

# CUBA: REFORMING THE POWER, TELECOMMUNICATIONS AND WATER SECTORS DURING A TRANSITION

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The first section of the paper discusses the importance of infrastructure. It concludes that adequate infrastructure is necessary for economic growth and that it can contribute to reduction in inequality. The second section of the paper summarizes the lessons learned from infrastructure reform in Latin America and in the “transition” economies of Eastern Europe and the former Soviet Union. The lessons from Latin America show the importance of introducing competition where feasible, regulating where monopoly power exists and encouraging private participation. An important lesson from the “transition” economies is that it is necessary to introduce mechanisms to avoid asset stripping and tunneling. While lessons from other countries can be useful, the specific reforms in Cuba or any other country must be modified to fit the local conditions.

The third section analyses the present situation in Cuba, a difficult task given the paucity of data. The power situation, which was dismal in 2004–06, has improved significantly, and the frequency and severity of blackouts has been reduced; however, the relatively small gensets that have been installed throughout the island are costly to operate. Telecommunications coverage is very low for a country of Cuba’s level of income and the water sector provides low quality services; sewerage disposal in general is a main source of contamination. The fourth and final

section establishes an agenda for the reform of the three sectors designed to maximize private sector involvement. Private sector participation is easiest in telecommunications, somewhat more difficult in power, and generally most problematic in water. First steps in a reform agenda would be to draft a strategy, develop the enabling legal/regulatory framework for the sectors, and establish the regulatory institution. At the same time, mechanisms should be established to curtail asset stripping and tunneling in existing enterprises, principally Unión Eléctrica.

## DEFINITION AND IMPORTANCE OF INFRASTRUCTURE

The *American Heritage® Dictionary* defines infrastructure as: “An underlying base or foundation especially for an organization or system.” Other authors (Lukasik et al, 1998: 11), define it as “The basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions including schools, post offices, and prisons.”

However, the U.S. Agency for International Development (USAID), the World Bank and other development institutions generally describe infrastructure more narrowly. This narrower definition of infrastructure comprises utilities and certain “public

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1. The opinions expressed in this presentation are those of the authors and do not represent the views of the U.S. Government. Comments on the paper were received from Stephen Tupper (USAID), Elizabeth P. Belt and from the discussant at the ASCE meetings, Roger Betancourt (University of Maryland). Only the authors are responsible for any errors that remain.

works.” Specifically, utilities include power (electricity); telecommunications; piped water supply and sanitation; piped gas; and piped heat. Public works include transport infrastructure including highways, secondary roads, rural roads, railroads, urban transport, ports and waterways, and airports; and major dam and canal works for irrigation and drainage.

All those infrastructure services have the characteristics of networks. Therefore while the technologies are different, there are a number of common elements such as the presence of network externalities, essential facilities, and economies of scale, density and scope. This paper deals with power, telecommunications and piped water supply and sanitation (water and sewerage). One common element shared among the sectors is the need for economic regulation to avoid the exercise of monopoly power, at least within certain segments of these networks.

Numerous studies, principally from the World Bank, conclude that infrastructure can have a very positive effect on economic growth and can contribute to a reduction of poverty. Some specific conclusions are:

- Infrastructure services are crucial for supporting economic growth, reducing poverty and increasing international competitiveness;
- Safe water is essential for health, and health posts with access to modern energy are more effective;
- Without reliable power, businesses must invest in costly backup generators that generate electricity at a high financial cost, and with a negative effect on the environment;
- Telecommunications services reduce transaction costs for businesses and can expand the range of markets;
- Telecommunication services are characterized by positive network externalities; and
- Internet solutions for government (e-government), which require an adequate telecommunications infrastructure, can contribute to efficiency, effectiveness and transparency of government and can reduce transaction costs between the public and private sectors

Calderon and Serven (2004: 27) state: “... the conclusion that infrastructure both raises growth and lowers income inequality implies that infrastructure development can be a key win-win ingredient for poverty reduction. In addition to raising society’s overall level of income, it would help raise the income of the poor more than proportionately. This suggests that infrastructure development should rank at the top of the poverty reduction agenda.”

## LESSONS LEARNED

Beginning with Chile, Latin America set the pace for infrastructure reform in the telecommunications, power and water sectors. The reforms in Latin America were carried out in the context of essentially market based economies that had fairly large levels of government intervention. So while the infrastructure reforms were difficult, the general environment in which they took place was reasonably favorable towards private sector involvement. Cuba, on the other hand, has a very unfavorable environment for private investment. For example, Cuba ranks 156 out of 157 countries in the “Index of Economic Freedom” developed by the Heritage Foundation and the Wall Street Journal (Kane, Holmes and O’Grady 2007), just ahead of North Korea. Therefore, it would be naive to try to attempt to implement in Cuba the Latin America type of reforms without modification. We believe that while Cuba can reach an end state that approaches the best of the Latin American models for infrastructure reform, such as those of Panama for power, Guatemala and El Salvador for telecommunications, and Chile for water, the path for reaching that end state must be informed by—and benefit from—the lessons from the countries of Eastern Europe. In Cuba it will be necessary to protect existing state-owned enterprises, principally Unión Eléctrica, from asset stripping and tunneling that prevailed in the transition countries and that resulted in monumental losses.

### Lessons from Latin America

Previous papers by Belt (ASCE 2000, 2006) have summarized the main lessons learned from the power and telecommunications sector reforms in Latin America. Excellent summaries of the lessons from power sector reforms are in a book by Hunt (2002)

**Table 1. Summary of Sectoral Characteristics and Lessons Learned**

Sector	Impact of new technology and ease of private participation	Technological change and main aspects of reforms
<b>All sectors</b>	Regulate only in monopoly segments	Need strategy and separation of policy (Ministry) from regulatory function. Independent regulator necessary. Multi-sector regulator such as in Panama and El Salvador may be advisable. Tariffs need to be adjusted to cover at least Operation and Maintenance (OandM) before privatization; preferably, full costs, including Capital Expenditures (CAPEX) should be covered. Tariffs should be raised before privatization.
<b>Energy</b>	Significant technological change; private participation possible but will take time (3–5 years for full privatization)	Optimal size of generation unit has declined. Competition in generation is possible but distribution has to be regulated. Dispatch center can be a “club,” owned by all market participants while distribution can stay in state hands. Sequence of reform: corporatize and unbundle, raise tariffs, privatize distribution companies, privatize generation after distribution companies have been privatized for one year. For success, need many buyers and sellers; demand and supply responsive to prices with hourly metering of large customers with high elasticity of demand; liquid and efficient marketplaces; equal access to essential facilities (transmission and distribution wires); and subsidies and environmental controls that go with the “grain of the market.”
<b>Telecoms</b>	Revolutionary technological change; wireless technology reduces local loop monopoly.	Need to renegotiate exclusivity agreement, end monopoly and establish competition before full privatization. Develop simplified procedure for issuing licenses, allocate spectrum through auctions (at least three additional cellular companies); establish interconnection rules, define clearly methodology for estimating interconnection charges and develop simplified Alternate Dispute Resolution (ADR) mechanism to resolve interconnection disputes. Consider not regulating rates, encourage Cable TV to offer telecommunications services, do not restrict VOIP, encourage deployment of new broadband wireless technologies such as WIMAX. Ensure access to international connectivity at competitive rates.
<b>Water</b>	Moderate technological change in areas such as Telemetry and satellite imaging; IT controls (SCADA). Concessions and/or leases effective	Separation between policy, regulation and operation; encourage private sector participation, at least in management. Bolivia combined municipalities under “mancomunidad” and Chile established 13 companies serving the entire country. Many international companies leaving Latin America, a result of change in corporate strategy, change in national policies, populism, social conflict, devaluations. Need to improve contract design and bidding processes, increase tariffs before privatization, conflict resolution mechanisms established <i>a priori</i> , strengthen regulation.

and a paper by Bessant-Jones (2006). The main lessons from the water sector reforms in Latin America are summarized in the outstanding paper by Vivian Foster (2005). The main sectoral lessons are summarized in Table 1.

#### **Lessons from the Transition Countries and Other “Difficult” Situations<sup>2</sup>**

The World Bank has prepared a number of reports on the transition in Eastern Europe. In general terms, the Bank concludes that the authorities should:

- Introduce market friendly policies, including laws and regulations;
- Strengthen market economy institutions, which is more difficult and time consuming than the introduction of policies, laws, and regulations;
- Establish a social safety net and/or employment/livelihood programs, which is difficult and costly;
- Protect health/education gains to avoid the deterioration that took place in countries such as Russia;
- Pursue discipline in existing state-owned enterprises (SOEs) to avoid asset stripping and tunneling; and
- Encourage establishment of new enterprises mostly by improving the enabling environment.

Establishing discipline in existing SOEs is particularly important for infrastructure because of their large size and systemic effects. For example, the electric utility (Unión Eléctrica) has sales valued at economic prices \$2.0 billion. Main lessons related to discipline include: (1) hard budget constraints on existing organizations should be established as soon as practical. Obviously, tariff increases are necessary; and (2) systems for monitoring and influencing managerial behavior to reward efficient stewardship of assets and to discourage tunneling and asset stripping should be established. Performance-based management contracts (operations contracts) can play a role.

USAID has carried out a study of 11 operations contracts in different “difficult settings: post-conflict, post-disaster and transition economies.” Models studied include management contracts (Kosovo, Georgia), divestiture with regulation (North Delhi), incentive-based management contracts with former employees (Uganda) and lease and concession contracts (Pamir; Cote d’Ivoire; Senegal). Some of the lessons from this study include:

- The incentive based operating contracts reviewed are “turning around” poorly performing electricity and water utilities and providing reliable services in difficult situations;

- The contracts are reducing technical and commercial losses, increasing billing rates and collections, and introducing efficient and accountable management;
- They work in difficult environments—post-conflict situations, disaster relief, desperately poor local economies with weak and corrupt government, and transition economies;
- No single formula applies to every situation, i.e., successful designs are tailored to the local situation. Each case is uniquely constructed;
- Operators must have enough control to be able to manage the business; and
- Managers and employees should get financial gains from better performance.

These lessons clearly indicate the viability of a broad diversity of business options for successful private sector participation in difficult settings. A schematic representation of these different modalities is given in Table 2.

Other lessons learned include:

- Authorities must be knowledgeable about the different models and be cognizant of the difficulties involved in implementing infrastructure reforms so that they can take make adequate decisions;
- Lessons from other countries can be used in the design of reforms but must be adapted to the local conditions;
- While foreign consultants can assist, all decisions must be made by the local authorities;
- Reforms should proceed as fast a possible but this is in conflict with the legitimacy of policy-makers in the initial stages of a transition;
- Transparency in all transactions is absolutely necessary; and
- Tariff adjustment, protection of vulnerable groups, compensation for claims, and private participation policies must be formulated in the context of national policies dealing with those subjects. In other words, the power sector re-

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2. This section is based on Selowsky and Mitra (2002).

**Table 2. Continuum between Totally Public and Totally Private**

Support to existing operations		Incentive-based Contracts			
P	TA and/or outsourcing contracts for bill collecting, fleet maintenance	Management contracts with incentives for performance	Leases	Concessions	P
U					R
B	May work if there is full co-operation from present managers	Introduce discipline; private firm runs company; similar to receivership; managers must have full control	Private firm operates and maintains; investment funded by public sector	Private firm operates and maintains; investment by private firm	I
L					V
I					A
C					T
					E

Separate policy from regulation; independent multi-sector regulator

forms can only succeed if they are coordinated with the policies guiding reforms in other sectors

### Institutional Framework

A basic lesson learned from transition and Latin American countries is that it is easier to develop the legal/regulatory framework than to develop adequate institutions. The institutions include the relevant ministries in charge of policy-formulation and the regulatory agencies. The latter must be independent from the former as well as accountable for its actions. In the case of smaller countries with limited experience in regulation, it will be more efficient and effective to have a multi-sector regulator, an approach taken by a number of countries in Latin America and the Caribbean, including Panama, El Salvador and Jamaica. Given that the sectors are quite different, a typical multi-sector regulator would have legal, economic and administrative departments providing support across all sectors but will also have specialized departments dealing with water, power, telecommunications, etc.

Independence and autonomy of the regulator includes (Smith, 1997):

- Regulator established by law;
- Arms length relationship with operators, consumers and other private interests;
- Arms length relationship with political authorities;

- Financial independence, with funding from a fee charged regulated companies and the ability to pay competitive salaries;
- Professional criteria for appointment of commissioner(s);
- Fixed, staggered terms and removal only for well defined cause; and
- The executive and legislative branches of government involved in selection.

Independence, however, has to be accompanied by accountability. This requires (1) strong provisions prohibiting conflicts of interest; (2) established rules and procedures for appeal and overturning decisions of the regulator; (3) public availability of budget and scrutiny (usually) by Parliament; (4) external audits; (5) permitting removal for just cause; and (6) open hearings with participation by the regulated industries and the consumers.

### PRESENT SITUATION IN CUBA

#### Power Sector

The power sector in Cuba is characterized by an aging and obsolete infrastructure, poor levels of energy efficiency, a high level of electricity losses of about 30% in transmission and distribution, and a heavy dependence on liquid fuels for power generation. Since the dissolution of the Soviet Union, Cuba stopped receiving large transfers, which were estimated at \$5.0 billion annually, and then plunged into an economic crisis. During the time known as “Special Period,” the Cuban government was unable to

pay for oil imports for power generation or maintain the facilities. However, Cuba signed Production Sharing Agreements (PSAs) with foreign oil companies and increased its domestic production of crude oil and began using the high-sulfur, heavy oil as plant fuel for power generation, thus significantly damaging the power plants. Finally, a series of 16 hurricanes over the last 15 years damaged the power transmission and distribution network.

Following these events, the power sector nearly came to a collapse in 2005–06 when power plant breakdowns led to severe blackouts lasting up to 18 hours a day, contributing to growing civil unrest. To address these issues, the Government of Cuba declared an “energy revolution” at the beginning of 2006. Through a combination of stringent energy efficiency programs, price increases, and the installation of a significant number of small power generator sets (gensets) throughout the country, Cuba is now apparently emerging from the energy crisis. Moreover, recent information also reports some efforts of the Cuban government to promote renewables, including ethanol fuel from sugar cane.<sup>3</sup>

Information on the details and exact locations of the newly installed power plants is not available. Nevertheless, it is a well documented case of the “energy revolution” that approximately 2,000 new small gensets, adding up to 1,200 MW, are being installed throughout Cuba, replacing and complementing larger and older power plants that have suffered chronic breakdowns due to lack of maintenance, limited investments, damage from heavy Cuban oil, and many years of prolonged operation. However, the installation of these small capacity generators is an unconventional solution to the power sector in Cuba, and it has advantages and disadvantages, both in the short-term and in the long-term. On the positive side, the generators were rapidly installed and put in service, thus offering an immediate solution to the problem of blackouts and popular discontent. Additionally,

this solution may be more robust in the aftermath of natural and man made disasters that could damage the transmission network. The genset “solution” has many problems. First and foremost, the unit cost of electricity per kWh is very high if diesel is valued at its opportunity cost.<sup>4</sup> Second, it is difficult to provide maintenance and fueling services to a multitude of generators installed throughout the Island. Finally, it will be difficult to dispatch these generators to ensure an instantaneous balance between supply and demand. A more rational, comprehensive, and long-term solution to the power generation problem in Cuba is still outstanding.

Table 3 presents a list of the major power plants in the country and their nominal capacities. Cuba’s present electricity market has a total of approximately 3.3 million customers, composed of 45% residential customers and 55% non-residential customers. These figures include commercial, industrial, service, and state enterprises. Assuming that the older plants will not be replaced and continue working at a plant capacity factor of 40%, and the newer plants at 50%, the combined power generating capacity may increase the annual energy production in 2007 to an estimated 21,500 Gigawatt hours (GWh), with an average peak hourly demand of 2,450 Megawatts. Thus, under that assumption, the existing levels of installed capacity should be sufficient to meet the existing market demand. However, there is still the issue of heavy system losses of 30% in transmission and distribution, and the need to secure refined oil products given the 92% dependence on liquid fuels for power generation.

To complement the scope of the “energy revolution,” the Cuban government introduced strict energy saving measures and enacted legislation to simultaneously improve conservation, reduce consumption waste, address increasing energy demands, and penalize electricity theft. New efficiency programs for the production, transmission and deliv-

3. “UN Official: Cuba solved energy crisis.” *The Miami Herald*. July 4, 2007.

4. Assuming a production rate of 15 kWh per gallon of diesel, and a market price of \$3 per gallon of diesel, the generation cost of these units is about \$0.25 to \$0.30 per kWh. Subsidies from Venezuela have been estimated at \$2.0 billion annually.

**Table 3. Major Cuban Power Plants and Nominal Capacity**

Name	Location	Capacity (MW)
Máximo Gómez	Mariel	450
Este Habana	Santa Cruz del Norte	300
Antonio Guiteras	Matanzas	330
Carlos Manuel de Céspedes	Cienfuegos	500
10 de Octubre	Nuevitas	425
Lidio Ramón Pérez (Felton)	Mayarí	500
Antonio Maceo (Renté)	Santiago de Cuba	450
Energas	Varadero/Jaruco	180
<b>Total Unión Eléctrica</b>		<b>3,135</b>
Other Producers <sup>a</sup>		1,205
<b>Sub-Total Capacity (2006)</b>		<b>4,340</b>
New generator sets installed throughout 2006		1,200
<b>Total estimated capacity (2007)<sup>b</sup></b>		<b>5,540</b>

Source: Belt, Juan A.B. (2006). Energy Sector in Cuba: Present Situation.

a. Hydro, solar, wind and Sugar Industry cogeneration among others

b. Assumes no replacement of older units

ery of electricity were incorporated into these measures. Today, there is new legislation imposing severe penalties for the theft of electricity which include imprisonment for up to eight years for a third violation. Another important and recent initiative is a shift on the promotion of renewable energy sources, notably wind and solar.

As a result of these activities, there is an improvement in the Cuban power sector compared to the previous year. In only one year, power outages became less frequent, a significant number of obsolete, high-energy consumption household appliances were replaced, and many small generators were added. These results represent a considerable advancement, achieved at an estimated cost of \$800 million. However, these milestones are only an indicator of a short-term improvement in the sector as there is still a need to modernize the entire power sector infrastructure. Furthermore, and as stated by Cuban authorities, the real focus of the “energy revolution” is to instill a culture of energy savings in the Cuban population “... through the introduction of high energy efficiency household appliances, the application of a graduated fee/fine structure in the domestic sec-

tor, the rehabilitation of the national transmission and delivery system, and a concerted effort to minimize losses at the production inputs of energy generation ...” (Benjamin-Alvarado, 2005: 15–16). There is no clear indication, however, that the Cuban population has embraced that energy-saving culture. On the contrary, the mandatory nature of the acquisition of energy saving appliances and efficient light bulbs, coupled with cost prohibitive fines for the majority of the Cuban population, may be interpreted as a new set of coercive and authoritarian policies that may now be in effect in the energy sector.

Finally, the “energy revolution” is built upon the premise of available and subsidized refined petroleum products from Venezuela as its main energy security foundation. If—and when—these subsidized imports end, the Cuban economy is likely to experience another oil price shock and product supply restrictions. The long-term success of the “energy revolution” is yet to be proved.

The institutional base of the Cuban power sector is complex, and follows the bureaucratic structure of the centralized economy of the Cuban government. (Pérez et al, 2005). The Ministry of Economy and

Planning (MEP) rules the energy and economic policy of the country, and presides over the Energy Council (CAAE), which is the body in charge of controlling the Program for National Energy Sources and energy efficiency, fostering renewable energy sources, and elaborating laws and legislation to improve energy efficiency in the national economy. The Energy Council in turn is made up of 16 other government agencies with some indirect responsibilities on the energy sector, such as the powerful Sugar Ministry (MINAZ), the Ministry of Agriculture (MAG), the Ministry of Basic Industry (MINBAS), and others. The Energy Council, under the leadership of MEP, runs the operations of the national Electric Utility (Unión Eléctrica) and Cuba Petróleo (Cupet), which are the main government institutions responsible for the administration of the electricity and fossil fuel sectors, and all their related activities of production, transmission, distribution, and commercialization. Their operations are intimately related as more than 90% of the energy produced in Cuba depends on oil products as power generation fuels.

MEP is also in charge of State Energy Inspection and regulatory enforcement throughout the country, acting as the *de facto* regulator of the energy sector. In addition, the Energas joint venture with the Canadian energy and mining firm Sherritt Ltd., operating in Matanzas, and Genpower, another independent power producer in the Isle of Youth, contribute to oil production, electricity generation and distribution. The National Assembly of People's Power has an Industry and Energy Commission that represents the legislative power. Finally, all the government agencies, including the Energy Council, report to the Executive Power through the Council of State, which is made up of Ministries within which the above-mentioned energy related structures are inserted. The ultimate authority remains with Fidel Castro, President of Cuba, and the head of the Council of State and Ministers.

Cuba's power tariff system is also very complicated. There is a multitude of tariffs, most of which, how-

ever, do not reflect the actual costs of the power supply, in particular to residential customers and low energy consumers. This incorrect pricing led to an improper allocation of energy use and energy technology, and prompted the Cuban government to develop a new tariff system that more closely approximates economic reality. Today, the basic structure of the existing price system makes a distinction between rates in local pesos ("Tarifas en Moneda Nacional") and rates in US Dollars, and their application differs mostly with respect to the customers being served.

Cuban homes, the public sector, agricultural businesses, and the sector of industry not producing for the dollar markets pay their power bills in Cuban pesos. Foreign companies, employees of foreign companies, diplomats, and joint venture companies (*empresas mixtas*) are billed in U.S. dollars (or convertible pesos) at full cost recovery rate for their power. As the prices in dollars and Cuban pesos are nominally roughly equal and the exchange rate for dollar and Cuban pesos is around 1:26 (April 2007), the actual prices for power for the two groups are much different.<sup>5</sup> The basic structure of the electricity rates is described below.

The tariff system for residential customers does not have a basic price, consisting instead of a "work price" that is progressively "zoned":

- The first 1,200 kWh per year (100 kWh per month) cost 0.09 Cuban pesos per kWh.
- Each additional kWh costs 0.2 Cuban pesos for up to a total of 3,600 kWh/year.
- Above 3,600 kWh per year, each kWh costs 0.3 Cuban pesos.
- The rate for customers that pay in dollars is US\$ 0.1215 per kWh across the board.

Cuban industry is charged a combined "power price" tariff with various time zones. The three zones are the peak load time (6 pm to 10 pm), medium load (6 am to 6 pm), and low load ( *madrugada*, 10 pm to 6 am). The actual power price is based on a contractual purchase commitment. For example, an industry cus-

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5. The figures are presented in Cuban pesos given the difficulty of using a "correct" rate of exchange with respect to the U.S. dollar.

tomers with two-shift production and a monthly purchase commitment between 1,000 kWh and 2,999 kWh would pay 4 Cuban pesos per kWh per month. If the ordered amount is exceeded during peak times, the difference between the actual load and the ordered load costs 12 pesos per kWh. The “work price” then increases during peak load hours.

The power prices for industrial customers paying in dollars for the comparable tariff are US\$0.09 during peak loads, US\$0.04 during medium loads, and US\$0.03 during low loads. Foreign industrial customers pay US\$0.12 per kWh. (SEPCO, 2005).

The policy issues related to electricity rates are summarized as follows:

- The power prices for all customer groups should be adapted to the actual costs for power generation and distribution. Measures to accommodate for the incomes of Cuban families and industries that pay in pesos should be implemented as the cases merit.
- The structure of the tariffs for different customer segments does not reflect the true costs of power generation and distribution, therefore a unification of the full cost recovery tariffs would make economic sense.
- Given these rates, energy efficiency programs make both economic and environmental sense, as the costs for the import of these energy saving technologies would quickly be paid off by the import costs for the oil burned in Cuban power plants.

### Telecommunications Sector

Despite revolutionary changes in telecommunications technology in recent years, the Cuban telecommunications sector is still far behind the rest of the world, and is very underdeveloped for a country of its level of per capita income. Today, Cuba has the second lowest fixed line penetration (6.8%) of any other Latin American country, ahead only of Haiti,

and only 1.7% of the population has access to Internet communications.<sup>6</sup> Cellular telecommunication is expensive (about \$2.70 per minute to the USA), and is available to less than one per hundred inhabitants—the lowest teledensity rate in Latin America.<sup>7</sup>

International communications and Internet access are highly restricted in terms of prohibitive rates, actual connections, and the number of government-owned Internet sites that Cuban citizens can “visit” to browse the “local Cuban” intranet which only offers access to government-approved web sites. Access to the world wide Internet is limited to a select number of government institutions, the diplomatic sector, and approved foreign businesses. It is available for tourists at the main hotels, but they must pay for the service approximately \$5 for 30 minutes and a common Cuban citizen cannot “legally” buy a personal computer and request a service from an Internet Service Provider (ISP). For that common task, a Cuban needs to have a private telephone line and a government permit, and once it is obtained, must also be able to afford a monthly service rate of approximately \$35.<sup>8</sup> Radio stations and TV channels are state-owned and operated throughout the country, and private broadcasting is prohibited by Cuban law.

The national telecommunications infrastructure in Cuba consists of a network of approximately 2,100 kilometers of fiber optic lines, a digital microwave network with 1,840 channels, and an outdated coaxial cable trunk system, using an X.25 network. There are currently 896,000 fixed line services in the country, of which 768,000 are operating with existing customers. Ironically, the Cuban regime argues that it is attempting to reorient the economy away from traditional sectors such as sugar, tobacco, and mining, and trying to convert Cuba into a “knowledge economy” with an emphasis on high-tech and service oriented sectors, such as medical services, bio-technolo-

6. The information on this section is based on CAFC (2004) and Ricourt and Leyva (2006).

7. There are 90,000 cellular customers.

8. Internet World Statistics. Cuba. [www.internetworldstats.com/car/cu.htm](http://www.internetworldstats.com/car/cu.htm)

gy products, and tourism. But developing these modern economic activities, while restricting communications and Internet access, seems to be highly contradictory, as these industries and service sectors demand state of the art telecommunications technology and fast connectivity to information.

Telecommunications services are provided by the Empresa de Telecomunicaciones de Cuba S.A. (ETECSA), a mixed capital company that is owned by the Government of Cuba, and managed by the Ministry of Information and Communication, with a majority share of 73%, and by Telecom Italia, with the residual 27%. The monopolistic services of ETECSA include telephone, internet and wireless services, and at the present time, it is the only provider of telecommunication services in Cuba as result of an exclusive, 20-year right to operate in the telecommunications sector issued in 2003.

With revenues of more than \$400 million in 2005, ETECSA is one of the most powerful and visible companies in the country. It is under the direct control of the new Minister of Information, Technology and Communications, Ramiro Valdés, 74, a sinister military commander, former Minister of the Interior, long-time member of the Cuban government, and loyal to the Castro brothers. His recent appointment has been the only ministerial appointment that Raúl Castro has made since he took over temporarily from his brother Fidel in July 2006, and as the Minister of Information and Communications, Valdés is in charge of regulating information technology, telecommunications, postal services, information exchange networks, value-added services, the construction of electronic components, and the operation of radio, press, and TV channels.

Following his appointment, Valdés fired José Antonio Fernández, Director of ETECSA, and Nelson Ferrer, Vice Minister of Information, for “failing to

control the company.” However, according to industry reports, the appointment of Valdés, the concession to ETECSA and the dismissal of senior government officials are in response to the Cuban government efforts to bring the computing and telecommunications enterprises back under firm state control ...” and restrict the telecommunications sector “... to foreign capital or to information and entertainment from outside the country ... [and impose] ... further restrictions for participation of foreign companies in the sector.<sup>10</sup>” It is evident that the Government of Cuba is concerned with the control, access, and dissemination of information across the country.

### Water Sector

Cuba today faces severe water and sanitation issues. Most of the water and sewer facilities located in the country still depend on technologies and infrastructure installed over 50 years ago. The water and sanitation sector is outdated, obsolete, and insufficient to meet the growing national demand for safe drinking water and adequate sanitation services. Access to safe drinking water and the provision of sanitation services are essential to public health, labor productivity, economic growth, infant mortality rates, and environmental protection, but after many years of neglect, and according to the most recent set of official data, access to piped drinking water is available to 65% of the national population, and sewerage services to only 38%.<sup>11</sup>

The City of Havana has now grown to population of about two million people, but the water and sanitation system is over 50 years old, and was originally designed for a population of 600,000 people.<sup>12</sup> The rest of the population is currently served with alternative means, known as “easy access” (*fácil acceso*), that include other options such as water trucks or common taps for drinking water, or latrines for sani-

9. “Raúl Castro fires Directors of ETECSA, Telecom Italia, and Copextel.” *Havana Journal*. October 3, 2006 (www.havanajournal.com).

10. *Ibid.*

11. The information on this section is from CUBAGUA/Instituto Nacional de Recursos Hídricos (www.hidro.cu)

12. CAFC (2004).

tation, but these sources of water are usually from open flow systems typically contaminated by industrial waste, groundwater contamination, or saltwater intrusion. The main transmission lines and the distribution network have also deteriorated due to lack of maintenance, and the service life has been extended far beyond reasonable industry standards of normal, useful life, and losses in the distribution system are estimated at 50%.

There are 8 wastewater treatment plants in the country, three of them around the City and Province of La Habana, but according to information from the Institute of National Hydraulic Resources (INRH), only 4 of the plants are considered “efficient” — none of them located around La Habana — and only 4% of the national effluent receives some sort of primary treatment. The rest of the wastewater is discharged into the ocean, or into other public water streams like the Almendares river, with minimal treatment.

A severe drought experienced between 2000 and 2005 also affected the volume, quality, and availability of water in Cuba. It is reported that INRH operates about 240 dams and about 700 small dikes to store water as a source of potable water, but following the dissolution of the Soviet Union, Cuba lost its subsidies, and had to buy spare parts, pumping equipment, and treatment chemicals in the open markets, paying full market prices. As a result, during 2006 shortages of materials, spare parts, and water pumping equipment reduced the availability of water in the country, and worsened the already precarious conditions of the wastewater sector. The water supply in rural areas likely also lacks proper disinfection treatment.

Information about the water sector in Cuba is limited. Official reports are focused on quantity, rather than the quality of the service. Thus, although Cuba reports a national drinking-water coverage rate of 95%, and access to sanitation of 94%, there is no current information about the quality of the water, service pressure, and hours of operation. In general

terms, and during the years known as the “Special Period,” the water and sanitation sector of Cuba has deteriorated significantly, and major investments are necessary for water transportation and drainage systems, water purification and treatment, inspection and quality control systems, loss reduction programs, systems for the collection and disposal of wastewater, and renovations at the wastewater treatment plants.

The Government of Cuba has used the media effectively to instruct the population on critical sanitation practices, such as boiling drinking water and disposing wastewater, which may account for some positive health indicators in the country, such as the low infant mortality rate of 7.27 per 1,000 live births and the long (77 year) life expectancy rate. Tourism areas do not report water or wastewater issues.

As highlighted in the CAFC II Report (2006: 36): “... the Cuban people today face daunting water supply and sanitation issues.” The quality of the drinking water is unsafe and the quantity is limited. The existing infrastructure has reached the limits of its operational level and useful life. Distribution system losses have been estimated to be as high as 50%, and according to reports from Carlos Lage, Vice President of Cuba, “... the City of La Habana uses twice the [volume of] water of the City of Madrid, Spain which has twice the population of La Habana.”<sup>13</sup> He also said that about “... US\$600 million would be required to modernize the total water system in Havana.”

The insufficient capacity of the wastewater treatment plants and water runoff from industrial facilities have caused a degradation of surface water and groundwater quality. Individuals who have traveled to Cuba in recent years report that systematic disinfection of drinking water and untreated wastewater discharges continues to be a major problem for the Cuban people. Water tariff rates are also clearly inadequate to allow operation on a commercial basis since reportedly the water bill for a family in Havana is 1 Cuban peso per month for water service, and after the installation

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13. Public statement of Carlos Lage, Vice President of Cuba — [www.cubatrade.org](http://www.cubatrade.org)

of new water meters is complete, the rate will then be 25 centavos per 1,000 liters up to 3,000 liters, 50 centavos per 1,000 liters from 3,000 to 4,500 liters, 75 centavos for the next 1,000 liters, then 1 peso, 1.50 pesos, and so on.<sup>14</sup> In 2004–06 there were spontaneous protests over power and water shortages. According to *The Economist*<sup>15</sup> “... daily blackouts of up to 18 hours in the summer of 2005 and water shortages resulted in a high level of dissatisfaction” and that at “night, anti-Castro graffiti appear and stones and bottles fly in blacked-out streets.”

The accumulation of all these problems prompted the Government of Cuba to call on the private sector and allow some participation in water and wastewater activities, and the Government of Cuba formed a joint venture partnership with the Spanish firm Aguas de Barcelona (AGBAR) to manage a portion of the drinking water system in the City of La Habana and the tourism resort of Varadero. Aguas de Valencia also works in Cuba as a private contractor under contract with AGBAR in water treatment activities in the same areas. While the participation of the private sector is a positive development and should be supported, there is very limited information disclosed about the terms of this agreement. The second major change in the future strategic direction of the water sector in Cuba is the reorganization of INRH, the Cuban government agency managing all the water resources in the country, which according to Law No. 245, has ceased as a central government agency, and is now under the direct responsibility of the Ministry of Construction.

### AGENDA FOR ACTION

Reliable information on Cuba’s infrastructure is elusive. All data used for this paper comes from open sources and may suffer from inaccuracies, bias, and partial information. The purpose of this section is not to be prescriptive. The authorities in Cuba must take all the decisions related to the reform of the power, telecommunications and water sectors. This

section simply tries to use the lessons learned in the reforms of infrastructure in Latin American and transition economies and applies them as a first approximation to the case of Cuba.

The reforms of the infrastructure sector discussed in this paper have to be undertaken in coordination with macroeconomic reforms and reforms in other sectors. The following examples illustrate this point:

1. There may be a need to have an overall privatization strategy;
2. Some of the assets of the three sectors were confiscated and some of the assets are built on land that was confiscated, so a reform of these infrastructure sector and particularly privatization has to be carried out under a framework for addressing property claims;
3. The large subsidies from Venezuela, and their potential withdrawal under a transition, will result in a macroeconomic imbalance that has to be addressed;
4. There is a need to increase utility rates, some sharply, to reach full cost recovery, but those rate adjustments have to be coordinated closely with policies designed to bring all prices in the economy closer to international prices; and
5. Rate increases will affect real incomes of the poor and must be coordinated with the establishment of a social safety net and the establishment of life line rates or other mechanism to ensure that the poor are not hurt too much by the necessary increase in rates of some services, particularly power and water.

An infrastructure reform strategy should be developed by the authorities, and should address issues not only of the power, telecommunications and waters sectors, but also should deal with roads, ports, and airports.<sup>16</sup> Consultants could assist in the formulation of the strategy. Other important activities would be visits by Cuban officials to countries that have reformed in Latin America (Chile, Guatemala,

14. Assuming an unofficial rate of 24 CUP per US\$, the monthly cost of CUP 1.50 is only \$0.06 per month.

15. “Onward into the Twilight.” *The Economist*, July 28, 2005.

16. In the discussion that follows, it will be assumed that the authorities have requested support from bilateral and multilateral donors.

Peru, El Salvador and Colombia, for example) as well as countries in Eastern Europe (Czech Republic, Estonia and Poland, for example). This strategy could be completed in 3–6 months; periodic seminars involving civil society should be carried out to increase transparency. It would also be necessary to make a rapid assessment of the assets of the power company and the main water systems.

The legal/regulatory framework for the different infrastructure sectors has to be developed and the laws enacted. A critical issue is the legitimacy of the authorities before free and fair elections are conducted. Once the laws are enacted, a multi-sector regulator should be established and staffed. The staff will require training on the job as well as abroad. Good possibilities for training abroad include the Public Utilities Research Center of the University of Florida (PURC), the U.S. Telecommunications Training Institute (USTTI) and the Kennedy School of Government at Harvard (specifically the course *Infrastructure in a Market Economy*). The regulator can also be supported by foreign consultants who would also provide on the job training. Additionally, partnerships under the National Association of Regulatory Utility Commissions (NARUC) with a U.S. state regulator could be a powerful instrument for enhancing the skills of the staff of the Cuban regulator.

The specific reforms of the power, telecommunications and water sectors are discussed below. Table 4 summarizes the timing.

### Power Sector

While in 2005–06 Cuba faced blackouts, the situation has improved markedly as a result of conservation measures, the installation of additional gas fired generation (100 MW) and the installation of over 1,000 MW of small gensets, although these gensets are a very high cost, short-term solution. The first priority for the authorities would be to introduce measures to avoid asset stripping and tunneling. The second priority would be to perform an emergency rehabilitation program of crucial infrastructure components to ensure the availability of power to critical facilities. Depending on the willingness of the managers of Unión Eléctrica (UE) to implement measures to in-

crease efficiency and safeguard the assets, two programs of external support could be considered.

- Under Plan A, the GOC would seek international support to bring in consultants to help UE improve financial management, billing, information and communications technology (ICT) systems, etc. For this plan to be effective, the managers of UE must be fully supportive.
- Under Plan B, the authorities may choose to develop some form of performance-based management contract. These contracts should: (1) be awarded through an international competitive bidding (ICB) process; (2) they must give operators control to be able to manage the business, including reducing staff; and (3) managers and employees should get financial gains from better performance. The lessons learned from USAID's study of operations contracts could be a valuable input for the design of a contract for UE.

To achieve a competitive market, it is first necessary to unbundle the sector, i.e., separate generation from transmission and from distribution. In a market the size of Cuba, three to four distribution companies would have to be formed. Each generation plant is of a sufficient size that could become a separate enterprise. Limits on vertical integration, i.e., prohibition of ownership of generation and transmission, and horizontal limits, i.e., maximum ownership of generation assets as a percent of total system generation, would be advisable. A complex issue is whether it is advisable to have a transmission company separate from the system operator. The different alternatives are discussed thoroughly in Hunt's (2002) excellent book. One is to combine transmission and system operations in one company (Transco), such as the National Grid Company in the United Kingdom. This is also the model in Spain and Scandinavia. The other option is to separate the system operation into a separate organization, the independent system operator (ISO) and a separate transmission company (Gridco). This is the model in Argentina and in many parts of Australia. The determination of the most appropriate model for Cuba has to be the result of an intense dialogue between the authorities and consul-

**Table 4. Estimated Timeline for Sector Reforms**

Activity Description	Year				
	1	2	3	4	5
<b>Transition begins</b>	█				
<b>Infrastructure Strategy and Legal Framework</b>	█	█	█	█	█
Draft strategy	█				
Develop consensus		█			
Draft laws (power, telecom and water)			█		
Enact laws				█	
Establish regulatory agency					█
<b>Power sector</b>	█	█	█	█	█
Emergency Rehabilitation Program		█	█	█	
Operation contracts			█	█	
Unbundle / corporatize				█	
Adjust rates				█	
Sell DISTCOS				█	
Sell GENCOS					█
<b>Telecommunications</b>	█	█	█	█	
Renegotiate exclusivity agreement with incumbent		█			
Spectrum auctions			█	█	
License cellular companies				█	
Privatize remaining stock in telecomms company				█	
<b>Water</b>	█	█	█	█	█
Develop concessions for key cities	█	█	█	█	█

tants. The characteristics of possible distribution companies are summarized in Table 5.

Privatizing the power sector is, by necessity, a lengthy process. The privatization process must be carried out competently and with a high degree of transparency, including consultations with civil society. The privatization of the power sector of Chile, the first such process in Latin America, took almost 10 years while the one of Argentina took two years. In the case of Cuba, where many of the necessary in-

stitutions do not exist, such a process would take 3–5 years.

The sequence of privatization of the different components is also important. After the laws have been enacted and the regulator has been established, it is important to adjust rates before privatization takes place. The recommended sequence is to privatize the distribution companies first, after rates are at—or close to—cost recovery. After these rates have been market tested for a few months or a year, the generation companies can be privatized. Given that the

**Table 5. Possible Electricity Distribution Markets**

Market Areas	Provinces	Estimated number of customers (millions) and % market participation
<b>3 Distribution Areas</b>	Provincia de La Habana	1.1 (33.3%)
	Provincias Centrales	1.2 (36.4%)
	Provincias Orientales	1.0 (30.3%)
	<b>Total</b>	<b>3.3 (100%)</b>
<b>4 Distribution Areas</b>	Provincia de La Habana	1.1 (33.3%)
	Provincias Centrales 1	0.7 (21.0%)
	Provincias Centrales 2	0.8 (22.8%)
	Provincias Orientales	0.8 (22.9%)
	<b>Total</b>	<b>3.3 (100%)</b>

main clients of the generation companies are the distribution companies, it is important that they are in a strong financial position before the generation companies are privatized. It is best to keep transmission in the public sector, and the system operator can be either a state-owned enterprise or owned jointly by all market participants, including the government.

### Telecommunications Sector

Introducing private participation in telecommunications is much easier than in the power or water sectors. Even in such conflictive countries such as Iraq and Afghanistan, there has been significant private investment in telecommunications.

In Cuba's case, the first step is to develop the legal framework and at the same time renegotiate the exclusivity agreement with the incumbent. This has been done in many countries, including Jamaica and Trinidad and Tobago.<sup>17</sup>

A country of Cuba's size should be able to sustain at least three additional cellular companies. A spectrum auction and licensing for cellular carriers would be a priority. Also, licensing Internet Service Providers and potential cable TV companies, permitting them to offer telecommunications service, can be done rapidly. Cuba should not restrict in any way Voice Over Internet Protocol (VOIP). An agile mechanism for resolving interconnection disputes should be established following the El Salvador and Guatemala models.<sup>18</sup> Foreign consultants can support the regulator in the auctions. Eventually, the Cuban government should consider selling its equity in the incumbent carrier after competition is in place, to avoid efforts by the incumbent to stifle competition. With a modern telecommunications sector Cuba can capitalize on its well trained population and become an exporter of ICT services.

### Water

Introducing private participation in the water sector is difficult, but possible. It is remarkable that Cuba, a socialist country, has already done so in Havana and Varadero through a water concession contract with Aguas de Barcelona. It is also possible that the presence in these markets of a major international corporation may leverage—and further encourage—private sector participation, but it is also necessary to introduce discipline in the sector and prevent the possibility of corruption through asset stripping and tunneling.

The water sector provides difficult challenges, but it may be reorganized according to market supply and demand characteristics following provincial and municipal boundaries, and according to legal issues related to the ownership and location of the drinking water sources and wastewater disposal sites. The water treatment and transportation infrastructure, the quality of the drinking water, and the proximity to markets should serve as guidance for the organization of efficient municipal and/or provincial companies managing the water sector, and providing water

17. Juan A. B. Belt was involved in those renegotiations. They are difficult, but possible.

18. Belt (2000).

and wastewater services. The participation of the private sector in the water sector should follow the organization of these municipal utilities, and most importantly, the formulation of a national water policy, the enactment of a legal and regulatory framework, and the creation of a new regulatory institution, separate from any other government policy-making institution. The role of the regulatory agency should be initially focused on the identification and enactment of a set of rules designed to attract and retain the participation of the private sector. New pricing policies and rules should be designed on the basis of full cost recovery, efficiency, and equity.

The priority activities of the water sector include, but are not limited to,

- The organization of municipal and provincial public utility companies,

- The rapid assessment and rehabilitation of water and wastewater treatment plants and their associated infrastructure (i.e., storage tanks, pipelines, and distribution lines),
- The modernization of the wastewater treatment plants located in the interior of the country.

Private sector participation can include a broad diversity of activities ranging from management and technical services, outsourced activities, water treatment processes, long-distance transportation, and wastewater treatment and disposal, among others. The main issue in the water sector is to avoid further environmental degradation of water sources that could have an immediate effect on public health, and provide adequate services of sewage treatment and disposal.

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