

HAITI

ENERGY SECTOR WHITE PAPER

DRAFT/FINAL REPORT

December 18, 2010

CURRENCY EQUIVALENTS

Haitian Currency Unit = Gourde
40.3 Haitian Gourde = 1 US\$

ABBREVIATIONS AND ACRONYMS

BAU	Business as Usual
BME	Bureau des Mines et de l'Énergie
BOO	Build, own, operate
BOT	Build, own, transfer
BOOT	Build, own, operate, transfer
CEAC	Comisión de Electrificación de América Central
CMEP	Commission de Modernisations des Entreprises Publiques
EDH	Électricité d'Haïti
HFO	Heavy fuel oil
ICF	Interim Cooperation Framework
IHSI	Institut Haïtien de Statistique et d'Informatique
IPP	Independent Power Producer
kW	kilowatt
kWh	kilowatt-hour
LMPE	Law for the Modernization of Public Enterprises
LPG	Liquefied Petroleum Gas
LSD	Low speed diesel
MARNDR	Ministère de l'Agriculture, Ressources Naturelles et Développement Rural
MCI	Ministère du Commerce et de l'Industrie
MDE	Ministère de l'Environnement
MEF	Ministère de l'Économie et des Finances
MSD	Medium speed diesel
MTPTC	Ministère des Travaux Publics, Transport et Télécommunications
MW	Megawatt
PPA	Power Purchase Agreement
PV	Photovoltaic
RE	Rural Electrification
ROT	Repair, operate and transfer
toe	Tons of oil equivalent
UGSE	Unité de Gestion du Secteur de l'Énergie

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY	1
II. CURRENT SITUATION AND ISSUES	10
A. The energy matrix	10
B. Energy sector organization	13
C. The electricity sector	15
1. Reliability and quality of electricity service.....	16
2. EDH operational and financial performance.....	17
3. Electricity coverage	19
4. Generation mix and costs.....	21
D. Summary of Energy Sector Issues	23
III. GOVERNMENT'S DEVELOPMENT PLANS AND ACTION PROGRAMS	24
1. Short and medium term plans	24
2. Long term plans.....	27
IV. GOALS, CHALLENGES AND POLICY OPTIONS	29
A. Overcoming the earthquake impacts.....	29
B. Governance and institutional framework	30
1. Governance considerations: transparency, accountability, and responsiveness	30
2. Improving decision making procedures	35
3. Options for improving the energy sector's institutional framework	36
C. Electricity	39
1. Improving the operational and financial performance of the power sector	39
2. Increasing electricity coverage.....	46
3. Reducing the dependence on high price imported fuels	50
4. Options for Power Sector Regulation.....	55
D. Biomass	56
E. Renewable energy.....	58
1. On-grid renewable power generation	58
1. Off-grid renewable power generation	59
V. White Paper Roadmap.....	62

I. EXECUTIVE SUMMARY

1. Haiti exhibits some of the lowest development indicators in the world. According to the Human Development Index it ranks 149th with respect to other countries and scores particularly badly regarding life expectancy, literacy, and population below the income poverty line (55% of the population live with less than \$1.25 a day). This reflects in the energy sector, where energy consumption per capita is about 20 percent of the LAC average. The problem is compounded because the country lacks native energy resources (all oil products are imported and there are few attractive native resources for electricity production). Electricity access is the lowest in the LAC region: although data is uncertain, it is presumed to be lower than 30 percent.

2. Electricity issues and domestic energy are the most prominent problems of the sector. Electricity is provided by Electricité d'Haïti (EDH), which can only supply about 11 hours of service per day to a typical customer. The inefficient and unsustainable use of firewood and charcoal has led to extensive deforestation; in 2008 woodfuel accounted for about 71 percent of total energy supply, with the balance corresponding essentially to imported oil products. It continues to be by far the main source of energy in the residential and industrial sectors.

3. The dysfunctional performance of the power sector is due technically to poor reliability of existing equipment. Although there are approximately 270MW of installed capacity, the system cannot meet the 218MW peak load due to the unavailability of generating units associated with inadequate maintenance and lack of spare parts, as well as sedimentation and obsolescence of equipment in the main hydro plant of Péligre. These failings are compounded by a low reliability of the transmission and distribution grids.

4. The sector is recovering from the effects of the January 2010 earthquake. Physical damage to the power sector infrastructure was substantial but not catastrophic. More significantly, the earthquake disrupted EDH's commercial operations: billing and collection reached all time lows thereby further weakening an already precarious financial situation. The cash recovery index, which measures billing and collection performance, has never been satisfactory (it oscillated around 40 to 50 percent against a minimum sustainable value of around 70 percent), but it reached a historical low point on the order of ten percent during the period of January to March 2010. The earthquake also provoked the displacement of thousands of refugees to Port au Prince, which could lead to a permanent change in the demand pattern for electricity. Although the direct damages to the system were estimated at around US\$21 million, in the short term investment needs for rehabilitation and repair of different assets amount to an estimated US\$75 million.

5. Electricity production costs are higher than warranted. About 67 percent of electricity supplied is produced in diesel power plants which consume expensive gas oil, thereby making the underlying costs particularly vulnerable to high and volatile oil prices in the international market. The high cost of gas oil generation (the levelized energy price from Independent Power Producers—IPPs—was in the range of 27 to 30US¢/kWh in late 2009) could be circumvented by substituting those units with heavy fuel oil (HFO), which is about 30 percent less expensive. By the end of 2010 E-power, a new 30MW Independent Power Producer (IPP), will begin production using HFO, which should help in reducing the average cost of energy purchases. The rehabilitation

of the Péligre hydroelectric station will also contribute to reducing the average generation costs in the medium term.

6. The main problems with EDH concern a defective commercial operation.

Although fuel costs are high, together with purchase prices from IPPs, they are not at the heart of the problem with EDH. The main failing lies in that the company does not bill a sufficiently high fraction of the electricity provided to the network, and it only collects a fraction of what it bills. As noted above, the cash recovery index has rarely exceeded 50 percent, which indicates that out of every dollar injected into the network less than half is returned to EDH through its sales. The technical reasons for this poor performance lie in a poorly kept customer database, lack of metering equipment, little effort to prevent electricity theft and an ineffective capacity to react to the detection of unpaid bills. In fact, if EDH were able to significantly improve billing and collection, it would be able to pay the high costs of generated and purchased energy.

7. As a consequence of its poor performance, there are massive transfers from the public treasury to the electricity sector. The Ministry of Finance (MEF), as guarantor of the IPP contracts, settles them routinely given EDH's financial incapacity to do so (IPP bills are paid directly by MEF). The amount is estimated at around US\$100 million per year.

8. The root causes of poor operational and financial performance and electricity service lie in a combination of governance and management failings. The principal problems in this respect include:

- Lack of a legal and regulatory framework: the power sector operates without any rules or required performance criteria other than a few general directives contained in the EDH charter decree; in particular, tariff setting criteria are not set out and are left implicitly to EDH but are consulted informally with Government; the President usually has a final opinion on tariff questions;
- The Government's conflicting roles as policy maker, owner, and customer of EDH which manifests itself in eventual political interference and in the blurring of lines between the finances of EDH and the Government budget, which tends to distort EDH's incentives and accountability;
- Lack of institutional capacity to put in place sector development plans;
- Weak corporate governance standards at EDH;
- Lack of transparency and competition in the process of private sector participation, and an inability in some cases to attract a capable and responsible private sector;
- An entrenched public-oriented approach towards the management of public utilities like EDH;
- A deficient decision-making process in the energy sector, and the lack of functional executive and regulatory authorities;
- Lack of resources and strategy to provide electricity services to rural areas; and
- A weak human resource base.

9. The current attempts to improve EDH's corporate governance include the weakest proposed alternative for performance enhancement. The proposal of privatization or putting in place a management contract has been discussed since 2004.

The World Bank financed studies for studying its feasibility. The stronger options were rejected due to the poor precedents set by management contracts elsewhere and were replaced by the alternative of seeking advisors for the four critical areas of the company (commercial, technical, planning, and finance); these advisors are now in place. They are a welcome asset for EDH management in the short term, but a stronger long term solution is required.

10. EDH's commercial performance is being addressed through World Bank and IDB support. The World Bank and the IDB have supported a project for putting in place two management information systems (commercial and technical) for improving EDH's commercial performance; they are due to be commissioned in 2010/2011, but have been delayed due to the low level of commitment of EDH in the process, which itself has led to an absence of reliable data for feeding the information systems. The IDB project complements the latter with a resource management system, and also includes components for regularizing service to seven circuits in Port au Prince, which involves network improvements, detection and correction of fraudulent connections, meter installation, and, in general, reengaging customers and orienting EDH's actions towards better service in exchange for accepting billing and collection activities. This will only be fruitful if service can be effectively improved, as it is unlikely that customer behavior will change if power cuts remain unaltered.

11. Although modest, there are some indigenous energy resources which can be developed. Considering that at the margin power production is being done with very expensive and inefficient gas oil units, some otherwise high cost renewable resources become attractive: there is a sizable hydroelectric potential estimated at about 153MW, with costs in the US\$4,000–US\$6,000 range, together with a few interesting sites for development of wind farms, and a good solar energy radiation which can be used to charge photovoltaic systems and to provide lighting and communications in isolated areas. The Artibonite 4C project, downstream from Péligre has been studied with resources from the Brazilian Government, and Lake Azuei, west of Port au Prince, appears to have a good wind potential. Solar power is being promoted through the Emergency Program for Solar Power Generation with funding from IDB, the World Bank, and GEF as part of the emergency response to the earthquake.

12. The Law for the Modernization of Public Enterprises provides a vehicle for introducing private sector participation. This law created the CMEP commission which is authorized to reform public enterprises and introduce private sector participation through management contracts, concession contracts, or capitalization of public companies. The law has already been used to reform successfully the telecommunications sector in Haiti. The law is demanding in terms of CMEP discretion and CMEP was already invoked in a previous attempt to reform the power sector. Approaching CMEP again will require revisiting the previous experience and identifying the critical steps in its implementation, including the factors that made it successful in telecommunications.

13. Proposed Strategy. The critical factors to be addressed in reforming the sector include:

- Unreliable and insufficient electricity service which requires inefficient and costly investments in self- generation solutions by the largest consumers;
- Reliance on high-cost generation thereby stressing the sector's finances and requiring high and unaffordable prices;

- An unsustainable financial situation of the power sector, which relies on extraordinary transfers from the Government to meet its obligations;
- Poor governance both at the Government level and at the enterprise level, with insufficient resources to implement policies, as well as little oversight and accountability of management;
- A reliance on traditional fuels (i.e. biomass) particularly at the domestic level, combined with the use of low-efficiency stoves, with serious consequences in terms of health and the environment due to the deforestation of wide areas of the countryside.

14. **The actions proposed to face the problems in the Haitian energy sector** are centered on the following axes:

- Governance reform and improved decision making in the medium term, which seeks to establish a modern legal and regulatory framework for the energy sector in general, and the power sector in particular, seeking to promote transparency and to provide viable solutions for extending electricity service and managing the woodfuel problem;
- Using the Law for the Modernization of Public Utilities (CMEP Law) to implement the process of restructuring the power sector with private participation through management or concession contracts or capitalization of EDH. Initiate this process as soon as possible to be able to implement any of these options if there is political agreement that this is the best way forward when the initial stage of EDH recovery plan is completed;
- Providing a legal and regulatory framework for the electricity sector, according to the selected sector structure with a view to establish the institutional framework, and the general conditions for private participation through concession and management contracts, and other PPP arrangements, define the structure and operation of the electricity market, regulate tariffs and quality of service, and promote the development of renewable generation.;
- Commercialization of EDH in the short term, complementing the current initiatives for improved commercial practices, in order to introduce corporate discipline, transparency, accountability, and responsiveness in power sector affairs;
- Corporatization of EDH, or private participation in EDH through a concession contract or capitalization in the medium term if the initial stage of EDH recovery plan is successful in improving performance and restoring the financial health of the company;
- Management contracts with private operator to take over EDH operations in the medium term if the initial stage of EDH recovery plan is not successful in improving performance and restoring the financial health of the company
- Rethinking the role of Government and EDH in rural electrification.

15. **In operational terms, the proposed strategy focuses on:**

- Expanding power infrastructure and taking advantage of native resources;
- Improving governance and regulation of the sector and its associated organizations, notably EDH;

- Increasing access to electricity in rural, urban, and peri-urban areas;
- Attracting private sector participation by improving the business environment and exploring/creating opportunities for establishing strategic partnerships;
- Improving the supply of domestic energy by supporting the introduction of modern energies and higher efficiency end-use equipment.

16. **Scenarios for power sector reform.** The proposed energy strategy can be implemented for any of the two basic scenarios of power sector reform identified in this report, which reflect differences in the structure of the power sector and the degree of decentralization: a national monopoly and regional monopolies. The regional scenario contemplates the possibility of awarding concession or management contracts to private operators to provide electricity service in an isolated system or a new industrial park or touristic area. This would seek to replicate the decentralization experiences of Jacmel and Les Cayes which are widely credited as being a successful alternative. In both scenarios the monopoly companies would be single buyers which would purchase electricity from IPPs or auto-generators according to regulated procedures.

17. **Governance reform.** The analysis shows that the decision making quality within Government, which is vested in the Ministry of Public Works, Transport, and Communications (MTPTC), leaves a lot to be desired: although the Energy Sector Management Unit (UGSE) is capable of producing good plans, it doesn't have the means to put them in place. Decisions within the Ministry are congested due to the multiple sectors it covers and energy questions do not seem to have the required profile. The proposed strategy is to face this problem (a) by the creation of a government energy authority in the medium term, which could be a Ministry of Energy and Mines, (b) by strengthening UGSE in the short term within MTPTC and endowing it with a high authority profile, which would become the government authority/ministry in the medium term, and (c) by the creation of an executive agency for rural electrification, domestic energy affairs, and the development of renewables (it is arguable whether these functions should reside within a single organization, but given the dearth of human resources in Haiti, it may be wiser to avoid a proliferation of new agencies).

18. **Legal framework for the power sector.** In the medium term the action to be taken is to introduce an Electricity Law which would provide the legal basis for power sector functioning, including regulations for concession and management contracts, rules for setting electricity tariffs and subsidies, quality of service standards, structure and operation of the electricity market, rules for auto-generation and cogeneration, responsibilities for policy making, planning, regulation and supervision functions. In particular, the electricity law would (a) establish norms and procedures for competitive procurement of long-term energy supply by single buyers; (b) establish norms and rules allowing large consumers to group together and develop generation plants to serve their own demand; and (c) allow the new Ministry of Energy and Mines to **award regional concessions** in order to allow private operators to provide electricity service in particular enclaves (e.g. industrial or touristic) or isolated systems. These three proposals would constitute the core of a new approach to providing electricity, by concentrating on the job of "getting competitively priced electricity into the economy" through sound private investors, as opposed to the current approach of supplying it through State channels, and EDH in particular.

19. **Additional studies required for the regional monopolies scenario.** Additional studies are necessary to complete a technical, economic and financial

analysis of alternatives to decentralize electricity service in financially viable concession areas or regions, which may be attractive for private investors, as well as to analyze the regulatory framework required in this scenario. These studies are considered in the restructuring process under the CMEP law. One aspect that should be analyzed is the operation of the power market after the regions have been interconnected. One option that can be considered is to create a national transmission company responsible for developing the national transmission grid and for acting as single-buyer for the regional companies.

20. **Corporate governance reforms of EDH.** This is urgently required to complement the management information systems (MIS) being installed with World Bank funding, comprising a Commercial Management System (CMS), and the Technical Service Management System (TSMS). The MIS will not be effective in improving EDH performance if current practices and opacity regarding the day to day operations of EDH are not improved. The proposed reforms include, among others (a) attract sound private sector participation in generation in a transparent and competitive manner as a way to introduce efficiency and mobilize financial resources through improved public sector bidding processes; and (b) complementing the current efforts to strengthen EDH management with other usual good governance measures such as, among others, (i) introducing discipline through the regular meetings of the Board of Directors, and requiring that strategic decisions be ratified by the Board, (ii) hiring an audit firm and regularly submitting financial statements for their approval, (iii) the development of corporate plans and objectives which will be monitored through performance measures established under a performance contract, (iv) competitive hiring of key personnel, (v) documentation of key processes to be followed, from bookkeeping to maintenance and operations procedures, (vi) overseeing and controlling power purchases and IPP contracts, and (vii) disseminating regular operational and corporate reports. Introducing this governance discipline will require hiring a firm of management consultants to audit and put in place corrected processes.

21. **Corporatization or private participation in EDH.** If the reforms outlined beforehand, together with the management strengthening introduced with the delegate directors of EDH, are successful in rehabilitating EDH and the enterprise can reasonably be expected to operate with minimal Government support, the stage should be set for either the corporatization of EDH so that it operates independently of Government and according to enterprise law, or to consider options to attract private participation in capitalization schemes or concession contracts.

22. **Putting in place a management contract for EDH.** The efforts to improve EDH's performance may not yield the expected results; the contract for the delegate directors has a two year term, by which time stock should be taken to assess progress achieved and decide whether continuing with EDH as an independent company is realistic. In this case private participation in concession contracts or capitalization schemes is unlikely and the proposed alternative option is to put in place a management contract for EDH in which the Government retains the responsibility for investment in the company and the management company runs the enterprise under an incentive based contract.

23. **The preparatory work for any private participation scheme should be started very soon, rather than waiting for the eventual rehabilitation of EDH.** The decision to put in place a management contract, a concession contract or the capitalization of EDH can be made once the term of the delegate directors is up and the

results of this approach have been evaluated. However, the preparatory work for any of these options should be initiated as soon as possible under the CMEP process as it could easily take two years to hire a consulting firm and complete the required studies on the structure of the power sector, the regulatory and institutional framework and the rules and conditions for private participation, upon which, depending on the situation of EDH, a decision can be made about implementing a private participation option and it could be put in place opportunely, rather than initiating it at that late date.

24. Whatever the option for reform of EDH, it requires political commitment. It is unlikely that operational and financial performance is improved if there is no political commitment and support to operate EDH or any electricity utility as commercial companies, stop political interference, control and penalize electricity fraud and theft, and establish cost-covering tariffs. It also requires ownership of the strategy on the part of all stakeholders, which would be achieved by suitable preparation and dissemination. The current situation, with large pledged resources by donors is particularly suitable to implementing a top-down approach where agreement on the major reforms can be established at the highest levels, as opposed to bottom-up approaches through individual projects.

25. Rural electrification and domestic energy agency. A rural electrification program should seek to enhance economic development and social benefits, affordability, private participation, and financial sustainability of the electrification enterprise; it should also seek to minimize overall costs, environmental impacts, and the Government's fiscal burden. The proposed approach consists of rethinking the role of the Government/ EDH as a provider of rural electrification services, in which it adopts a new role in rural electrification as market enabler, regulator, and provider of targeted subsidies. This would be the role of the proposed rural electrification agency to be created together with the new Ministry of Energy and Mines. Providers could be involved through a variety of models, including distribution utility franchises, small licensed operators and equipment supply.




















26. Rural electrification. There are opportunities for rural electrification which would include the extension and consolidation of isolated power systems, the development of isolated mini-distribution systems to serve small towns and of micro-distribution grids supplied by micro-hydro generation and solar photovoltaic generation for schools, health centers, and community centers of small isolated pockets of population. All of these decentralized and small scale operations require special and simpler regulations and major financial support and subsidies.

27. Biomass and modern energies. Substituting firewood and charcoal as the major source of energy for cooking and industrial heating is a major challenge and a high priority to reduce deforestation. The problem has been studied extensively but little progress has been made. The proposed strategy is to emphasize the use of LPG and other substitutes for charcoal, mainly in the urban centers. An effective penetration of LPG can be achieved in association with private sector suppliers who have tabled different proposals to address the problem. One of the tasks for the proposed rural electrification and domestic energy agency would be to enable the program, which would require significant subsidies in order to overcome the initial investment barrier faced by poor households (high upfront costs of the LPG cylinder and stove). It would also be involved in identifying the best LPG industry model (particularly regarding LPG cylinder management, safety controls, and refilling) for ensuring the penetration of LPG in the household and commercial sectors. This will also require adequate regulation,

starting with an LPG law or similar statute which would establish the fundamentals of how this sector would operate. A private company (TOTAL) has proposed plans to use the existing and idle capacity in filling stations to expand the LPG market from 14,000 to 100,000 tons per year in seven years with an investment of US\$40 million.

28. **Structuring an action plan: the importance of process.** One of the outputs of this White Paper is a Road Map, which outlines the way forward for implementing reforms in the energy sector. However, it must be stressed that the question of ownership on the part of the Haitian stakeholders—Government, producers, consumers, among others—is essential for reforms to succeed. In this sense, consultations should be undertaken with the stakeholders to ensure that the objectives as well as the means for attaining them are well understood and that there is broad agreement around the pillars for improving the energy sector's performance. In this sense the process itself is a critical component of the reform plan in ensuring a wide acceptability of proposed actions.

29. **Road map.** The following table summarizes the proposed road map for the energy sector, which is discussed in chapter V.

Energy sector road map					
Priority actions					
		Semester			
		I/2011	II/2011	I/2012	II/2012
Initial stage of sector recovery					
	Short term restoration and rehabilitation of diesel plants, T and D facilities				
	Implementation of the PREPSEL project and the supplemental loss reduction projects				
	Rehabilitation of the Péligre Hydroelectric plant and other small hydroelectric plants in the isolated				
Improving sector governance					
	Establish a high profile energy sector management				
	Political decision and engage CPME in process				
	Hire consultants for power sector restructuring and private participation study				
	Complete restructuring study				
	Government decides on new structure				
	Draft and approve new electricity sector statute				
	Establish new authorities				
	Instill commercial practices in EDH with support of				
Scenario 1: National monopoly					
	Prepare information memorandum, bidding documents for private participation in EDH				
Scenario 2: Regional monopolies					
	Prepare information memorandum, bidding documents for awarding regional concession areas				
	Prepare information memorandum, bidding documents for private participation in EDH				
Promote development of renewable generation					
	Complete the evaluation of the solar, wind, small hydro energy potential and Artibonite C				
	Study and draft necessary legislation and regulations for the promotion of renewable generation with consultant assistance				
Reduce demand for charcoal and firewood					
	Draft legislation with consulting support to promote the penetration of LPG				
	Implement the program to expand the LPG market with private participation				
	Revive the manufacture and distribution of efficient woodfuel stoves for rural areas				

II. CURRENT SITUATION AND ISSUES

Haiti is the poorest and least developed country in Latin America and the Caribbean, with an income per capita below US\$700, 55% of the population living with less than US\$1.25 a day, a life expectancy of 61 years, and an adult literacy rate of 62%, as compared to US\$6,681, <10%, 73.4 years and 91.2%, average values for Latin America and the Caribbean (UNDP- 2009 Human Development Report, 2007 statistics). In 2007, Haiti had a medium-low human development index (ranked 149 among 182 countries), an indication of low progress made in health, education and income level, and a medium-low human poverty index for developing countries (97/134), an indication of minor advances in income distribution and poverty reduction. It lagged well behind relatively poor countries in Central America and the Caribbean, like Honduras and Nicaragua (see Table 1).

Table 1

Human Development Indicators								
HAITI and selected countries in the region								
2007								
	Human development index		Human poverty index (HPI-1)		GDP /capita	Life expectancy at birth	Adult literacy rate	Population below income poverty line (%)
	Rank	value	Rank	Value	US\$	years	% aged 15 and above	\$1.25 a day
Haiti and selected countries in the region								
Cuba	51	0.863	17	4.6	..	78.5	99.8	..
Costa Rica	54	0.854	11	3.7	5,887	78.7	95.9	2.4
Panama	60	0.840	30	6.7	5,833	75.5	93.4	9.5
Trinidad and Tobago	64	0.837	27	6.4	15,668	69.2	98.7	4.2
Dominican Republic	90	0.777	44	9.1	3,772	72.4	89.1	5.0
Jamaica	100	0.766	51	10.9	4,272	71.7	86.0	<2
El Salvador	106	0.747	63	14.6	2,973	71.3	82.0	11.0
Honduras	112	0.732	61	13.7	1,722	72.0	83.6	18.2
Guatemala	122	0.704	76	19.7	2,536	70.1	73.2	11.7
Nicaragua	124	0.699	68	17.0	1,022	72.7	78.0	15.8
Haiti	149	0.532	97	31.5	699	61.0	62.1	54.9
Latin America and the Caribbean		0.821			6,681	73.4	91.2	
Very high human development		0.955			39,821	80.1	..	
High human development		0.833			8,470	72.4	94.1	
Medium human development		0.686			1,746	66.9	80.0	
Low human development		0.423			380	51.0	47.7	

Source: UNDP Human Development Report 2009

A. The energy matrix

Haiti is also an energy poor country as compared to other countries in Central America and the Caribbean. The consumption of primary energy per capita in LAC is about 4.5 times Haiti's consumption, and energy use in lower income countries in the region as Honduras and Nicaragua is more than twice that of Haiti (see Table 2). The differences in electricity use are more striking. Electricity consumption per capita in LAC is about 85 times Haiti's consumption and electricity use in Nicaragua, a low income country in the region, is about 20 times greater. These comparative results can be partially explained by differences in economic development (see Figure 1), as wealthier people consume more energy, but also, in the case of electricity use, by very low electricity coverage and very high electricity losses and electricity rationing in Haiti, which underestimates real electricity demand and consumption.

On the other hand, energy intensity in Haiti is relatively high as compared to other countries in the region, an indication of an inefficient use of energy (see Table 2). This is mainly explained by a low economic development and a very high participation—94%— of woodfuel as an energy source in the residential sector. Energy intensity in other countries in the region with a high participation of woodfuel in the residential sector (Honduras and Nicaragua) is between 15% and 33% lower than in Haiti. There are also differences in energy intensity between countries with a much lower participation of woodfuels. While energy intensity in a country with energy intensive industries (Jamaica), is about 75% higher than in Haiti, in countries with a high participation of the services sector (Costa Rica and Dominican Republic) it is about 60% lower than in Haiti.

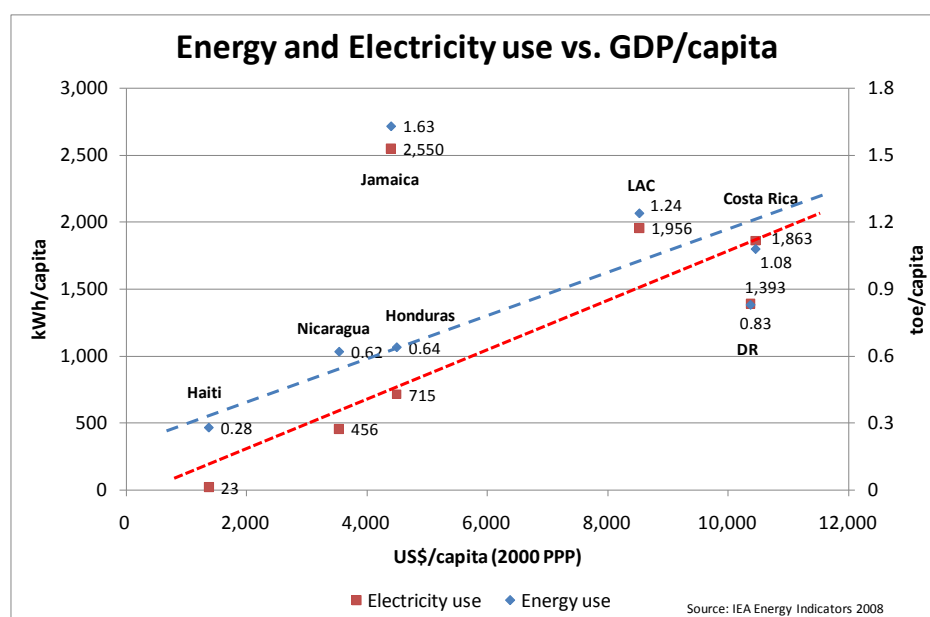
Table 2

Energy indicators in 2008
HAITI vs. Selected countries in LAC

Indicator	Unit	Haiti	LAC	DR	Jamaica	Honduras	Nicaragua	Costa Rica
Population	million	9.8	462.0	9.8	2.7	7.2	5.7	4.5
GDP/capita	2000 PPP US\$/capita	1,370	8,520	10,367	4,398	4,492	3,535	10,450
Energy use	(toe/capita)	0.28	1.24	0.83	1.63	0.64	0.62	1.08
Electricity use	(kWh/capita)	23	1,956	1,393	2,550	715	456	1,863
Energy intensity	toe/2000 PPP 000 US\$	0.21	0.15	0.08	0.37	0.14	0.18	0.10
Biomass in energy matrix								
% total energy supply	%	71%	20%	19%	11%	42%	52%	17%
% residential consump	%	94%	38%	41%	44%	86%	94%	52%

Source: International Energy Agency - key indicators

Figure 1



Woodfuel is by far the main energy source in Haiti. In 2008 woodfuel accounted for about 71% of total energy supply, imported oil products about 28% and hydro for a marginal 0.6% (see Table 3). Coal and natural gas are not used as an energy source. Woodfuel is the main energy source in the residential (for household cooking in low efficiency open wood and charcoal stoves) and industrial sectors (94% and 66% of energy consumption, respectively). The local woodfuel resources have been overexploited for more than 20 years at a rate exceeding the natural regeneration capability of trees, which has caused an accelerated exhaustion of the forest area (from 60% in 1923 to 3.8% in 2007). Electricity has a marginal participation in final energy

consumption (0.8%) as compared to LAC (17%), an indication of the very low electricity use in Haiti.

Table 3

HAITI						
Energy balance 2008						
in thousand tonnes of oil equivalent (toe)						
	Oil products	Hydro	Biomass	Electricity	Total	%
Total energy supply	28.3%	0.6%	71.2%		2,773	
Total final consumption	28.4%		70.9%	0.8%	2,482	100%
Industry	32.9%		65.9%	1.2%	504	20%
Transport	100.0%		0.0%	0.0%	451	18%
Residential	5.5%		94.1%	0.5%	1,480	60%
Other	0.0%		85.4%	14.6%	41	2%

Source: International Energy Agency-2008 energy balances

Imported oil products accounted for about 28% of energy supply in 2008. Gas oil accounts for about 55% of oil products supply and is used for power generation, transport and industry. Kerosene and LPG account for about 6% of total residential energy consumption (0.7% corresponds to LPG), used mainly for cooking and lighting (see Table 4).

Table 4

HAITI						
Oil balance 2008						
thousand tonnes						
	LPG	Gasoline	Jet fuel	Kerosene	Gasoil	HFO
Imports	10	227	21	67	414	26
International Aviation	0	0	-21	0	0	0
Domestic Supply	10	227	0	67	414	26
Transformation						
Electricity Plants	0	0	0	0	59	15
Final Consumption	10	227	0	67	351	11
Industry	0	0	0	0	150	11
Transport	0	227	0	0	201	0
Residential	10	0	0	67	0	0

Source: International Energy Agency-2008 energy balances

The extensive and inefficient use of woodfuel. The energy balance for 2008 indicates that about 70% of the energy needs are met with woodfuels, mostly charcoal and firewood used by about 94% of the households for cooking in low efficiency open firewood (in rural areas, 12.5% efficiency) and charcoal stoves (mainly in urban areas, 20% efficiency). The extensive and inefficient use of woodfuels is a major cause for the accelerated and unsustainable deforestation in Haiti.

The extensive use of woodfuels in Haiti is explained by the low income per capita and difficulties of most poor people to pay for higher efficiency but higher cost stoves, either more efficient charcoal burners or efficient kerosene and LPG burners and cylinders, and also by the fact that the exploitation of wood and production of charcoal

employ a substantial workforce in a country with chronic underemployment and generates about 16 percent of the rural income.

Although clear strategies to reduce the dependence on woodfuels and improve the efficiency of its use have been formulated, the results so far have been modest. The potential for the substitution of LPG, kerosene and briquettes (agricultural and municipal waste, charcoal fines and imported coal) for charcoal in stoves seems to be substantial (200,000 tons/year of charcoal) and would have substantial economic benefits. However, high switching costs, lack of adequate regulations and incentives and other factors limit its penetration in Haiti, the poorest country in LAC, where about 55% of the population lives on less than US\$1.25 a day. Initiatives to promote the use of efficient charcoal burners in urban areas made some progress in the past but have not been successful in displacing the use of traditional and cheaper burners apparently due to the higher cost of equipment, quality control problems, limited local manufacturing capacity and lack of promotion.

B. Energy sector organization

Responsibilities for energy matters are currently shared among four ministries:

- MTPTC (Ministère des Travaux Publics, Transport et Télécommunications). This ministry is the main Government agency for energy affairs which are assigned to the Energy Sector Management Unit (Unité de Gestion du Secteur de l'Énergie—UGSE) and the Bureau of Mines and Energy (BME);
- MCI (Ministry of Commerce and Industry) which is in charge of regulating petroleum products and assuring their supply;
- MARNDR (Ministère de l'Agriculture, Ressources Naturelles et Développement Rural) which is in charge of biomass affairs including the exploitation of woodfuel and biofuels; and
- MDE (Ministère de l'Environnement) in charge of environmental affairs which manages parks and protected areas, and is concerned with woodfuel exploitation.

In addition to the latter, MEF (Ministry of Economy and Finance) plays a critical role in providing funds for the energy sector and paying IPP bills which EDH cannot cover. The Bureau of Monetization also plays a role in the sector by settling the Petrocaribe bills.

The main energy-sector related functions are concentrated in MTPTC which has developed numerous sector plans and diagnostics, such as, among others, a Project for Energy Policy in Haiti (2008), the Energy Sector Development Plan 2007–2017 (2006), the Strategy for the Development of the Electricity Subsector 2006–2011 (2006), an Electricity Sector Analysis in the framework of poverty reduction (2006), and an Energy Sector Diagnostic (ca. 1995) whose main conclusions remain largely valid (it can be found on the BME website) but require some adjustment to take into account the effects of the earthquake.

The diagnostics and plans produced by MTPTC indicate a high degree of knowledge with respect to the functioning of the energy sector in general and the electricity sector in particular. They also evidence a good grasp of the technicalities involved in the

sector. However, there is little emphasis on the measures required for implementation of the recommendations identified in the plans. For example, the 2007–2017 Development Plan proposes milestones for the conversion from woodfuel to LPG with little consideration to the institutional steps required for achieving them, other than noting that “*for the implementation of these laws a National Authority and agencies working on site need to be established*”. The Energy Management Unit at MTPTC (UGSE) lately took the initiative in preparing an LPG sector regulatory framework.

Although the plans and milestones would achieve the development objectives if the pertinent institutional capabilities existed and were adequately funded, the lack of emphasis on implementation details and the non-assignment of specific responsibilities for putting recommendations in place results in proposals which remain on paper and are never executed. This is symptomatic of the weakness of the MTPTC for managing energy sector affairs. Indeed, the concentration of responsibilities for such demanding sectors as transport and communications together with energy leads to a weakening of decision making capabilities due to a dispersion of responsibilities.

The lack of focus of the primary ministry on the decision-making requirements of the energy sector has, to a degree, resulted in a neglect in the direction of EDH, the ministry’s main supervised organization. For example, the Board of EDH does not meet on a monthly basis, as ordered by its statutes, despite having the minister as president of the Board. In fact, EDH operates quasi-independently of the MTPTC.

In order to appreciate the need for strengthening the Government’s authority in the sector, it is useful to review the stakeholders in different subsectors. In the electricity subsector they include domestic users and potential customers who have still to be connected, industrial and commercial users who rely on a reliable power supply to run their businesses, suppliers of equipment to both EDH and self-generating users, and existing and potential independent power producers, including eventual hydro or wind developers. Because of its monopoly characteristics in Haiti, taking account of stakeholders’ interests requires the development of a regulatory function, which is entirely missing in the power sector.

Ultimate consumers of electricity should be the focus of service provision. At present they express their frustration with precarious service by not paying their bills, by circumventing meters, or by direct connections. Illegal connections to EDH are not perceived as a serious offense in good measure because the utility is unresponsive to users’ requirements. EDH consequently finds itself in a low service, high cost equilibrium which does not satisfy its customers and prevents it from raising the resources required to better serve them. Consumers generally appreciate good service and pay their bills when it is provided; they also protest when service deteriorates, as evidenced in Jacmel¹ recently.

Large industrial and commercial firms are also losers despite their possibility of producing their own energy, because they do so at a high cost using diesel oil, they are required to hold higher than normal reserve margins for their equipment, and they are unwillingly involved in a business which they would rather avoid. Stakeholders who do benefit from the existing situation in EDH are notably the independent power producers

¹ Jacmel is a community whose electricity infrastructure was rehabilitated with the support of the Canadian Government and managed to provide 24-hour service to its consumers.

whose payments are guaranteed by the Government and are regularly paid by the Ministry of Finance.

In the domestic energy subsector, stakeholders include households and commercial users of charcoal, LPG and firewood as well as producers of charcoal and distributors of LPG. Normally markets take care of allocating resources, but in the case of domestic energy the effects of deforestation are an important externality which requires Government regulation, either by enabling mechanisms for encouraging conservation or by fostering the use of modern energies with eventual subsidies. Indeed, stakeholders in this sector include unborn future generations which will have to cope with the consequences of severe deforestation. All these interventions require a well-developed and functional Government authority in the energy sector, which is currently lacking.

C. The electricity sector

A state-owned monopoly for the provision of public electricity service in Haiti was established in 1971 with the nationalization of a private utility, the creation of Électricité d'Haïti (EDH) and the commissioning of the first units of the 54 MW Péligre Hydroelectric station, which became the major source of electricity supply to the metropolitan area of Port-au-Prince until the early 1980's. Beginning in the 1980's, EDH relied on diesel generation plants to meet demand growth and in the mid 1990's began to contract energy supply from independent power producers (IPP), under power purchase agreements (PPA) and repair, operate and transfer (ROT) contracts using diesel engines. In 2008, a new scheme was used to develop new power generation: 60 MW in three new diesel plants² were installed based on a tripartite agreement between the governments of Venezuela, Cuba and Haiti.

Currently there is an incipient transmission grid. The metropolitan area of Port-au-Prince, with about 28% of the population and 75% of electricity demand of the country is served by an interconnected 69 KV transmission system and a 115 kV line from the Péligre station. There are four small isolated power systems that serve small cities and towns in other regions with 23 kV distribution lines (Cap Haitien, Gonaives/Saint Marc, Les Cayes and Jacmel).

The total installed generation capacity in 2010 is about 300 MW, of which about 80% in diesel plants, most of it running on gas oil. Besides the Péligre generation station, there are 6 small hydroelectric plants with a total installed capacity of about 7 MW serving the isolated systems (see Table 5). By the end of 2010, the metropolitan area of Port-au-Prince will be served by about 75% of the total installed generation capacity in the country: 4 large diesel stations (Carrefour, Petion, Varreux and E-Power) and the Péligre hydro plant (see Table 5). About 50% of the thermal generation in Port au Prince will be operated by two 2 IPPs (Sogener and E-Power) and another private contractor operates about 6 MW at Les Cayes (Haytian Tractor).

² Petion plant at Carrefour (30 MW), Marti plant at Cap Haitien (15 MW) and Bolivar plant at Gonaives (15 MW)

Table 5

HAITI				
Power generation capacity mid 2009				
Region	Hydro		Thermal	
	Installed	Available	Installed	Available
North	0.8	0.5	19.9	11.2
Artibonite/Centre	4.0	2.3	31.8	13.8
Port-au-Prince Metropolitan	54.0	13.0	165.2	112.8
South	2.9	1.8	20.5	9.0
Total	61.7	17.6	237.4	146.8
Note: Capacity for all regions except PAP, taken from EDH report of August 11, 2009. For PAP, capacity is estimated for end of 2010 based on PDNA energy report of March, 2010				

Port-au- Prince Metropolitan area				
Generation capacity (estimated in December 2010)				
	Capacity (MW)		Operator	Comments
	Installed	Firm		
Carrefour I	49.5	25.0	EDH	Repair and rehab. pending
Carrefour II, Petion	34.0	27.0	Venez/Haiti	
Varreux I	15.0	10.0	Sogener	
Varreux II	18.7	16.8	Sogener	
Varreux III	18.0	10.0	Sogener	
Epower	30.0	24.0	epower	Commissioning dic 2010
Subtotal thermal	165.2	112.8		
Peligre hydroelectric station	54.0	13.0	EDH	US\$40 million rehabilitation program being executed
Total	219.2	125.8		
Source: PDNA energy report- March 2010				

1. Reliability and quality of electricity service

There has been a chronic electricity shortage in the metropolitan area of Port au Prince. The 300 MW installed generation capacity (270 MW if the E-Power diesel station, expected to be commissioned by the end of 2010, is not taken into account) is not sufficient to meet a peak demand estimated in 218 MW for 2009 because about 45% of this capacity is not available on a firm basis. A low availability of generation capacity is related to inadequate maintenance and lack of spare parts of EDH's diesel generators, and low availability of generation capacity at the Péligre Hydroelectric plant due to sedimentation problems in the reservoir and electromechanical equipment which is near the end of its useful life. In combination with a low reliability of the transmission and distribution grids and lack of needed investments to strengthen the existing grids, it explains the chronic electricity shortage (it is estimated that in 2009 electricity consumers in Port au Prince had on average 11 hours of electricity service per day). On the other hand, some isolated systems, where generation and distribution facilities have been rehabilitated, have better electricity service than Port au Prince.

Due to a poor quality service and high tariffs, most of the industrial and commercial consumers have become auto-generators, using diesel engines running on gas oil, an expensive solution forced by poor service. Current legislation only allows large consumers to purchase electricity from EDH or install self-generation to serve its own load at a single site.

Impact of the 2010 earthquake

The 2010 earthquake caused substantial but not catastrophic damages to the power sector infrastructure, worsened the already poor quality service and disrupted EDH commercial operations. The earthquake affected mainly the metropolitan area of Port au Prince, and Petite and Grand Goave, two towns closer to the epicenter of the earthquake. At the generation level, there were substantial damages in the 49.5 MW Carrefour diesel plant, which was taken out of service for inspection and some of its units need to be repaired. In transmission and substations, the damages were minor (displaced transformers, broken insulators and oil leakage), except for two substations in Port au Prince which had more extensive damages. Damages in the low voltage distribution systems, the power control center and the commercial agencies of EDH were more important and disrupted electricity service and meter reading, billing and collection processes and EDH revenues were reduced substantially. The earthquake also displaced population from the affected areas in the south mainly to Port au Prince, putting more pressure on electricity service in this area, and it may have a permanent impact on the geographical distribution of electricity demand.

The direct damages to the power system were estimated at about US\$20 million, minor as compared to damages in other sectors of the economy or to the investment needs to provide a good electricity service to current customers³. The expected loss of revenue associated with the disruption of billing and collection is larger, estimated at US\$37 million for February 2010 to April 2011.

Electricity service was restored but will continue to be of poor quality until substantial and needed investments in the rehabilitation and strengthening of the power system are implemented and the financial and operating performance of EDH is improved. The post disaster needs assessment (PDNA) energy group estimated investments of about US\$100 million in the short term (February 2010 to September 2011) and US\$160 million in the medium term to repair main installations and restore electricity service, refurbish and rehabilitate existing generation stations, rehabilitate and strengthen transmission and distribution networks and, in general, investments necessary to provide a reliable and good quality service to meet current demand⁴.

2. EDH operational and financial performance

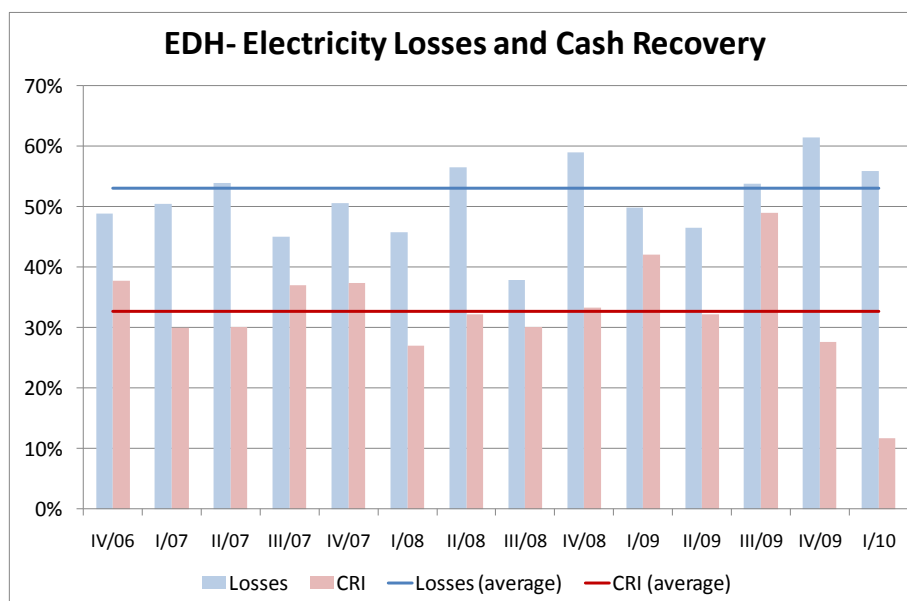
EDH's operational and financial performance has been poor. Total electricity losses are extremely high, about 53% for 2007-2009. Assuming high technical losses of 18% due to the poor condition of transmission and distribution grids, commercial losses could account for 35%. The high commercial losses could be explained by a combination of a culture of non-payment for electricity services, relatively high consumer tariffs, a low base of metered customers, and widespread theft of electricity. Revenue collection is low, which in combination with very high losses, produce a very low cash recovery index (CRI) that makes EDH financially insolvent. In 2009 revenue collection was 83% and CRI was 38% (see Figure 2). EDH cash revenues covered less than 50% of its

³ Haiti Earthquake PDNA: Assessment of damage, losses, general and sectorial needs, Annex to the Action Plan for National Recovery and Development of Haiti, March 2010

⁴ PDNA, Assessment of damage, losses, general and sectorial needs. Annex to the Action Plan for National Recovery and Development of Haiti. March 2010

administrative and operating costs. Besides, EDH has been unable to meet demand, and quality of service is unsatisfactory.

Figure 2



Electricity tariffs were not adjusted from December 2005 to July 2009 and the average tariff in that period was about 17 US¢/kWh, which was insufficient to cover efficient supply costs, let alone to cover high commercial losses and poor revenue collection. However, in August 2009 EDH's tariffs almost doubled for all consumers, except residential consumers with monthly consumption below 200 kWh. In mid 2010 the average tariff was about 32.5 US¢/kWh and for commercial and industrial consumers about 35 US¢/kWh, which are sufficient to cover EDH revenue requirements, allowing for relatively high electricity losses and are high as compared to efficient supply costs estimated at 22 US¢/kWh under optimistic conditions⁵.

The financial results of EDH during the 4th quarter of 2009 illustrate the reasons why EDH is insolvent (see Table 6). During this quarter EDH operational performance was worse than the average for the year (61% losses and 28% CRI), the average electricity tariff was already high (32.7 US¢/kWh) and WTI crude oil prices had stabilized at an intermediate level of 75 US\$/bbl and the earthquake had not disrupted EDH commercial operations. The average monthly revenue collection of US\$6.2 million was not sufficient to cover the cost of the monthly energy purchases to the IPPs (SOGENER and Haytian Tractor) and of the fuel used by the other thermoelectric plants, estimated at US\$9.3 million, let alone to cover administration and other operation and maintenance costs. The government had to make fiscal transfers from the Treasury for about US\$7 million per month to pay for most of the energy purchases and fuel expenses of EDH.

⁵ Electricité d'Haïti Tariff Study 2008, five reports submitted by a group of individual consultants in late 2008 and early 2009, financed by the Public-Private Infrastructure Advisory Facility (PPIAF). The consultants used an annual discount rate of 8%, 12%-13% electricity losses and heavy fuel oil prices of about 65 US\$/bbl)

Table 6

EDH			
Revenues and selected expenses			
4th quarter 2009			
Monthly average a/			
	GWh	US\$M	US¢/kWh
Revenues			
Billed	26.0	8.5	32.7
Collected		6.2	
Energy purchases and fuel costs			
Energy purchases			
SOGENER	16.3	4.5	27.8
HAYTIAN Tractor	3.6	1.2	31.8
Fuel consumption EDH, PMB b/	48.3	3.6	75.3
Total		<u>9.3</u>	
Shortfall		3.1	
National budget transfers		7.0	
Notes:			
Total generation	67.4 GWh		
Electricity losses	61%		
Revenue collections	73%		
CRI	28%		
a/ All information taken from the "Tableau de suivi du secteur électricité, ME"F, except for the cost of fuel, estimated on the basis of fuel consumption reported by MEF and the international fuel prices for that period (71 US\$/bbl for HFO and 88 US\$/bbl for gas oil.			
b/ Fuel consumption in thousand barrels, average price in US\$/bbl			

Although the average energy purchase prices from IPPs were high in late 2009 (27.8 US¢/kWh for Sogener and 31.8 US¢/kWh for Haytian Tractor) and contributed to EDH financial losses, they can be taken care of with current tariffs if EDH improves performance. It is not advisable nor feasible to increase tariffs to pay for EDH's inefficiencies (the current average tariff for industrial and commercial customers, of about 35 US ¢/kWh, is high considering EDH's low quality of service and encourages inefficient auto-generation solutions by these consumers and the loss of the best customers) and, therefore, direct transfers from the national budget would be required in the meantime.

EDH's poor performance is related to a combination of political interference, inadequate governance arrangements, poor management practices, lack of investment, poor supervision of EDH's performance by MTPTC and MEF, and loss of experienced staff.

3. Electricity coverage

Electricity coverage is very low and the data that is available to estimate coverage is inconsistent. According to a survey on the living conditions of households completed in 2003 by the Statistics and Data Processing Institute of Haiti (IHSI) electricity coverage was 92% in the Port-au-Prince metropolitan area, 23% in other urban areas, 11% in rural areas and about 32% at the national level. IHSI estimation of the population and households in 2009, distributed by regions and urban and rural areas, indicates that the rural areas account for 53% of the population and the Port au Prince metropolitan area for about 28% (see Table 7).

Table 7

HAITI						
Population and households						
2009						
	Urban			Rural		
	Population	Households	%	Population	Households	%
Ouest/Port-au-Prince	2,791,058	604,613	60%	873,562	195,555	17%
North	766,778	156,062	16%	1,224,771	242,493	21%
Artibonite/Centre	732,212	160,123	16%	1,517,434	351,317	31%
South	366,127	79,659	8%	1,651,301	357,871	31%
Total	4,656,175	1,000,457	100%	5,267,068	1,147,236	100%
%	47%			53%		

Source: Population et menages, estimés en 2009, Institut Haitien de Statistique et d'Informatique (IHSI). Mars 2009

Assuming that electricity coverage in Port au Prince, other urban areas and rural areas has not changed in 2003-2009, national coverage in 2009 would be about 36%, equivalent to about 769,000 electricity connections. However, in June 2010 EDH reported about 346,000 customers, of which about 144,000 were not active (disconnected), which is equivalent to 16% coverage (or 9% if only active customers are taken into account) (see Table 8). Assuming that the clients that have been disconnected are now illegal consumers and considering other illegal connections (29% of total connections, according to an electricity market survey carried out in 2009⁶), coverage would increase to 23%, well below the 36% estimate based on the results of the 2003 survey. Either electricity coverage is much lower in the metropolitan area of Port au Prince or the percentage of illegal connections is much higher⁷.

Table 8

HAITI									
Electricity coverage									
	Households	Coverage	Connections						
	b/	a/							
Urban									
Port-au-Prince	604,613	92%	556,244						
Other	395,844	23%	91,044						
Rural	1,147,236	11%	120,460						
Total	2,147,693	36%	767,748						
EDH customers June 2010^{c/}									
Active		9%	191,881						
Inactive		7%	144,378						

a/ Electricity coverage: IHSI/ Enquetes sur le conditions de vie en Haiti, 2003

b/ Population et menages, estimés en 2009, Institut Haitien de Statistique et D'informatique (IHSI), Mars 2009

c/ Monthly Report, August 2010, Commercial Director

⁶ Urban market study, AETS, April 2009

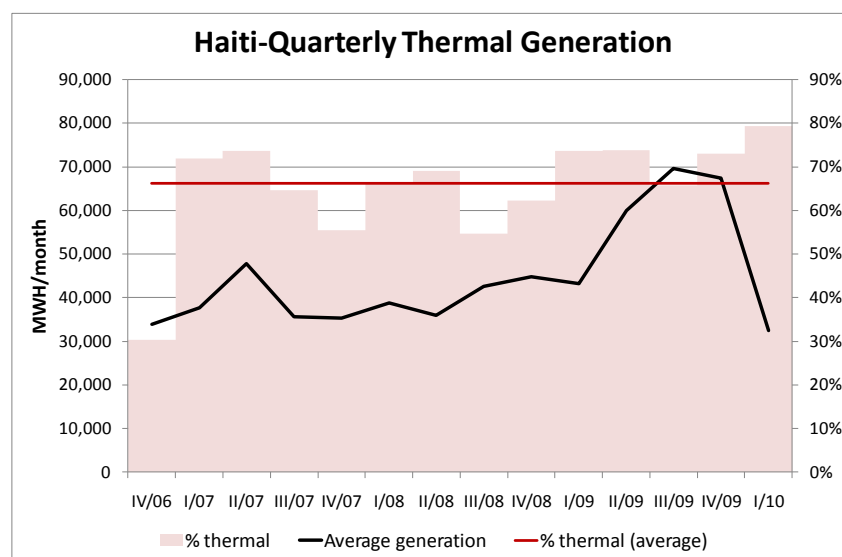
⁷ A large portion of the population in the main cities appears to live in shantytowns which usually have illegal and substandard distribution systems, which may explain an increase in illegal connections.

4. Generation mix and costs

Electricity generation depends on expensive diesel generation with imported fuels and generation costs are high and vulnerable to the volatility of international oil prices. In 2007-2009 about 67% of electricity generation was produced on average in diesel engines using imported fuels, mostly expensive gas oil. In 2009 the private IPPs contributed with about 40% of thermal generation, but its participation will increase in 2011⁸ with the commissioning of the E-Power diesel station in late 2010 and the energy purchase prices under these contracts may have a substantial impact on EDH's financial results. Energy purchase prices from IPPs are generally high, which reflect the fact that private generators use mostly diesel engines running with expensive gas oil and that they may face high contract and country risks that are compensated with high fixed capacity charges. In late 2009 the levelized energy prices from PPAs were in the range of 27 to 30 US¢/kWh. The participation of thermal generation varies between 55% to 80% depending on the seasonal variations and availability of the generation at the Péligre hydroelectric station (see Figure 3).

Improving the performance of existing diesel engines and the availability of hydroelectric units, the substitution of more efficient diesel engines using heavy fuel oil for expensive gas oil generation and the diversification of energy sources with the development of renewable energy could help to reduce the vulnerability to oil prices and to reduce generation costs.

Figure 3



The new PPA with the E-Power diesel plant illustrates the benefits of more efficient engines running with heavy fuel oil. E-Power levelized energy price is about 28% lower than the energy price of Haytian Tractor. The price of heavy fuel oil is about 22% lower than the price of gas oil (on a per BTU basis) and the efficiency of the diesel engines is about 17% higher (see Table 9).

⁸ According to projections made in the tariff study of 2008, in 2011 the share of thermal generation may increase to 85% and the participation of IPPs to 60% of thermal generation. Analyse des coûts d'approvisionnement EDH, October 2008

Table 9

PPA			
Levelized energy prices			
	Unit	E- Power PaP	HAYTIAN Tractor Les Cayes
Capacity charge	US\$/kw-month	32.5	43.3
Energy charge	US\$/MWh	114	162
Fuel		HFO	Gas Oil
Fuel price	US\$/bbl	71	88
Specific consumption	gal/MWh	59	72
Efficiency	%	40%	34%
Levelized price @ plant factor			
40%	US\$/MWh	225	310
60%	US\$/MWh	188	261
80%	US\$/MWh	170	236
100%	US\$/MWh	159	221

Source: Tariff study 2008 and Tetra Tech October/10 presentation

Indigenous renewable energy (other than woodfuels) could make a significant contribution in the long-term as an energy source to increase access to modern energy in rural areas and reduce the dependency on woodfuels and imported fossil fuels, especially in a scenario of high oil prices.

The hydroelectric generation potential is important. The potential that has not been developed is estimated at about 153 MW, of which 15% (23 MW) in small and mini hydros, based on studies prepared in the 1970s and 1980s. The most attractive medium size projects are located on the Artibonite river, downstream of the Péligré dam. A feasibility study for the 32 MW Artibonite 4C, completed in 2010 by the Brazilian Army's engineering institute, estimated the investment cost in US\$190 million (about 6,000 US\$/kW, very high for a medium-size hydroelectric plant, although it is a multipurpose project and a portion of the investment is related to irrigation works⁹). The studies of four small hydro sites in the Jacmel area, completed in 2007 and financed by CIDA, concluded that about 6 MW could be developed at investment costs between 3,900 and 7,600 US\$/kW and levelized costs in the range of 11 to 17 US\$/kWh.

A few interesting sites for the development of wind farms have been identified. A recent evaluation of wind conditions in three sites in Haiti¹⁰ concluded the site of Lake Azuei, west of Port au Prince, has good wind conditions (wind speeds of 6.7 m/sec at 50m) and wind generation projects with capacity factors above 40% could be developed. A feasibility study is required to confirm the characteristics and practicality of wind power projects at this site.

Haiti has a good solar energy radiation (about 5 kWh/m²/day) but no detailed solar maps are available. The installed capacity in photovoltaic (PV) panels was estimated in 2006 in about 0.7 MW, a part of it the remains of PV modules installed in households to alleviate the impact of the embargo on Haitian imports and exports imposed in the early

⁹ There is not enough information available on the energy production and costs of the Artibonite 4C project to prepare an economic analysis. However a hydroelectric plant with an investment cost of 6,000 US\$/kW and a plan factor of 60% would have a levelized cost of about 165 US\$/MWh, similar to the levelized price of E-Power.

¹⁰ Etude de vents dans trois sites en Republique d'Haiti, 3E company, April 2010

1990s. The use of PV panels as an option for the supply of sustainable and clean energy for basic needs in rural areas would be tested and promoted by the Emergency Program for Solar Power Generation financed by the World Bank, IDB and GEF to support the emergency responses to the 2010 earthquake. The program includes the installation of PV generators and solar powered refrigerators mainly for lighting, communications and vaccine conservation in emergency centers, and the acquisition and distribution of solar lanterns. Solar water heaters are widely used in some of the Caribbean islands and should also be considered as an energy supply option. On the other hand, the use of solar stoves is limited and does not appear to be an attractive option at this time

D. Summary of Energy Sector Issues

Putting together the main elements in the previous sections of this chapter provides an illustrative picture of the energy sector's main failings:

- Unreliable and insufficient electricity service which requires inefficient and costly self-generation solutions by large consumers;
- Reliance on high-cost generation thereby stressing the sector's finances and requiring high and unaffordable prices;
- An unsustainable financial situation of the power sector, which relies on extraordinary transfers from the Government to meet its obligations;
- Poor governance both at the Government level and at the enterprise level, with insufficient resources to implement policies, as well as little oversight and accountability of management;
- A reliance on traditional fuels (i.e. biomass) particularly at the domestic level, combined with the use of low-efficiency stoves, with serious consequences in terms of health and the environment due to the deforestation of wide areas of the countryside.

III. GOVERNMENT'S DEVELOPMENT PLANS AND ACTION PROGRAMS

The Government prepared in 2006 an Energy Sector Development Plan for 2007-2017, which was complemented with a development strategy and an analysis of investment needs for the rehabilitation and expansion of generation, transmission and distribution systems. An evaluation of damages, losses and investment needs of the energy sector was prepared after the 2010 earthquake¹¹.

The sector issues identified in the 2006 energy plan are still valid and coincide, by and large, with our assessment of the sector situation in section II:

- a) An energy matrix dependent on the extensive and inefficient use of woodfuel to meet local demand
- b) A weak institutional framework
- c) Unreliable and inadequate electricity service due to the poor condition and insufficient capacity of the generation, transmission and distribution grids. The 2010 earthquake worsen the situation and increased the investment needs to restore and rehabilitate the electric power system.
- d) EDH's poor operational and financial performance. EDH is financially insolvent if it does not improve its poor operational performance (electricity losses of 53%, low revenue collection of 81% and very low cash recovery index CRI of 38% in 2009). Furthermore, EDH has been unable to meet demand and electricity coverage and quality of service are unsatisfactory.
- e) High generation costs and dependency on imported fuel oil for power generation

1. Short and medium term plans

The ongoing activities in the sector have been developed by the Government in consultation with the donor community, including, among others, IDB, the World Bank, USAID, and CIDA. These activities have come about as a result of many years of interaction with the energy sector and its very limited resources. The following priority objectives and action plans address the short term and urgent issues:

- a) **Restore electricity service and rehabilitate and strengthen the generation, transmission and distribution systems** to reduce generation costs and improve the reliability and quality of service to current customers.

To meet this objective, the government has identified and ensured financing for priority investments: (i) the rehabilitation of the Péligre Hydroelectric Plant and the construction of the Tabarre substation to improve quality of service in a key area of

¹¹ - "Haiti Energy Sector Development Plan 2007 – 2017" and "Stratégie de développement du sous-secteur de l'Electricité en Haïti (2006 à 2011)", Ministry of Public Works, Transport and Communications, Bureau of Mines and Energy, and EDH with the assistance of the International Atomic Energy Agency, November 2006

- Électricité d'Haïti, Technical Assistance for the electricity generation, transmission and distribution project, financed by USTDA, Power Engineers & Taylor DeJongh, June 2007

- Y a-t-il un avenir énergétique pour Haïti, presentation by René JEAN-JUMEAU, November 2009

- Plan d'action pour le relèvement et le développement national d'Haïti, Les grands chantiers pour l'avenir, Mars 2010

Port au Prince (IDB financing); (ii) the rehabilitation of 5 substations in Port au Prince (USAID financing); (iii) preparation of a ROT contract to repair and rehabilitate the Carrefour diesel plant (looking for a contractor); and (iv) update of the feasibility study of a medium term investment program for generation, transmission and distribution (USTDA financing).

- b) Improve quality of service, reduce commercial losses and increase revenue collection of EDH** in order to improve EDH's financial and operational performance and reduce the need for financial transfers from the national treasury.

The government is implementing the PREPSEL and the distribution system rehabilitation projects, financed by The World Bank and IDB¹², which would improve EDH's commercial and operational performance in a sustainable manner by the rehabilitation and strengthening of distribution grids in Port au Prince and the introduction of a customer-oriented approach for the provision of electricity services. The PREPSEL project includes the implementation of modern commercial, technical service and corporate resources management systems, with the support of a management team of four foreign experts that will act as commercial, planning, financial and technical managers delegated by EDH's general manager under a two year contract.

In an initial phase the PREPSEL project will concentrate on improving the quality of service, reducing commercial losses and improving revenue collection for large customers, which represent the major source of EDH's revenues; in a second phase it will expand to other commercial and residential customers in a selected zone in Port au Prince and in the recently rehabilitated distribution system of Les Cayes, and lastly the project will lay the basis for the replication of this approach to the rest of the country. The project is complemented with the IDB's distribution rehabilitation project in Port-au-Prince (technical and commercial loss reduction in 7 distribution feeders that serve about 57,000 customers in Port au Prince and Pétionville).

The program seeks to normalize the situation of all customers in the Port au Prince metropolitan area and in Les Cayes by the end of 2011. The normalization process includes the following actions: (i) collect and validate all customer information and the topology of the distribution grid necessary to create the databases for the implementation of the commercial, technical service and corporate resources management systems; (ii) replace or install new meters and upgrade service drops and distribution feeders as required to provide an electricity service of good quality; and (iii) detect and correct illegal connections, electricity theft and fraud.

- c) Reduce the dependence on woodfuels as a source of energy and improve the efficiency of its use.**

The energy sector development plan of 2006 adopted, by and large, the strategy proposed in the ESMAP study¹³ to reduce woodfuel demand in the medium term by the substitution of conventional inefficient stoves in about 25% of households in

¹² Haiti, Electricity Loss Reduction Project (PREPSEL). WB. Project Assessment Document, June 2006. Rehabilitation of the Electricity Distribution System in Port au Prince. IDB. Project documents HA L1014 and HA L1035

¹³ Haiti: Strategy to Alleviate the Pressure of Fuel Demand on National Woodfuel Resources, ESMAP Technical Paper 112/07, April 2007

Haiti: (i) implementing a program to promote the use of imported LPG, kerosene and coal and locally produced briquettes as a substitute for charcoal for cooking in the Port au Prince metropolitan area; and (ii) promoting the use of more efficient stoves (like the MIRAK stove that was introduced in Haiti some years ago) in the rural areas, training artisans in the production of the stoves and establishing quality controls.

The action plans established by the Government address the most important short-term challenges faced by the energy sector and are necessary for improving the performance of the sector in the long-term: (i) Restoration of electricity service and rehabilitation of key generation, transmission and distribution facilities is essential to improving quality of service to existing customers and reducing the generation costs in the short term, and establishing the minimum conditions necessary for the financial recovery of the sector; (ii) the implementation of modern commercial, technical service and corporate resources management systems, and the upgrade and improvement of customer metering and distribution feeders is necessary to reduce commercial losses and revenue collection, increase EDH revenues and reduce EDH's financial losses and the burden of the electricity sector on fiscal resources. It is necessary that EDH improve its commercial performance and eliminates its financial losses before increasing electricity coverage; and (iii) the promotion of more efficient stoves and liquid fuels for cooking is essential to reduce the consumption of wood and charcoal and a further environmental degradation.

The actions plans are a necessary first step in the recovery of the sector but, as explained below, further actions should be considered to support a long-term strategy for a sustainable development of the energy sector in Haiti.

The strategy to improve the operational and financial performance of the electricity sector considers as the first step the improvement of the financial and operational performance of a poor-performing state-owned monopoly company by introducing a customer-oriented approach based on the implementation of modern information and commercial systems, the improvement of corporate governance and its management practices with the support of external experts acting temporarily as managers of the main organizational units. The original strategy prepared by the government in 2006 contemplated an option of contracting an experienced operator to take over EDH operations under a management contract with well defined performance targets and indicators that would be supervised by a technically capable regulatory agency. Privatization of distribution activities was not considered as an option due to political considerations. However, as a result of the OPTEC-FARINA study of 2008¹⁴ and the mixed results of using management contracts to improve performance of power distribution utilities in several developing countries, it was agreed to implement the PREPSEL project with the support of four external experts covering the commercial, financial, technical and planning functions of EDH, as a first stage of the recovery plan. These experts (delegate directors) were incorporated starting August 2010 and their term extends for two years; their presence within EDH was conceived as an integral component of the information and management systems being put in place with donor support. However, these experts lack the decision-making power necessary for a successful implementation of the recovery plan. Besides, EDH corporate governance is weak and substantial improvements are needed in this initial stage. Once EDH has implemented the modern information and commercial systems, completed the basic

¹⁴ Projet de Renforcement Managérial de EDH, Groupement OPTEC-FARINA, Novembre 2008

rehabilitation of distribution grids and obtained some performance improvements, other public-private partnership options could be considered in a second stage to continue improving the performance of the electricity sector.

Decentralization options. The plans and strategies for improving performance seem to consider the provision of electricity service in all the country by one national company, except for decentralized solutions to serve rural and isolated areas using non-conventional renewable energy like solar PV modules and micro-hydro. Although EDH apparently is implementing a decentralized organization to improve electricity service in the main regions outside Port au Prince, it may be important to analyze other options to deepen the extent of decentralization, like independent business units, management contracts with experienced operators or concession contracts with private firms, taking stock of the experience with the Jacmel semi-autonomous distribution system financed by CIDA in the late 1990's¹⁵. Besides, the projects for the development of industrial parks and tourism in the northern region and at Les Cayes would need reliable and good quality service and it would be important to consider other option to facilitate private participation in the provision of electricity service to these parks and surrounding areas like concessions, management contracts and other public-private partnership arrangements.

Woodfuels substitution. The strategy for reducing the dependence on woodfuels was formulated several years ago but it seems that little progress has been made in its implementation. There are some concrete proposals by the LPG industry to increase the penetration of LPG as a substitute for charcoal for cooking in the Port au Prince area, by establishing clear regulations for this service and a subsidy scheme to finance the higher cost of LPG stoves, burners and cylinders. However, apparently the Government has not decided yet what to do. The MIRAK stove program apparently has not made significant inroads in the market. These and other topics would be explored in the proposed strategy

2. Long term plans

For the longer term, the development plans seek to meet other objectives:

- **Development of the renewable energy potential** to reduce the dependency on imported oil and stabilize generation costs.

The government has taken some actions. It obtained the support of the Brazilian government to complete the feasibility study of the Artibonite 4C hydroelectric project and to provide US\$40 million in partial financing for this project. It is obtaining additional technical assistance to complete feasibility studies for the development of wind generation at Lac Azuei. IDB is about to approve a technical assistance for the preparation of a national action plan for the development of bioenergy.

- **Increase electricity coverage and expand generation capacity** according to least-cost plans.

The government will prepare a generation expansion plan with the support of USTDA and is planning to prepare a new national energy plan.

¹⁵ CIDA. Technical Assistance Project EDH-HQI, Jacmel Phases I, II, III. 1998-2008

- **Develop a national transmission grid** to interconnect the North, South and Artibonite regions with the Port au Prince area in order to benefit from economies of scale with the development of larger generation units and the consideration of other sources of energy like coal and natural gas.

Although these actions are important, there is a need to address more important issues for the long-term development of renewable energy and increasing service coverage:

- a) **Private participation and the development of renewable power.** A sort of single-buyer model has operated so far but with no clear rules or policies about contracting long-term energy supply and financing investments in new renewable energy projects. PPAs and ROT schemes have been effective so far in mobilizing private investments for the development of diesel plants in a country with high credit risks. The adoption of competitive and transparent procurement practices and the improvement of EDH's financial and operational performance will help in reducing project risks and obtaining better prices.

The development of renewable generation require different financial schemes and contractual conditions to account for much higher investment costs and project risks and may require special incentives to compete with conventional thermal generation.

- b) **The role of EDH as a monopoly.** EDH has a legal monopoly for the provision of public electricity service in Haiti but has not been able to provide a reliable and good quality service, forcing consumers that are willing to pay for this service to adopt costly solutions like auto-generation and hindering the development of productive industries. Therefore, as discussed above for distribution services, it is important to analyze other options to facilitate energy sales to final consumers by private generators, like the case of touristic areas, industrial parks and large consumers, consistent with the need to increase access to electricity service to low income consumers.
- c) **The design of a business model to increase service coverage and provide reliable and good quality service.** The electricity sector in Haiti faces a major challenge in financing substantial investments in the rehabilitation and improvement of the existing plants and networks as well as new investment to increase electricity coverage and serve demand growth. Assuming that EDH's financial and operational recovery is successful, it is not clear if a business model with cost-recovering tariffs is feasible and sustainable in Haiti to increase service coverage taking into account the low income of most households in Haiti and the high cost of electricity generation. Substantial subsidies and grant money may be required during a transition period.

IV. GOALS, CHALLENGES AND POLICY OPTIONS

The Energy Sector Development Plan of 2006 identifies critical issues and challenges facing the energy sector that, by and large, are still valid today. The 2010 earthquake worsened an already critical situation of the electricity sector, particularly the poor condition of the generation, transmission and distribution facilities and EDH's financial losses. It, therefore, increased the investment needs in repairing and rehabilitating the electric power installations and the fiscal transfers from the budget to cover EDH financial losses.

The issues identified in Section II lead to the following key strategic priorities which will be examined in this section. They include:

- Expanding power infrastructure and taking advantage of native resources;
- Improving governance and regulation of the sector and its associated organizations, notably EDH as an instrument to improve the operational and financial performance of the electricity sector;
- Increasing access to electricity in rural, urban, and peri-urban areas;
- Attracting private sector participation by improving the business environment and exploring/creating opportunities for establishing strategic partnerships;
- Improving the supply of domestic energy by supporting the introduction of modern energies and higher efficiency end-use equipment.

The main policy options to address these strategic priorities are discussed below, grouped in four main areas of the energy sector: (a) Institutional framework, sector governance and decision making; (c) electricity: improving performance, attracting private participation, diversifying energy sources, increasing access and improving regulation; (d) biomass: introducing modern energies and efficient stoves to reduce the dependency on woodfuels; and (e) renewable energy: promoting the use of renewable energy in on-grid and off-grid applications. An initial section summarizes the short-term needs to overcome the earthquake impacts.

A. Overcoming the earthquake impacts

Although the direct damages on the electricity system were estimated at only US\$20.8 million, the short-term investment needs for the repair, restoration and rehabilitation of generation, transmission and distribution installations is much larger. The Post-Disaster Needs Assessment (PDNA) energy working group made a gross estimation of about US\$75 million in investments in works, equipment and spare parts for repairing and replacing damaged installations and for the rehabilitation of essential installations to improve quality of service and reliability of supply (see Table 10). Financing of these urgent investments would require a combination of grants, like IDB's US\$14 million supplemental financing to expand the rehabilitation of seven distribution feeders in Port au Prince and the resources channeled through the Interim Haiti Recovery Commission (USAID allocated US\$8 million project to rehabilitate five substations in Port au Prince), and private financing, like the ROT contract to rehabilitate the Carrefour diesel station.

Table 10

PDNA	
Electricity	
Short-term investment needs (US\$ million)	
Feb/10-Sept/11	
	Investment
Generation	<u>21</u>
Repair and rehabilitation Carrefour 49 MW diesel station	21
Transmission	<u>12</u>
Repair and rehab substations	6
Repair and upgrade dispatch center	10
Distribution	<u>41.3</u>
Repair and restoration distribution grids	24
Public lighting	5
Replace and upgrade meters	9
Rehabilitation operation offices	3.3
Total	74.3
Source: Haiti Earthquake PDNA: Assessment of damage, losses, general and sectoral needs. Annex to the Action Plan for National Recovery and Development of Haiti, March 2010	

The indirect impacts of the earthquake include the disruption of EDH commercial operations and the widespread displacement of population. The PDNA energy work group estimated in about US\$37 million the loss in revenue associated with the disruption of EDH operations for Feb/10 to Sept/11, and in US\$59 million EDH's financial deficit for the same period. EDH's financial losses are not a transitory problem related to the earthquake but a structural problem associated with poor governance and performance of the state-owned monopoly.

As of end May, 2010 an estimated 1.3 million people (or about 13% of the total population) were living in spontaneous settlements¹⁶. The resettlement of this population in safe and permanent places may result in a substantial reallocation of the regional distribution of the population, and an important impact on the electricity demand and on the short-term investment needs for the rehabilitation of the existing power grid, and should also be taken into account in the plans to increase access to electricity service.

B. Governance and institutional framework

1. Governance considerations: transparency, accountability, and responsiveness

An important challenge for the Government and the sector concerns the subject of governance. At a country level, Haiti exhibits poor governance indicators. A project of the World Bank providing a quantitative comparison comprises six areas, as follows:

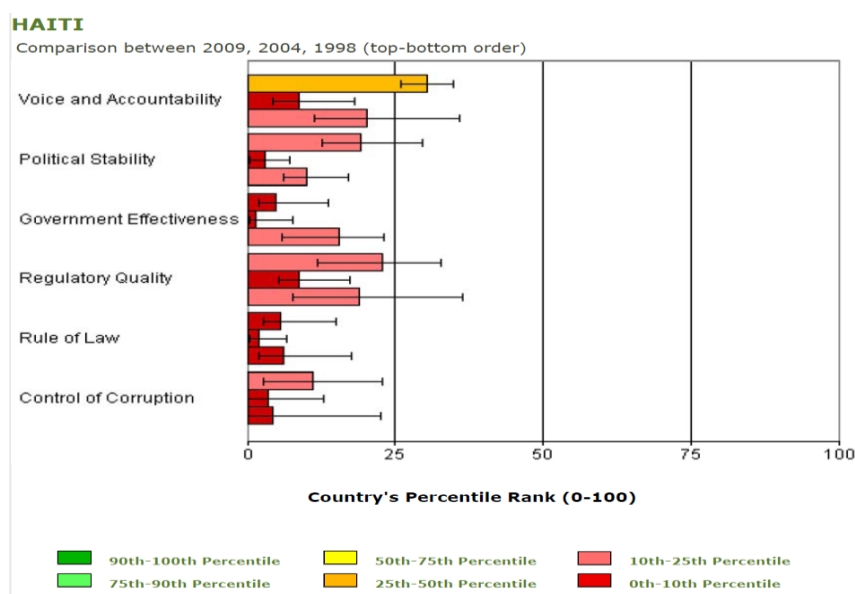
¹⁶ Response to the humanitarian crisis in Haiti following the 12 January 2010 earthquake. Inter-Agency Standing Committee (IASC) July 2010

- **Voice and Accountability:** the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression freedom of association, and a free media;
- **Political stability and absence of violence:** perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including domestic violence and terrorism;
- **Government Effectiveness :** the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies;
- **Regulatory Quality:** the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development;
- **Rule of Law:** the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence
- **Control of corruption:** the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

The indicators cover 212 countries and territories and encompass hundreds of variables from 35 different data sources to reflect the opinions of thousands of polled people.

Haiti's performance for each variable according to the latter indicators is illustrated in the following graphs.

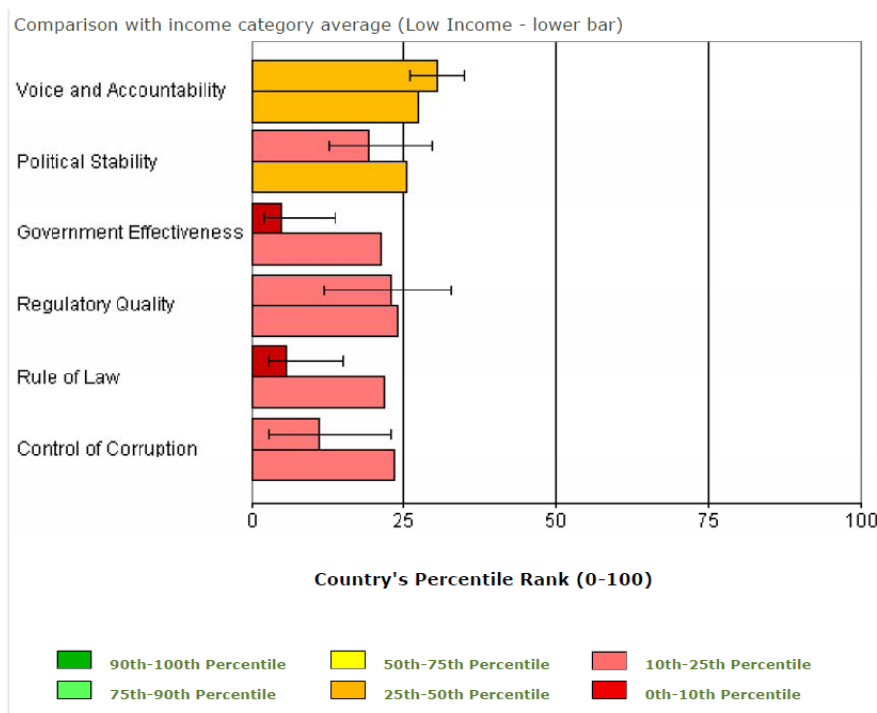
a. According to its performance relative to all other countries:



The graph shows how Haiti has consistently ranked among the lowest percentiles relative to other countries. However, it also shows that in some cases there has been

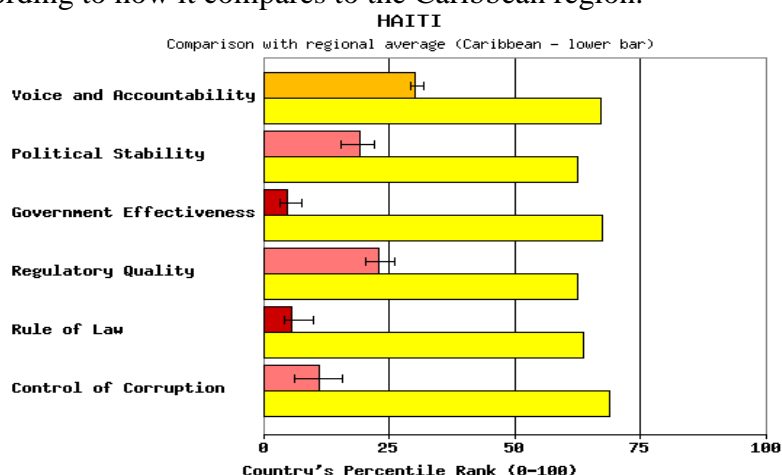
progress in the later years as compared to 2004, which was below the 1998 level for all indicators.

- b. According to how it compares with other low income countries.



Except for the voice and accountability category, Haiti's rankings are lower than the average of similar income countries. The graph also shows a significant association of governance with income levels. Particularly worrisome for the energy sector is the rule of law and the Government effectiveness categories.

- c. According to how it compares to the Caribbean region.

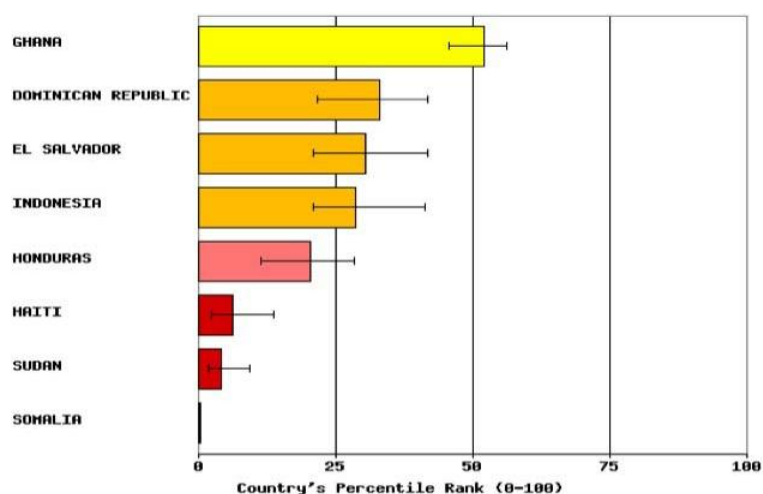


Source: Kaufmann D., A. Kraay, and M. Mastruzzi (2010), The Worldwide Governance Indicators: Methodology and Analytical Issues
Note: The governance indicators presented here aggregate the views on the quality of governance provided by a large number of enterprise, citizen and expert survey respondents in industrial and developing countries. These data are gathered from a number of survey institutes, think tanks, non-governmental organizations, and international organizations. The WGI do not reflect the official views of the World Bank, its Executive Directors, or the countries they represent. The WGI are not used by the World Bank Group to allocate resources.

The regional comparison clearly shows that Haiti is particularly lagging if compared to other economies in the region, in all governance categories.

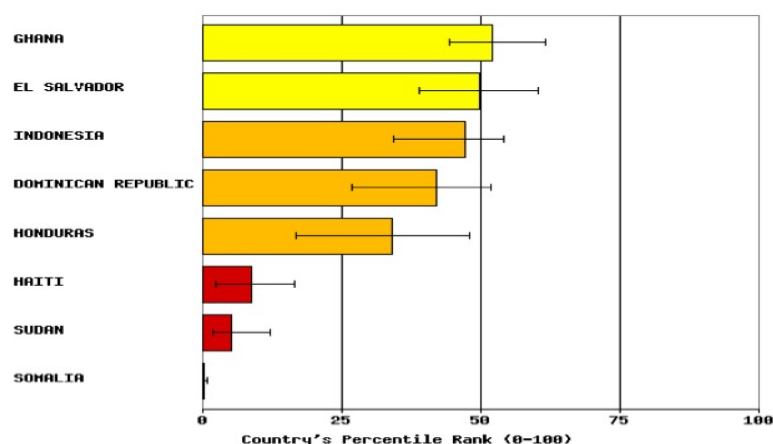
- d. Compared to selected countries in the dataset, Haiti ranks among the lowest in terms of rule of law and Government effectiveness

Rule of Law, end-2008 (Worldwide Governance Indicators)



Source: Kaufmann D., A. Kraay, and M. Mastruzzi 2009: Governance Matters VIII: Governance Indicators for 1996-2008

Government Effectiveness, end-2008 (WGI, selected countries)



Source: Kaufmann D., A. Kraay, and M. Mastruzzi 2009: Governance Matters VIII: Governance Indicators for 1996-2008

Historically treated as sources of funding or employment for political followers, Haiti's public enterprises, including EDH, have fallen prey to a legacy of mismanagement that ultimately undermined their service delivery capabilities and profitability. In the energy sector in particular, governance becomes an issue as it is associated with the weaknesses regarding sector organization pointed out in the previous section. Some of the basic criteria for evaluating governance include transparency, accountability, and responsiveness¹⁷. Applied to EDH there are evident failings:

- **Transparency:** there has been laxity in documenting power sector operations, from having audited financial statements as contemplated in the statutes, to publishing regular operational information which can be used to

¹⁷ Other criteria include Participatory approach, Rule of law, Consensus, Effectiveness and efficiency, and Equity and inclusiveness.

monitor EDH's performance. Because there are no regular meetings of the Board of Directors, and therefore no minutes which can explain decisions made within the company's management, opacity is particularly serious. Efforts have been made to introduce some transparency into EDH's performance, notably the publication of regular information on basic power sector operations, as a condition of the World Bank's EGRO II grant. However, other efforts have floundered, such as the EGRO II condition establishing that power purchase contracts would be awarded competitively, which was disregarded in August 2007 when the Government and EDH prolonged the contract with SOGENER.

- **Accountability:** the consequences of lax management of EDH do not impinge on its staff; the financial consequences, in particular, are merely taken in hand by the MEF; for many years financial statements were not even produced by EDH, let alone audited (the last to be produced by EDH corresponded to the 1999–2000 fiscal year); thereafter EDH ignored them and the Government did not require them (due *inter alia* to EDH's obsolete financial and billing systems). An EU grant in 2004–2005 financed the reconstruction of EDH's accounts for the missing years until 2005 together with their audit. The auditors did not qualify the resulting financial statements because an inventory of assets was missing as well as serious failings regarding financial management in EDH. In 2006–2007 the EU financed the asset evaluation. EDH has not updated the financial statements since 2006. Under these conditions there is no way of assessing performance and much less providing incentives for improved performance.
- **Responsiveness:** this factor requires that an organization respond to its stakeholders within a reasonable amount of time. In the case of EDH its chronic state of disarray has meant that long-suffering customers have not had their supply conditions fulfilled. In order to supply their needs major businesses have opted for self-generation and even smaller businesses are using high-cost small generators to cover their demand.

All of these factors indicate that for EDH to become a disciplined enterprise governed by modern principles it would require a corporate overhaul, putting in place the required checks and balances for the company to function efficiently. Some of this is being done through World Bank support which is financing the implementation of a Management Information System to streamline the day to day operations of the company, thereby bringing a measure of transparency to corporate management. The World Bank project also contemplates putting in place a system for managing distribution network faults and a call center to service customer queries, thereby resulting in greater responsiveness to users.

EDH has been the subject of continued scrutiny from the donor community due, among others, to the substantial transfers of funds from the public budget to pay for commitments with IPPs. In 2005 the so-called Brussels Protocol agreed that further procurement of power by EDH would be done competitively. Since then, this condition has been built into a governance reform operation by the World Bank (EGRO II), and a waiver had to be requested due to non compliance. However, many of the failings of the power sector cannot be placed at EDH's doorstep: decisions not only bypass the MTPTC, they also bypass EDH in order to reach agreements between Government and private sector agents, such as the negotiations for supply by Independent Power

Producers¹⁸. Remedying the problem will not be easy, given the limited credibility of EDH and the Haitian government in the international financial scene; for example, in 1996/1997 EDH bid out the supply of 30MW in HFO units, but the bidding only produced two offers, one of which was considered non-responsive for technical reasons (the contract was eventually awarded to E-power, which will begin generating in 2011).

EDH was also the focus of the Interim Cooperation Framework (ICF) of 2004¹⁹, which set as one of its goals for improved governance putting in place a management contract for the company. Many of the findings of the ICF are still valid today, such as: *“Electricity of Haiti (EDH), an independent public corporation with the monopoly for electricity production, transport, distribution and commercialization, was created in 1971. Successive governments did not grant it the expected autonomy, resulting in irrational decisions and investments, and the application of a public tariff that compromised the commercial goals of the company ... EDH has been paralyzed for 10 years by the crisis, while at the same time suffering from disastrous management. EDH has therefore become incapable of providing minimal electric service. EDH has a negative cash flow and the organization is unable to function without government financial transfers. It has therefore been impossible in the past few years to formulate and maintain a company strategy”*.

2. Improving decision making procedures

Putting in place the required institutional changes needs a rethinking on how the decision making processes are working in the sector. Ideally (and schematically) the following sequence illustrates decision making within a democratic framework:

- Constitution and laws provide a legal framework;
- Government establishes a national development plan with prioritized actions;
- Ministries develop sector plans which reflect the national development plan;
- Executing agencies put the plans in place.

In practice, Haiti has traditionally had a strong presidential system wherein the president holds the seat of power and does not submit to the normal checks and balances that accompany the democratic process²⁰. This translates into a decision making process whereby approval of different courses of action is exclusively measured by the closeness of the heads of the executing agencies to the presidency. Non-observance of ministerial guidelines or plans is tolerated as long as it is implicitly sanctioned by the highest levels of Government. In the case of EDH this leads to a breakdown of governance and the prioritization of company activities as a function of interests which are not necessarily aligned with those of the customers (and potential customers). EDH is also a significant organization in the country: despite its low billing and collection ratios, revenues estimated at around US\$60 million per year are roughly equivalent to 1% of GDP (2008) and up to 20% of Government revenues, which makes the company

¹⁸ In one of the more notorious instances, recently-rehabilitated units in the Carrefour power plant were destroyed by fire—widely ascribed to sabotage—which was promptly followed by a direct negotiation with a private sector IPP (SOGENER).

¹⁹ Interim Cooperation Framework. IDB, World Bank, United Nations, European Commission, July 2004

²⁰ Social Resilience and State Fragility in Haiti—A country social analysis, the World Bank, Report No. 36069-HT, April, 2006.

a powerful and visible asset within the public sector. With around 2000 permanent employees EDH is a valuable source of bureaucratic power for the Government (the current ratio of customers to employees is about 100 compared to values above at least 200 in well-run utilities), which reinforces the permissiveness regarding its management.

Decision making regarding electricity prices is another area where there is a lack of guidelines and is a good example of the former phenomena. Although it is not contemplated in EDH's law, EDH in practice calculates tariffs and promulgates them. However, given the impact they have, they are consulted with Government and in practice are approved by the President. The absence of tariff-setting rules resulted, for example, in frozen tariffs between December 2005 and August 2009, despite the substantial increase in fuel prices. This discrepancy undermined the financial sustainability of EDH, which has had to rely on fiscal transfers from the Treasury in order to continue operating. Prices were adjusted in August 2009, and an automatic price adjustment was envisaged, in line with fuel price fluctuations (a condition contained in the EGRO III operation of the World Bank), which has not been applied in practice.

In fact, MTPTEC suffers from decision congestion. With demands for attention from four sectors (public works, transport, telecommunications, and energy), decisions are often postponed due to the relative urgency of demands on the minister and his aides. Additionally, given the budgeting process of Government, energy has to share resources with other sectors, which are not necessarily set according to economic priorities, but rather according to other factors, including the minister's interest for a given area or stakeholder influence.

A further aspect of decision making in the energy sector is the absence of executing agencies. The only executing agency under MTPTEC is EDH. This leaves a broad number of unattended needs, such as rural electrification, the supply of isolated loads using renewable resources, and the whole area of biomass management and domestic energy. The Bureau of Mines and Energy has had some execution capacity but its efforts have been very specific and have tapered off without leaving a sustainable program in place. Such is the case of the efficient MIRAK stoves which were developed through BME but whose production has practically ceased. This is to be expected when ministries seek to perform execution functions. In general, these are better left to agencies which can attract better technical personnel and have more continuity regarding specific programs.

All actions in the energy sector do not require an execution agency: many initiatives can be implemented and made sustainable if a market can be developed. Under such circumstances the role of Government becomes that of a promoter for launching new businesses or that of regulator when specific circumstances require it.

3. Options for improving the energy sector's institutional framework

Background. As discussed above, the sector requires streamlined decision making procedures which are not being achieved with the current setup with MTPTEC taking care of energy matters. The alternatives found elsewhere include a Ministry-level organization which provides the highest level of attention for energy matters; this is

particularly useful in countries with significant energy resources. However, alternative organizations are also feasible, such as the Chilean National Energy Commission (which is however, linked to the Ministry of Mines), the Panamanian Energy Secretariat, which was only recently created, or the case of Guyana in which energy affairs are directly managed by the Prime Minister's office. In any case, there is a clear cut responsibility for energy matters and an authority that can translate institutional decisions into actions.

The place for energy within Government. The lack of concentration of energy matters in a particular institution, with the accompanying absence of dedicated attention at the MTPTC, point the way towards improving the chain of command through institutional means. Among the options that have been discussed (e.g. at the workshop convened in Port au Prince on October 19, 2010), one of them consists of strengthening the Energy Sector Management Unit (UGSE) within MTPTC to take care of energy affairs. The other possibility is the establishment of a Ministry of Energy in Haiti or some other organization external to MTPTC for dealing with energy and mining matters.

Whatever the type of agency, its functions should comprise, among others:

- Participating in the formulation of Government policy in those affairs pertaining to energy, and formulation of energy policy in Haiti in particular;
- Preparing laws and decrees associated with energy affairs, including those to emanate at the Presidential level;
- Taking the necessary actions to establish the regulatory framework of the sector and delivering the pertinent regulations;
- Preparing development plans and investment plans for the energy sector, and coordinating their execution with other public authorities and private agents, including the preparation of least-cost generation and transmission expansion plans;
- Establishing norms to be applied by different agents in the sector;
- Promoting, according to legal statutes, the participation of private sector agents in the energy sector;
- Ensuring that activities in the energy sector ensure the sustainable development of natural resources;
- Establishing price-setting rules for monopolistic activities, such as EDH, and approving their application;
- Regulating hydrocarbons-related activities, notably petroleum products (taking over this function from the Ministry of Industry and Commerce), and LPG.
- Regulating questions associated with household energy, and establishing, if necessary, subsidization schemes for energy products, and their financing;
- Maintaining a database regarding energy activities and disseminating energy information through a website;

These activities would constitute an important addition to the responsibilities allocated to MTPTC and it would not be reasonable to assume that an Energy Management Unit within the ministry could accomplish them competently: the decision congestion problem would persist and there would be no assurance that the Unit would operate with an adequate budget. Consequently, the best option would be to establish a high level political organization which could be either an Energy Commission with executive authority, or a Ministry of Mines and Energy which would incorporate the functions currently exercised by the Bureau of Mines and Energy within MTPTC.

The advantages and disadvantages of an Energy Commission and a Ministry include:

- An Energy Commission implies a collegiate decision making procedure with multiple commissioners and an institution headed by an executive secretary or an executive director; such an option has the advantage that interests of multiple stakeholders can be reflected in the commission and that, up to a point, political influence may be contained, but it also has the notorious disadvantage that it can result in deadlock when decisions must be taken, and that ensuring its smooth operation (e.g. by periodical meetings) could be difficult.
- A Ministry provides a clear authority route for decision making, at the expense of having influences motivated by short term political motivations which could jeopardize long term gains. An advantage with respect to the Commission would be the direct control of executing agencies, such as EDH, which would be more difficult under the other concept. All in all, these considerations would favor the creation of a Ministry of Energy and Mines (MEM) in the longer term.

In addition to the policy decision-making organizations in the sector, consideration should be given to the execution agencies which would be responsible for putting into effect the policies and plans of the Government. EDH would be one institution directly linked to the Commission/ Ministry. A more direct involvement of the MEM in its management could be expected as it would become the main focus of the Ministry's decisions.

One of the Ministry/Commission functions would include regulation of the energy sector, including power and hydrocarbons, i.e. a function which it would take over from the Ministry of Commerce and Industry. In this respect, it would be essential to shield the Ministry/Commission from interference by the Presidency, by establishing legal decision making procedures which, if not observed, would render them open to challenges in court. Shielding the Ministry/Commission could eventually go as far as impeding the direct appointment of the Minister or the commissioners by the Presidency, and requiring that they be appointed by Parliament.

In addition to EDH, an executing agency to act upon policies related to domestic fuels, electrification, and energy efficiency would be required. The rationale for including electrification as the responsibility of this agency resides in that with its current resources EDH cannot be expected to realistically perform adequately in this respect; furthermore, it makes more sense for EDH's management to concentrate on its financial and technical rehabilitation without any further distracting functions. The proposed agency would be responsible for, among others:

- Promoting and managing renewable energy projects for use in areas which are not connected to the power grid;
- Promoting and managing rural electrification through grid extensions;
- Promoting and executing energy efficiency programs;
- Promoting and managing projects related to efficient household cooking devices such as improved charcoal stoves;
- Managing subsidy programs for improved stoves;
- Coordinating LPG penetration programs with the private sector;
- Cooperating with the Ministry of Agriculture and the Ministry of the Environment in the implementation of programs for forest conservation insofar as energy use is involved.

Putting in place a high-level organization such as a Ministry of Energy and Mines will require time, and the problems with the sector cannot be ignored in the short and medium terms. Accordingly, the first step would be to consolidate an Energy Management Unit within MTPTC, which would include a policy and planning section (i.e. the current *Unité de Gestion du Secteur de l'Énergie*) together with the Bureau of Mines and Energy; more significantly, it would be headed by a director with an enhanced profile at the vice-ministerial level. The Management Unit would subsequently be transformed into the Ministry of Energy and Mines. The unit would urgently require support in the planning area; the existing energy unit in MTPTC is intended to include a planning expert to lead the effective implementation of a Master Plan for the power sector in the short and medium term; there have been difficulties in finding a suitable local candidate, and a foreign hire should be contemplated. Planning in the power sector context would include putting together and evaluating options on the mix of primary energy resources to supply projected demand with an adequate level of reliability. The planning role would be one of the major responsibilities at the Government level, either within the existing UGSE at MTPTC or an alternative organization, as outlined above.

C. Electricity

1. Improving the operational and financial performance of the power sector

Improving the performance of the electricity sector and ensuring its financial sustainability are major challenges that require actions in several areas:

- Restoring service and rehabilitating the generation, transmission and distribution system. A transmission and distribution system that can provide a reliable and good quality service to existing demand (taking into account urban planning and housing reconstruction programs) is essential to eliminate electricity shortages, provide 24 hours per day service and improve customer service and implement the strategy to reduce commercial losses based on a customer- oriented service. Rehabilitating the existing hydroelectric plants will increase the average

hydroelectric generation and displace expensive thermoelectric generation, essential to reduce generation costs and financial losses.

- Improve electricity metering billing, collection and customer service systems and procedures, in order to reduce commercial losses and increase revenue collections. The diagnosis shows that the current very low cash-recovery index explains most of the financial losses of EDH and should be improved in the short-term to reduce the fiscal transfers that are a major burden for the Government finances
- Improve the sector governance. The diagnosis of the sector indicates that EDH's poor performance is related not only to lack of investment and information tools but to a combination of political interference, poor corporate governance arrangements and management practices of EDH, and poor supervision of EDH's performance by MTPTC and MEF, all related to the sector governance.

EDH financial projections prepared in early 2009 by the consultant who prepared the electricity tariff study²¹ indicate that the elimination of electricity shortages, the rehabilitation of hydroelectric stations and the reduction of commercial losses would have a substantial impact on EDH financial results for 2010-2016. If total electricity losses are reduced to about 25% by 2016 (currently about 53%), an average electricity tariff of 28 US¢/kWh (currently about 33 US¢/kWh) would be sufficient to eliminate financial losses and fiscal transfers by that year, assuming that international fuel prices remain at about the current level. Of course the financial projections would have to be revised to take into account the impact of the earthquake on investment needs and financial costs and to validate some assumptions on the demand projections and generation costs, but it gives an indication of the financial recovery that could be achieved by basically improving EDH operational performance.

Regarding electricity tariffs, the current structure does not reflect costs of supply, as lower cost, large clients, are being charged prices commensurate or in excess of small, high cost clients. This provides an incentive to self-generate, eventually with high cost diesel fuel. Such a tariff schedule does not provide an adequate structure for reaching an efficient use of resources and should be a prime candidate for reform once costs are under control. In the short term, given the dependence of EDH on large clients' revenue, reforms in this area cannot be implemented. Assuming that an appropriate scenario can be reached, the pricing system should ensure the collection of the revenues needed to sustain all operations. In remote areas with high costs a measure of subsidization will probably be required, which could consist of cross-subsidization among, or preferably within, consumer categories.

The first two areas of the actions required to improve performance are covered by the short-term action plan that the government is implementing and the investments in the rehabilitation of power facilities to overcome the impact of the earthquake and (discussed above). However, these actions are not sufficient to improve financial performance on a sustainable basis if the governance issues are not addressed effectively. The options to improve the sector institutional framework were discussed in section IV.B.3. The options to improve EDH corporate governance are discussed below.

²¹ Electricité d'Haïti Tariff Study 2008, Impact de la grille tarifaire sur les projections financiers d'EDH, Fevrier 2009. Oscar Guzmán. Study financed by PPIAF.

The international experience in developing countries indicate that most government-owned electricity utilities perform poorly in large part because politicians and bureaucrats frequently use their power to advance their own interests and pursue noncommercial goals instead of improving the performance of the utility. The international experience also shows that improving corporate governance (changing the rules that define the relationship between the company and the government as its owner) and the operational and financial performance of electricity utilities is not an easy task.



The developing countries in the region have improved operational and financial performance of the sector using three basic instruments: competition, private participation and commercialization and corporatization of state owned enterprises.

There is a wide range in **the scope of private participation and competition** in the region and in the combination of these two instruments (see Table 11). On the scope of competition:

- a) **No competition**, a traditional model used before the 1990's, in which state-owned enterprises or private companies have monopoly rights for the provision of electricity service and are responsible for expansion planning, construction, financing, operation, maintenance and commercial activities. This scheme is used mainly in small island states and in a few South American countries.
- b) **Some competition by private investors** which participate in competitive bidding procedures to develop new generation plants to supply energy under a PPA to a vertically integrated monopoly or to a single buyer responsible for procuring new supplies to meet expected electricity demand. This is used in countries like Mexico, Costa Rica and Honduras, that decided to keep a state-owned monopoly but wanted to promote private participation in generation expansion.
- c) **A competitive wholesale market** where several distribution companies and large consumers can purchase electricity from several generators in a contract market (select their own energy supplier and negotiate prices) or in a spot market to meet demand. This scheme requires a complex restructuring of the sector: vertically unbundling of generation, transmission and distribution activities, horizontal unbundling of distribution and generation activities, the separation of the policy making, regulation and service provider roles, and the creation of a system operator and a market administrator.

Table 11

Power sector reform in LCR

% demand		1%	33%	47%	18%	
Competition 	Unbundling, wholesale power market, large consumers		Ecuador	Brazil, Colombia, Guatemala, El Salvador, Nicaragua, Dominican Republic	Argentina, Bolivia, Chile, Peru, Panamá	65%
	Single buyer & IPPs		Guyana	T&T, Honduras	Jamaica	2%
	Vertically integrated monopoly and IPPs	Uruguay	Costa Rica, Mexico	Surinam		24%
	No competition	Paraguay	Venezuela		most island states	9%
		SOE	low	medium	high	% dem
		private participation 				

On the scope of private participation:

- No participation.** State owned enterprises are responsible, by and large, for electricity service.
- Low participation.** Private companies participate as IPPs with a minor share of the market.
- Medium participation.** Private companies participate as IPPs or as generation and distribution companies in a competitive market with a medium share of the market.
- High participation.** Private companies have a high share of the market either as vertically integrated monopolies (in island-states in the Caribbean), a combination of IPPs and distribution companies or as generation, transmission and distribution companies in a competitive market. Private participation was introduced through divestiture of state-owned assets, capitalization of state-owned enterprises, concession contracts for the provision of electricity service or IPPs.

Haiti is currently in a position of low private participation (IPPs) and no competition, as in most cases competitive bidding procedures have not been used to contract energy supply from IPPs.

In spite of the power sector reforms implemented in many countries in LAC during the 1990s, based on a market model with competition and private participation, in some cases (for example, Dominican Republic and Nicaragua), private operators were not successful in reducing electricity losses and improving revenue collections after having introduced modern commercial management systems and practices, due in part to the fact that they faced an adverse political environment characterized by lack of commitment to control electricity fraud and implement cost-recovery tariffs and dissatisfaction with the performance of private operators. Countries with small power systems that tried to use a competitive market to improve performance learned the hard way the problems of market power (the case of El Salvador). However, most private

operators were successful in improving the performance of thermal generation plants, by introducing good operation and maintenance practices and developing efficient technologies, in some cases using long-term PPAs that helped reduce market risks, although energy prices in these contracts were considered to be relatively high.

The commercialization and corporatization of private enterprises is the third instrument used to improve corporate governance and performance. Some countries decided to keep the responsibility of electricity service under state-owned enterprises, in some cases in a monopoly position, and improve the performance of these companies by enhancing corporate governance. Improvements in corporate governance were sought through the commercialization (instill a commercial culture in the utility) and the corporatization (convert the utility in a corporation subject to standard private-sector company law). In the 1980's governments tried the initial stages of commercialization by negotiating performance contracts or *contrat-plans* with their managers, a written agreement that specify targets that management should achieve in a given time frame and actions that the government should undertake, and define how performance will be measured. However, in most cases the results were disappointing as no evidence was found that performance contracts had improved efficiency: targets were set too low or were hard to evaluate, there was a lack of adequate incentives for managers to improve performance or the Government did not keep its promises.

Other countries advanced in the process of commercialization and corporatization of state-owned electricity utilities, with mixed results. From appointing professional managers and an independent and competent board of directors, exposing SOEs to competition and ending preferential treatment, establishing hard budget constraints and increasing the autonomy of SOEs, to establishing the SOE as a commercial company subject to standard private-sector company law and to general rules enforced by an independent regulatory agency and listing a minority of shares in the stock market. However, there are cases of state-owned electricity enterprises, with a long tradition of good management, that operate as commercial companies and have an excellent performance like, for example, ICE in Costa Rica or EPM and ISA in Colombia. Good performance is not a question of public vs. private ownership, but of good governance, effective competition and sound regulation.

A few countries in the region applied the model widely used in Africa and in water supply to keep government ownership but transfer operational control of the utility to a private operator, as an interim measure to improve performance. That is the case of *affermage* or management contracts with experienced operators, under which the private operator has operational control and regulatory obligations but no investment responsibilities. Again, the results are mixed and depend, as in the case of *contrat-plans*, on setting realistic and enforceable targets, adequate incentives and keeping the government commitments.

Summarizing, developing countries in the region have used many schemes for improving the operational and financial performance of state-owned electricity utilities, with different degrees of public-private participation, although none of them has worked in a situation where there is no political commitment and support to operate the public utilities as commercial companies, stop political interference, control and penalize electricity fraud and theft and establish cost-reflective tariffs.

Haiti faces special and critical conditions that impose constraints on the options that can be considered to improve corporate governance in a second stage after the PREPSEL project has been implemented:

1. **A small power system with only long-term prospects for an interconnection with the Dominican Republic.** The international experience shows that introducing a competitive wholesale market is not effective as an instrument to improve performance in countries with small power systems. The costs of restructuring and managing a competitive market exceed the benefits of competition in a market where there are few participants and a high risk of abuses of market power. A competitive market (and unbundling) is justified in small countries in Central America where a regional interconnection is being commissioned and a much larger market will be created, but is not an option in Haiti, with a tiny and fragmented market and only long-term opportunities to interconnect with Dominican Republic.
2. **High risks for private investors.** Large investments are needed for the rehabilitation and refurbishing of the generation, transmission and distribution systems to meet current demand in the Port au Prince metropolitan area and in the expansion of supply to increase electricity coverage; electricity supply in the Port au Prince area is not financially viable unless there is a substantial reduction of electricity losses; high country and credit risks; and the judiciary system is weak.

We think that in the short and medium term it is unlikely that qualified private investors would be interested in participating in Haiti in activities with high investment risks, in addition to the high country and credit risks. For example, private investors would have a low appetite in participating in a concession contract for providing electricity service in the Metropolitan area of Port au Prince with a power system still in poor condition and with very high commercial losses.

However, qualified private operators may be interested in participating in performance-based management contracts with no investment responsibilities and the opportunity to obtain a success fee for improved performance.

3. **Regional differences in electricity service.** The conditions in some isolated systems are better than those in the metropolitan area. In some cases like in Jacmel and Les Cayes the distribution networks have been rehabilitated and operational performance is better. There are projects to develop touristic areas and industrial parks in the northern region that would require the development of new and reliable power supply.

Private investors could be interested in a concession contracts (operational and investment responsibilities) or management contracts to provide electricity service in isolated areas with recently rehabilitated power systems or to provide electricity service to a new industrial park or touristic areas. The scope of private participation would be determined by political support and the appetite of private investors to take risks.

4. **EDH still operates as a non-commercial electricity monopoly with substantial political interference**

We consider that in this case rehabilitating distribution grids, modernizing the information management systems, retaining international experts in the management

team of EDH, strengthening the supervisory capacity of MTPCT and signing a *contrat-plan* with the government would not be sufficient to improve performance on a sustainable basis. It would be necessary to have political commitment and support to implement a commercial operation of the sector with minor political interference.

The box in the next page summarizes the different options considered for the development of new generation (discussed in section IV.C.3 below), the operation and expansion of the Port au Prince metropolitan system and the isolated systems and electricity supply to new industrial parks and touristic areas. We note the following:

- a) All the options require strong political support for a commercial operation of the sector minimizing political interference, and for strengthening the Government capability to design, prepare bidding documents, evaluate and negotiate proposals, enforce and monitor contracts, either *contrat-plans*, management or concession contracts, or PPA.
- b) The Law for the Modernization of Public Enterprises (LMPE) of 1996²² seems to be a good instrument to improve corporate governance with private participation. It authorizes the use of management contracts, concession contracts and capitalization (creation of a mixed-capital enterprise based on EDH assets and capital contributions from a private partner). The Council for the Modernization of Public Enterprises (CMEP) is responsible for awarding the management and concession contracts on behalf of the State, which is the owner of the assets. The concession contracts will require Parliamentary approval. However, it has to be confirmed if this law can be used to award concession or management contracts for providing electricity service in regions or small isolated systems.
- c) The demands on strong supervisory and regulatory functions increase with the scope of private participation, from management contracts to concession contracts. In both cases the contract itself should establish, among other things, the rights and obligations of the State and the operator, performance targets, price formulas, the remuneration of the operator, quality of service standards, investment responsibilities and the rules for conflict-resolution. Concession contracts are more complex because the operator has investment responsibilities and the return on investment is basically determined by its performance and the price-setting formulas established in the contract. This model of regulation relies on detailed contracts to establish all the rules and regulations for the provision of electricity service and is commonly called “regulation by contract”. The regulatory contract does not replace the regulator but substantially limits the regulator’s discretion. It works better if there is an independent and capable regulatory agency responsible for administering (monitoring, enforcing and adjusting) the contract.
- d) Commercialization, corporatization and outsourcing of key services of EDH can be implemented without changing the structure of the power sector. EDH continues to operate as a vertically integrated monopoly under new statutes and internal organization and outsources key services.
- e) The use of concession and management contracts at regional level, either for electricity supply in isolated systems, industrial parks or touristic areas may

²² Loi portant sur la modernization des entreprises publiques

have a substantial impact on the structure and regulation of the power sector. According to the CMEP law, these contracts transfer operational and/or investment responsibilities for the provision of electricity service (previously assigned to EDH) to a private operator, equivalent to a horizontal unbundling of EDH. The contract should establish the limits of the area where the operator should provide electricity service and the scope of the responsibilities of the operator for the connection of new customers in this area. Usually the operator does not have responsibility for the interconnection of the isolated area to the Port au Prince metropolitan area and is necessary to assign this responsibility to a national transmission company. In the case that the isolated area is interconnected, it is necessary to define all the rules and regulations for the operation and control of the power system and the commercial interchanges between areas. This is equivalent to an incipient energy market that should be regulated.

- f) In any case, it is important to realize that the fees for the services rendered by private operators will increase as risks increase. The use of instruments to mitigate investment and credit risks will reduce these fees, among other things: the financial recovery of EDH, and the use of credit-enhancement mechanisms (sovereign guarantees and partial risk guarantees).

2. Increasing electricity coverage

As discussed in section II.C.2, the information available about electricity coverage is incomplete and inconsistent. What is clear is that in urban centers the legal connections represent a fraction of electricity consumers actually connected to the grid and that most consumers appear to have illegal connections that do not meet any safety or technical standards, especially in the large shantytowns in the main cities. It is also clear that electricity rationing is chronic in the metropolitan area, electricity coverage in rural areas is very low and electricity coverage at the national level is likely to be below 30%.

Increasing electricity coverage, therefore, should include the normalization of electricity service to current consumers and the electrification of peri-urban and rural areas. In both cases consumers and the national economy benefit from having access to a lower cost, more convenient and higher quality energy source.

In the short term the priority is to **normalize electricity service to consumers that are connected to the distribution grid and meet minimum technical standards**. Providing 24 hours a day quality electricity service to EDH customers and reducing theft and fraud from the larger consumers will have a substantial positive impact on electricity demand and EDH revenues, and will stimulate economic development with a reliable and probably lower cost electricity supply to industrial and commercial consumers. This action is included in the PREPSEL project and is a key element of the actions taken to improve operational and financial performance.

HAITI		
Options to improve operational and financial performance		
Activity	Options	Comments
New generation or rehabilitation of existing thermal plants	BAU- Direct negotiations with private generators	Not recommended. Lack of transparency and of competition would increase generation prices and result on inconvenient contractual conditions
	Competitive bidding for PPAs under BOT or ROT schemes	It is an option. Standardized contracts and bidding procedures should be established and instruments to mitigate risks for private investors
	Special purpose vehicle (SPV) and public-private partnership	Adequate for a high project risk plant like Artibonite 4C
PAP- Metropolitan area.	BAU. Modern information management systems, rehab. Of existing facilities and international experts in key management positions, contrat-plan.	Incentives for performance are weak. First stage in the process of improving performance.
	BAU+ commercialization and corporatization of EDH	Necessary to improve chances of success of first stage. Require strong political commitment for a commercial operation of EDH without political interference
	Concession contract	Private company takes operational and investment risks. It would be feasible when country conditions improve and the generation, transmission and distribution systems are rehabilitated. Need strong political support and regulation and clear targets on service coverage .
	Affermage or management contract to take over EDH operations	Feasible. Private operator does not take investment risks. Need to strengthen capacity to design, negotiate and supervise management contract with clear performance targets and ensure resources to finance needed investments for rehabilitation and expansion . Need strong political support
	Outsourcing of key activities	Feasible. Private operator does not take investment risks. Need strong incentives for performance, enforceable targets and good supervision. Transitory improvements in performance.
Isolated systems	BAU. Decentralized and semi-autonomous operations.	Feasible if EDH is run as a commercial company.
	Management contract.	Feasible. Same comment of PaP affermage case
	Concession contract	Feasible. See comments above
New industrial parks and touristic area	BAU. EDH provides electricity service.	Not recommended. Put at risk these plans because of poor performance of EDH.
	Concession contract	Feasible. Need strong political support and regulation. Need to establish clear regulations, including responsibilities for the connection of new customers in the concessional area .

The electrification of peri-urban and rural areas is a long-term goal in a country with very low electricity coverage. Countries in Central America that in 1985 had electricity coverage at levels similar to the current coverage in Haiti (see Table 12) were able to increase coverage to levels in the range of 77% to 86% in 20 years (El Salvador, Guatemala and Honduras) and in the case of Nicaragua, the poorest country in the region that lags behind in coverage, real progress was only made in the 2000's. These countries implemented rural electrification policies and programs that tried to address the challenges of high capital and operating costs, affordability of the electricity service for the rural poor and the institutional difficulty of distribution utilities to meeting the especial demands of rural electrification. The programs usually involved a strong Government support and leadership, the creation of subsidy funds with clear criteria to expand electricity service and rules for subsidizing upfront costs, establishing adequate institutional structures for planning, financing and implementing these programs, the support of concessional funds and grants from the donor community and proper consideration of off-grid alternatives.

Electricity coverage						
Haiti vs. Countries in Central America						
	1985		2000		2008	
	% urban ^{a/}	% coverage	% urban	% coverage	% urban	% coverage
El Salvador	47%	41%	55%	76%	60%	86%
Guatemala	33%	30%	43%	69%	57%	84%
Honduras	38%	31%	45%	55%	50%	77%
Nicaragua	51%	47%	55%	46%	58%	65%
Haiti	27%		38%		45%	30%
a/ Urban/total population						

Source: CEPAL-Estadísticas Sector Eléctrico en Centro América 2008 and Boletín Demográfico- Proyección Población Urbana y Rural en América Latina

Haiti is a special case for rural electrification. Excluding the metropolitan area of Port au Prince, which is served by an interconnected power system, all the population with access to electricity service is served by a few isolated 23 and 12.37 kV power grids supplied by diesel and mini-hydro stations²³, and several isolated mini-distribution systems supplied by diesel engines. There are still several small towns with a population in the range of 5,000 people that do not have electricity or have only access to isolated diesel engines. Rural electrification in this case includes the extension and consolidation of isolated power systems, the development of isolated mini-distribution systems to serve small towns and of micro-distribution grids supplied by micro-hydro generation and solar photovoltaic generators to serve small communities.

EDH is responsible for electricity service in isolated systems and the planning and implementation of rural electrification projects. It is implementing, with resources provided by the national treasury, about 30 small projects for about US\$9 million for the extension of distribution grids in isolated power systems, the development of micro-hydroelectric plants and micro-distribution systems to serve small communities and solar photovoltaic systems to serve small communities (see Table 13).

Table 13

Rural electrification		
Projects under execution		
Financed by the National Treasury		
Type	Number	Budget US\$M
Strengthening and extension of distribution grids in isolated systems	13	5.8
Micro-hydroelectric plants and micro-distribution grids	10	2.3
Solar photovoltaic panels to supply electricity to small communities mainly for lighting	8	0.4
Total		8.5
Source: MPTC-Etat des dépenses des projets du secteur de l'électricité		

The electrification strategy should also define the timing and conditions for the development of a national interconnected system. The national energy plan of 2006 indicates that the Artibonite and the North isolated power systems should be interconnected with the Port au Prince metropolitan area in 2013-2015 when peak demand in the isolated systems are expected to exceed 30 MW. However, it is necessary to prepare a feasibility study of the interconnections which should include a cost-benefit analysis of the project. The justification would depend on possible economies of scale of developing larger generation units and the benefits of reducing reserve capacity and improving economic dispatch.

²³ The isolated distribution system in the Artibonite province which serves the cities of Gonaives and Saint-Marc (over 100,000 people each) and nearby towns; the distribution system in the Nord province which serves the city of Cap-Haïtien (over 150,000 people) and nearby towns; the distribution system in the Sud Province which serves the small city of Les Cayes (about 70,000 people) and nearby , and the distribution system in the Sud-Est province which serves the small city of Jacmel (40,000 people) and nearby towns.

3. Reducing the dependence on high price imported fuels

The dependence on gas oil fired diesel engines has increased the generation costs, made them vulnerable to the volatility of international oil prices and threatens the financial recovery of the electricity sector.

In the short term, generation costs can be reduced by the rehabilitation and refurbishing of the Peligre hydroelectric station and the mini-hydroelectric stations installed in the isolated power systems, as well as the rehabilitation of the Carrefour diesel plant. This is part of the short-term action plan that the government is implementing.

However, the reduction in the average generation cost may not be substantial because the energy demand may increase substantially if 24 hours a day quality service is provided to existing consumers, as well as the generation of less-efficient and more expensive diesel generation using gas-oil.

In the medium and long-term a diversification of energy sources used for power generation could reduce the dependence on imported liquid fuels and stabilize and/or reduce generation costs. The diversification of energy sources can be achieved by:

- Developing generation based on the indigenous renewable energy potential, mainly hydroelectric, wind and solar.
- Using other imported fuels like coal and LNG for power generation
- An electricity interconnection with the Dominican Republic to import lower cost electricity.

The generation expansion plans that were prepared in 2006 and 2007 concluded that renewable generation was not an option in the medium term: it would take several years to study and develop the hydroelectric potential and wind generation does not provide firm capacity to meet peak demand in Haiti. Generation had to rely basically on more efficient medium speed diesel engines or combined cycle plants. Coal-fired generation could be attractive in the long-term when larger generation units could be installed, but its negative externalities has be evaluated and taken into account.

After the planning studies were completed in 2006 progress was made in the study of renewable generation projects and additional information is available that could help assessing a diversification policy. As indicated above, a feasibility study of the Artibonite 4C hydroelectric project was completed in 2010 and attractive wind conditions for the development of wind generation farms at Lac Azuei were confirmed. Furthermore, a general study of regional electricity generation and interconnection in the Caribbean countries was also completed in 2010²⁴.

The regional study prepared by Nexant, reached some interesting conclusions about the prospects in the long-term for diversification of energy sources in Haiti:

- Wind and hydroelectric energy could be competitive if good sites with low development costs can be identified and secured.
- Low speed 20 MW diesel units running with LNG could be attractive in a scenario of high prices of gas oil and fuel oil projected in the long-term by the

²⁴ Caribbean Regional Electricity generation, interconnection and fuel supply strategy, Final Report submitted to the World Bank by Nexant. March 2010

Energy Information Administration (EIA). The traditional supply of LNG using large tankers with sizes above 135,000 cubic meters can only be justified with a large gas market (combined cycle plants >300 MW) and, therefore, it is not an option for Haiti. However, it may be possible to develop a mid-scale LNG supply scheme with small tankers appropriate for small scale generation, at competitive fuel prices.

- A 250 MW, 563 km electricity interconnection with the Dominican Republic is not economic if exports are based on the generation of diesel stations using HFO, currently operating in the Dominican Republic.
- Coal-fired generation is not attractive if the externalities of the high emissions of greenhouse gases (GHG) are taken into account.
- Concentrating Solar Power generation is not competitive and photovoltaic solar generation is only attractive for off-grid solutions.

These conclusions need to be confirmed by further studies. The mid-scale LNG supply scheme is only an idea that has to be tested in pilot projects and would require some years to develop. The economic justification of wind and hydro projects would depend on more detailed feasibility studies and economic analysis of generation costs and benefits.

A comparison of generation costs based on screening curves helps to understand the assumptions and conclusions of the Nexant study, taking into account additional cost information of hydroelectric projects in Haiti. Table 14 shows the basic parameters of the generation options that are compared. We note that:

- Nexant uses investment costs for low and medium speed engines, in the range of 590-650 US\$/kW, much lower than the investment of about 1,900 US\$/kW used in generation expansion planning studies in Central America, provided by the CEAC²⁵, where there is substantial experience with this technology.
- E-power is included with the capacity charge of the PPA.
- For the small hydro and Artibonite 4C alternatives, we used the cost information that was made public recently.

Table 14

**Generation plants
Basic parameters**

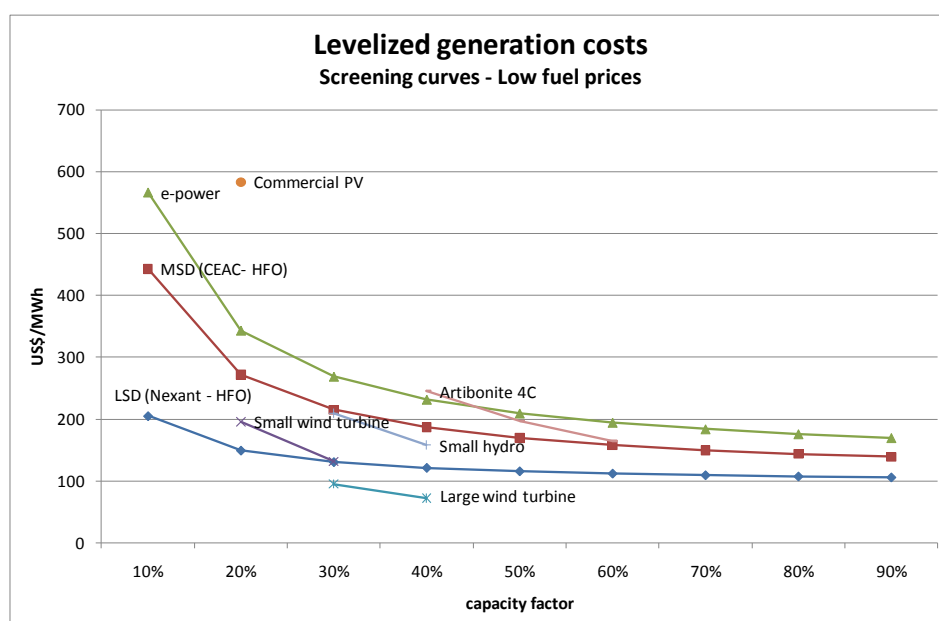
Plant	Fuel	Cap.	Economic life	Investment cost w/IDC		Variable costs	Fixed costs	Efficiency/Heat rate		
		MW	years	\$/kW	\$/kW-year	US\$/MWh	\$/kW-year	%	BTU/kWh	kWh/gal
MSD (Nexant-gas oil)	FO2	10	30	642	80	5.0	30.0	43.9%	7,772.0	17.7
LSD (Nexant - HFO)	FO6	20	30	589	73	5.0	25.0	46.2%	7,393.0	20.2
MSD (CEAC- HFO)	FO6	20	20	1,885	252	7.5	47.1	43.4%	7,853.1	19.1
e-power	FO6	4			390	0.0	0.0	40.0%	8,530.0	16.9
Small wind turbine	wind	0.5	30	2,260	281	4.0	55.0			
Large wind turbine	wind	1.5	30	1,695	210	2.0	35.0			
Commercial PV	solar	0.5	20	7,200	964	4.0	50.0			
Small hydro	hydro	4	40	4,120	500	4.0	40.0			
Artibonite 4C	hydro	34	40	6,947	843	3.3	5.0			
Source: Own calculations based on information of Nexant report except for e-power, Artibonite 4C and small hydro, and MSD CEAC										
Discount rate:	12%									

²⁵ Consejo de Electrificación de América Central

Figure 4 compares the levelized energy generation costs for these alternatives as a function of the capacity factor, for a scenario of low international fuel prices (about the current prices). We note the following:

- The levelized energy prices for the thermoelectric generation options are shown for the full range of capacity factors between 10% and 90%. The efficient thermal plants should be dispatched at high plant factors. For renewable generation, the plant factor is project specific. The levelized energy costs are only shown for typical annual plant factors: 30%-40% for small hydro, 20%-40% for wind generation. In the case of Artibonite 4C, there is no information available to calculate the plant factor and its levelized energy costs are shown for plant factors between 40%-60%, typical of hydroelectric projects with some storage capacity.
- The large wind turbines with low investment cost of about 1,700 US\$/kW and relatively high plant factors have a low levelized energy cost in the range of 8-10 US¢/kWh, lower than the other options. However, the wind projects do not supply firm power and back-up (at an additional cost) needs to be considered.
- The LSD with low investment costs is the most attractive option for firm base-load generation. If higher investment costs are considered (e.g. based on CEAC data for MSD/HFO), diesel engines running with HFO are still the most attractive option for base-load generation.
- The small hydro option that was considered (based on information about the Pichon Hydroelectric project) with investment costs of about 4,000 US\$/kW is attractive but should be penalized to account for the lack of firm power.
- The Artibonite 4C is not competitive with the very high investment cost that was considered and that may be distorted by investments that are not directly related with electricity generation (multi-purpose project) and conservative costing by the military institute of engineers.
- The E-power project has higher costs than the other diesel generation options, which may reflect the high country and project risks faced by a private developer in Haiti. In any case, the thermoelectric plants have levelized energy costs between 15-17 US¢/kWh when dispatched at high plant factors, i.e. above 80%.

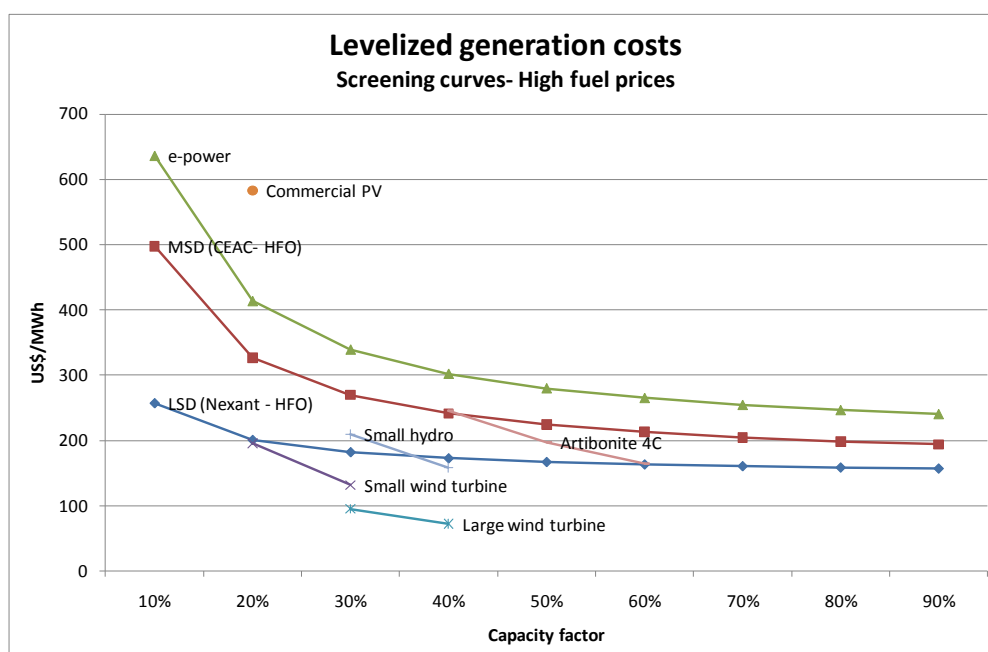
Figure 4



For a scenario of high international fuel prices (119 and 125 US\$/bbl for HFO and gas oil, respectively) shown in Figure 5, one can conclude that:

- The levelized energy costs for diesel generation increase to the range of 20-25 US¢/kWh for high plant factors
- The renewable generation projects could be competitive, even considering a penalization for lack of firm power.

Figure 5



Summarizing, although wind and hydroelectric energy could be competitive if good sites with low development costs can be identified and secured, the Artibonite 4C

hydroelectric project is not competitive with the high investment costs that were reported recently. Additional information and analysis is required to confirm the economic justification of this project. For the near future it seems that the best option is to use medium or low speed diesel engines running on HFO. Solar PV and micro-hydro seems to be attractive options to supply energy in remote communities.

Private participation is important for the development of new generation and the implementation of a diversification policy based on renewable energy. EDH does not have the financial or technical capability to undertake the development of renewable generation projects and it will take some time to improve its operational and financial performance. The participation of IPPs will be important to develop diesel generation other than small engines used in the isolated systems and for the development of small renewable generation.

However, private investors face large risks for the development of generation projects in Haiti. EDH is not a creditworthy institution and the fiscal situation is critical. The country risks are also very high. Project risks are high in the case of long-lived capital intensive renewable projects with long construction times and high preparation costs. High unmitigated risks result in high generation costs and prices, few qualified developers and bids. Therefore, mitigating risks and reducing preparation and transaction costs is very important to increase the participation of qualified private developers, increase competition and reduce generation costs and prices.

There are several instruments for mitigating risks in the development of generation projects:

- a) Long-term power purchase contracts are essential to reduce market risks and facilitate the use of *project finance* schemes by private developers.
- b) The financial recovery of EDH is essential to reduce credit risks
- c) The assessment of the wind and hydro generation potential, additional studies to identify the most attractive sites and the dissemination of this information will reduce the preparation costs and facilitate the participation of private developers.
- d) The use of credit enhancement products, like partial risk guarantees and syndication arrangements, reduces credit/default risk of a debt, lower interest rates and help attract private participation.
- e) Public/private partnerships help to manage investment risks in larger renewable projects like the Artibonite 4C hydroelectric projects. The Government can mobilize concessional financing and is in a better position to manage resettlement programs.

The scheme used so far to finance the development of new diesel plants by private developers has been a BOO (build-own-operate) arrangement backed by a long term energy purchase contract (PPA). The IPP is responsible for the design, financing, construction, operation of the project and energy supply and maintain the property of the asset, in some cases with an option to transfer the property of the asset to EDH at the end of the contract for a nominal fee.

The lack of transparent and competitive procurement practices to award the PPA contracts may have increased the energy prices. In most countries of the region the distribution company should contract energy supply using competitive bidding procedures and purchase contracts that meet the rules and principles established by the

regulatory agency, which have been designed to promote competition and obtain good prices and supply conditions. In the case of Haiti, where EDH operates as a single-buyer, it is important that MPTC establish these rules and procedures and supervise the bidding process.

In section IV.E.1 we suggested to establish in a law special incentives for the development of small renewable generation and consider using a feed-in price scheme. In this case, EDH has to purchase energy to qualified generation projects, under a long-term contract, if the energy price is lower than the maximum price established in the regulation and, therefore, it is not necessary to use competitive bidding procedures.

For the development of larger hydroelectric projects like Artibonite 4C, a public/private partnership can be considered. The Government and a private sponsor can create a special-purpose vehicle (SPV), responsible for the development of the project.

4. Options for Power Sector Regulation.

The concept of regulation in this case is the means for applying governance to the power sector. This includes tariffs and performance standards required to protect consumers and simultaneously allow a financially healthy sector to develop. The nature of regulation becomes critical depending on the expectations regarding market structure and the types of participants in the market. In those cases where the regulated entity consists of state owned enterprises (SOEs) this function is often exercised by a government organization such as the ministry responsible for the sector. When private sector participants are present (or are expected to enter the market) questions surrounding the regulatory process may determine whether private sector participation is a success, or even if it is feasible. In the latter cases there is usually an independent agency responsible for supervising and enforcing the essential rules for an economic exploitation of the system.

The case of Haiti is particular in that at present there is no regulation for the power sector, neither are there any explicit obligations regarding EDH in terms of pricing its services or providing service to its consumers. As noted above, EDH has been autonomous in setting electricity prices but in practice they are consulted with the President and, given the political consequences, adjustments are few and far between as shown by the 2005–2009 tariff freeze.

Under a business as usual scenario in which EDH remains the monopoly provider of electricity it would be desirable to set out regulations for its operations in terms of pricing rules and service standards. This could also be extended to financial performance requirements; in this case the regulations could be embodied in a contract-plan which spells out the expectations the Government has with respect to EDH, as well as the rules for pricing in order to provide the enterprise with a well-defined norm to ensure it remains financially healthy. The contract-plan may also regulate explicit subsidies to particular consumers and how they are to be financed. The contract-plan approach has been used extensively in France to manage public enterprises. The regulation for such a contract-plan could be exercised by the ministry in charge of energy affairs and the Ministry of Economics and Finance

Moving towards private sector participation would probably require a different approach. If geographical concessions are envisaged, in which a private operator is also responsible for investment in the system, more detailed regulations are required. In

many countries the obligations of the concessionaire and those of the Government are included in a license or in a contract (which is why this is called regulation by contract). In these cases the contract should be sufficiently detailed to ensure that pricing and service conditions are adequate. It may no longer be desirable to supervise such contracts through a ministry, and thought should be given to establishing a regulatory agency beyond the political influence of Government with sufficient expertise to be able to supervise the contracts. Indeed, the presence of an independent regulator may be a crucial factor in attracting private concessionaires to the sector. This approach is used in Jamaica with a multi-sector regulation agency.

As long as concessions are electrically separated the supervision of individual contracts is fairly straightforward. Once there are electrical interconnections among suppliers, regulation becomes more involved and requires more specialized skills. In these cases establishing regulated prices may depend on dispatch conditions for the interconnection, as well as the regulation of a transmission company. Because transmission is commonly monopolistic, the corresponding company is usually Government-owned. This will impose a greater burden in terms of quality and degree of difficulty on the regulating agency.

Another option when there are multiple private sector agents in the power market consists of establishing the basic rules for the technical and commercial operation of the system within a body of law (starting with a basic Electricity Law or Decree) which is progressively complemented by regulations which take into account specific situations which are bound to arise in a more complex environment. This requires a strong regulating agency with sufficient independence and credibility to ensure that confidence (and therefore investment) in the sector is maintained.

As can be seen, the requirements for regulation will vary according to the degree and nature of private participation in the sector. A factor that is critical to the effectiveness of the regulator consists of having a strong judiciary, which provides comfort for investors who can have recourse with respect to the enforcement of contracts. Unfortunately, Haiti is particularly weak in this respect, as it ranks around the 5th lowest percentile in terms of 'rule of law' in the world.

Under these circumstances, the initial actions required in the short term consist of reinforcing the normative aspects of power sector operations, thereby providing rules under which EDH would operate. In many countries this has taken the form of an Electricity Law which spells out a basic structure of the sector and the rules which apply to the different agents. In the case of Haiti passing such a law may take a long time and, as no private sector agents other than IPPs are expected to participate in the electricity business, the best short term course of action could consist of putting in place a contract-plan with EDH as a first step in introducing explicit goals and norms in the sector. The contract would be supervised by the ministry or government agency in charge of energy together with the Ministry of Economics and Finance.

D. Biomass

The substitution of firewood and charcoal as the major source of energy for cooking and industrial heating by more sustainable energy sources is a major challenge and a high priority to reduce the irrational exploitation of this biomass and prevent the exhaustion of the forest area in Haiti. As indicated above, the energy sector development plan of

2006 adopted a reasonable and well thought strategy proposed in the ESMAP study to address this challenge but little progress has been made in its implementation.

MTPTC have defined general actions to deal with this problem on the supply and demand sides. On the supply side, they include actions to control and constrain the charcoal market and to promote sustainable woodfuel production alternatives. The charcoal market would be constrained by a gradual application of taxes on the transport and bulk sale of charcoal, and strengthening the capability of the government to enforce the restriction on tree-cutting and the application of taxes on this activity. This would be complemented by a program to offer other employment options to the workforce that currently is employed in the exploitation of wood and the production of charcoal. The development of pilot energy wood plantations and improvements in the carbonization techniques would promote a sustainable production of woodfuels.

On the demand side, the emphasis would be given to providing adequate incentives for the substitution, as an energy source for cooking, of modern fuels (LPG and others) for charcoal mainly in the urban centers and the promotion of more efficient firewood and charcoal stoves in the rural areas.

The proposed actions are necessary and most of them were analyzed in the ESMAP study, especially those related with demand-side management. However, it is necessary to establish priorities and focus the government interventions on those actions that will have a short-term and sustainable impact of the consumption of woodfuels. The expansion of the existing LPG market and the promotion of more efficient woodfuel stoves are actions that should have priority.

In ten years the LPG market has had a modest development in spite of having a relatively large capacity in filling stations and a large potential as a substitute for woodfuels in the urban market, mainly in Port au Prince. The average consumption is about 1.4 kg/capita, low as compared to other countries in the region where demand is above 5 kg/capita. TotalGaz and Dinasa, the major marketers of LPG have analyzed the barriers for the development of the LPG market and have prepared specific proposals to address these barriers.

Although price-wise LPG appears to be competitive with charcoal (taking into account a much higher efficiency of the burner- 55% vs. 20%) a major barrier is the high switching costs (much higher cost of LPG cylinders and stoves) and the fact that the poor people, major consumers of woodfuels, can only afford to buy small quantities of fuel at any time. Other barriers identified by Total are the lack of regulation (licenses, quality and safety standards and price structure) and the competition of micro-centers that can refill any cylinder and discourages the renewal and importation of new cylinders.

The Total plan proposes to expand the LPG market from 14,000 to 100,000 tons/year in 7 years which would require an investment of about US\$40 million, an enabling regulatory environment, and a public-private partnership to finance or subsidize upfront costs. This plan proposes²⁶ an industry composed of marketers, distribution companies and points of sale, regulated by an LPG law that should promote investment in new cylinders, protect brands, eliminate the micro-centers, establish quality and safety standards, and a price structure that provides adequate margins to marketers, distributors

²⁶ Développement durable par le GPL, Total LPG Business

and gas shops and temporary subsidies to promote LPG consumption and pay for the price of imported LPG in the international market.

The proposed plans needs to be revised and complemented to address, among other things, concerns about the concentration of the industry in two major players, analyze alternative subsidy schemes, review the financial plan and evaluate the justification and impact of eliminating the micro-centers, but appears to be a good discussion paper and can serve as a basis for making some short-term decisions to promote the LPG market.

The United Nations Environment Program (UNEP) has recommended and is supporting a serious effort to expand the LPG market as the main instrument to reduce the consumption of woodfuels in the Port au Prince metropolitan area. UNEP is coordinating and supporting a taskforce with the participation of representatives of government, industry and consumer to identify the barriers for the development of this market, agree on required interventions and define a medium-term plan. USAID is also supporting a study on the LPG market in Haiti.

On the promotion of a more efficient consumption of woodfuels, mainly in the rural areas, UNEP has reported²⁷ short-term investments of about US\$1 million in improved cooking woodfuel stoves, financed mainly by humanitarian organizations, without any coordination or guidance by the Government. UNEP organized with BME an Improved Stoves Technical Working Group to facilitate the coordination of short-term interventions and prepare a medium-term strategy for the promotion of improved stoves.

E. Renewable energy

The sustainable development of native renewable resources in Haiti is a high priority not only to diversify the energy sources and reduce the dependence of high and volatile oil prices (discussed above) but also to increase access to modern energy services for the poor. In the first case we refer basically to on-grid power generation from wind and small hydro (capacity of less than 20 MW). Concentrating solar power generation is not a competitive option for the near future and larger hydroelectric generation is a mainstream technology that should compete with other conventional generation in its own merits (taking care, of course, of an adequate assignment of the investment costs between water uses- mainly irrigation, flood control and generation- in the case of multi-purpose projects) In the second case we refer to off-grid solutions based on solar PV, micro-hydro and micro-wind generation.

1. On-grid renewable power generation

There is consensus about the need and economic justification for adopting long term energy policies that provide incentives to improve the efficiency reduce the cost and facilitate the development of a sustainable renewable energy industry, necessary to overcome the barriers to the development of these resources²⁸. The main policy

²⁷ UNEP in Haiti- Laying the groundwork for the Clean Energy Sector. Note of mid- 2010 prepared by Andrew Morton and Maximilien Pardo

²⁸ The development of the indigenous renewable resources in LAC faces many barriers. Economic barriers like high capital and firm energy costs; and the failure to internalize all costs and benefits of energy production and use (environmental, security and diversification benefits). Regulatory barriers like the lack of a legal framework for the development of these projects by independent power producers; high

instruments to promote the development of on-grid renewable energy are: regulatory frameworks that facilitate access to generation markets, financing assistance and fiscal incentives, technical norms and quality standards, and information dissemination (see Box 2).

In the case of Haiti wind and mini-hydro power generation could be competitive and developed with private participation if adequate policy instruments are in place. The preliminary analysis on power generation expansion discussed above (section IV.C.3 Reducing the dependence on high price imported fuels) shows that wind and hydroelectric energy could be competitive if good sites with low development costs can be identified and secured. Their levelized energy prices may be competitive with the avoided generation costs (about 16 US¢/kWh, the variable generation cost of diesel engines running on gas-oil). However, there is a lack of regulations, incentives, norms and standards and information necessary for the development of these projects by private investors at reasonable prices and the Government should take some basic actions to facilitate this process and attract new investors.

First, it is important to complete the assessment of the most attractive sites for the development of wind power that BME has initiated with the support of the European Union and implement the PNUD project to establish adequate conditions for the development of mini and micro-hydro generation. The availability and dissemination of information on the generation potential and the most attractive sites reduce the development risks and costs for private investors. Second, it is important to define the scheme that will be used to purchase the energy generated by these projects. The conventional scheme used by EDH (PPA contracts) is not advisable because these projects are site specific, and the preparation costs are high (feasibility and other studies and may not be enough competition). A feed-in price scheme with long-term contracts would be advisable to make these projects bankable, complemented with financial and fiscal incentives. And last, minimum regulations, norms and standards should be established (construction and operation standards and a grid code).

1. Off-grid renewable power generation

The economic development of renewable off-grid solutions based on solar PV, micro-hydro and micro-wind generation needs a different approach. These are stand-alone systems that serve remote and dispersed areas with micro or mini-grids once it is established that connecting an unserved community via grid extension is not justified and that the economic and social benefits outweigh the costs of these technologies. The selection of a generation technology would depend on site-specific conditions on energy consumption, income, willingness and ability to pay among the various sectors in the community and information on the availability of local energy resources. Therefore these are decentralized and small scale operations that require special and simpler regulations and larger incentives and subsidies than on-grid solutions to attract private participation.

standards and costs of connection to and use of the transmission grid; and restrictions on siting and construction. And other barriers like high transaction costs on a per kW basis; the impact of intermittent sources of energy in power system operation and generation reserve; the lack of adequate financial instruments and lack of technical or commercial skills and information on the new technologies.

Box 1

Main policy instruments to promote the development of on-grid RE

Taken from the report “Latin America and the Caribbean (LCR) - Energy sector retrospective review and challenges”, prepared in 2007 by Trevor Byer, Enrique Crousillat and Manuel Dussan

Access to electricity markets. Two schemes have been used to facilitate access to wholesale energy markets of on-grid projects: feed in prices and quotas. In the pricing system the regulatory framework establishes a price at which the public utility has the obligation to buy energy from RE projects and the investors define the generation capacity that are willing to develop at that price. In the quota system, the regulations determine a target quota for the participation of RE projects in the generation market and the feed in price is determined by competitive bidding procedures.

Financial and fiscal incentives. The fiscal incentives frequently used in developed countries to promote RE are tax credits for investment and production and exemptions on value added taxes and import duties. Tax holidays are also used as an incentive. Frequently the subsidies are financed by a surcharge on electricity tariffs. As a complement, many governments establish funds that provide long term credits at preferential rates. Probably the most important financial incentive for the development of RE is the elimination of subsidies to conventional sources, meaning that the energy prices for these sources should reflect real fuel costs, including environmental costs.

Norms and quality standards. This includes norms and standards on equipment, on the project site, the grid code (norms and conditions for the connection and use of the electric power grid) and the construction code. Construction and operation standards are useful to avoid the use of inferior or inadequate technology that have a negative impact on the quality of supply service and that may ruin the reputation of new technologies. Open access to transmission grids and fair transmission charges are important policy instruments to facilitate the development of RE in competitive wholesale power markets.

Information dissemination. Information dissemination include assessments of the potential of RE resources, education and training on new technologies, data bases on RE energy information, information on incentives and procedures for the development of RE resources. Public consultation and participation of stakeholders in the process of formulating policies and planning of RE resources are also important to generate wide public support for the new technologies.

PV solar systems have a predominant role in off-grid electrification in developing countries because this technology can function virtually anywhere despite variations in solar radiation intensity or number of days without sunshine. In Haiti, the solar resource is more than sufficient throughout much of the year to enable PV systems to function usefully.

Although the economic analysis of renewable energy-based, off-grid solutions in other countries generally show robust economic rates of return when gains in consumer surplus are considered (benefits from lower cost higher quality illumination) in addition to the avoided cost of other fuels, in the case of Haiti, with electricity access of only 30% at national level, and 55% of the population living with less than US\$1.25 a day, other grid extension projects would compete with higher social and economic returns for the scarce fiscal resources available, and the resources allocated to off-grid solutions should concentrate on fully subsidized social programs of energy supply to isolated schools, clinics, and community centers that would benefit by electric lighting, refrigeration, educational television, communication and simple entertainment systems that require small amounts of power.

In the case of isolated communities and productive activities that are not connected to the grid and have the willingness or ability to pay a significant portion of the renewable energy-based, off-grid solutions, and one can apply the experience and best practices used in other developed countries²⁹.

²⁹ See “Designing Sustainable Off-grid Rural Electrification Projects: Principles and Practices. The World Bank. November 2008.

V. White Paper Roadmap

In section IV we discussed several policy options to address the main challenges facing the energy sector and achieve a sustainable recovery and development of the energy sector. Some of these options are mutually exclusive and other options complement each other, depending on the strategy that the Government finally adopts for the development of the sector. In this section we will identify and discuss a few alternative strategic scenarios and propose a roadmap for their implementation.

The general goals of any strategy for a sustainable recovery and development of the energy sector are:

- a) Reduce woodfuel demand by substituting the use of firewood and charcoal in urban areas with efficient stoves using other fuels and improving the efficiency in the use of firewood and charcoal in rural areas
- b) Provide a reliable, sufficient and good quality service to existing electricity consumers at affordable prices
- c) Reduce electricity losses and increase revenue collection as required to eliminate financial losses and achieve a positive cash-flow for the electricity sector without increasing existing electricity tariffs.
- d) Reduce the vulnerability of generation costs to high and volatile oil prices and reduce generation costs by diversifying energy sources and developing native renewable resources
- e) Increase electricity coverage by xx% in yyy years (goals to be determined)

Any strategy to improve the operational and financial performance of the electricity sector should include the short-term actions that the Government is implementing, which establish the minimum conditions to improve performance, namely:

- a) The short-term restoration and rehabilitation of generation, transmission and distribution installations to be able to provide 24 hours and reliable service to existing customers.
- b) The implementation of the PREPSEL project and the supplemental loss reduction projects, to rehabilitate distribution grids, improve quality of service, normalize illegal connections, reduce electricity losses and improve revenue collection.
- c) Establish commercial practices in EDH and endow the delegate directors with substantial authority to implement the changes required in EDH
- d) The rehabilitation of the Péligre Hydroelectric plant and other small hydroelectric plants in the isolated systems to displace expensive diesel generation and reduce generation costs.

Additionally, other short term actions that seek to meet the goals of reducing the woodfuel demand, diversifying the energy sources and increasing electricity coverage should be common to any energy sector strategy. Some of them are being implemented by the Government and the rest should not be controversial:

- a) Establish a high profile energy sector management unit in MTPTC and an executive agency for rural electrification and domestic energy

- b) Evaluate the economic and financial feasibility of developing the Artibonite 4C hydro plant
- c) Complete the evaluation of the solar, wind and small hydro energy potential
- d) Study and establish necessary legislation and regulations for the promotion of power generation using domestic renewable resources
- e) Prepare a program for the short-term substitution of LPG for charcoal and wood in the metropolitan area of Port au Prince.

Based on the analysis and conclusions of this report, we consider that the business as usual (BAU) scenario—to complete these initial actions of the recovery plan, keeping EDH as a vertically integrated state-owned monopoly without substantial improvements in its corporate governance, and maintaining a weak institutional framework with substantial political interference—is not an option for a sustainable recovery of the sector and should be discarded. We propose the introduction of private sector interests as a means to improve sector performance under two different structural scenarios.

We suggest considering two basic scenarios that reflect differences in the structure of the power sector and its degree of centralization, and that can accommodate different options on the role of EDH in the electricity sector and the scope of private participation:

- a) **A national monopoly.** EDH will continue to be a vertically integrated monopoly and single buyer responsible for electricity service in the whole country. EDH will contract the long-term supply of electricity to meet demand from IPPs (small diesel and renewable generation plants) or other electricity generators using alternative PPP arrangements (for larger generation plants like Artibonite 4C) based on competitive bidding procedures established and supervised by the regulator. The extent of private participation in EDH would not be constrained: EDH could improve performance by remaining as a state-owned enterprise and implementing a corporatization program (in case the initial stage of EDH recovery plan is successful), or the government could retain a private operator to provide electricity service in the whole country through a management contract or through a concession contract; it could also seek private participation through the capitalization of EDH. These measures would be implemented after the first stage of the recovery plan is completed, but the last two, in which the private operator takes investment responsibilities, most likely will only be feasible if the initial stage of the EDH recovery plan is successful, as qualified private operators would be unwilling to make investments in a situation of high credit and market risks. EDH, while maintaining its monopoly, would engage private sector management contracts for selected localities, following, for example, the model established in Jacmel. A rural electrification executive agency will be responsible for planning, financing and implementation of RE projects at the national level.
- b) **Regional monopolies.** The Government will award management or concession contracts to private operators for the provision of electricity service in some isolated areas or in new industrial parks or touristic areas, which will be responsible for expansion and operation of the generation and distribution systems in these areas and increasing electricity service in urban and peri-urban areas in the concession area. These regional companies will be vertically integrated monopolies and single buyers in their concession area. EDH will

continue providing electricity service to the rest of the country. EDH will create a transmission business unit responsible for the rehabilitation and expansion of the transmission grid and the future interconnection of the isolated systems. Once the isolated areas are interconnected, the transmission unit will become a separate transmission company responsible for transmission operation, planning and expansion, system operation and single buyer functions in the interconnected system. Establishing the single buyer function within the transmission company would be necessary to allow a relatively simple allocation of generation resources avoiding the complications of a wholesale market. EDH could remain as a state-owned enterprise or the government could retain a private operator/investor to provide electricity service in the areas served by EDH under a management contract, or a concession contract, or the capitalization of EDH. A rural electrification executive agency will be responsible for planning, financing and implementation of RE projects at the national level.

In the two scenarios we did not consider the possibility of developing a wholesale power market with direct sales to large consumers by third parties because the market is small and there are no conditions to introduce competition in the market. However, if the monopoly supplier is not able to provide good quality electricity service to large customers at a reasonable price, it would be justifiable to allow large consumers to find better supply options, like auto-generation, as established in the current regulations, or to develop private small-scale generation to meet the demand of a group of large consumers and sell any surplus to the monopoly supplier. In this case, it is not necessary to establish a wholesale market with all its complex regulations, but establish simple regulations to have access, if necessary, to transmission or distribution grids of the monopoly supplier and to apply net-metering principles to calculate energy purchase or sales with the monopoly supplier.

It is argued that under this scheme the monopoly supplier would lose his best customers and will be left with a residential market of mostly poor consumers, which is not financially feasible and will not be able to generate sufficient cash flow to finance the expansion of electricity service in its concession area. The experience in other countries in the region shows that it is possible to establish cross-subsidy schemes, in which large consumers have the obligation, regardless of their source of supply, to pay a contribution to a subsidy fund to finance targeted subsidies to low-income consumers. It also shows that an efficient monopoly supplier is in a good position to offer competitive and attractive electricity service to large consumers. This scheme can be used in any of the two scenarios.

Additional studies are necessary to complete a technical, economic and financial analysis of alternatives to decentralize electricity service in financially viable concession areas or regions, which may be attractive for private investors, as well as to analyze the regulatory framework required in this scenario. Furthermore, it is necessary to analyze and define the terms and conditions of private participation through a management contract, a concession contract, or capitalization. The Law for the Modernization of Public Enterprises (CMEP law) seems to be an adequate instrument to implement the whole process of restructuring the power sector and attracting private operators/investors under the two scenarios. The CMEP law mandates that the restructuring process should start with an assessment of the electricity sector and the

option for private participation, which will require the assistance of a qualified consulting firm and may take about one year. Therefore, the process should be initiated as soon as practicable and would dovetail with the outcomes of the short term measures under implementation in EDH; in case they are unsuccessful, the CMEP process would continue with a management contract for EDH; otherwise, it would continue through concessioning or capitalization. If the regional monopolies scenario materializes, the CMEP process would provide the means for establishing the concessioned areas.

Implementation of the roadmap, described in the following tables, will require a degree of political will within the Government. The current situation in Haiti, in the aftermath of the earthquake and given the large amount of resources pledged by donors, presents a particularly propitious opportunity to reach a consensus among the authorities and the donor community to implement lasting change in the sector. Previous efforts, such as the current IDB and World Bank programs—which are absolutely essential to the recovery of EDH—can be characterized roughly as “bottom up” efforts to rehabilitate the sector, whereas many of the actions proposed in the roadmap, particularly those related to governance, can now be implemented through a “top down” approach by agreeing on a spectrum of measures at the highest Government levels, to be followed up with substantial supportive investments.

Having said this, the question of ownership of the actions involved in the roadmap cannot be sufficiently emphasized. In the past, reforms have floundered because of a lack of broad ownership. A recent example includes the 2005 Brussels protocol, mentioned beforehand, which has not been complied with. Ownership should be sought through adequate dissemination of the proposed actions, including presentations and discussions within workshops organized jointly with donors and the Government.

Roadmap for the energy sector development

Objective	Actions	Executing Agency	Time Frame starting 1/2011	Indicators	Resources Required
<i>Actions common to all scenarios</i>					
Short term restoration and rehabilitation of electricity service	Overcome earthquake damage and rehabilitate EDH facilities and networks	EDH	Months 1-12	Availability of generation capacity increases from xxxMW to xxxMW	\$75 million
Reduce electricity losses and improve revenue collection	Implementation of the PREPSEL project and the supplemental loss reduction projects	EDH	Months 1-12		
Reduction of electricity production costs	Rehabilitation of the Péligre Hydroelectric plant and other small hydroelectric plants in the isolated systems	EDH	Months 1-12		
Governance improvement	Establish a high profile energy sector management unit in MTPTC	MTPTC and Government	Months 1-6		
	Engage the CMEP to initiate the reform of EDH through a management contract /concession/ capitalization	CMEP	Months 1-2		
	Retain the required consultant services and assess options for restructuring the power sector and define terms and conditions for private participation in management and concession contracts or capitalization. Define institutional and regulatory framework.	CMEP with consulting support,	Months 1-18	Assessment study prepared and submitted to the authorities	

Objective	Actions	Executing Agency	Time Frame starting 1/2011	Indicators	Resources Required
Governance improvement	Draft an electricity sector statute establishing the regulatory framework, the institutional structure, the restructuring of EDH and the operation of a market according to the selected sector structure	MTPTC with consulting support	Months 12-18	Draft laws/ decrees prepared and submitted to the authorities	
	Create and establish the new sector authorities, including an executive agency for rural electrification and domestic energy	Government with consulting support	Months 12-18	High level agency and executive agency operating	
	Hire a management consulting firm to review EDH's processes, organization, and human resources, recommend an implementation plan, and accompany its implementation	EDH	Months 1-12	Report from consultants, operational audit of EDH	
Reduce vulnerability to oil price fluctuations and introduce renewables	Evaluate the economic and financial feasibility of developing the Artibonite 4C hydro plant under concessional financing and design and conclude a PPP if it is found feasible	MTPTC/ EDH	Months 6-18	PPP concluded	
	Complete the evaluation of the solar, wind and small hydro energy potential	MTPTC/BME	Months 6-18		
	Study and draft necessary legislation and regulations for the promotion of power generation using domestic renewable resources	MTPTC			

Objective	Actions	Executing Agency	Time Frame starting 1/2011	Indicators	Resources Required
Substitute firewood and charcoal in urban areas Substitute firewood and charcoal in urban areas	Draft legislation with consulting support to promote the penetration of LPG and estimate subsidization requirements	Initially MTPTC and subsequently the rural electrification and domestic energy agency	1-8	Draft law/decreed prepared and submitted	
	Implement the distribution of LPG through private sector companies and subsidize the cylinders and stoves		9-18	LPG sales increase from xxx lbs per year in 2010 to xxx per year in XXX	
	Revive the manufacture and distribution of the MIRAK improved stoves with eventual subsidies	MTPTC energy management unit / Rural electrification and domestic energy agency	4-	Xxx stoves sold in 2011–2012	
Rural electrification	Engage consulting resources to produce a prioritized inventory of grid extension options for villages and the subsidy requirements	Rural electrification and domestic energy agency	8-16	Inventory documented	
	Implement the grid extension projects	Rural electrification and domestic energy agency and EDH	16-48	Xx new communities with electricity service	
Rural electrification and development of renewables	Engage consulting resources to identify options for off-grid electrification of communities and required resources and subsidies	Rural electrification and domestic energy agency	8-16	List of prioritized projects, proposed technology, financing scheme	
	Implement off-grid electrification projects	Rural electrification and domestic energy agency	16-48	Xx communities with basic electricity services	

Objective	Actions	Executing Agency	Time Frame starting 1/2011	Indicators	Resources Required
SCENARIO NATIONAL MONOPOLY					
Corporate governance and management improvement of EDH	Hire the required firms to prepare the information and ‘cahier de charges’ for a management contract/ concession/ capitalization of EDH	CMEP	Months 12-24	Information memorandum, bidding documents	
	Put in place a management contract/ concession/ capitalization depending on EDH situation	CMEP	Months 24-36		

Objective	Actions	Executing Agency	Time Frame starting 1/2011	Indicators	Resources Required
SCENARIO REGIONAL MONOPOLIES					
Corporate governance and management improvement of EDH	Hire the required firms to prepare the information and ‘cahier de charges’ for a management contract/ concession/ contracts for regional utilities	CMEP	Months 12-18	Information memorandum, bidding documents	
	Put in place a management / concession/ contract for isolated systems and new industrial parks/ touristic areas	CMEP	Months 18-24		
	Put in place a management contract/ concession/ capitalization depending on EDH situation	CMEP	Months 24-36	EDH with private sector participation	