistance Management Program
FCFA	Franc - Communauté Financière Africaine
FOB	Free On Board
GDP	Gross Domestic Product
GNP	Gross National Product
GoG	Government of Gabon
GT	Gas Turbine
HHV	Higher Heating Value
HV	High Voltage
IEA	International Energy Agency (OECD)
IOC	International Oil Company
ISO	International Standards Organization
LHV	Lower Heating Value
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gases
PSA, PSC	Production Sharing Agreement / Contract
RTP	Reserves to Production ratio
SEEG	Société de l'Energie et de l'Eau du Gabon
SOGARA	Société Gabonaise de Raffinage
SSA	Sub Saharan Africa
ST	Steam Turbine
UNDP	United Nations Development Program
USD	US Dollar

Units of Measure

bcf	billion cubic feet
bcm	billion cubic meters
bcmy	billion cubic meters per year
bl, bbl	barrel, barrels
bpd	barrel per day
cf	cubic foot (feet)
cfcd	cubic feet per day
GJ	gigajoule
cm, cmh	cubic meter, cubic meter per hour
GW, GWh	gigawatt, gigawatthour
kcal	kilocalorie
km²	square kilometer
KW	kilowatt
kWh	kilowatthour
Mcal	megacalorie
mbpd	thousand barrels per day
mcf	thousand cubic feet
mcfcd	thousand cubic feet per day
mcm	thousand cubic meters
mcmd	thousand cubic meters per day
mcmy	thousand cubic meters per year
mmb	million barrels
mmbtu	million BTU (British Thermal Units)
mmcfcd	million cubic feet per day
mmcm	million cubic meters
mmcmmy	million cubic meters per year
mmt	million tons
mt	thousand tons
mtoe	thousand tons oil equivalent
mt_y	thousand tons per year
MVA	mega volt ampere
MW	megawatt
MWh	megawatthour
t	ton
tcf	trillion cubic feet
tc_m	trillion cubic meters
toe	ton oil equivalent
tp_y	ton per year
TWh	terawatthour

Conversion Factors

Volume

1 barrel	=	159 liters
1 cm	=	6.29 barrels
1 cm	=	35.315 cf
1,000 cf	=	28.3 cm

Energy

1 mmbtu	=	252 Mcal = 293 kWh
1 mmbtu	~	1 mcf
1 GJ	=	0.95 mmbtu
1 kWh	=	0.86 Mcal = 3,412 btu

Oil products

crude oil	7.30 bbl/ton
diesel/gas oil	7.46 bbl/ton
fuel oil	6.66 bbl/ton
jet fuel	7.93 bbl/ton
kerosene	7.74 bbl/ton
naphtha	8.80 bbl/ton

Rules of Thumb

1 bpd	~	50 tpy
1 mmbtu	~	1 mcf ~ 1 GJ
1 mmcf/d	~	10 mmcm/y
1 USD/mmbtu	~	40 USD/mcm
1 tcf	~	30 bcm

1

Oil and Gas Resources

Overview of the Gas and Oil Sector

Exploration and Production

1.1 With 1.2 million people for 267,000 km², Gabon is one of the less populated and less dense countries in Central Africa. The oil industry has become the most important sector of the country's economy, accounting for about 40 percent of GDP, 60 percent of government revenues, and 80 percent of total exports revenues. Until the development of the oil industry, the timber industry was the leading economic sector. It exploits the dense equatorial forests and is now Gabon's second-largest economic sector. Mining is active with manganese and uranium exploitation. Such combination of rich primary resources and limited population makes Gabon the richest country in SSA, expressed in GDP per capita. At USD 3,950 per capita, GDP is about 8 times higher than SSA average, 20 percent above South Africa.

1.2 Heavy reliance on oil revenues makes Gabon very sensitive to the variation of international prices. In fact, low prices in 1998 through mid-1999 have significantly deteriorated the account balance in the recent past. In the same time, however, Gabon strengthened its long term potential as it occurred in neighboring oil countries, such as Congo and Angola. Proved oil reserves nearly doubled in two years, from 1.3 billion barrels in 1996 to 2.5 billion barrels in 1998 (about 350 million tons (mmt)). Oil production amounted to 362,000 barrels per day (bpd) in 1998, i.e. 18 million tons per year (mmt), which gives a reasonable RTP ratio of 19 years. Oil output is almost entirely exported, mainly to the US and Western Europe.

1.3 In spite of a recent hike, the government is concerned about a longer-term trend of diminishing oil reserves. Gabon's largest oil field, the Shell-operated Rabi-Kounga field, which holds an estimated 440 million barrels and currently accounts for almost 60 percent of total national output, is projected to start declining in 2000 by up to 10 percent of production per year. This would represent an annual production decline of up to 20,000 bpd. To help boost reserves and production, Gabon's oil ministry has revised the terms of production-sharing contracts to attract new investors. In its eighth oil licensing round in 1998, Gabon offered its deep-water blocks by tender, for which three oil majors -- France's

Elf-Aquitaine and Total (now merged into the single company TotalFina), and Chevron submitted bids. A newly-formed consortium consisting of Total, Unocal, Vanco and other partners, signed PSCs for two deepwater exploration blocks.

1.4 In addition to majors, several smaller operators and investors concluded PSCs or started to produce oil in 1998. Most of them come from the US and Canada (Marathon, Perenco, Amerada Hess, Ocelot), but South Africa's Energy Africa and Sasol, as well as Italy's Agip have been active. Five new fields were put in production during that year.

Refining and Downstream Oil

1.5 Gabon is home to one of the smallest refineries in SSA (as is Congo) located in Port Gentil, the country's oil capital. The Société Gabonaise de Raffinage (Sogara), a JV between the Gabonese State (25 percent), a consortium led by TotalFina consisting of the IOCs that market oil products in the country, and private investors, operate a 21,000 bpd (1.05 mmt) facility that actually works at about 80 percent of its capacity. The refinery serves the local market and exports production in excess, mainly fuel oil in and naphtha. In spite of small population, local requirements exceed the refinery's output, in particular with regard to light products and middle distillates. Gabon needs to import about 210,000 tpy of oil products, mainly gas oil and jet fuel. Imports and exports are globally about balanced, although Gabon is still, by a thin margin, a net exporter of products, with imports and exports amounting to 210,000 tons and 263,000 tons of products in 1997, respectively. Imbalances, however, are strong with regard to some products, in particular middle distillates. Coverage ratio (i.e. domestic production over domestic demand) is as low as 54 percent for jet fuel and gas oil, a figure that is expected to keep on decreasing as the demand for transportation middle distillates increases. This is a characteristic that tends to worsen in most SSA countries that operate refineries.

Table 1.1: Oil Products Supply and Demand, 1997

	<i>Refinery Output (mt)</i>	<i>Imports (mt)</i>	<i>Exports (mt)</i>	<i>Domestic Demand (mt)</i>	<i>Coverage Ratio (%)</i>
LPG	17	1	1	17	100
Motor Gasoline	56		15	41	127
Aviation Gasoline		13		13	0
Jet Fuel	43	37		80	54
Kerosene	24	6		30	80
Gas Oil	162	137		299	54
Fuel Oil	272		186	86 ¹	316
Naphtha	71		61	10	710
Other Products	43	16		59	73
Overall	688	210	263	642	107

Source: IEA: Energy Statistics and Balances for non-OECD Countries, 1997 (1999 Edition)²

¹ Including marine bunkers (54,000 t).

2

Prospects for Natural Gas

Gas for the Industry

2.1 Natural gas is used to a limited extent for power generation and in the industrial sector. All gas consumption is located in Port-Gentil, as there is no gas pipeline beyond, e.g. to supply Libreville. Gas supplied is associated gas from offshore production sites (Rabi), delivered to Port-Gentil by a sealine. Major consumers include the local thermal plant and a few industries (brewery, construction materials) located in Port Gentil's industrial area. According to IEA's data, total gas production is about 90 mmcmy. 39 percent is used directly by the oil and gas industry (own use), while 61 percent is used for power generation and in the industrial sector.

2.2 Due to limited market, the conventional industry in Gabon is of small size, and concentrated in Libreville, the capital city, and Port Gentil. Although energy demand by the industrial sector is not negligible (128,000 tons of oil products and 458 GWh of electricity in 1997), none of the two cities is equipped with sizeable industrial areas, as are Abidjan and Douala. A significant proportion of energy demand of the industrial sector comes from specific industry, such as the timber industry, which, except for loading activities, operate in the forest, out of reach of gas sources. A preliminary estimate shows that potential gas market in Libreville would be around 8,000 tons of oil products, equivalent to 10 mmcmy of gas.

2.3 In Libreville, the industrial market alone is considered too weak to warrant a gas project on its own, while potential consumption in the residential and commercial sector -- for cooking and hot water, and possible air-conditioning of some buildings -- does not justify on its own the installation of a street network. However, a gas project that would be supported by gas demand from a major consumer, such as power generation, could become the driving force for the development of an industrial network, should industrial potential consumers be easily accessible at modest marginal cost.

2.4 The AGI recommends that the pre-feasibility study of industrial networks be undertaken in Gabon's main two cities. The use of natural gas would be limited to suburban areas around Libreville and Port Gentil, and linked to the need for gas for power generation. For Port Gentil, the study would pay attention to the possible extension of the

existing network. The study would assess the feasibility of a project that would consist of the following components :

- assessment of the potential market;
- cost of construction of gas pipelines from the gas landing points, depending on the scenario proposed for power generation (see relevant section below), to the industrial zone entry points;
- cost of construction of the industrial distribution networks;
- cost of conversion of the plants' thermal equipment (boilers, furnaces, etc.);
- set up of arrangements to handle financing of plant conversion, where appropriate;
- technical and commercial training for operations personnel.
- economic cost of gas at burnertip, and comparison with the cost of competing energies.

Gas for Power Generation

Gabon's Electric System

2.5 The electric system in Gabon consists of three separate main networks covering, respectively, the regions of Libreville (Central region), Port Gentil (Coastal region) and Franceville (Eastern region). Regional networks are not inter-connected. The Central network - the largest of the three - is essentially supplied by two hydroelectric stations, located along the Mbei river :

- Kingulé : installed capacity 57.6 MW, average annual energy output 410 GWh
- Tchimbélé : installed capacity 68.4 MW, average annual energy output 260 GWh;

2.6 This system also includes the Owendo thermal station, located on the river in the southern outskirts of Libreville. Two gas turbines are installed, of 22 MW each, fired by gas oil. The Owendo station was built by the end of the last decade to supply a large industrial project that was actually never built. In normal operation, Owendo is idle most of the time, as the short term marginal cost of the hydro plants is obviously lower. It only provides extra capacity during exceptionally dry seasons.

2.7 The Coastal network is supplied by two gas turbines of 21 MW each and 3 diesel groups of 5 MW each, located in Port-Gentil. The power effectively available, however, is limited to 32 MW, since one turbine and one diesel group are out of service. Gas turbines are fed by associated gas from offshore oil fields operated by Shell. The Eastern network is supplied by diesel stations only.

2.8 In March 1997, a 20-year concession to run the state-owned electricity and water utility (Société de l'Energie et de l'Eau du Gabon - SEEG) was awarded to a French-Irish consortium. This is the first privatization of a sub-Saharan water and electric utility that entails full commitment for future investment by the private operator. France's Vivendi and the Irish firm ESBI have pledged to invest USD 800 million to upgrade and modernize the systems. The consortium holds a 51 percent interest in SEEG.

Options for Improving Power Generation

2.9 While electricity service for those customers that are connected to the grid is generally considered satisfactory in Libreville, there is a significant suppressed demand that prevents additional consumers from being connected to the grid. Suppressed demand is reportedly due to lack of adequate distribution lines as well as insufficient generation capacity. Although no specific figures are available, suppressed demand is estimated at about 30 percent of the current power consumption. It is also widely admitted that several industrial facilities as well as large commercial consumers have no suitable access to the network and rely on expensive, diesel-fired self-generating facilities. Even where suppressed demand is not considered, there is a urgent need to develop additional capacity as the existing hydro facilities are expected to be saturated at the turn of the century.

2.10 The AGI has identified several options (five, and a few variants) to allow power generation capacity to meet overall demand. While the core issue lies in the expected imbalance in the Central region market, attention was paid to the supply of the Coastal region as well, as some options consider gas or power interconnection between these two larger markets. Preliminary assessment of the work to be done and of the economic cost of the options has been carried out, the result of which is presented below. Discounted costs presented in the comparison may need to be updated, as some cost estimates refer to former, non-AGI studies made during the second half of the 1990s. The gaps between the costs of the various options, however, are substantial and they are believed to remain unchanged in the case of updating.

2.11 Among these options, a first one (A), used as the reference, business-as-usual case, considers additional hydro capacity to be developed on the Mbei river, where the existing hydro plants are located. The main hydro scheme consists in a new station to be developed at Ngouimendjim. Three further options consider the development of gas-based power capacity, using either identified, undeveloped non-associated gas fields located in the vicinity of Libreville (Mbilagone and Ozoumbele, Option B), or associated gas available in Port-Gentil (Options C and D). The fifth option (E) is an oil-only, non-gas option, based on the construction of new diesel plants near Owendo.

2.12 ***Option A: Hydro Scheme.*** In this scenario, growing demand is met in the beginning by the existing Owendo gas turbines running on gas oil, following what they are replaced by new hydro schemes to be developed at Ngouimendjim and lower Kingué. Estimates of the capital cost of the hydro units is USD 340 million for Ngouimendjim, and USD 180 million for lower Kingué. Operating costs (not including fuel) are estimated at USD 0.4 million per year for Owendo, and at 0.2 percent of capital cost for the new hydro

stations. Due to the high upfront capital cost of the hydro units, total discounted cost reaches USD 185 million for the Central region. Additional cost for increasing the capacity of the Coastal region, in the absence of interconnection, amounts to USD 106 million, i.e. a total of USD 287 million for this option (all costs in NPV).

2.13 Variant A1 of this option would consist in bringing the Ngouimendjim station on line earlier, so as to limit to the extent possible the fuel costs associated with operating the Owendo gas turbines with expensive gas oil. Ngouimendjim station would be moved ahead to 2002. However, because the savings achieved in reducing operating (fuel) costs would be lower than the increase in (discounted) capital cost, variant A1 actually comes to an even higher total cost (USD 325 million).

2.14 **Option B: Owendo Gas Turbines Running on Non-associated Gas.** In this option, the Owendo gas turbines are fired with natural gas supplied from small-size gas fields located in the estuary (Mbilagone and Ozoumbele). Cost of conversion to natural gas of the currently diesel oil-fired GTs is considered negligible, when compared to the global project investment. Subsequently, additional gas turbines (40 MW) are put on stream, the first of which in 2005. It will lay the ground for a combined cycle of 3x40 MW, to be completed in 2010. Non-fuel operating costs for all the units fired with natural gas are estimated at USD 0.3 million a year. The total cost of the gas infrastructure (production, treatment and transport to Owendo) is estimated at USD 55 million; a variant B 1 has been calculated, assuming a higher infrastructure cost of USD 79 million. The economic cost the gas in place is assumed to be zero (depletion premium is not considered). Annual operating costs are estimated at 5% of investment, i.e. 2% for the transport portion, and 8% for production, treatment and compression.

2.15 Option B turns out to be the lowest-cost option, due to lower investment cost and modularity of gas turbines when compared to hydro schemes, which allows for a timely introduction tightly linked to the development of the requirements. Avoided costs are much higher than the relatively high cost of the gas production and transmission infrastructure (at USD 55 million). In total, including the costs relating to the Port Gentil network, we arrive at a discounted cost of USD 178 million, which is over USD 100 million below the cost of the reference option (A).

2.16 **Option C: Owendo Gas Turbines Running on Associated Gas.** In this option, the Owendo GTs are fired with associated gas from offshore oil fields, as currently done for the small market in Port Gentil. Gas is transported from Port Gentil to Owendo through a 150 km-long underwater pipeline. All gas comes from oil fields, so that Mbilagone and Ozoumbele are not put on stream and remain undeveloped. The cost of the pipeline is estimated at USD 34.3 million. The purchase price of gas at Port Gentil is taken at 75 percent of Brent quality, i.e. the price at which the gas seller sells gas to existing consumers. At USD 24/bl, purchase price of gas in Port Gentil is estimated at USD 3.34/mmbtu.

2.17 Option C results in a substantially higher cost for the electricity sector (USD 83 million for Libreville), due to higher purchase price for gas at the Libreville city gate

(delivery) station. Although the cost of the to-be-built gas system is lower in Option C than Option B (construction cost of the gas sealine is lower than that of developing the non-associated gas fields), overall cost over the period is USD 218 million, a figure that is USD 40 million higher than option B.

2.18 **Option D: Additional Power Generation in Port Gentil.** In this option, additional power requirements are met in Port Gentil, using associated gas from the oil fields. Then power, not gas, is transmitted to the Libreville area. Owendo gas turbines are not converted. An interconnection power line is built between Port Gentil and N'douaniang, a new station to be created along the existing line linking Kinguele and Libreville. An HV, 225 kV line of 303 km allows for the transmission of 50 MW of active power. The cost of the line is estimated at USD 160/m, i.e. USD 48 million, to which must be added USD 6 million for the two terminal stations. A loss rate of 2% per 100 km is assumed, and an annual operating cost equal to 2% of investment. In this scenario, the Owendo station remains available for operation with gas oil, and the Ngouimendjim station comes on line in 2010. With respect to the Port Gentil network, total power of the turbines to be installed over the study period goes from 74 MW (separate network options) to 104 MW. The purchase price of gas at Port Gentil is similar to that of Option C. A variant D1 consists in replacing the hydro station at Ngouimendjim by four successive diesel units of 20 MW (see Option E).

2.19 Option D, involving the interconnection of Coastal and Central electricity networks, allows better use to be made of the gas-fired units at Port Gentil, where a portion of the energy produced is transmitted to Libreville, so that the Owendo station can be fully by-passed. In 2010, when the connection is saturated (360 GWh a year), start-up of the hydro station at Ngouimendjim will reverse the flow for a few years, which will allow this unit to operate immediately on base load. The discounted cost for the Libreville network is USD 114 million, taking into account the cost of the interconnection. To this we must add the costs associated with the Port Gentil system, which are higher than in the previous options since the energy intended for Libreville must be generated in Port Gentil. This cost is USD 135 million, i.e. USD 36 million more than when they are operated separately. That leads to a total discounted cost of USD 252 million, or USD 74 million above that of option B.

2.20 In variant D1, the hydro station of Ngouimendjim is replaced, in the long term, by several diesel units running on heavy fuel-oil to be built near Libreville. This avoids the capital intensive construction of the hydro plant. The Port Gentil – N'Douaninang interconnection continue to be used in that direction (no reverse flow) as no excess capacity is available in the Central system to supply the Coastal system. Missing capacity in Port Gentil is met by bringing on-line an additional GT at Port Gentil. The additional capital cost required (USD 150 million versus USD 138 million) is largely offset by savings at Libreville (USD 81 million versus USD 114 million). As a result, total cost of variant D1 amounts to USD 231 million, a USD 13 million increase compared to Option C.

2.21 **Option E: Incremental Demand Met by Diesel Units.** The investment program consists exclusively of seven diesel groups of 20 MW each, put on stream in sequence as requirements increase. They are of the semi-fast or slow type, fired by heavy fuel oil No. 2 produced by Sogara, in order to decrease fuel cost. The price of fuel oil at refinery gate is taken at USD 137 for a crude price of USD 24 per barrel. Actual cost of fuel oil would be higher if its specifications would make it necessary to treat it, e.g. to remove heavy metals and other impurities. The total cost of fuel oil delivered at the station could thus be higher than that adopted here in a first approximation. The investment cost of the diesel units is estimated at USD 36 million for the first unit to be implemented, then at USD 32 million for the subsequent ones; moreover, the network will need USD 2 million in reinforcements once the third unit comes on line. Annual operating costs are estimated at USD 0.4 million per unit.

2.22 Option E involves bringing seven diesel groups into service in succession, at 20 MW each, until 2015. The discounted cost of this option is USD 132 million for the Central network, which is substantially lower than that of Option A. This option does not require any additional costs for the Port Gentil network, nor any cost for gas, and thus comes out at a total of USD 234 million (including the “standard” 102 million USD cost for the Port-Gentil network). It is well below that of the reference option using gas-oil (Option A), and close to the cost of the interconnection option (Option D).

Table 2.1 – Summary of the Economic Costs of Various Options for the Central System

	<i>Options</i>	<i>Economic Cost (NPV, million USD)</i>	<i>Percent above Least-cost Option</i>
A	Hydro Scheme in Central Region	287	61
B	Owendo Gas Turbines Running on Non-associated Gas from Mbilagone/Ozoumbele	178	0
C	Owendo Gas Turbines Running on Associated Gas from Port Gentil	218	22
D	Additional Power Generation in Port Gentil. Power line to Central region	252	42
E	Incremental Demand in Central region Met by Diesel-fired Units	234	31

Conclusions and Recommendations

2.23 Despite an installed capacity that looks sufficient for the time being, an option that would consist in relying on the Owendo gas turbines running on gas-oil, in order to delay any investment until the mid-2000s, appears to be a costly option. Although the existing GTs are sunk cost, they would have to run, while gas is not available, on expensive gas oil. Since Gabon is already a net middle distillates importer, gas oil is

expected to remain costly due to high freight. An alternative to imported gas oil (and middle distillates as a whole) would consist in implementing a gas-to-liquids production unit based on either associated or non-associated gas, the study of which option is recommended in the Main Report.

2.24 These preliminary results tend to assign the advantage to solutions based on bringing gas to the Libreville area, whether in the form of associated gas from Port Gentil, or non-associated gas from Mbilagone / Ozoumbele rather than relying on purely electricity-based development schemes, either with or without interconnection. It would be premature, however, given the degree of precision, to draw any definitive conclusions. Although the gaps between the various options seem to be large enough to consider gas-based alternatives the least-cost options, another round of assessments is required, which would deepen and refine market projections, the bases for cost estimates, technical conditions of the Owendo gas turbines, and the reserves in Mbilagone and Ozoumbele, as well as the cost of gas at Port-Gentil. The only options that seem to be hopelessly handicapped at this point are those relying on pure hydroelectric facilities.

2.25 The least-cost option clearly consists in using non-associated gas from Mbilagone and Ozoumbele to be burnt in the existing gas turbines at Owendo, followed in the longer term by a set of three new 40 MW turbines (two GTs and one ST), so as to constitute a combined cycle in due course. The option offers an economic advantage of USD 40 million compared with the second-best option, i.e. the gas pipeline option from Port Gentil. Cost advantage remains even under the high investment cost hypothesis, although it shrinks to USD 19 million. Such figures consider, on the one hand, that recoverable gas reserves from Mbilagone and Ozoumbele fields are sufficient to supply 80 MW of gas turbines during their entire useful lifetime, and on the other hand, that the value of the gas in place is zero. This means that the economic cost of the gas produced is only linked to the construction and operating cost of producing it, and that, for instance, no provision is made for depletion premium. Under these circumstances, the netback value of gas at wellhead is USD 2.3/mmbtu.

2.26 The solution whereby natural gas would be brought from Port Gentil to Owendo by pipeline (Option C) leads to a cost that is USD 13 million lower than the least-cost option. This gap corresponds roughly, in discounted terms, to the difference in investment costs between the power line and the pipeline. The consequences on the power investment program are just about the same (combined cycle in both options). This result is clearly very sensitive to the cost estimates for the gas infrastructure, and assumes that the dimensioning of the pipeline will be sufficient to supply 80 MW of gas turbines, at a rate of some 25,000 cmh.

2.27 Power inter-connection between the two networks (Option D) would lead (to the extent that the following investments are solely thermal) to a total cost very close to that of the diesel option (lower by USD 3 million, to be specific, which is not meaningful in terms of a preliminary calculation). The capital cost of such interconnection is in fact offset by the lower capital cost of the gas turbines (at Port Gentil) compared with diesel units. It also benefits from economies of scale, through better scheduling of investments in

production, within a unified system. This is particularly helpful to the extent that it would allow a combined cycle of 3x30 MW to be inserted, gradually and under proper operating conditions, at Port Gentil.

2.28 In the absence of any major energy transmission project (whether a gas pipeline or an electricity inter-connection), the best program of investment in production facilities would be the one based on heavy fuel-oil powered diesel groups (Option E); this option, which was once envisioned by SEEG, leads to a reduction of USD 53 million in total discounted cost, compared with the reference option (A, all hydro).

Table 2.2: Comparison of Alternative Schemes for Power Generation

<i>Option #</i>	<i>Option</i>	<i>New Facilities</i>	<i>Schedule</i>	<i>Direct Cost</i>	<i>Cost of Libreville Power Network (NPV)</i>	<i>Cost of Port Gentil Power Network (NPV)</i>	<i>Cost of the Gas Component (NPV)</i>	<i>Total Cost of the Option (NPV)</i>
					<i>million USD</i>	<i>million USD</i>	<i>million USD</i>	<i>million USD</i>
A	Owendo Gasoil	Hydro Ngoulmendjim	2005	340	185	102	0	287
		Hydro Kinguele downstream	2012	180				
(A1)	Owendo Gasoil - variant	Hydro Ngoulmendjim	2002	340	223	102	0	325
		Hydro Kinguele downstream	2012	180				
B	Gas Mbilagone	Gas Production + Gas Pipeline	2000	55	25	102	51	178
		GT 40 MW	2005	20				
		GT 40 + ST 40 MW (CC)	2010	64				
		GT 40 MW	2015	20				
(B1)	Gas Mbilagone - variant	Gas Production + Gas Pipeline	2000	78	25	102	72	199
		GT 40 MW	2005	20				
		GT 40 + ST 40 MW (CC)	2010	64				
		GT 40 MW	2015	20				
C	Gasoduc PG-LBV	Gas Pipeline	2000	34	83	102	33	218
		GT 40 MW	2005	20				
		GT 40 + ST 40 MW (CC)	2010	64				
		GT 40 MW	2015	20				
D	Power Interconnection + hydro	Interconnection 225 kV	2000	54	114	138	0	252
		Hydro Ngoulmendjim (additional GT in PG)	2010	340				
(D1)	Power Interconnection + diesel	Interconnection 225 kV	2000	54	81	150	0	231
		Diesel 4x20 MW (additional GT in PG)	2010 to 2014	134				
E	Diesel / FO	Diesel 7x20 MW	1999 to 2015	230	132	102	0	234

Joint UNDP/World Bank
ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

LIST OF REPORTS ON COMPLETED ACTIVITIES

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SUB-SAHARAN AFRICA (AFR)			
Africa Regional	Anglophone Africa Household Energy Workshop (English)	07/88	085/88
	Regional Power Seminar on Reducing Electric Power System Losses in Africa (English)	08/88	087/88
	Institutional Evaluation of EGL (English)	02/89	098/89
	Biomass Mapping Regional Workshops (English)	05/89	--
	Francophone Household Energy Workshop (French)	08/89	--
	Interafrican Electrical Engineering College: Proposals for Short- and Long-Term Development (English)	03/90	112/90
	Biomass Assessment and Mapping (English)	03/90	--
	Symposium on Power Sector Reform and Efficiency Improvement in Sub-Saharan Africa (English)	06/96	182/96
	Commercialization of Marginal Gas Fields (English)	12/97	201/97
	Commercializing Natural Gas: Lessons from the Seminar in Nairobi for Sub-Saharan Africa and Beyond	01/00	225/00
	Africa Gas Initiative – Main Report: Volume I	02/01	240/01
Angola	Energy Assessment (English and Portuguese)	05/89	4708-ANG
	Power Rehabilitation and Technical Assistance (English)	10/91	142/91
	Africa Gas Initiative – Angola: Volume II	02/01	240/01
Benin	Energy Assessment (English and French)	06/85	5222-BEN
Botswana	Energy Assessment (English)	09/84	4998-BT
	Pump Electrification Prefeasibility Study (English)	01/86	047/86
	Review of Electricity Service Connection Policy (English)	07/87	071/87
	Tuli Block Farms Electrification Study (English)	07/87	072/87
	Household Energy Issues Study (English)	02/88	--
	Urban Household Energy Strategy Study (English)	05/91	132/91
Burkina Faso	Energy Assessment (English and French)	01/86	5730-BUR
	Technical Assistance Program (English)	03/86	052/86
	Urban Household Energy Strategy Study (English and French)	06/91	134/91
Burundi	Energy Assessment (English)	06/82	3778-BU
	Petroleum Supply Management (English)	01/84	012/84
	Status Report (English and French)	02/84	011/84
	Presentation of Energy Projects for the Fourth Five-Year Plan (1983-1987) (English and French)	05/85	036/85
	Improved Charcoal Cookstove Strategy (English and French)	09/85	042/85
	Peat Utilization Project (English)	11/85	046/85
	Energy Assessment (English and French)	01/92	9215-BU
Cameroon	Africa Gas Initiative – Cameroon: Volume III	02/01	240/01
Cape Verde	Energy Assessment (English and Portuguese)	08/84	5073-CV
	Household Energy Strategy Study (English)	02/90	110/90
Central African Republic	Energy Assesment (French)	08/92	9898-CAR
Chad	Elements of Strategy for Urban Household Energy The Case of N'djamena (French)	12/93	160/94
Comoros	Energy Assessment (English and French)	01/88	7104-COM
	In Search of Better Ways to Develop Solar Markets: The Case of Comoros	05/00	230/00
Congo	Energy Assessment (English)	01/88	6420-COB

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Congo	Power Development Plan (English and French)	03/90	106/90
	Africa Gas Initiative – Congo: Volume IV	02/01	240/01
Côte d'Ivoire	Energy Assessment (English and French)	04/85	5250-IVC
	Improved Biomass Utilization (English and French)	04/87	069/87
	Power System Efficiency Study (English)	12/87	--
	Power Sector Efficiency Study (French)	02/92	140/91
	Project of Energy Efficiency in Buildings (English)	09/95	175/95
	Africa Gas Initiative – Côte d'Ivoire: Volume V	02/01	240/01
Ethiopia	Energy Assessment (English)	07/84	4741-ET
	Power System Efficiency Study (English)	10/85	045/85
	Agricultural Residue Briquetting Pilot Project (English)	12/86	062/86
	Bagasse Study (English)	12/86	063/86
	Cooking Efficiency Project (English)	12/87	--
	Energy Assessment (English)	02/96	179/96
Gabon	Energy Assessment (English)	07/88	6915-GA
	Africa Gas Initiative – Gabon: Volume VI	02/01	240/01
The Gambia	Energy Assessment (English)	11/83	4743-GM
	Solar Water Heating Retrofit Project (English)	02/85	030/85
	Solar Photovoltaic Applications (English)	03/85	032/85
	Petroleum Supply Management Assistance (English)	04/85	035/85
Ghana	Energy Assessment (English)	11/86	6234-GH
	Energy Rationalization in the Industrial Sector (English)	06/88	084/88
	Sawmill Residues Utilization Study (English)	11/88	074/87
	Industrial Energy Efficiency (English)	11/92	148/92
Guinea	Energy Assessment (English)	11/86	6137-GUI
	Household Energy Strategy (English and French)	01/94	163/94
Guinea-Bissau	Energy Assessment (English and Portuguese)	08/84	5083-GUB
	Recommended Technical Assistance Projects (English & Portuguese)	04/85	033/85
	Management Options for the Electric Power and Water Supply Subsectors (English)	02/90	100/90
	Power and Water Institutional Restructuring (French)	04/91	118/91
Kenya	Energy Assessment (English)	05/82	3800-KE
	Power System Efficiency Study (English)	03/84	014/84
	Status Report (English)	05/84	016/84
	Coal Conversion Action Plan (English)	02/87	--
	Solar Water Heating Study (English)	02/87	066/87
	Peri-Urban Woodfuel Development (English)	10/87	076/87
	Power Master Plan (English)	11/87	--
	Power Loss Reduction Study (English)	09/96	186/96
	Implementation Manual: Financing Mechanisms for Solar Electric Equipment	07/00	231/00
Lesotho	Energy Assessment (English)	01/84	4676-LSO
Liberia	Energy Assessment (English)	12/84	5279-LBR
	Recommended Technical Assistance Projects (English)	06/85	038/85
	Power System Efficiency Study (English)	12/87	081/87
Madagascar	Energy Assessment (English)	01/87	5700-MAG
	Power System Efficiency Study (English and French)	12/87	075/87
	Environmental Impact of Woodfuels (French)	10/95	176/95
Malawi	Energy Assessment (English)	08/82	3903-MAL
	Technical Assistance to Improve the Efficiency of Fuelwood Use in the Tobacco Industry (English)	11/83	009/83

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Malawi	Status Report (English)	01/84	013/84
Mali	Energy Assessment (English and French)	11/91	8423-MLI
	Household Energy Strategy (English and French)	03/92	147/92
Islamic Republic of Mauritania	Energy Assessment (English and French)	04/85	5224-MAU
	Household Energy Strategy Study (English and French)	07/90	123/90
Mauritius	Energy Assessment (English)	12/81	3510-MAS
	Status Report (English)	10/83	008/83
	Power System Efficiency Audit (English)	05/87	070/87
	Bagasse Power Potential (English)	10/87	077/87
	Energy Sector Review (English)	12/94	3643-MAS
Mozambique	Energy Assessment (English)	01/87	6128-MOZ
	Household Electricity Utilization Study (English)	03/90	113/90
	Electricity Tariffs Study (English)	06/96	181/96
	Sample Survey of Low Voltage Electricity Customers	06/97	195/97
Namibia	Energy Assessment (English)	03/93	11320-NAM
Niger	Energy Assessment (French)	05/84	4642-NIR
	Status Report (English and French)	02/86	051/86
	Improved Stoves Project (English and French)	12/87	080/87
	Household Energy Conservation and Substitution (English and French)	01/88	082/88
Nigeria	Energy Assessment (English)	08/83	4440-UNI
	Energy Assessment (English)	07/93	11672-UNI
Rwanda	Energy Assessment (English)	06/82	3779-RW
	Status Report (English and French)	05/84	017/84
	Improved Charcoal Cookstove Strategy (English and French)	08/86	059/86
	Improved Charcoal Production Techniques (English and French)	02/87	065/87
	Energy Assessment (English and French)	07/91	8017-RW
	Commercialization of Improved Charcoal Stoves and Carbonization Techniques Mid-Term Progress Report (English and French)	12/91	141/91
SADC	SADC Regional Power Interconnection Study, Vols. I-IV (English)	12/93	--
SADCC	SADCC Regional Sector: Regional Capacity-Building Program for Energy Surveys and Policy Analysis (English)	11/91	--
Sao Tome and Principe	Energy Assessment (English)	10/85	5803-STP
Senegal	Energy Assessment (English)	07/83	4182-SE
	Status Report (English and French)	10/84	025/84
	Industrial Energy Conservation Study (English)	05/85	037/85
	Preparatory Assistance for Donor Meeting (English and French)	04/86	056/86
	Urban Household Energy Strategy (English)	02/89	096/89
	Industrial Energy Conservation Program (English)	05/94	165/94
Seychelles	Energy Assessment (English)	01/84	4693-SEY
	Electric Power System Efficiency Study (English)	08/84	021/84
Sierra Leone	Energy Assessment (English)	10/87	6597-SL
Somalia	Energy Assessment (English)	12/85	5796-SO
Republic of South Africa	Options for the Structure and Regulation of Natural Gas Industry (English)	05/95	172/95
Sudan	Management Assistance to the Ministry of Energy and Mining	05/83	003/83
	Energy Assessment (English)	07/83	4511-SU
	Power System Efficiency Study (English)	06/84	018/84
	Status Report (English)	11/84	026/84

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Sudan	Wood Energy/Forestry Feasibility (English)	07/87	073/87
Swaziland	Energy Assessment (English)	02/87	6262-SW
	Household Energy Strategy Study	10/97	198/97
Tanzania	Energy Assessment (English)	11/84	4969-TA
	Peri-Urban Woodfuels Feasibility Study (English)	08/88	086/88
	Tobacco Curing Efficiency Study (English)	05/89	102/89
	Remote Sensing and Mapping of Woodlands (English)	06/90	--
	Industrial Energy Efficiency Technical Assistance (English)	08/90	122/90
	Power Loss Reduction Volume 1: Transmission and Distribution System Technical Loss Reduction and Network Development (English)	06/98	204A/98
	Power Loss Reduction Volume 2: Reduction of Non-Technical Losses (English)	06/98	204B/98
Togo	Energy Assessment (English)	06/85	5221-TO
	Wood Recovery in the Nangbeto Lake (English and French)	04/86	055/86
	Power Efficiency Improvement (English and French)	12/87	078/87
Uganda	Energy Assessment (English)	07/83	4453-UG
	Status Report (English)	08/84	020/84
	Institutional Review of the Energy Sector (English)	01/85	029/85
	Energy Efficiency in Tobacco Curing Industry (English)	02/86	049/86
	Fuelwood/Forestry Feasibility Study (English)	03/86	053/86
	Power System Efficiency Study (English)	12/88	092/88
	Energy Efficiency Improvement in the Brick and Tile Industry (English)	02/89	097/89
	Tobacco Curing Pilot Project (English)	03/89	UNDP Terminal Report
	Energy Assessment (English)	12/96	193/96
	Rural Electrification Strategy Study	09/99	221/99
Zaire	Energy Assessment (English)	05/86	5837-ZR
Zambia	Energy Assessment (English)	01/83	4110-ZA
	Status Report (English)	08/85	039/85
	Energy Sector Institutional Review (English)	11/86	060/86
	Power Subsector Efficiency Study (English)	02/89	093/88
	Energy Strategy Study (English)	02/89	094/88
	Urban Household Energy Strategy Study (English)	08/90	121/90
Zimbabwe	Energy Assessment (English)	06/82	3765-ZIM
	Power System Efficiency Study (English)	06/83	005/83
	Status Report (English)	08/84	019/84
	Power Sector Management Assistance Project (English)	04/85	034/85
	Power Sector Management Institution Building (English)	09/89	--
	Petroleum Management Assistance (English)	12/89	109/89
	Charcoal Utilization Prefeasibility Study (English)	06/90	119/90
	Integrated Energy Strategy Evaluation (English)	01/92	8768-ZIM
	Energy Efficiency Technical Assistance Project: Strategic Framework for a National Energy Efficiency Improvement Program (English)	04/94	--
	Capacity Building for the National Energy Efficiency Improvement Programme (NEEIP) (English)	12/94	--
	Rural Electrification Study	03/00	228/00

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EAST ASIA AND PACIFIC (EAP)			
Asia Regional	Pacific Household and Rural Energy Seminar (English)	11/90	--
China	County-Level Rural Energy Assessments (English)	05/89	101/89
	Fuelwood Forestry Preinvestment Study (English)	12/89	105/89
	Strategic Options for Power Sector Reform in China (English)	07/93	156/93
	Energy Efficiency and Pollution Control in Township and Village Enterprises (TVE) Industry (English)	11/94	168/94
	Energy for Rural Development in China: An Assessment Based on a Joint Chinese/ESMAP Study in Six Counties (English)	06/96	183/96
	Improving the Technical Efficiency of Decentralized Power Companies	09/99	222/999
Fiji	Energy Assessment (English)	06/83	4462-FIJ
Indonesia	Energy Assessment (English)	11/81	3543-IND
	Status Report (English)	09/84	022/84
	Power Generation Efficiency Study (English)	02/86	050/86
	Energy Efficiency in the Brick, Tile and Lime Industries (English)	04/87	067/87
	Diesel Generating Plant Efficiency Study (English)	12/88	095/88
	Urban Household Energy Strategy Study (English)	02/90	107/90
	Biomass Gasifier Preinvestment Study Vols. I & II (English)	12/90	124/90
	Prospects for Biomass Power Generation with Emphasis on Palm Oil, Sugar, Rubberwood and Plywood Residues (English)	11/94	167/94
Lao PDR	Urban Electricity Demand Assessment Study (English)	03/93	154/93
	Institutional Development for Off-Grid Electrification	06/99	215/99
Malaysia	Sabah Power System Efficiency Study (English)	03/87	068/87
	Gas Utilization Study (English)	09/91	9645-MA
Myanmar	Energy Assessment (English)	06/85	5416-BA
Papua New Guinea	Energy Assessment (English)	06/82	3882-PNG
	Status Report (English)	07/83	006/83
	Energy Strategy Paper (English)	--	--
	Institutional Review in the Energy Sector (English)	10/84	023/84
	Power Tariff Study (English)	10/84	024/84
Philippines	Commercial Potential for Power Production from Agricultural Residues (English)	12/93	157/93
	Energy Conservation Study (English)	08/94	--
Solomon Islands	Energy Assessment (English)	06/83	4404-SOL
	Energy Assessment (English)	01/92	979-SOL
South Pacific	Petroleum Transport in the South Pacific (English)	05/86	--
Thailand	Energy Assessment (English)	09/85	5793-TH
	Rural Energy Issues and Options (English)	09/85	044/85
	Accelerated Dissemination of Improved Stoves and Charcoal Kilns (English)	09/87	079/87
	Northeast Region Village Forestry and Woodfuels Preinvestment Study (English)	02/88	083/88
	Impact of Lower Oil Prices (English)	08/88	--
	Coal Development and Utilization Study (English)	10/89	--
Tonga	Energy Assessment (English)	06/85	5498-TON
Vanuatu	Energy Assessment (English)	06/85	5577-VA
Vietnam	Rural and Household Energy-Issues and Options (English)	01/94	161/94

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	Household Energy Technical Assistance: Improved Coal Briquetting and Commercialized Dissemination of Higher Efficiency Biomass and Coal Stoves (English)	01/96	178/96
	Petroleum Fiscal Issues and Policies for Fluctuating Oil Prices In Vietnam	02/01	236/01
Western Samoa	Energy Assessment (English)	06/85	5497-WSO
SOUTH ASIA (SAS)			
Bangladesh	Energy Assessment (English)	10/82	3873-BD
	Priority Investment Program (English)	05/83	002/83
	Status Report (English)	04/84	015/84
	Power System Efficiency Study (English)	02/85	031/85
	Small Scale Uses of Gas Prefeasibility Study (English)	12/88	--
India	Opportunities for Commercialization of Nonconventional Energy Systems (English)	11/88	091/88
	Maharashtra Bagasse Energy Efficiency Project (English)	07/90	120/90
	Mini-Hydro Development on Irrigation Dams and Canal Drops Vols. I, II and III (English)	07/91	139/91
	WindFarm Pre-Investment Study (English)	12/92	150/92
	Power Sector Reform Seminar (English)	04/94	166/94
	Environmental Issues in the Power Sector (English)	06/98	205/98
	Environmental Issues in the Power Sector: Manual for Environmental Decision Making (English)	06/99	213/99
	Household Energy Strategies for Urban India: The Case of Hyderabad	06/99	214/99
	Greenhouse Gas Mitigation In the Power Sector: Case Studies From India	02/01	237/01
Nepal	Energy Assessment (English)	08/83	4474-NEP
	Status Report (English)	01/85	028/84
	Energy Efficiency & Fuel Substitution in Industries (English)	06/93	158/93
Pakistan	Household Energy Assessment (English)	05/88	--
	Assessment of Photovoltaic Programs, Applications, and Markets (English)	10/89	103/89
	National Household Energy Survey and Strategy Formulation Study: Project Terminal Report (English)	03/94	--
	Managing the Energy Transition (English)	10/94	--
	Lighting Efficiency Improvement Program Phase 1: Commercial Buildings Five Year Plan (English)	10/94	--
Sri Lanka	Energy Assessment (English)	05/82	3792-CE
	Power System Loss Reduction Study (English)	07/83	007/83
	Status Report (English)	01/84	010/84
	Industrial Energy Conservation Study (English)	03/86	054/86
EUROPE AND CENTRAL ASIA (ECA)			
Bulgaria	Natural Gas Policies and Issues (English)	10/96	188/96
Central and Eastern Europe	Power Sector Reform in Selected Countries	07/97	196/97

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	The Future of Natural Gas in Eastern Europe (English)	08/92	149/92
Kazakhstan	Natural Gas Investment Study, Volumes 1, 2 & 3	12/97	199/97
Kazakhstan & Kyrgyzstan	Opportunities for Renewable Energy Development	11/97	16855-KAZ
Poland	Energy Sector Restructuring Program Vols. I-V (English)	01/93	153/93
	Natural Gas Upstream Policy (English and Polish)	08/98	206/98
	Energy Sector Restructuring Program: Establishing the Energy Regulation Authority	10/98	208/98
Portugal	Energy Assessment (English)	04/84	4824-PO
Romania	Natural Gas Development Strategy (English)	12/96	192/96
Slovenia	Workshop on Private Participation in the Power Sector (English)	02/99	211/99
Turkey	Energy Assessment (English)	03/83	3877-TU
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	Energy Assessment (English and French)	03/84	4157-MOR
	Status Report (English and French)	01/86	048/86
Morocco	Energy Sector Institutional Development Study (English and French)	07/95	173/95
	Natural Gas Pricing Study (French)	10/98	209/98
	Gas Development Plan Phase II (French)	02/99	210/99
Syria	Energy Assessment (English)	05/86	5822-SYR
	Electric Power Efficiency Study (English)	09/88	089/88
	Energy Efficiency Improvement in the Cement Sector (English)	04/89	099/89
	Energy Efficiency Improvement in the Fertilizer Sector (English)	06/90	115/90
Tunisia	Fuel Substitution (English and French)	03/90	--
	Power Efficiency Study (English and French)	02/92	136/91
	Energy Management Strategy in the Residential and Tertiary Sectors (English)	04/92	146/92
	Renewable Energy Strategy Study, Volume I (French)	11/96	190A/96
	Renewable Energy Strategy Study, Volume II (French)	11/96	190B/96
Yemen	Energy Assessment (English)	12/84	4892-YAR
	Energy Investment Priorities (English)	02/87	6376-YAR
	Household Energy Strategy Study Phase I (English)	03/91	126/91

LATIN AMERICA AND THE CARIBBEAN (LAC)

LAC Regional	Regional Seminar on Electric Power System Loss Reduction in the Caribbean (English)	07/89	--
	Elimination of Lead in Gasoline in Latin America and the Caribbean (English and Spanish)	04/97	194/97
	Elimination of Lead in Gasoline in Latin America and the Caribbean - Status Report (English and Spanish)	12/97	200/97

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Bolivia	Energy Assessment (English)	04/83	4213-BO
	National Energy Plan (English)	12/87	--
	La Paz Private Power Technical Assistance (English)	11/90	111/90
	Prefeasibility Evaluation Rural Electrification and Demand Assessment (English and Spanish)	04/91	129/91
	National Energy Plan (Spanish)	08/91	131/91
	Private Power Generation and Transmission (English)	01/92	137/91
	Natural Gas Distribution: Economics and Regulation (English)	03/92	125/92
	Natural Gas Sector Policies and Issues (English and Spanish)	12/93	164/93
	Household Rural Energy Strategy (English and Spanish)	01/94	162/94
	Preparation of Capitalization of the Hydrocarbon Sector	12/96	191/96
	Introducing Competition into the Electricity Supply Industry in Developing Countries: Lessons from Bolivia	08/00	233/00
	Final Report on Operational Activities Rural Energy and Energy Efficiency	08/00	235/00
Brazil	Energy Efficiency & Conservation: Strategic Partnership for Energy Efficiency in Brazil (English)	01/95	170/95
	Hydro and Thermal Power Sector Study	09/97	197/97
	Rural Electrification with Renewable Energy Systems in the Northeast: A Preinvestment Study	07/00	232/00
Chile	Energy Sector Review (English)	08/88	7129-CH
Colombia	Energy Strategy Paper (English)	12/86	--
	Power Sector Restructuring (English)	11/94	169/94
	Energy Efficiency Report for the Commercial and Public Sector (English)	06/96	184/96
Costa Rica	Energy Assessment (English and Spanish)	01/84	4655-CR
	Recommended Technical Assistance Projects (English)	11/84	027/84
	Forest Residues Utilization Study (English and Spanish)	02/90	108/90
Dominican Republic	Energy Assessment (English)	05/91	8234-DO
Ecuador	Energy Assessment (Spanish)	12/85	5865-EC
	Energy Strategy Phase I (Spanish)	07/88	--
	Energy Strategy (English)	04/91	--
	Private Minihydropower Development Study (English)	11/92	--
	Energy Pricing Subsidies and Interfuel Substitution (English)	08/94	11798-EC
	Energy Pricing, Poverty and Social Mitigation (English)	08/94	12831-EC
Guatemala	Issues and Options in the Energy Sector (English)	09/93	12160-GU
Haiti	Energy Assessment (English and French)	06/82	3672-HA
	Status Report (English and French)	08/85	041/85
	Household Energy Strategy (English and French)	12/91	143/91
Honduras	Energy Assessment (English)	08/87	6476-HO
	Petroleum Supply Management (English)	03/91	128/91
Jamaica	Energy Assessment (English)	04/85	5466-JM
	Petroleum Procurement, Refining, and Distribution Study (English)	11/86	061/86
	Energy Efficiency Building Code Phase I (English)	03/88	--
	Energy Efficiency Standards and Labels Phase I (English)	03/88	--
	Management Information System Phase I (English)	03/88	--
	Charcoal Production Project (English)	09/88	090/88
	FIDCO Sawmill Residues Utilization Study (English)	09/88	088/88

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Jamaica	Energy Sector Strategy and Investment Planning Study (English)	07/92	135/92
Mexico	Improved Charcoal Production Within Forest Management for the State of Veracruz (English and Spanish)	08/91	138/91
	Energy Efficiency Management Technical Assistance to the Comision Nacional para el Ahorro de Energia (CONAE) (English)	04/96	180/96
Panama	Power System Efficiency Study (English)	06/83	004/83
Paraguay	Energy Assessment (English)	10/84	5145-PA
	Recommended Technical Assistance Projects (English)	09/85	--
	Status Report (English and Spanish)	09/85	043/85
Peru	Energy Assessment (English)	01/84	4677-PE
	Status Report (English)	08/85	040/85
	Proposal for a Stove Dissemination Program in the Sierra (English and Spanish)	02/87	064/87
	Energy Strategy (English and Spanish)	12/90	--
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Saint Lucia	Energy Assessment (English)	09/84	5111-SLU
St. Vincent and the Grenadines	Energy Assessment (English)	09/84	5103-STV
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	The International Network: Policies and Experience (English)	04/90	--
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	The Effect of a Shadow Price on Carbon Emission in the Energy Portfolio of the World Bank: A Carbon		

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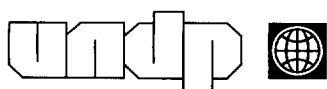
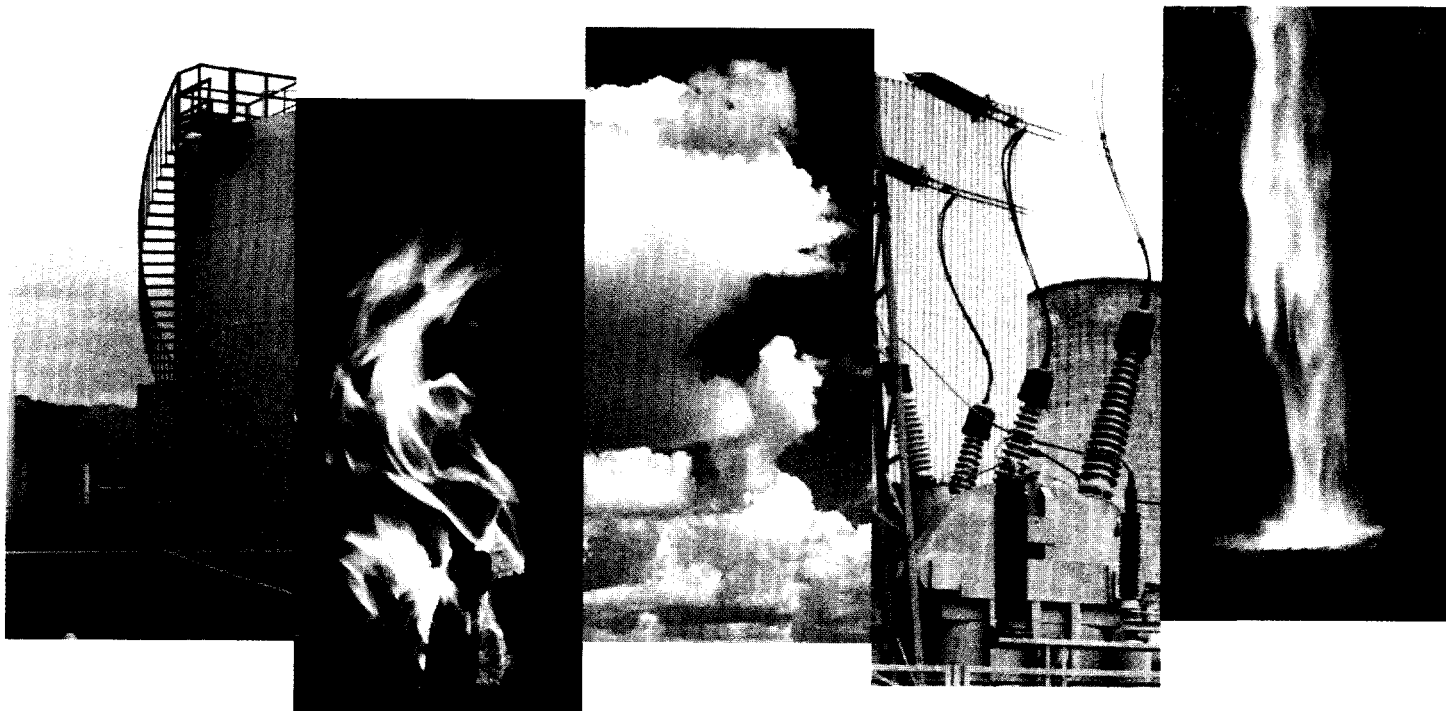
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