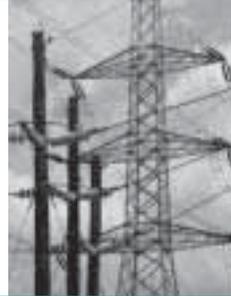


Strengthening Energy Security in Uruguay



Energy Sector Management Assistance Program

Energy Sector Management Assistance Program (ESMAP)

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The Energy Sector Management Assistance Program (ESMAP) is a global technical assistance partnership administered by the World Bank and sponsored by bi-lateral official donors, since 1983. ESMAP's mission is to promote the role of energy in poverty reduction and economic growth in an environmentally responsible manner. Its work applies to low-income, emerging, and transition economies and contributes to the achievement of internationally agreed development goals. ESMAP interventions are knowledge products including free technical assistance, specific studies, advisory services, pilot projects, knowledge generation and dissemination, trainings, workshops and seminars, conferences and round-tables, and publications. ESMAP work is focused on four key thematic programs: energy security, renewable energy, energy-poverty and market efficiency and governance.

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Funding

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ESMAP Technical Paper 116/07

Strengthening Energy Security in Uruguay

Energy Sector Management Assistance Program (ESMAP)

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First printing May 2007

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Units of Measure

bbbl	Barrels
Ktoe	Kiloton Per Oil Equivalent
kWh	Kilo Watt (s) Per Hour
kW	Kilo Watt (s)
MMBTU	Million British Thermal Units
m/s	Miles Per Second
MW	Mega Watt (s)
MWh	Mega Watt (s) Per Hour
lt	Liter
toe	Ton Per Oil Equivalent

Acronyms and Abbreviations

ADME	<i>Administración del Mercado Eléctrico</i> (Electricity Market Administration)
ANCAP	<i>Administración Nacional de Combustibles, Alcohol y Portland</i>
CCGT	Combined Cycle Gas Turbine
CIER	<i>Comisión de Integración Eléctrica Regional</i>
CNG	Compressed Natural Gas
CO ₂	Carbon dioxide
DINAMA	National Environmental Agency
DNETN	<i>Dirección Nacional de Energía y Tecnología Nuclear</i> (Director, National Directorate of Energy and Nuclear Technology)
ESMAP	Energy Sector Management Assistance Program
EU	European Union
GoU	Government of Uruguay
IGCC	Integrated Gasification Combined Cycle
LNG	Liquefied Natural Gas
MIEM	Ministry of Industry, Energy and Mining
OPP	Budget and Planning Office
RB	Republica Bolivariana de Venezuela
RE	Renewable Energy
REs	Renewable Energies
RPS	Renewable Portfolio Standard
S&L	Standard and Labeling
SOEs	State-Owned Enterprises

T&D	Transmission and Distribution
TUs	Trade Unions
UNIT	Technical Norms Institute
URSEA	<i>Unidad Reguladora de Servicios de Agua y Energía</i> (Regulatory Entity for Energy and Water Services)
UTE	<i>Administración Nacional de Usinas y Trasmisiones Eléctricas</i> (National Administration for Electric Transmission)
VAT	Value Added Tax

Acknowledgments

This Technical Paper consists of the Executive Summary of a full report prepared as part of the joint World Bank and Energy Sector Management Assistance Program (ESMAP) in support to the Government of Uruguay (GoU) for the preparation of an energy strategy.

Mr. Manuel Dussan, Mr. Jorge Chamot and Mr. Pedro Touzett (individual consultants) contributed with a report on “Energy Strategy – Support on Specific Energy Issues.” Mr. Héctor Pistonesi and Mr. César Chávez (Fundación Bariloche) facilitated the consultative workshop which took place in May 2006 with key public stakeholders in the energy sector.

The Uruguay team which prepared the “Guidelines for an Energy Strategy” section of this Executive Summary included Mr. Jorge Lepra (Minister of Industry, Energy and Mining), Mr. Martín Ponce de León (Vice Minister of Industry, Energy and Mining), Mr. Gerardo Triunfo, Dirección Nacional de Energía y Tecnología Nuclear (Director, National Directorate of Energy and Nuclear Technology) – DNETN, Mr. Pablo Mosto (DNETN) and Ms. Carmen Villasante (DNETN).

The World Bank team included Mr. Philippe Durand (Task Manager), Mr. Carlos Vélez, Mr. Fernando Lecaros and Ms. Lucia Spinelli. Ms. Marjorie K. Araya and Ms. Ananda Swaroop from ESMAP coordinated the publication and dissemination process.

Executive Summary

Introduction

The need for an energy strategy. The Uruguayan energy sector is at the crossroads. As in the case of many other countries, high oil prices in the international market are taking their toll on an economy which imports all of its oil and oil products. Uruguay has also depended, to a large extent, on import of electricity from Argentina to complement its supplies. Trade in electricity and natural gas collapsed during the economic recession of 2001-02 and Argentina's crisis in the same period, which, together with the rise of oil prices, have brought to the fore questions of energy security (that is, ensuring sufficient, reliable and cost-effective supply of national energy demand) and the cost/risk trade-offs involved in depending on foreign suppliers. The Uruguayan government has rightly perceived this to be a fundamental economic issue and sought to put together a strategy for addressing it.

Objectives and scope of the study. The study was conceived as support to the GoU for addressing strategic issues in the energy sector. The process through which the strategy was developed consisted of three phases. In the first phase, issues and options in the energy sector were examined with support from specialized consultants,¹ who had an overall look at energy sector issues and options. At GoU's request, the consultants examined more specifically the following themes: comparative analysis of energy strategies and power sector reform in relevant countries, review of prospects for local hydrocarbon production, analysis of options to promote Renewable Energy (RE) sources and review of power generation alternatives including the ones based on imported coal or Liquefied Natural Gas (LNG). A second phase of the study took place through a seminar in which options to address issues in the energy sector were shared and consulted with key public stakeholders in the energy sector, including the two government-owned companies Administración Nacional de Usinas y Transmisiones Eléctricas (National Administration for Electric

¹ Manuel Dussan, Jorge Chamot and Pedro Touzett.

Transmission) (UTE) and Administración Nacional de Combustibles, Alcohol y Portland (ANCAP), the energy sector regulator Unidad Reguladora de Servicios de Agua y Energía (Regulatory Entity for Energy and Water Services) (URSEA) and the power market administrator Administración del Mercado Eléctrico (Electricity Market Administration) (ADME); Fundación Bariloche, a well-known Argentinean think tank, acted as seminar facilitator.² In the final phase, the government team alone put together an energy strategy based upon the information gained from the preceding phases and its own analysis and considerations, through final consultations with the same key public stakeholders.

Report organization. The results of the study are presented in this Executive Summary which includes: (a) a general review of energy resources in Uruguay together with basic data on consumption, the sector's institutional set-up and the main actors; (b) background, issues and options for electricity and natural gas; (c) supply and demand issues and options for oil and oil products; (d) pricing and energy efficiency issues; and (e) a summary and discussion of the government's energy strategy.

Energy Sector Background

Uruguay does not possess great energy resources. Local energy is limited to hydropower and biomass and other RE; however, the former has been practically developed in its entirety and the latter entails relatively high costs. Therefore, the country is dependent on imports for a large part of its supply of modern primary energy. The issue is whether to depend on trade for supplies of secondary energy, for example, should electricity be produced in Uruguay with an imported resource such as coal or natural gas, or should it be imported from a neighboring country.

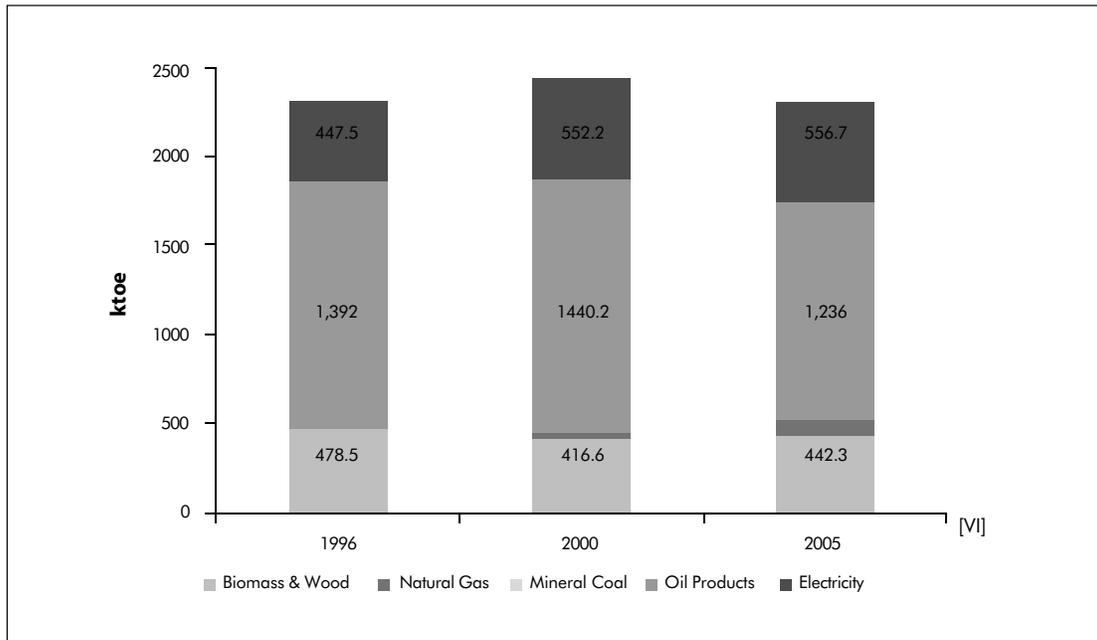
Despite the dearth in natural energy resources, there may be possibilities for increasing supply. In the case of hydroelectricity, the potential is well known,³ but the same may not be true for the oil sector. Although the country has always depended on imports to feed its refinery, it possesses sedimentary basins where oil exploration could yield positive results. Exploration has not taken place because the primary indications have not been optimistic; however, as in many other countries, high oil prices and modern drilling technology have become an incentive to search for oil deposits in areas which had been neglected until now.

² Héctor Pistonesi and César Chávez.

³ Including medium-sized projects on the Rio Negro (80-160 Mega Watt (s) (MW) Isla Gonzalez project, 70 MW Villa Darwin project) or binational projects with Argentina (Salto Grande expansion) and Brazil (Paso Centurion and Talavera projects), as well as a total of 200 MW of smaller projects in Uruguay. However, all these projects have high generation costs (above US\$90/Mega Watt (s) hour [MWh]).

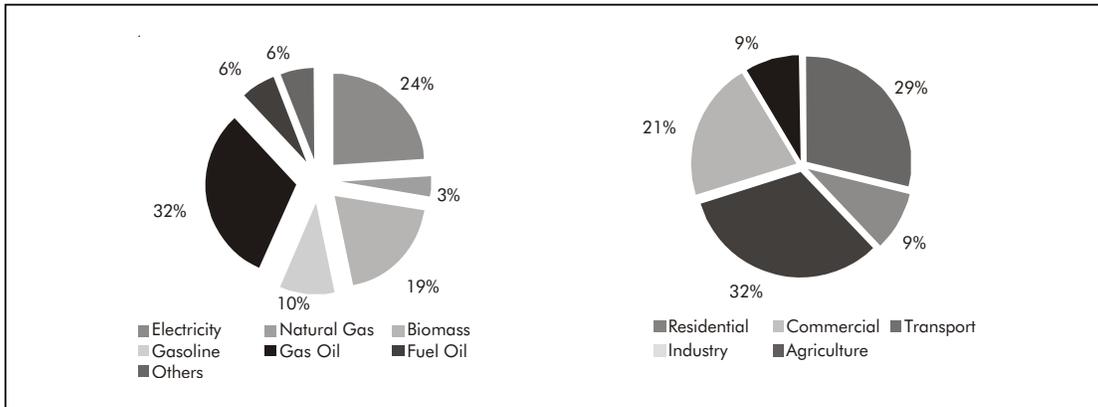
Uruguay has a relatively modest demand for energy. Energy demand in Uruguay is relatively low on a per capita basis compared to other Latin American countries. While Argentina and Chile consume about 1,000 and 1,200 Ton Per Oil Equivalent (toe) per habitant per year respectively, Uruguay consumption is only about 600 toe per capita per year. This is in contrast to its per capita income, which is among the highest in the region. The discrepancy between these two factors may be explained because of a lack of energy-intensive industries in Uruguay, as well as relatively high energy prices compared to the region. Figure 1 shows the evolution of final energy consumption. One can observe the growing participation of electricity, the predominant role of petroleum products, the limited contribution of natural gas and the still important role of biomass energy.

Figure 1: Final Energy Consumption, by Source of Energy



Source: DNETN.

Oil products constitute the major element of energy demand. Oil products account for 51 percent of the total energy demand, followed by electricity (24 percent), biomass (19 percent) and natural gas (3.5 percent). Within demand subsectors, transport accounts for over 32 percent of the total consumption, followed by the residential subsector (29 percent), industry (21 percent) and the commercial subsector (9 percent) as shown in Figure 2. The relatively low participation of industry confirms the low energy consumption pointed out above.

Figure 2: Energy Demand by Energy Source and by Sector, 2005

Source: DNETN.

The energy sector exhibits a predominant public sector presence. The Ministry of Industry, Energy and Mining (MIEM), through its DNETN, is the principal government authority in the sector. Other agents and authorities include:

- ANCAP imports, stores and refines all crude oil and oil products and sells in bulk to distribution companies. The company has a refinery with a 50,000 Barrels (bbl)/day capacity and it also has a downstream presence through its participation in companies which distribute natural gas, propane and liquid fuels, as well as through its presence in the transport of natural gas;
- UTE concentrates its activities on generation, transport and distribution of electricity, including imports and participation in the Salto Grande binational project. Although UTE has no legal monopoly, it has a de facto monopoly on power sector activities;
- URSEA, an agency within the executive branch, regulates operations in electricity, natural gas, oil products, water and sanitation. Besides, URSEA advises the executive on concessions and market rules, and has functions of consumer protection; and
- ADME is nominally the power system's dispatcher and clearing house; however, UTE continues to operate the market and to dispatch the production facilities.

Despite the above, there is a significant private sector presence in the oil subsector.

Private sector companies are present in the distribution of natural gas (Petrobras); there is also private sector participation in natural gas transport, for example, in the Gas del Sur pipeline (British Gas group, Pan American Energy, Wintershall), in association with ANCAP. In addition, several private companies participate in the distribution of liquid fuels – Esso, Texaco and Petrobras operate 60 percent of the country's gas stations.

Issues and Options in the Energy Sector

Several issues in the energy sector put at risk the security of supply and the efficiency in energy demand and supply. These issues include mainly: the vulnerability of electricity supply to external factors; the unconsolidated regulatory and institutional framework in the electricity sector; the obstacles to the development of the electricity and gas regional markets; the low penetration of natural gas in the energy matrix; the lack of transparency in electricity prices; the limited incentives for development of Renewable Energies (REs); the dieselization of the automotive stock; the high fuel prices compared to regional prices; and the prospects for further improving governance and management of State monopolies in the energy sector. The causes and consequences of these sector issues are summarized in Table 1 and are analyzed in greater detail in the rest of this section, which also identifies policy options to address sector issues.

Table 1: Synthesis of Critical Aspects in the Energy Sector

<i>Critical Aspect</i>	<i>Causes</i>	<i>Consequences</i>
Vulnerability of electricity supply to uncontrollable factors	<ul style="list-style-type: none"> • Dependence on hydro generation without seasonal water storage • Lack of firm contracts for purchase of electricity and gas from Argentina due to energy crisis in that country • Lack of diversification of energy sources 	<ul style="list-style-type: none"> • Compromises certainty of electricity and gas domestic supply • Lack of trust in the regional market and higher supply costs • Costly emergency/back-up solutions • Risk of energy rationing with social, economic and political impacts
Unconsolidated regulatory and institutional framework of the electric sector	<ul style="list-style-type: none"> • Assumptions for the power market model not fulfilled (demise of regional markets) • Argentina's economic crisis in 2002 and energy difficulties since 2004 	<ul style="list-style-type: none"> • Weakening of new institutions for power market regulation and administration • Lack of incentives for development of independent or cogeneration projects
Power wholesale market model established by law is not applied	<ul style="list-style-type: none"> • Economic crisis in Uruguay • Undefined market development strategy • Doubts on convenience of model 	<ul style="list-style-type: none"> • Obstacles to Uruguay's insertion in regional energy markets

<i>Critical Aspect</i>	<i>Causes</i>	<i>Consequences</i>
Necessary transition to the new electricity tariff scheme	<ul style="list-style-type: none"> • DNETN's lack of operative capacity • Good public perception of UTE's performance and good quality of electricity service 	<ul style="list-style-type: none"> • Private investors avoid assuming risks and prefer direct electricity sales to UTE guaranteed by the State • Lack of incentives for UTE to improve its efficiency • Higher costs of energy supply in the medium- and long-terms
Obstacles to the development of electricity and gas regional markets	<ul style="list-style-type: none"> • Energy difficulties in Argentina • Lack of trust in regional market as firm back-up to meet demand of electricity and gas 	<ul style="list-style-type: none"> • Higher costs of energy supply • No advantage taken of benefits of natural gas as a clean fuel vs. fuel oil and gas oil
Low penetration of natural gas in the energy matrix	<ul style="list-style-type: none"> • Limitations of power interconnection with Brazil • Low electric tariffs in the industrial sector 	
Lack of transparency in electricity prices	<ul style="list-style-type: none"> • No application of distribution and transmission calculated prices (VAT and VADE) • Cost-plus system for tariff-setting upon UTE's proposal 	<ul style="list-style-type: none"> • High final prices and/or doubts in this respect
Limited incentives for development of renewable energies	<ul style="list-style-type: none"> • Costs of these alternative sources • Limited potential in Uruguay 	<ul style="list-style-type: none"> • Greater vulnerability to volatility of hydrology and prices of imported fuels
Dieselization of automotive stock	<ul style="list-style-type: none"> • Distorted fuel tax structure resulting in lower retail prices for diesel than for gasoline • GoU strategy of support to hauling and industrial sectors 	<ul style="list-style-type: none"> • Higher cost of imported crude (light crude to maximize diesel production) • Excess production of relatively low value gasoline in refinery (due to surpluses of gasoline production at regional level) • Increased environmental pollution
High fuel prices compared to regional prices	<ul style="list-style-type: none"> • Fiscal objectives • Possible efficiency gains in the fuel chain 	<ul style="list-style-type: none"> • Discourages efficient substitution of fuels

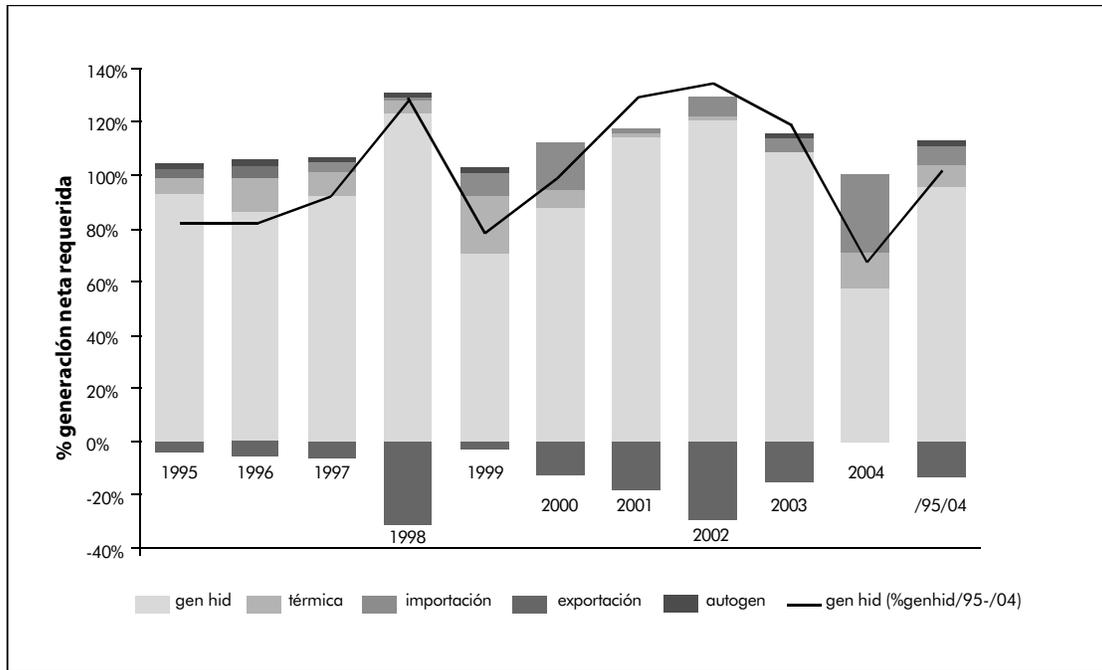
<i>Critical Aspect</i>	<i>Causes</i>	<i>Consequences</i>
Prospects for further improving governance and management of State monopolies in the energy sector	<ul style="list-style-type: none"> • Incomplete separation of policy, regulation and operational functions in the sector • State monopolies (de facto or de jure) with insufficient transparency and incentives to increase efficiency • Good public perception of UTE and ANCAP's performance and service quality 	<ul style="list-style-type: none"> • Consumers pay higher prices than they should • UTE at a disadvantage to compete in regional power market

Electricity and Natural Gas

The power system exhibits characteristics and issues of hydro-based generation.

In quantitative terms, maximum demand to the order of 1,500 MW is met with a generation system of around 2,200 MW capacity. The apparently wide reserve margin conceals the vulnerability to hydrology – as 70 percent of installed capacity is hydro – with important fluctuations in hydropower generation; in dry years (1999 and 2004, for instance) it was necessary to import up to 30 percent of the demand. In 2004 and 2005, the system depended on purchases in Argentina's and Brazil's market, with some degree of uncertainty and impacts in terms of system vulnerability. For these reasons, a secure, sufficient and reliable power supply has become a priority objective of energy policy.

For a full decade no power capacity was added to the power system. Until the incorporation of the 100 MW Punta del Tigre diesel power plant in August 2005, UTE added its last power station to the system in 1995 (last unit of the Salto Grande binational project) following the installation of La Tablada gas turbine in 1991. The absence of commissioning of new production facilities during this extended period was the product of a conscious, strategic decision to take advantage of market developments in Argentina and in the region, which would allow imports to supply shortfalls which might occur in Uruguay, while exporting hydropower surplus production to Argentina and Brazil during wet years (Figure 3).

Figure 3: Electricity Production, by Source

Source: DNETN.

Dependence on imports from Argentina started facing difficulties in 2004. Before 2004, UTE was able to supply its demand growth through a combination of contracts and purchases on the Argentinean spot market. As a result of the Argentine energy difficulties, UTE's contracts with Argentina for firm supply of 365 Mega Watt (s) (MW) were reduced to 150 MW and are not expected to be extended beyond 2007. Notwithstanding this forced reduction in supply contracts from Argentina over the low hydrology period of 2004-06, UTE was able to maintain energy imports through a noticeable increase of imports from Brazil (Table 2) and purchase of energy from the Argentine spot market.

It should be noted that the average price of imported energy has been lower than US\$26.5/ Mega Watt (s) Per Hour (MWh) in recent years, which reflects attractive prices in the spot market and a rather favorable price of the energy purchasing contract with the Güemes plant in Argentina (of less than US\$25/MWh). This means that during the years 2004 and 2005, Uruguay obtained some back-up energy from the regional market at prices far below the costs of thermal generation in Uruguay, having benefited from low prices in the Argentine spot market and from hydraulic surpluses in the Brazilian system.

Table 2: Electricity Imports

Year	Argentina	Brazil Average MW	Total	Average Price US\$/MWh
1999	81	0	81	
2000	152	0	152	
2001	13	1	14	
2002	64	0	64	
2003	50	0	50	12.2
2004	221	47	268	22.0
2005	95	86	181	26.2

Source: DNETN.

Power sector reform of 1997; the standard reform model was put in place. In 1997, the national electricity law was updated following the principles of the so-called “standard model,” which contemplated the separation of regulatory/governance functions from corporate functions, and put in place the regulatory agency URSEA and a market administrator ADME. The reform contemplated the remuneration of generators in order of merit, the creation of a wholesale market with regulated prices in those activities where competition was not possible (Transmission and Distribution [T&D]).

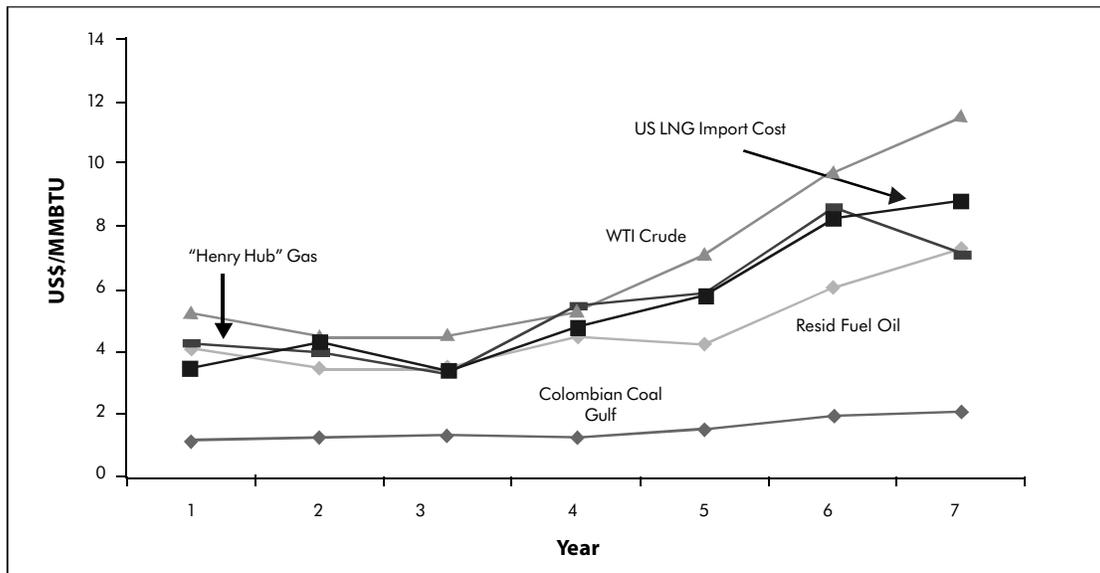
The reform has not been effectively implemented. After passing the modifications to the electricity law, secondary legislation was not forthcoming and the system continued to operate without any significant change. The new model was regulated in 2002 and it was expected that new operators would enter into a competitive market. The market did not develop as planned and demand actually decreased due to the economic crisis in the region. For instance, natural gas provision, which could have supplied new power generating units, did not materialize and, to this day, the existing gas pipelines between Argentina and Uruguay are underutilized. Although URSEA and ADME were established, to this day, they cannot fulfill most of the functions established in their mandate, especially in the case of ADME (power system dispatch and market administration).

Policy options to ensure energy security include back-up thermal generation in Uruguay, the strengthening of the regional electricity market, the expansion of interconnection capacity

with Brazil, the development of renewable sources, the development of an efficient market of electric energy and the strengthening of the electric institutional and regulatory framework. A detailed evaluation of power capacity expansion alternatives should be conducted to assess their respective economic and environmental merits over the long term, based on different fuel price assumptions and with a probabilistic evaluation of supply risks entailed in each alternative.

The type of fuel is the determining factor regarding new thermal generation. For example, the use of mineral coal for electric generation can reduce uncertainty of supply and the vulnerability to the volatility of prices, because the international market for this resource is large and diverse, with multiple suppliers and ample reserves (Figure 4).

Figure 4: Evolution of Fuel Prices (2000-June 2006)



Source: WB, LCR Energy Strategy Study, January 2007.

Prospects for the use of mineral coal for electric generation. "Clean coal" technologies have been developed, which improve the environmental performance of coal and allow for compliance with internationally accepted environmental norms. There is ample supply for Uruguay of high quality bituminous coal (sulfur content less than 1 percent) from South Africa, Australia and Colombia. The average generation cost of a 300 MW basic unit, without including investments at port, would fluctuate between US\$40 and 50/MWh, with a monthly consumption of 60,000 tons of coal, delivered at prices between US\$1.8-2.7/MMBTU equivalent. As there are no ports in Uruguay to harbor bulk ships of appropriate size, it is necessary to make a detailed study of the plant site, to determine

additional costs of investments in port facilities, transport and handling of the coal and equipment to mitigate the environmental impact. Table 3 shows the compared costs of thermal generation in a recent study. The relative advantage of conventional coal shown in this Table is partly offset by the additional costs incurred in port facilities. Nevertheless, coal-based generation would seem to remain a viable alternative for an energy-poor country like Uruguay.

Table 3: Estimates of Thermal-generating Costs for 300 MW Units of Competing Fuels (US¢/kWh, 2005)

<i>Technology</i>	<i>Capacity Cost</i>	<i>Fixed O&M</i>	<i>Var. O&M</i>	<i>Fuel Cost</i>	<i>Total Cost³</i>
Residual Oil-Steam	1.27	0.35	0.30	5.32	7.24
CCGT ¹ -Gas	0.95	0.10	0.40	4.12	5.57
Coal (Sub. Crit. Steam)	1.76	0.38	0.36	1.97	4.47
Coal IGCC ²	2.49	0.90	0.21	1.79	5.39

¹ Combined Cycle Gas Turbine.

² Integrated Gasification Combined Cycle.

³ Assuming the following prices for primary energy: crude oil US\$30/bbl; coal US\$32/ton; natural gas US\$3.9/MMBTU.

Source: Technical and economic assessment: off-grid, mini-grid and grid electrification technologies. Summary Report, World Bank, November 2005.

Importing LNG is an expensive option. LNG imports have been adopted as an option in other countries, notably Chile within the Southern Cone. However, this does not seem to be a practical or economically viable solution, because the size of the Uruguayan market will not warrant the level of investment for it to become a realistic alternative. LNG prices are associated with the “Henry Hub” price of gas in the United States, which is expected to be around US\$7 to US\$8/MMBTU; in addition to the base price, a transport premium of US\$1-2/MMBTU would yield delivered prices on the order of US\$8-10/MMBTU, hence, variable production costs of around US\$55-70/MWh which would hardly be competitive with other options.

Importing more natural gas is a realistic possibility in the medium term. The gas pipelines are in place and have spare capacity. However, the dependence on Argentinean contracts which broke down during the economic crisis requires that any alternative of this type be considered within a regional perspective. The large regional reserves are in Bolivia, which has a small domestic market and must, therefore, turn to exports to profit from its resource. The first steps have been taken in a recent agreement between Argentina and

Bolivia, for a minimum offtake of 27Mm³/day, during 20 years, at the initial price of US\$5/MMBTU. Natural gas generation would appear to be the energy alternative with the lowest overall cost; the reactivation of Argentine production, together with production increases in Brazil, would point toward this option as the most convenient one to foster in the short- and medium-term. Electricity production using imported natural gas in the range of US\$4-6/MMBTU would yield total costs on the order of US\$45-55/MWh.

Another promising possibility is to import electricity. The energy difficulties in Argentina had a negative impact in Uruguay, leading to a crisis of confidence in the regional energy market as a reliable source of steady supply to meet the domestic demand. Yet, the strengthening of the regional electricity market and the expansion of the interconnection with Brazil are fundamental options for the supply of the Uruguayan market, given its geographic location. Uruguay recognizes the importance and the benefits of occasional exchanges of electricity to optimize the operation of the Uruguayan electrical system and provide assistance in case of low hydrology and emergency situations. The factors associated with the economic crisis and energy difficulties in Argentina, as mentioned above, should not discourage the efforts to achieve a regional electricity market: the experience in the development of the domestic electricity market in the European Union (EU) illustrates the process. Although slow in the region so far, it should begin to consolidate through the adoption of basic principles like reciprocity, nondiscrimination, the opening of the market to large consumers, a transparent balance market, open access to transmission networks and independence of the system operator.

Interconnecting with Brazil could be particularly attractive. The expansion of the interconnection capacity with Brazil may be carried out either along the Coast or from Salto Grande. This expansion would contribute to diversifying the supply sources and could be done in order to take advantage of the installation of large thermal (coal) plants in the South of Brazil (Candiota). Imports will take place when marginal costs in Brazil are lower than marginal costs in Uruguay, that is, to substitute expensive or inefficient generation in diesel or fuel oil-based plants,⁴ with cheaper hydropower or thermal energy from Brazil. Even if the electricity trade with Brazil could initially be developed independently from the regional market, it would obviously integrate into it in the medium term.

Renewables could play a role in future energy supply, in particular wind power. REs – wind or biomass, in particular – are an option which could contribute to reduce dependence on imported energy in Uruguay. To cover their additional costs, the development of energies could be promoted through incentives for project developers, which would be

⁴ For instance, in the La Tablada power plant (US\$230/MWh), Battle power plant (US\$105/MWh) or the new Punta del Tigre diesel power plant (US\$135/MWh), at current fuel prices.

justified on the grounds of associated environmental benefits which would accrue to Uruguayans. International experience offers a wide range of possibilities to promote these projects (essentially through fiscal incentives and/or tariff or capital subsidies), which may be competitive with natural gas combined cycle or coal power plants. In Uruguay, the wind resource has favorable characteristics, but its cost – estimated at US\$45-50/MWh for large projects (50-100 MW), assuming average wind speed of 10 Miles Per Second (m/s) and a capacity factor of 40 percent – is still uncertain, highly site-dependent and calls for more precise project assessments. Consequently, the estimated wind potential of 600 MW cannot yet be taken as a feasible value, from an economic standpoint. It is, however, advisable to continue developing small projects on the order of 10-30 MW to acquire experience with this resource which has seen an extraordinary growth in other countries.

Biomass is another renewable option. Biomass offers attractive renewable sources such as rice husk, whose volume could generate up to 20 MW at competitive prices; firewood has already been used as a substitute for fuel oil in the 80s and cellulose projects expect to generate up to 65 MW for sales to the network. Although biomass-based power generation is unlikely to become a core component of electricity supply, it does have a significant role within the spectrum of energy supply alternatives.

Instruments to foster RE investment. Two main types of (mutually exclusive) instruments are used worldwide to provide incentives for investment in large RE projects: (i) price-defined targets (generally known as feed-in laws⁵) where the price is determined and the market sets the amount of generation; these are used mostly in Europe (Austria, France, Denmark, Germany and Spain); and (ii) quantity-defined targets (including the Renewable Portfolio Standard [RPS] and tendering systems⁶) where the amount of generation is determined and the market sets the price – these are used in the United States and in Europe (Italy, Sweden, the Netherlands and the United Kingdom). In 2001, direct support for renewable electricity supply in Europe was ranging between US¢2_(v2)-7 per Kilowatt-hour (s) (kWh).⁷ Financial incentives, such as tax breaks, accelerated depreciation, upfront investment subsidies and so on, are also often used in addition to these above instruments, which are compared in Table 4.

⁵ Under feed-in laws, the government mandates a price at which utilities must take power from eligible renewable generators under long-term contracts (15-20 years) and pass the resulting costs to their consumers. There are three methods of setting price: (i) Estimated long-term cost of project including reasonable return on investment; (ii) Wholesale avoided cost of power; and (iii) Percent of retail electricity price. There is generally no cap on the amount of capacity receiving the subsidy.

⁶ Under an RPS system, electricity suppliers are required to obtain a certain amount of their electricity (specified in terms of either Kilo Watt (s) Per Hour kWh or Kilo Watt (s) kW) from RE sources. Least-cost acquisition to meet required targets is typically left to market mechanisms, with utilities either producing their own power, procuring it directly or by engaging in purchase of "Green Certificates" representing qualifying Renewable Energy (RE) power produced by another supplier. Such a certificate approach can facilitate cost-effective transactions across utilities or regions with differing abilities and RE resource. Under tendering schemes, the regulator or government calls for competitive bids from private developers to build capacity up to a predefined level, normally stated in terms of installed capacity. Developers providing the least-cost bid or bids receive funds to make up the difference between their bid cost and the market price of electricity.

⁷ Average weighed subsidy between all renewable sources (wind, photovoltaic (PV), biomass and hydro).

Table 4: Instruments for Fostering Renewable Energy Investment

	Quantity of RE Development	Cost/Price Reduction	Resource Diversity	Market Sustainability	Local Industry Development	Investor Certainty	Simplicity
Feed-in Laws	Large amounts of RE in short time	Cost-efficient if the tariff is periodically and wisely adjusted	Excellent	Technically and economically sustainable	Excellent	Can reduce investor risk with price guarantee and PPA	Most simple to design, administer, enforce, contract
RPS	If enforced, can meet realistic targets	RPS and tendering best at reducing cost and price with competitive bidding	Favor least-cost technologies	Technically and economically sustainable	Favor least-cost technologies and established industry players	Lack of price certainty difficult for investors/PPA can reduce risk	More complex to design and administer, complex for generators
Tendering	Related only to quantity RE established by process	Good at reducing cost	Favor least-cost technologies	Tied to resource planning process; sustainable if planning supported, stable funding	Favor least-cost technologies and established industry players	Can provide certainty if well designed (more risk than feed-in)	More complex than feed-in, simpler than RPS

Source: ESMAP Renewable Energy Policy Forum, Proceedings – August 2006.

The government has taken action to promote RE development. In March 2006, the executive power issued a decree to foster private generation through wind, biomass and small hydropower plants. A target of 60 MW (20 MW for each of the three RE sources) was established for the first bidding which was conducted by UTE in August 2006. Although bids received for wind and biomass projects were all higher than US\$70/MWh, this can be attributed to the small size of the proposed projects and the uncertainty of contractual arrangements.

A strategic line emerges for the power sector from the above considerations. There are evidently many options to consider and a full-blown power expansion plan lies outside the context and resources of this study. However, some strategic elements emerge (with the caveat that they still require greater quantification), such as:

- A balanced strategy which ensures that energy security is likely to consist of a combination of back-up production in Uruguay and market strengthening both in electricity and natural gas;
- Back-up production in Uruguay could consist of either gas turbines (open- or combined-cycle according to expected plant factor) or – if a base load plant is required – a coal-based power station; further feasibility analyses are required to make a final choice;
- Whatever the back-up production option in Uruguay, benefiting from trade of electricity becomes an essential strategic element; this requires seeking greater integration within Southern Cone markets as well as investments in interconnection facilities;
- An interconnection with Brazil would diversify sources of supply and would be consistent with trading benefits; quantifying the economics of this option is a priority within the overall strategy; and
- Supporting RE through incentive mechanisms is a sensible course of action which would help to gain greater familiarity with the resources and would provide diversification of supply.

An integral strategy requires an institutional strengthening component. The strengthening of the institutional and regulatory context is seen as an essential element in the long term, to ensure consistency in policy formulation, in regulation and in the management of energy corporations such as UTE and ANCAP. The separation of functions and the establishment of a more competitive market would facilitate the insertion of the Uruguayan power sector into the regional electricity market and would promote private participation in future generation projects. This requires strengthening and consolidating government and regulation entities (DNETN, URSEA, ADME).

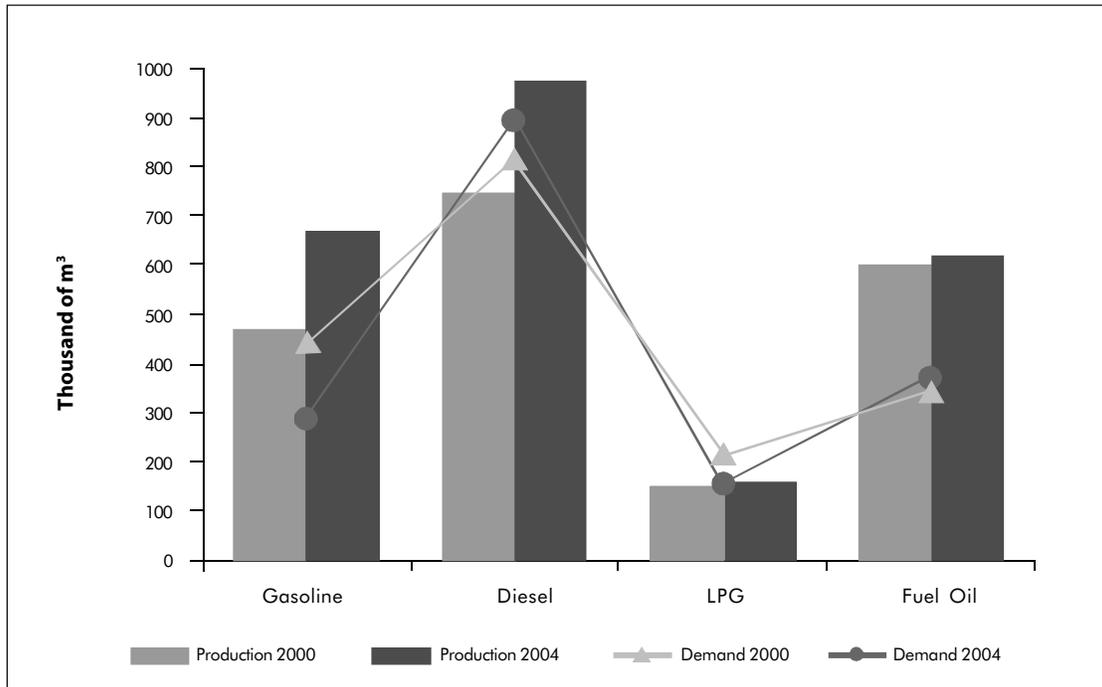
A gradual approach to power sector reform implementation appears to be a sensible option. This study proposes a gradual implementation of the power market, starting from a very simple model in the short term, in which UTE operates as a main buyer of energy and system operator, continuing with an orderly transition, to reach a medium term with ADME as system operator, together with a domestic spot and contract market, with a strengthened UTE which would compete in the regional market.

Crude Oil and Oil Products

Strategic questions associated with crude oil and refined products are less complex than those associated with electricity. ANCAP imports crude oil through international public tenders, paid at market prices, to feed its refinery. It also imports oil products, mainly gas oil and fuel oil. The sector has an increasingly prominent position, especially due to its participation in total country imports, which has grown along with the increase in international prices. From 14 percent of total imports in 2002, the oil participation went to 21 percent in 2005, hence the need to optimize the few controllable variables in the process of imports, production and wholesale distribution by ANCAP.

Despite the absence of oil production, it is worthwhile promoting exploration activities. The country has five sedimentary basins, both onshore and on the continental shelf. The latter are those which have generated greater expectations and, under existing commercial conditions, private sector interest is likely to develop. Updating the available information through seismic studies is a requisite for exploring these possibilities. The existing legal framework is flexible enough to accommodate investors once the updated information can be submitted to them regarding the best areas.

The oil refinery's feedstock should be optimized and the refinery should be able to process heavy crude. Adapting the refinery to the processing of heavy crude oil from Venezuela would diversify the sources of energy and reduce costs. Throughout the world, the demand for light crude has increased owing to the growing demand of gasoline; as a result, the price of heavy crude has dropped in relative terms and it could be processed in Uruguay, thus reducing the cost of feedstock imports. Additionally, the refinery has increased its gas oil production due to the dieselization of the automotive fleet; as a consequence, there is currently an imbalance between the supply of refined products and demand (Figure 5), which forces the exportation of gasoline surpluses of lower value in the market. However, a detailed assessment of the proposed upgrading and expansion of the refinery should be conducted, based on an evaluation of the domestic market and of the foreign market to dispose off surplus products from this project.

Figure 5: Relationship between Production and Demand of Oil Products

Source: DNETN.

Biofuels should also be promoted. In the case of Uruguay, biofuels are an interesting option to reduce dependence on imported energy and diversify the sources of supply. In 2002, Law 17.567 declared the local production of biofuels of national interest and empowered the Executive Power to grant significant fiscal benefits to biofuels – though the law has yet to be regulated, including the quantification of fiscal benefits. Additional subsidies (justified on the grounds of environmental externalities of fossil fuels) will probably be needed, especially in the case of biodiesel which would require an oil price of around US\$80-90/bbl to be financially viable, while ethanol production would be viable at oil prices around US\$60/bbl. Table 5 shows typical costs of biofuels for different countries and feedstock. A detailed economic assessment of benefits and impacts for the concerned sectors (energy, agriculture and environment) should be conducted in Uruguay to allow further policy decisions on the promotion of biofuels.

Table 5: Typical Costs of Biofuels, 2002

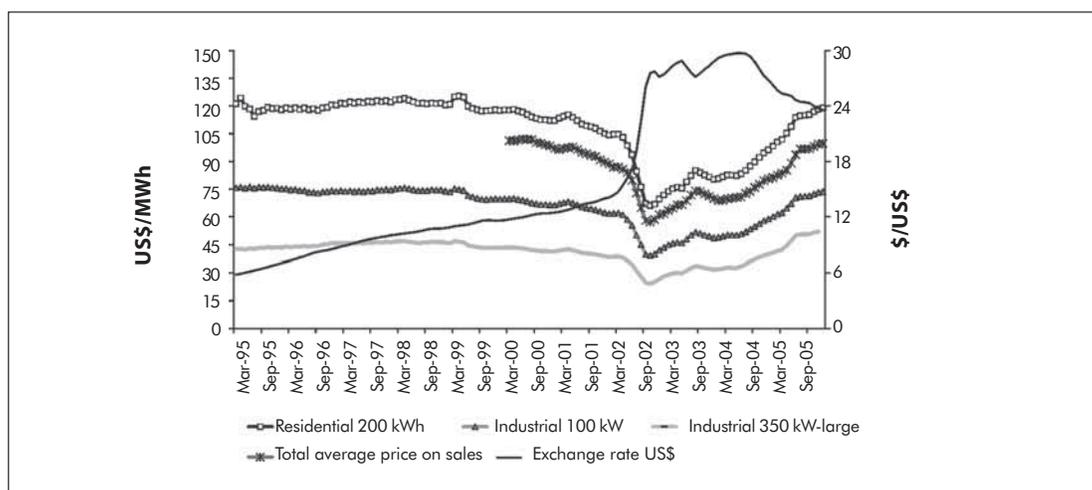
Fuels	Raw Material	Place	US\$/Liter
Biodiesel	Oleaginous	United States	0.50
	Oleaginous	European Union	0.62
Ethanol	Sugarcane	Brazil	0.19
	Wheat	United States	0.23
	Corn	European Union	0.45
	Sugar Beetroot	European Union	0.51

Source: AEA Technology 2003/ESMAP Report 2005.

Note: In December 2006, the retail prices of premium gasoline and diesel in Uruguay were US\$1.26 and US\$0.9 per Liter (lt), respectively.

Energy Pricing

Pricing is an integral element of the energy strategy. The controllable prices of some products are an integral element of any energy strategy, since they influence the level of demand and substitutions among sources of energy. In the case of electricity, the 1997 Law establishes that the rates should reflect economic costs under efficient conditions. The economic recession and its effects on the exchange rate led to a significant reduction in the price of electricity, rated in US\$, which has only recently recovered its prerecession value (Figure 6).

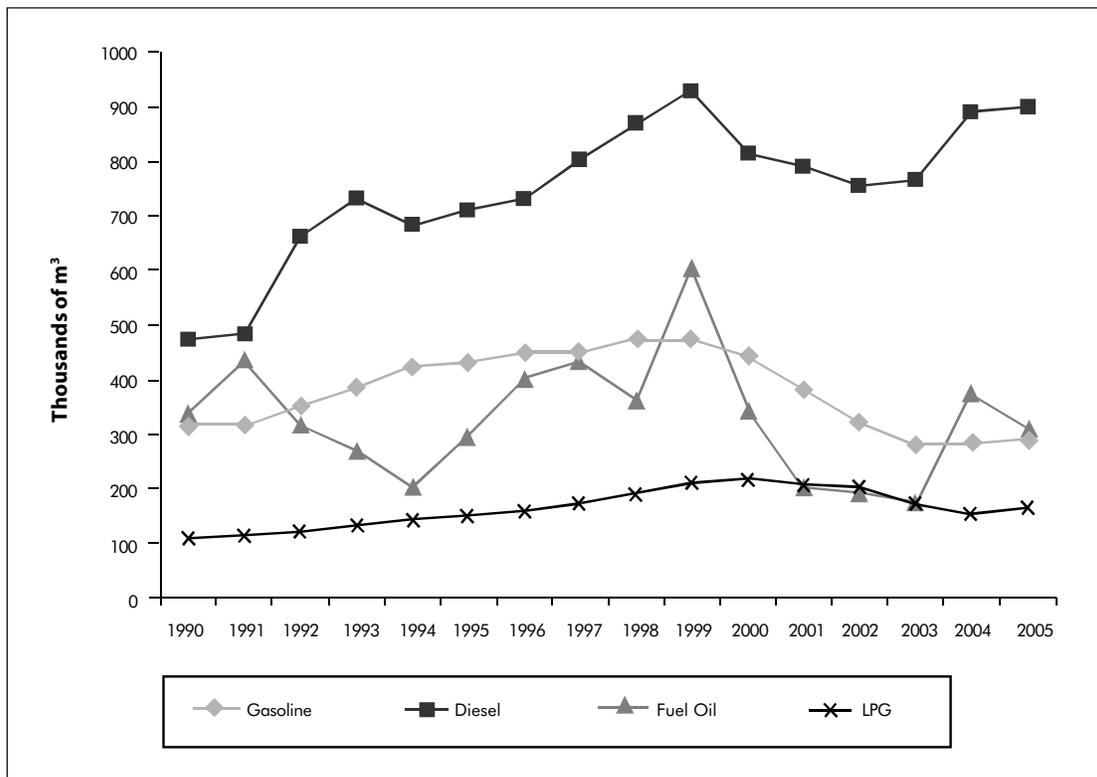
Figure 6: Electricity Prices, 1995-2005

Source: DNETN.

Electricity prices have recovered, but there are distortions among categories. Different calculations indicate that the methodology used to calculate reference costs undervalues supply costs at the generation level, and overvalues them at the T&D levels. This reflects in a greater measure on large consumer tariffs which are being adjusted at a higher rate than low voltage ones. In any case, an efficiency-oriented strategy requires that tariffs be adjusted to economic levels and be regulated by URSEA. This is one of the first and most important questions to address in implementing the reform.

Low diesel pricing has led to a distorted consumption pattern. In the case of oil products, an important consideration arises regarding the so-called dieselization of the automotive fleet; its consumption has grown as a consequence of a favorable tax structure as compared to gasoline. As shown in Figure 7, diesel consumption has grown by around 80 percent between 1990 and 2005, whereas gasoline consumption is at the same level for the same period. As pointed out before, this increases the cost structure of crude and leads to exportation of gasoline at depressed prices. It is clear that this policy needs to be reviewed, to reduce such distortions.

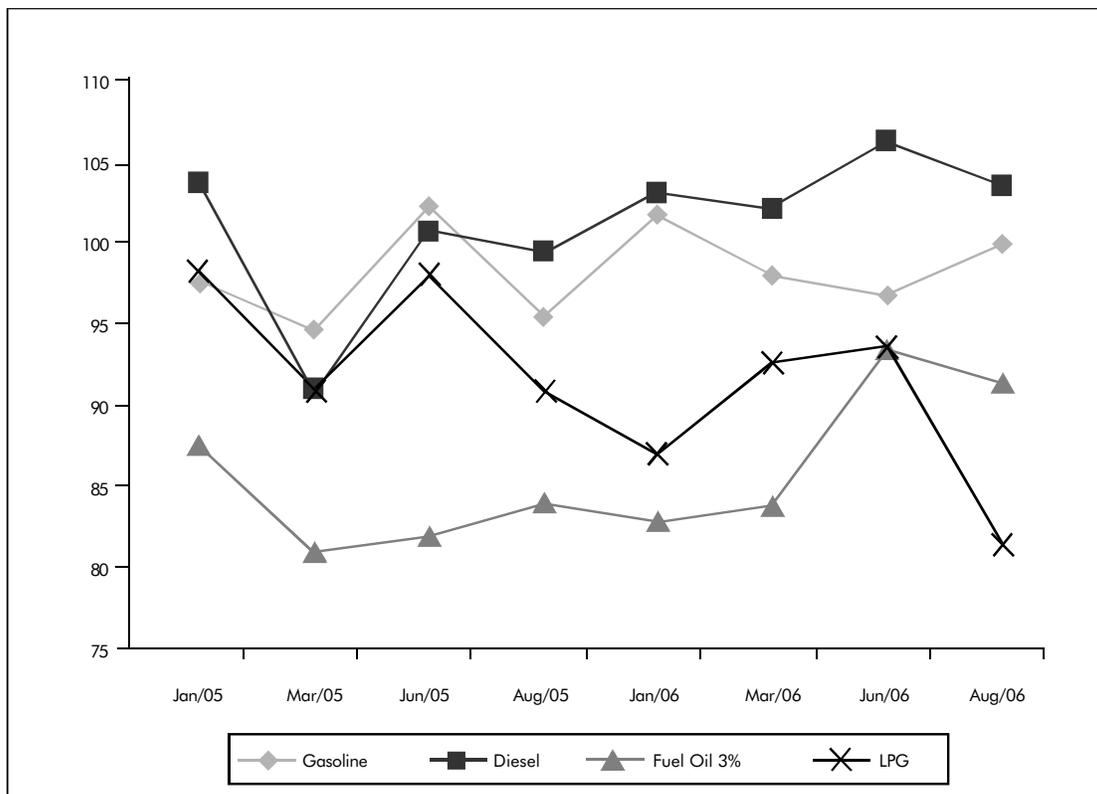
Figure 7: Evolution of the Domestic Consumption of Oil Products (Thousands of m³)



Source: DNETN.

Prices for oil products in Uruguay are the highest in the region. Additional analysis is required to be able to achieve prices for oil products – set by government – which are economically justified. The tax burden and its differential application to substitute products (gasoline and diesel), and the cost of distribution, could be too high. In any case, it is a cause of concern that the prices of by-products, though fluctuating around the importation parity prices, as shown in Figure 8, are the highest in the region (Table 6), and it would be advisable to revise the procedures for price-setting with the aim of achieving greater transparency and achieving efficiency gains in the fuel chain (imports, refining, wholesale and distribution). Such a review of the petroleum downstream sector would also evaluate the economics of the refinery and compare its viability over the longer run – with and without the proposed upgrading – to the products' importation option.

Figure 8: Relationship between Tax-free Domestic Fuel Prices and Import Parity Prices, in Percentage



Source: URSEA.

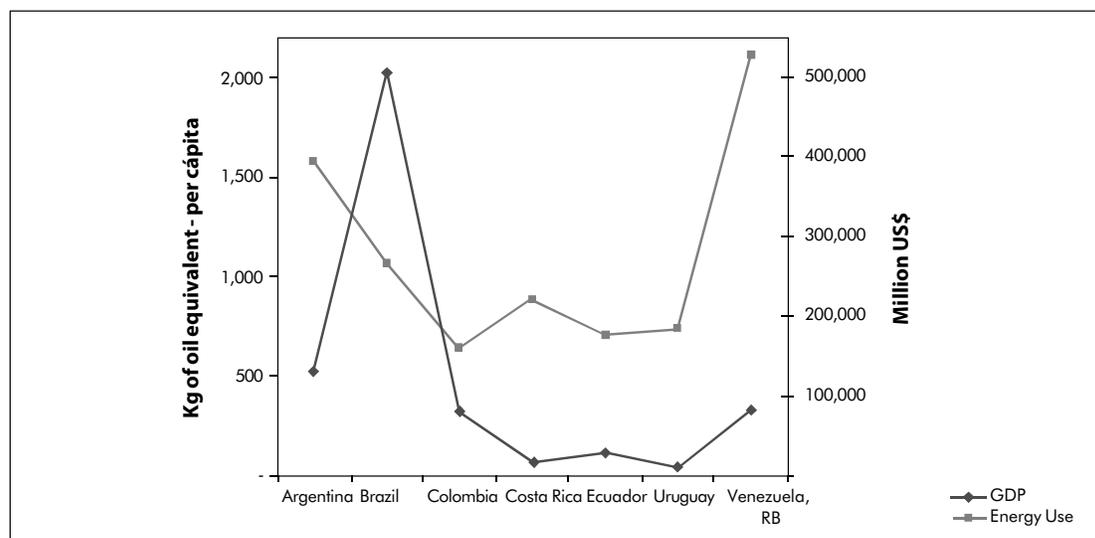
Table 6: Compared Prices of Oil Products (US\$/lt) as of May 2005

Product	Uruguay	Argentina (*)	Brazil	Chile	Paraguay
Regular Gasoline	1.10	0.58		0.96	0.54
Premium Gasoline	1.17	0.64	0.92	0.98	0.71
Diesel Fuel	0.74	0.49	0.67	0.69	0.62

*February 2005.

Energy Efficiency

Energy efficiency is becoming an increasingly important factor as a strategic element. Although Uruguay has a relatively low energy intensity (Figure 9), there is an important potential for savings in the industrial, commercial, residential and governmental sectors. In the industry sector, it is estimated that 5 percent of the total electric consumption, which, together with an important cogeneration potential, is equivalent to 21 percent of the total industrial electric consumption. In the other sectors, the improvements in efficiency are related mainly to changes in lighting equipment; for example, in the government subsector, there is still a high proportion of inefficient lighting equipment (70 percent mercury lamps, 10 percent incandescent).

Figure 9: Energy Use and GDP in some Latin American Countries

Source: World Bank Indicators, 2003.

GoU is promoting energy efficiency measures. A World Bank-financed energy efficiency project is currently in place, with the participation of DNETN, UTE, ANCAP, URSEA, the Budget and Planning Office (OPP), the technical norms institute (UNIT) and the national environmental agency (DINAMA). The project seeks to: (a) review norms and regulations to promote efficiency measures; (b) establish an equipment Standard and Labeling (S&L) program; (c) disseminate energy efficiency information through courses and campaigns; (d) establish an energy efficiency fund to finance improvements, particularly in the industrial subsector; and (e) promote energy efficiency companies to put in place the measures identified in the project. UTE, in particular, is expected to offer demand management services. The energy efficiency project, besides promoting energy savings, will help to postpone important investments in electricity generation facilities, reduce oil and natural gas imports and limit the carbon dioxide (CO₂) emissions associated with thermal generation. It is expected that during its six years of implementation, the project will produce total savings of 57 Kiloton Per Oil Equivalent (Ktoe), including 7 Ktoe in fuel savings, 6 Ktoe due to cogeneration projects and 44 Ktoe due to more efficient electricity use.

From an energy efficiency perspective, natural gas has a great potential. The region has abundant reserves of natural gas, which could be distributed to Uruguay at very competitive prices once the regional scenario is stabilized. Natural gas could replace fuel oil in the industrial sector and electricity in the residential and commercial sectors. Table 7 illustrates the differences in costs of final energy (under thermal equivalent basis).

Table 7: Comparison of Fuel Costs for Final Users

<i>Fuel</i>	<i>Residential US\$/MBTU</i>	<i>Industrial US\$/MBTU</i>
Natural Gas	20.9	6.6
LPG	25.3	
Electricity	(a)	24.6
	(b)	18.9
Firewood	4.8	2.4
Kerosene	25.4	
Gas Oil	25.8	25.8
Fuel Oil (Heating)	13.2	
Heavy Fuel Oil		10.8

Notes:

Market prices for the second semester of 2005, including taxes.

Exchange rate: 23.5 UR\$/US\$.

(a) Residential Consumption: 400kWh/month. Industrial Consumption: 300 kW and 50 MWh/month.

(b) Industrial Consumption: 350 kW and 100 MWh/month.

Corporate Performance

Despite the lack of competition, UTE has performed reasonably well in its role of providing electricity as a public service, but there is room for improvement. UTE's performance indices are reasonably good, and surveys of consumer satisfaction place it among the top performers in the Latin American region.⁸ However, its operation in the area of collections leave much to be desired, with significant delays on the part of municipalities, as well as its commercial operation, with the level of losses for 2006 estimated at 18 percent. There is, therefore, a lot of ground for improvement in reducing commercial losses.

Something similar occurs in ANCAP, where there is a seemingly high number of employees in relation to the level and amount of activity. The lack of a clear demarcation of normative, regulatory and operational tasks goes against ANCAP's efficiency, although the company has demonstrated its expertise as evidenced by its corporate incursions in the Argentinean market for oil products.

In this context, it is possible to implement measures to improve corporate governance in the State-Owned Enterprises (SOEs), UTE and ANCAP. Such measures would aim at providing incentives for greater efficiency and transparency within the SOEs and could include: (i) subjecting the SOEs to private law by transforming them into limited liability companies (Sociedades Anónimas); (ii) establishing a performance contract between the government and the SOEs, with a time frame to meet efficiency targets, linked to actual tariff and price adjustments; (iii) further strengthening the SOEs' reporting to the public and information on their performance and policies; (iv) taking further steps to instill a commercial culture in the SOEs, for example, by appointing independent directors from successful businesses; (v) requiring the SOEs to borrow from private lenders without the benefit of a government guarantee, to bring to bear the benefits of scrutiny by lenders and credit rating agencies; (vi) listing a minority of the SOEs' shares, to create market information on commercial performance, allow equity-linked compensation and create monitoring by other shareholders; (vii) eliminating any role of the SOEs in the policy and regulatory functions; and (viii) separating responsibility within government for policy and ownership of the SOEs.

Government Strategy and the Way Forward

Between May and August 2006, the GoU and key public stakeholders worked together toward the definition of guidelines for an energy sector strategy, taking into account the inputs from the previous phases of the ESMAP-financed work. As a result, on August 18,

⁸ According to surveys conducted by CIER (Comisión de Integración Eléctrica Regional) in Latin American power utilities.

2006, the MIEM published a document – “Guidelines for an Energy Strategy” – which is presented below.

The key objectives visualized by the government for the energy sector are to: (i) ensure cost-effective supply of domestic demand, with adequate service quality and under the orientation of the State, by maximizing the use of local, regional and RE resources, so as to contribute to Uruguay’s sustainable growth and environment; (ii) promote energy efficiency at supply and demand levels and pursue energy supply diversification and the promotion of clean energy; and (iii) allow sector development and expansion with public and private participation, through the adaptation and development of the legal and regulatory frameworks for the energy sector.

The government guidelines include the following lines of action:

Creation of a robust system of electricity supply at the lowest possible cost

- Establish local back-up of power capacity using diverse technologies and energy sources;
- Seek new ways of international trade and intensify actions for an interconnection with Brazil;
- Formulate, with the intervention of competent entities and the coordination of the MIEM, a reference plan for generation expansion; and
- Establish transmission tolls which are required for contracts between authorized market agents.

Improve ways of access and supply of fossil energy resources to reduce the impact of imported fuels on the national economy

- Foster prospecting of hydrocarbons within Uruguay (for example, studies and exploration on the continental shelf);
- Analyze local potential reservoirs of natural gas;
- Expand the options for crude processing in the refinery;
- Maintain a database on analysis of new energy sources: oil shale, coal, and so on;
- Establish specific lines of work on the consumer matrix of oil refined products (for example, to correct the imbalance between consumption of gas oil and gasoline); and
- Analyze the possibility of incorporating more significant amounts of coal to the country’s energy mix.

Definition on the participation of natural gas in the energy matrix

- Negotiate and put in application the existing gas contract with Argentina for power generation, with the possibility of alternative uses;
- Have an active role in possible multilateral gas pipelines;
- Evaluate other options for energy supply such as Compressed Natural Gas (CNG) and LNG; and
- Study gas pipeline expansion within Uruguay.

Advance significantly the incorporation of renewables (particularly biofuels, wind power and biomass-based power generation)

- Generate specific funds to support the implementation of development policies;
- Systematize and complete an evaluation of the potential of each resource;
- Create a national database and documentation within the DNETN;
- Develop pilot projects for less well-known sources of energy;
- Formulate specific regulatory norms to promote new and renewable sources in the energy system;
- Promote the articulation of productive chains for REs;
- Promote the use of local technological capacity and labor; and
- Consolidate government inter-institutional groups and their exchanges with the private and academic sector.

Consolidation of the energy efficiency policy

- Boost actions in the electric sector which form part of the ongoing energy efficiency project. Expand actions of this project to the hydrocarbons sector;
- Propose and support programs of efficient use of energy in sectors like transport, housing, and so on, as well as a plan to reduce losses in distribution systems; and
- Elaborate a law of energy efficiency as a general framework for long-term actions.

Adaptation of regulatory frameworks

- Prepare the regulatory framework for the gas sector;
- Establish regulation of service and product quality for hydrocarbons and biofuels; and
- Adapt the regulatory framework of the electricity sector by consolidating the roles of URSEA and ADME, developing capacity and efficiency in the public company and setting up the mechanisms for private participation in generation, with emphasis on distributed, renewable and back-up generation.

Increase access of population sectors below the poverty line to the various uses of energy

- Establish a basic energy basket (financed by a specific fund) in coordination with the rest of the social policies;
- Promote and inform about safety and efficient use; and
- Facilitate energy access through the tariff policy.

Articulation and coordination among actors and energy institutions responding to a global vision and supporting the formulation of policies and plans

- Strengthen human and material resources/capacity in the MIEM/DNETN;
- Systematize coordination among the actors and institutions of the sector, both national and international;
- Adopt decisions which consistently attend to the short-, medium- and long-term issues; and
- Take action toward developing a national energy plan.

In the above guidelines, the government successfully put together most of the results of the study. The guidelines are based on sound development objectives for the sector and, overall, they contain adequate actions to reach these objectives. The workshops and internal consultations with public stakeholders allowed to tailor the strategy to the sector's political economy and government priorities. The guidelines should be developed into a full-blown energy strategy, with detailed actions and specific targets to be reached within a given time frame. Ultimately, the strategy would result in the establishment of a national energy policy, through a broad-based consultative process with all sector stakeholders, including the private sector, legislative branch, trade unions (TUs), academic, consumers, civil society and others.

The consensus-building process, which led to the definition of the above guidelines, also resulted in a lack of specificity with respect to important issues in the sector. Such aspects include, for instance: i) the incentives and measures to improve corporate governance and increase efficiency of UTE and ANCAP; ii) the steps and sequence to achieve the insertion of Uruguay in the electricity and gas regional markets, and to develop a local power market, once the situation in Argentina is stabilized and Bolivia's gas exports materialize; iii) the detailed pricing policy for the power sector, which should aim to reflect efficiency costs, so as to achieve the objective of energy supply at the lowest possible cost and generate benefits for consumers and the economy; iv) the design and financing options for targeted subsidies, and the addressing of the tax distortions in the price of fuels; v) the consolidation of the

natural gas market in the medium term in substitution to electricity, fuel oil and diesel; vi) the specific incentives for the development of renewable and clean energy; vii) the consolidation and development of the sector regulatory framework, in parallel with the development of the power and gas markets and the further improvement of service quality; viii) the economic analysis of the upgrade and expansion of the oil refinery, comparing it against the option of importing refined products; and ix) the comparison of alternatives for power expansion through imported fuels – coal, natural gas and LNG – in economic, social and environmental terms. It is expected that these aspects and others would be addressed by the GoU in the preparation of a detailed strategy – leading toward the ultimate definition of a State policy for the energy sector.

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List of Technical Reports

Region/Country	Activity/Report Title	Date	Number
SUB-SAHARAN AFRICA (AFR)			
Africa	Power Trade in Nile Basin Initiative Phase II (CD Only): Part I: Minutes of the High-level Power Experts Meeting; and Part II: Minutes of the First Meeting of the Nile Basin Ministers Responsible for Electricity	04/05	067/05
	Introducing Low-cost Methods in Electricity Distribution Networks	10/06	104/06
Cameroon	Decentralized Rural Electrification Project in Cameroon	01/05	087/05
Chad	Revenue Management Seminar. Oslo, June 25-26, 2003. (CD Only)	06/05	075/05
Côte d'Ivoire	Workshop on Rural Energy and Sustainable Development, January 30-31, 2002. (<i>Atelier sur l'Énergie en régions rurales et le Développement durable 30-31, janvier 2002</i>)	04/05	068/05
Ethiopia	Phase-Out of Leaded Gasoline in Oil Importing Countries of Sub-Saharan Africa: The Case of Ethiopia - Action Plan	12/03	038/03
	Sub-Saharan Petroleum Products Transportation Corridor: Analysis and Case Studies	03/03	033/03
	Phase-Out of Leaded Gasoline in Sub-Saharan Africa	04/02	028/02
	Energy and Poverty: How can Modern Energy Services Contribute to Poverty Reduction	03/03	032/03
East Africa	Sub-Regional Conference on the Phase-out Leaded Gasoline in East Africa. June 5-7, 2002	11/03	044/03
Ghana	Poverty and Social Impact Analysis of Electricity Tariffs	12/05	088/05
	Women Enterprise Study: Developing a Model for Mainstreaming Gender into Modern Energy Service Delivery	03/06	096/06
	Sector Reform and the Poor: Energy Use and Supply in Ghana	03/06	097/06
Kenya	Field Performance Evaluation of Amorphous Silicon (a-Si) Photovoltaic Systems in Kenya: Methods and Measurement in Support of a Sustainable Commercial Solar Energy Industry	08/00	005/00
	The Kenya Portable Battery Pack Experience: Test Marketing an Alternative for Low-Income Rural Household Electrification	12/01	05/01
Malawi	Rural Energy and Institutional Development	04/05	069/05
Mali	Phase-Out of Leaded Gasoline in Oil Importing Countries of Sub-Saharan Africa: The Case of Mali - Action Plan (<i>Élimination progressive de l'essence au plomb dans les pays importateurs de pétrole en Afrique subsaharienne Le cas du Mali — Mali Plan d'action</i>)	12/03	041/03
Mauritania	Phase-Out of Leaded Gasoline in Oil Importing Countries of Sub-Saharan Africa: The Case of Mauritania - Action Plan (<i>Élimination progressive de l'essence au plomb dans les pays importateurs de pétrole en Afrique subsaharienne Le cas de la Mauritanie – Plan d'action.</i>)	12/03	040/03

Region/Country	Activity/Report Title	Date	Number
Nigeria	Phase-Out of Leaded Gasoline in Nigeria	11/02	029/02
	Nigerian LP Gas Sector Improvement Study	03/04	056/04
	Taxation and State Participation in Nigeria's Oil and Gas Sector	08/04	057/04
Regional	Second Steering Committee: The Road Ahead. Clean Air Initiative In Sub-Saharan African Cities. Paris, March 13-14, 2003	12/03	045/03
	Lead Elimination from Gasoline in Sub-Saharan Africa. Sub-regional Conference of the West-Africa group. Dakar, Senegal March 26-27, 2002 (<i>Deuxième comité directeur : La route à suivre - L'initiative sur l'assainissement de l'air. Paris, le 13-14 mars 2003</i>)	12/03	046/03
	1998-2002 Progress Report. The World Bank Clean Air Initiative in Sub-Saharan African Cities. Working Paper #10 (Clean Air Initiative/ESMAP)	02/02	048/04
	Landfill Gas Capture Opportunity in Sub Saharan Africa	06/05	074/05
	The Evolution of Enterprise Reform in Africa: From State-owned Enterprises to Private Participation in Infrastructure-and Back?	11/05	084/05
Senegal	Regional Conference on the Phase-Out of Leaded Gasoline in Sub-Saharan Africa (<i>Elimination du plomb dans l'essence en Afrique subsaharienne Conference sous regionales du Groupe Afrique de l'Ouest Dakar, Sénégal. March 26-27, 2002.</i>)	03/02	022/02
	Alleviating Fuel Adulteration Practices in the Downstream Oil Sector in Senegal	12/03	046/03
	<i>Maximisation des Retombées de l'Electricité en Zones Rurales, Application au Cas du Sénégal</i>	09/05	079/05
		03/07	
South Africa	South Africa Workshop: People's Power Workshop.	12/04	064/04
Swaziland	Solar Electrification Program 2001 2010: Phase 1: 2001 2002 (Solar Energy in the Pilot Area)	12/01	019/01
Tanzania	Mini Hydropower Development Case Studies on the Malagarasi, Muhuwesi, and Kikuletwa Rivers Volumes I, II, and III	04/02	024/02
	Phase-Out of Leaded Gasoline in Oil Importing Countries of Sub-Saharan Africa: The Case of Tanzania - Action Plan	12/03	039/03
Uganda	Report on the Uganda Power Sector Reform and Regulation Strategy Workshop	08/00	004/00
WEST AFRICA (AFR)			
Regional	Market Development	12/01	017/01
EAST ASIA AND PACIFIC (EAP)			
Cambodia	Efficiency Improvement for Commercialization of the Power Sector	10/02	031/02
	TA For Capacity Building of the Electricity Authority	09/05	076/05
China	Assessing Markets for Renewable Energy in Rural Areas of Northwestern China	08/00	003/00
	Technology Assessment of Clean Coal Technologies for China Volume I-Electric Power Production	05/01	011/01
	Technology Assessment of Clean Coal Technologies for China Volume II-Environmental and Energy Efficiency Improvements for Non-power Uses of Coal	05/01	011/01
	Technology Assessment of Clean Coal Technologies for China Volume III-Environmental Compliance in the Energy Sector: Methodological Approach and Least-Cost Strategies	12/01	011/01
	Policy Advice on Implementation of Clean Coal Technology	09/06	104/06
	Scoping Study for Voluntary Green Electricity Schemes in Beijing and Shanghai	09/06	105/06
Papua New Guinea	Energy Sector and Rural Electrification Background Note	03/06	102/06
Philippines	Rural Electrification Regulation Framework. (CD Only)	10/05	080/05
Thailand	DSM in Thailand: A Case Study	10/00	008/00
	Development of a Regional Power Market in the Greater Mekong Sub-Region (GMS)	12/01	015/01

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Vietnam	Options for Renewable Energy in Vietnam	07/00	001/00
	Renewable Energy Action Plan	03/02	021/02
	Vietnam's Petroleum Sector: Technical Assistance for the Revision of the Existing Legal and Regulatory Framework	03/04	053/04
	Vietnam Policy Dialogue Seminar and New Mining Code	03/06	098/06
SOUTH ASIA (SAS)			
Bangladesh	Workshop on Bangladesh Power Sector Reform	12/01	018/01
	Integrating Gender in Energy Provision: The Case of Bangladesh	04/04	054/04
	Opportunities for Women in Renewable Energy Technology Use In Bangladesh, Phase I	04/04	055/04
EUROPE AND CENTRAL ASIA (ECA)			
Azerbaijan	Natural Gas Sector Re-structuring and Regulatory Reform	03/06	099/06
Macedonia	Elements of Energy and Environment Strategy in Macedonia	03/06	100/06
Poland	Poland (URE): Assistance for the Implementation of the New Tariff Regulatory System: Volume I, Economic Report, Volume II, Legal Report	03/06	101/06
	Russia Pipeline Oil Spill Study	03/03	034/03
Russia	Russia Pipeline Oil Spill Study	03/03	034/03
Uzbekistan	Energy Efficiency in Urban Water Utilities in Central Asia	10/05	082/05
MIDDLE EASTERN AND NORTH AFRICA REGION (MENA)			
Turkey Regional	Gas Sector Strategy	05/07	114/07
	Roundtable on Opportunities and Challenges in the Water, Sanitation And Power Sectors in the Middle East and North Africa Region. Summary Proceedings, May 26-28, 2003. Beit Mary, Lebanon. (CD)	02/04	049/04
Morocco	Amélioration de l'Efficacité Energie: Environnement de la Zone Industrielle de Sidi Bernoussi, Casablanca	12/05	085/05
LATIN AMERICA AND THE CARIBBEAN REGION (LCR)			
Brazil	Background Study for a National Rural Electrification Strategy: Aiming for Universal Access	03/05	066/05
	How do Peri-Urban Poor Meet their Energy Needs: A Case Study of Caju Shantytown, Rio de Janeiro	02/06	094/06
	Integration Strategy for the Southern Cone Gas Networks	05/07	113/07
Bolivia	Country Program Phase II: Rural Energy and Energy Efficiency Report on Operational Activities	05/05	072/05
	Bolivia: National Biomass Program. Report on Operational Activities	05/07	115/07
Chile	Desafíos de la Electrificación Rural	10/05	082/05
Colombia	Desarrollo Económico Reciente en Infraestructura: Balanceando las necesidades sociales y productivas de la infraestructura	03/07	325/05
Ecuador	Programa de Entrenamiento a Representantes de Nacionalidades Amazónicas en Tems Hidrocarbúricos	08/02	025/02
	Stimulating the Picohydropower Market for Low-Income Households in Ecuador	12/05	090/05
Guatemala	Evaluation of Improved Stove Programs: Final Report of Project Case Studies	12/04	060/04
Haiti	Strategy to Alleviate the Pressure of Fuel Demand on National Woodfuel Resources (English) <i>(Stratégie pour l'allègement de la Pression sur les Ressources Ligneuses Nationales par la Demande en Combustibles)</i>	04/07	112/07

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Honduras	Remote Energy Systems and Rural Connectivity: Technical Assistance to the Aldeas Solares Program of Honduras	12/05	092/05
Mexico	Energy Policies and the Mexican Economy	01/04	047/04
	Technical Assistance for Long-Term Program for Renewable Energy Development	02/06	093/06
Nicaragua	Aid-Memoir from the Rural Electrification Workshop (Spanish only)	03/03	030/04
	Sustainable Charcoal Production in the Chinandega Region	04/05	071/05
Perú	Extending the Use of Natural Gas to Inland Perú (Spanish/English)	04/06	103/06
	Solar-diesel Hybrid Options for the Peruvian Amazon		
	Lessons Learned from Padre Cocha	04/07	111/07
Regional	Regional Electricity Markets Interconnections - Phase I		
	Identification of Issues for the Development of Regional Power Markets in South America	12/01	016/01
	Regional Electricity Markets Interconnections - Phase II		
	Proposals to Facilitate Increased Energy Exchanges in South America	04/02	016/01
	Population, Energy and Environment Program (PEA)		
	Comparative Analysis on the Distribution of Oil Rents (English and Spanish)	02/02	020/02
	Estudio Comparativo sobre la Distribución de la Renta Petrolera		
	Estudio de Casos: Bolivia, Colombia, Ecuador y Perú	03/02	023/02
	Latin American and Caribbean Refinery Sector Development Report - Volumes I and II	08/02	026/02
	The Population, Energy and Environmental Program (EAP) (English and Spanish)	08/02	027/02
	Bank Experience in Non-energy Projects with Rural Electrification Components: A Review of Integration Issues in LCR	02/04	052/04
	Supporting Gender and Sustainable Energy Initiatives in Central America	12/04	061/04
	Energy from Landfill Gas for the LCR Region: Best Practice and Social Issues (CD Only)	01/05	065/05
	Study on Investment and Private Sector Participation in Power Distribution in Latin America and the Caribbean Region	12/05	089/05
	Strengthening Energy Security in Uruguay	05/07	116/07
GLOBAL			
	Impact of Power Sector Reform on the Poor: A Review of Issues and the Literature	07/00	002/00
	Best Practices for Sustainable Development of Micro Hydro Power in Developing Countries	08/00	006/00
	Mini-Grid Design Manual	09/00	007/00
	Photovoltaic Applications in Rural Areas of the Developing World	11/00	009/00
	Subsidies and Sustainable Rural Energy Services: Can we Create Incentives Without Distorting Markets?	12/00	010/00
	Sustainable Woodfuel Supplies from the Dry Tropical Woodlands	06/01	013/01
	Key Factors for Private Sector Investment in Power Distribution	08/01	014/01
	Cross-Border Oil and Gas Pipelines: Problems and Prospects	06/03	035/03
	Monitoring and Evaluation in Rural Electrification Projects: A Demand-Oriented Approach	07/03	037/03
	Household Energy Use in Developing Countries: A Multicountry Study	10/03	042/03
	Knowledge Exchange: Online Consultation and Project Profile from South Asia Practitioners Workshop. Colombo, Sri Lanka,	12/03	043/03

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	June 2-4, 2003		
	Energy & Environmental Health: A Literature Review and Recommendations	03/04	050/04
	Petroleum Revenue Management Workshop	03/04	051/04
	Operating Utility DSM Programs in a Restructuring Electricity Sector	12/05	058/04
	Evaluation of ESMAP Regional Power Trade Portfolio (TAG Report)	12/04	059/04
	Gender in Sustainable Energy Regional Workshop Series: Mesoamerican Network on Gender in Sustainable Energy (GENES) Winrock and ESMAP	12/04	062/04
	Women in Mining Voices for a Change Conference (CD Only)	12/04	063/04
	Renewable Energy Potential in Selected Countries: Volume I: North Africa, Central Europe, and the Former Soviet Union, Volume II: Latin America	04/05	070/05
	Renewable Energy Toolkit Needs Assessment	08/05	077/05
	Portable Solar Photovoltaic Lanterns: Performance and Certification Specification and Type Approval	08/05	078/05
	Crude Oil Prices Differentials and Differences in Oil Qualities: A Statistical Analysis	10/05	081/05
	Operating Utility DSM Programs in a Restructuring Electricity Sector	12/05	086/05
	Sector Reform and the Poor: Energy Use and Supply in Four Countries: Botswana, Ghana, Honduras and Senegal	03/06	095/06



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