PUBLIC-PRIVATE PARTNERSHIPS IN RENEWABLE ENERGY IN LATIN AMERICA AND THE CARIBBEAN

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Project document

Public-private partnerships in renewable energy in Latin America and the Caribbean

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I. Introduction

The versatility of electricity, which can be transformed into heat, light or mechanical movement, makes it a very valuable form of energy. It can be used to light a home, cook food or move machinery in productive processes. Access to electricity is thus crucial for human and economic development.

In the 1980s and 1990s, Latin America and the Caribbean substantially reformed the electricity sector. During this process, most of the countries in the region privatized all or part of the sector, which historically had been in the hands of the state. Thus, private companies largely took charge of electricity generation, transmission and distribution, while the government became responsible for regulating the sector through institutions created specifically for that purpose. This process and model were generally successful and led to an improvement in service. In the majority of cases, the model remains in place today.

In 2003-2008, the Latin American region recorded an average annual economic growth rate of almost 5 per cent. Moreover, Latin American countries withstood the world economic and financial crisis better than other regions of the world, and they are showing signs of a relatively faster recovery.[1] The OECD projects that the region's growth rate will average 4.1 per cent in 2012.[2] This economic growth will increase the demand for all forms of energy, including electricity.

While hydroelectric power represents a strong share of the region's energy matrix, fossil fuels are used to generate almost half of the electricity in Latin America and the Caribbean, producing greenhouse gases and, in some cases, resulting in high and unpredictable electricity costs. Hydropower is the dominant renewable energy source, whereas unconventional sources represent only a marginal share of the region's energy matrix.

Renewable energy projects are generally characterized by high investment and maintenance costs, complex construction issues and economic returns that are not always high. These factors create a big challenge in the development of renewable energy projects and the penetration of the technology in the region. It is therefore necessary to explore mechanisms that can help overcome this challenge, particularly in the financing phase. One way to narrow the gap in financing is to incorporate private capital through public-private partnerships (PPP).

During the privatization process of the 1980s and 1990s, many Latin American countries sought out private sector participation in order to increase investment in infrastructure while keeping public debt

[1] Organization for Economic Cooperation and Development (2011), "Perspectivas Económicas de América Latina, 2011".
[2] Idem.

under control, as well as to break up the vertical integration of the services and increase management efficiency. Privatization was successful in areas where the public sector had a strong regulatory framework and where the specific project designs were solid and transparent. In other cases, however, privatization was less successful, as reflected in frequent renegotiations and conflicts between the parties. Moreover, the privatization process changed the role of the state from a traditional supplier of public goods to a market regulator.

Traditionally, public-private partnerships (PPP) were defined as a legally binding contract between the government and private firms for the provision of goods and services, with the majority of the responsibilities and risks transferred to the private partner.

Currently, however, PPPs are being transformed into a model in which the public and private sectors are both involved in all phases of the project, including construction, financing and operation. This makes the arrangement more attractive to the private sector, since the risks are shared by the government.

A big challenge for the region is to achieve sustainable development combined with economic growth, energy security, the well-being of the population and care for the environment. Energy security is becoming a crucial issue on domestic and international political agendas due to climate change and fluctuations in oil prices, which mainly affect developing countries.[3] The use of renewable energy sources can significantly reduce both greenhouse gas emissions from electricity generation and national dependency on imported fuels. Several countries in the region, especially in South America, have launched programmes to promote the use of unconventional renewable energy in the production of electricity.

The majority of these programmes are still in the implementation phase, but it is already possible to identify some areas for improvement, such as access to credit and the transparency and clarity of the processes. These programmes have in common the participation of the state in the role of regulator, promoter and, in some cases, guarantor and financial backer; while the private sector plays the basic role of executing and operating the project.

The PPP model appears to be having positive results in terms of promoting the use of unconventional renewable energy. The use of unconventional sources has increased significantly following the implementation of these programmes at the beginning of the last decade.

This report highlights the importance of private participation for increasing the use of unconventional renewable energy sources in large and medium-sized projects that are generally connected to a national distribution network. To this end, the report provides a brief description of electricity market segmentation in some target countries (namely, Argentina, Brazil, Chile, Colombia, Mexico, Peru and Uruguay) and identifies the main actors in the electricity sector. It also discusses some important environmental and social aspects of electric energy, such as climate change and access to electricity, with a focus on the key role that renewable energy sources can play in these areas.

The paper then discusses PPPs, presenting case studies of programmes being implemented in region to promote unconventional renewable energy, as well as some concrete efforts featuring public-private participation. It also provides a brief summary of best practices for the development of PPPs, ending with a discussion and final conclusions.

The research for this report was based on the collection of publicly available data, together with surveys and interviews of key personnel in the government entities in charge of the electricity sector in 13 countries in Latin America and the Caribbean, who were identified and initially contacted by ECLAC. The data were then categorized and analysed, and the government contacts were called on to complete and expand on data where necessary. The collected and analysed data are presented below.

[3] Sánchez, T. (2010), "The Hidden Energy Crisis, How Policies are Failing the World's Poor." Practical Action Publishing.

II. Electricity market structure in countries of the region

A. Argentina

1. Electricity market segmentation

In the early 1990s, the electricity sector in Argentina underwent a significant transformation and reorganization process due the privatization of different state enterprises involved in the generation, transmission and distribution of electric energy. The electricity sector is currently segmented among actors in charge of generation, transmission and distribution. Generation occurs in a competitive and largely liberalized market. The transmission and distribution sectors, in contrast, are largely regulated and are less competitive than the generation sector.

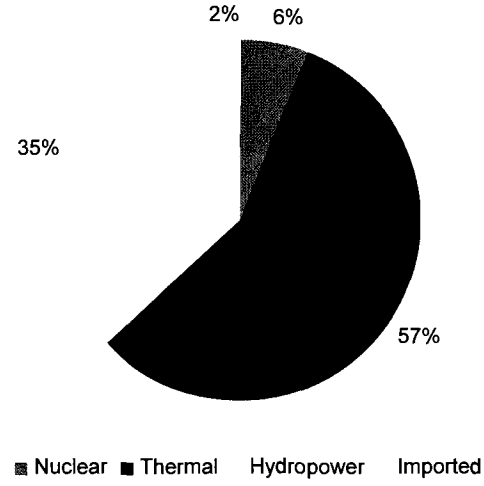
The segmentation of the production chain limits ownership in the different stages. For example, an electricity transmission company cannot also generate or distribute electricity. This segmentation serves as a consumer protection tool, preventing the formation of monopolies or oligopolies in which an economic group can abuse a dominant position and thus obtain differential profits.[4]

Argentina has two interconnected systems for electricity distribution. The Argentine Interconnected System (SADI) covers the northern and central areas of the county, while the Patagonian Interconnected System (SIP) covers the south. Both systems are integrated since 2006.

Electricity generation in the country is mainly based on thermal, hydroelectric and nuclear plants, with a small fraction of imported electricity thanks to bilateral agreements with Brazil and Paraguay (see figure 1).

[4] Zambon, F. and Gómez, R. (2006), "La segmentación vertical en el Marco Regulatorio Eléctrico Argentino." Paper prepared for the International Congress on Electricity Distribution, Argentina 2006.

FIGURE 1
SHARE OF ELECTRICITY GENERATION IN ARGENTINA BY SOURCE, 2010



Source: CAMMESA 2010.

The country's strong economic performance since the 2001 recession has increased the demand for electricity in line with the growth of gross domestic product (GDP).[5] This growing electricity demand is driving the increase in energy production, as well as the expansion and improvement of the distribution networks in the country. Argentina has a high electrification rate (95 per cent), but a substantial share of its rural population (30 per cent) is still without electricity service.[6]

The National Programme for the Rational and Efficient Use of Energy (PRONUREE) was created to raise citizen awareness of society's role and the importance of everyday decisions for achieving a more rational energy use. The programme is aimed at residential, industrial, agricultural and transportation sectors, both public and private.[7]

2. The functions and responsibilities of the different interested parties

The Secretariat of Energy, under the Ministry of Federal Planning, Public Investment and Services, is in charge of sectoral policies, while the National Electricity Regulatory Agency (ENRE) is responsible for the general supervision and regulation of electricity generation, transmission and distribution. Finally, the Wholesale Electricity Market Administration Company (CAMMESA) organizes the electricity generation, transmission and distribution companies and large users. It is in charge of planning the operation of the interconnected system so as to cover demand with a level of reserve margins agreed among the parties. Table 1 summarizes the functions and responsibilities of the main parties involved in the electricity sector.

5 Based on data from CAMMESA (2010) on the trend in the growth rate of electricity demand versus GDP.
6 National Institute of Industrial Technology (2008).
7 Secretariat of Energy. Available online at http://energia3.mecon.gov.ar/contenidos/verpagina.php?idpagina=2892 (accessed on 16 July 2011).

TABLE 1
FUNCTIONS AND RESPONSIBILITIES OF THE KEY PARTIES IN THE ELECTRICITY SECTOR IN ARGENTINA

Entity	Main function	Main responsibilities
Secretariat of Energy	Sectoral policies	• Design, propose and implement national energy policy; • Study and analyse energy market behaviour and develop strategic planning in the areas of electric energy, hydrocarbons and other fuels; • Carry out the necessary actions to apply sectoral policy with regard to the environment; • Oversee the proposal and implementation of national policy on hydrocarbons, coal and other fuels; • Promote and supervise the rational exploitation of hydrocarbon resources and preservation of the environment in all phases of the oil industry.
National Electricity Regulatory Agency (ENRE)	General supervision and regulation of the electricity industry	• Ensure contract compliance on the part of concessionaires; • Control service quality; • Monitor environmental and property protection and public security; • Establish regulations on technical security standards and service quality; • Authorize expansions of the transmission system; • Authorize utilization of the existing transmission capacity; • Organize and apply a system of public hearings and publish decisions reached therein; • Manage and monitor the application of sanctions for violations of current regulations; • Establish the bases for calculating regulated tariffs and oversee their application; • Prevent monopolistic or discriminatory conduct.
Wholesale Electricity Market Administration Company (CAMMESA)	Management of the wholesale electricity market	• Manage economic transactions in the wholesale electricity market (in particular, to collect the required payments from all transmission system users to cover the costs of transmission and to pay the transmission company's fees); • Analyse requests for access and extensions; • Assess users' share in the benefits of a given network extension; • Coordinate the installation of control equipment; • Make proposals for optimizing the Argentine Interconnected System; • Provide the Regulator with the necessary information for controlling the service quality of transmission system operators; • Plan for the optimal operation of the system, including the coordination of transmission system maintenance, so that at no time is any area subject to a supply deficit. To this end, every three months a meeting is held with all the transmission companies and generators; • Coordinate the operation of the entire Argentine Interconnected System. Supervise the dispatch of reactive power; • Analyse disturbances that occur in the system to find the cause and propose solutions.

(continued)

Table 1 (conclusion)

Entity	Main function	Main responsibilities
Federal Council on Electric Energy (CFEE)	Management and consulting on issues related to sectoral policies	• Manage specific funds for the electricity sector; • Advise the National Executive Office and provincial governments on the electricity industry, public or private energy services, priorities for the assignment of studies and works, concessions and authorizations, and prices and tariffs in the electricity sector; • Recommend modifications to the relevant legislation.
Argentine Energy Company (ENARSA)	Project execution and ownership rights for the exploitation of energy resources	• Exploration and exploitation of solid, liquid and gas hydrocarbons, transmission, storage, distribution, commercialization and industrialization of these products and their derivatives; • Provision of public natural gas transmission and distribution service, potentially including production, processing, refining, and purchases; • Generation, transmission, distribution and commercialization of electric energy, as well as sales activities associated with energy goods.
Private producers, transmission companies and distributors		

Source: Prepared by the authors.

Law 24,065 lays out the Electricity Industry Regulatory Framework, establishing the segregation of activities among different agents in the wholesale electricity market (WEM): namely, electricity generation companies, distribution companies, large users and transmission companies.

Electricity rates are defined by the Secretariat of Energy and the National Electricity Regulatory Agency (ENRE), which is in charge of controlling the tariff schedules established at the national level. Each province has an equivalent mechanism for controlling the tariff schedules set in each jurisdiction. The legislation stipulates that the rates should be fair, allowing an efficient and effective company to make a reasonable profit.

The national tariff schedule establishes maximum rates for given tariff periods (ten years for the first period and five years for successive periods), taking into account purchasing costs in the WEM and the costs of self-distribution (network operations, maintenance and commercialization). In the given period, rates are subject to adjustments solely on the basis of variations in the cost of buying and transmitting electricity in the WEM.

The profitability rate that is used to calculate future maximum tariffs is related to the company's degree of operating efficiency and effectiveness based on an industry average and the average of other activities that carry a nationally or internationally comparable or similar risk.

Rates are adjusted quarterly. The variables that are used to determine the tariffs, which are calculated quarterly by CAMMESA, include the following: the seasonal price of reliable baseload power, the seasonal price of the power reserve, the seasonal price of related services, the seasonal price of peak energy, the seasonal charge of additional energy and fixed transmission charges in the national network.

B. Brazil

1. Electricity market segmentation

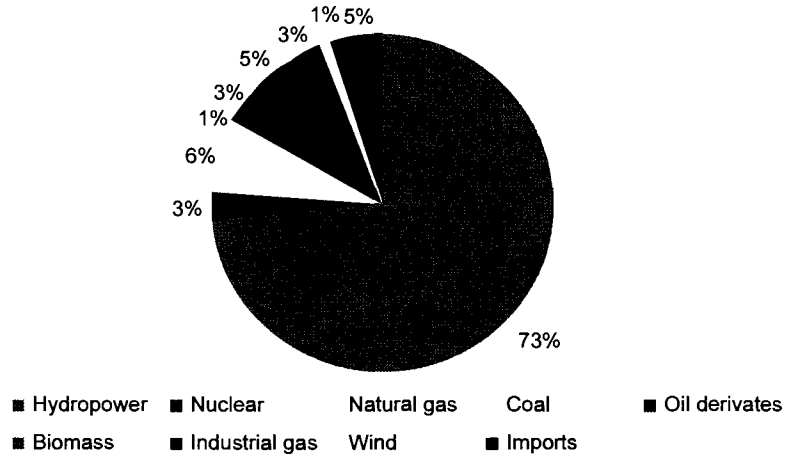
In 1996 Brazil began a process of restructuring its electricity sector in order to separate the electricity generation, transmission and distribution segments; promote competition in the generation and commercialization segments; and keep the distribution and transmission sectors under state regulation due to their condition as natural monopolies.

This process led to the creation of a state regulator (the National Electric Energy Agency, or ANEEL), an operator for the national electricity system (National Electricity System Operator, or ONS) and a platform for buying and selling electric energy (the wholesale electricity market). The country suffered an energy crisis in 2001, when scarce rains resulted in very low water levels in reservoirs. This experience gave rise to a new model for the electricity sector, with new institutions in charge of planning, monitoring the security of the electricity supply and commercialization (see figure 2).

The federal government accounts for an important share of generation, through ownership of the main hydroelectric generation companies: 80 per cent of generation is in the hands of the state through the state-owned company Eletrobras.

As shown in figure 2, hydropower holds a central position in Brazilian energy matrix, accounting for 74 per cent of production. The rest of the matrix is diversified among fossil fuels, biomass and nuclear. The share of renewable energy sources in the Brazilian energy matrix is larger than the world average and the OECD average.[8] In 2008, the country's electrification rate was 95 per cent according to data from the National Electric Energy Agency (ANEEL).

FIGURE 2
SHARE OF ELECTRICITY GENERATION IN BRAZIL BY SOURCE, 2010



Source: Brazilian Ministry of Mines and Energy.

2. The functions and responsibilities of the different interested parties

The new model for the Brazilian electricity sector created new institutions and changed the functions of some existing institutions.

The electricity regulator is ANEEL, which regulates and supervises the production, transmission, distribution and commercialization of electrical energy, in accordance with the federal government's policies and guidelines. ANEEL is also authorized to grant the rights to provide electricity services.

[8] Brazilian Ministry of Mines and Energy (2010).

Following a number of energy crises in the country, the federal government decided to implement a new model for the electricity sector in 2004, via Laws 10,847 and 10,848. Under the new model, the Executive Branch retains the responsibility for formulating sectoral policies, through the Ministry of Mines and Energy, with advice from the National Council on Energy Policy (CNPE) and the National Congress. Table 2 summarizes the functions and responsibilities of the main actors in the electricity sector.

TABLE 2
FUNCTIONS AND RESPONSIBILITIES OF THE KEY PARTIES IN THE ELECTRICITY SECTOR IN BRAZIL

Entity	Main function	Main responsibilities
National Electric Energy Agency (ANEEL)	Regulation and supervision of the production, transmission, distribution and commercialization of electric energy	• Regulate prices and other aspects of the electricity industry; • Hold auctions to grant concessions to electric companies; • Supervise concession contracts.
Ministry of Mines and Energy	Directing the country's energy policies	• Formulate and implement policies for the energy sector, in accordance with guidelines established by the CNPE; • Head up planning for the national energy sector; • Monitor the security of supply in the Brazilian electricity sector; • Identify preventive actions to restore the security of supply in case of imbalances in energy supply and demand.
National Council on Energy Policy (CNPE)	Monitoring and assessment of the security of electricity supply throughout the country.	• Supervise the generation, transmission, distribution, commercialization, import and export of electric energy; • Assess supply and service conditions and periodically analyse security; • Identify difficulties and obstacles that affect the consistency and security of supply and expansion in the sector; • Draw up proposals for preventive actions and adjustments to restore electricity supply and service security.
Energy Development Department (DDE)	Coordination of alternative energy development	• Coordinate strategic plans and actions for applying national policies on the development of alternative energy, energy efficiency and environmental sustainability.
Electricity Sector Supervisory Committee (CMSE)	Monitoring and assessment of the continuity and security of electricity supply throughout the country.	• Supervise the generation, transmission, distribution, commercialization, import and export of electric energy; • Assess supply and service conditions; • Identify difficulties and obstacles that affect the consistency and security of supply and expansion in the sector.

(continued)

Table 2 (conclusion)

Entity	Main function	Main responsibilities
Energy Research Company (EPE)	Service provision in the area of research and studies that support sectoral planning.	• Draw up proposals for preventive actions and adjustments to restore electricity supply and service security; • Conduct studies and projections on the Brazilian energy matrix and carry out studies that promote integrated energy resource planning; • Develop studies that promote planning of short-, medium- and long-term expansion of electricity generation and transmission; • Conduct technical-economic and socio-environmental feasibility analysis of plants; obtain prior environmental permits for hydropower exploitation and electricity transmission.
National Electricity System Operator (ONS)	Operation, supervision and monitoring of electricity generation in the national interconnected system and administration of the basic electricity transmission network in Brazil.	• Meet load requirements, optimize costs, guarantee system reliability and safeguard conditions for access to the high-voltage transmission network.
Chamber of Electric Energy and Commercialization (CCEE)	Regulation of the wholesale electricity market	• Verify the netting price; • Enter into the accounts the value of electricity sold; • Coordinate the financial settlement of the purchase and sale of electricity in the spot market; • Hold auctions for the purchase and sale of energy, as authorized by ANEEL.
Electrobras	Project implementation. In charge of the Programme for the Promotion of Alternative Electric Energy Sources (PROINFA)	• Provide electricity generation, transmission and distribution services.
Private producers		

Source: Prepared by the authors.

From the 1970s to the 1990s, Brazil had a single tariff in the electricity sector, which guaranteed profits to the electric companies independently of their efficiency. This led to a situation in which less efficient firms were kept afloat by more efficient companies and the federal government.

This tariff scheme did not provide incentives for companies to improve their efficiency or make new investments, causing the sector to stagnate. Consequently, Law 8,631 was passed in 1993 to redefine electricity rates to reflect the specific characteristics of each concession area.

Thus, factors such as the distribution distance, market size, cost of generation and state taxes were incorporated into the calculation of electricity rates in the country. The cost of electricity cannot exceed a maximum price (or price ceiling) set by ANEEL, which is responsible for regularizing electricity rates in the country. The electricity rate in Brazil can be broken down into approximately 31 per cent purchase price, 6 per cent transmission, 29 per cent distribution and 33 per cent taxes.[9]

[9] ANEEL (2008).

C. Chile

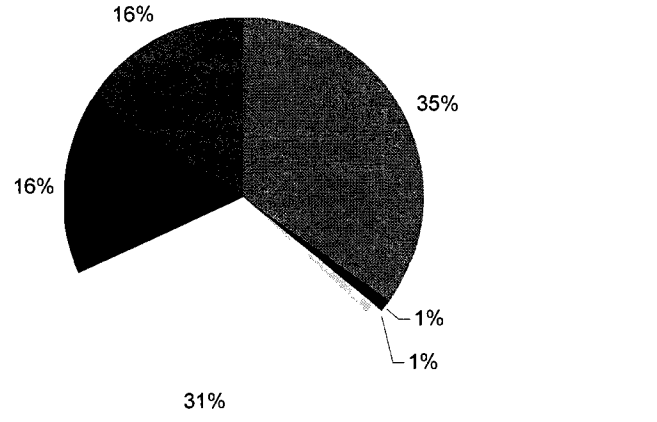
1. Electricity market segmentation

In 1982 Chile passed Law DFL 1/1982, which introduced competition and privatization in the electricity sector and thus decentralized the production, transmission and distribution of electricity.[10] This was an innovative model for the region. Under this regime, generation companies can freely write supply contracts with distribution companies and clients.[11]

As shown in figure 3, electricity production in Chile is dominated by thermal power, while hydropower accounts for 35 per cent and wind for 1 per cent.

The country has four interconnected systems: Central, Norte Grande, Magallanes and Aysén. In line with the country's economic activity, the largest energy consumption is in mining, followed by other industrial sectors, the residential sector, the commercial sector and the public sector. Large-scale mining is mostly located in the north,[12] where electricity is primarily generated by thermal plants using fossil fuels such as coal, oil and natural gas.

FIGURE 3
ELECTRICITY GENERATION IN CHILE BY SOURCE, 2010



Source: Prepared by the authors, on the basis of data from the National Energy Commission.

2. The functions and responsibilities of the different interested parties

In February 2010, Chile created the Ministry of Energy, which addresses issues on the energy market, renewable energy, energy efficiency, the environment and sustainable development, access to rural energy, related research and energy development.

In addition to the Ministry of Energy, other key institutions in the sector include the Superintendency of Electricity and Fuels (SEC), the Panel of Experts on the General Law on Electric Services and the Economic Load Dispatch Centres (CDEC). Table 3 provides additional details on the main functions and responsibilities of these and other actors in the electricity sector.

Electricity generation, transmission and distribution are carried out by the private sector in Chile, while the state acts as regulator and supervisor and also plays a subsidiary role when the market is not capable of providing solutions at a reasonable cost in segments where it is socially desirable to do so.

[10] Aguirre, F. (2009), "Sector Eléctrico en Chile, Evolución del Negocio y sus Precios". Paper prepared for the Banco BCI Conference. Antofagasta, Chile, 30 September 2008.

[11] National Energy Commission and Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (2009). "Las Energías Renovables No Convencionales en el Mercado Eléctrico Chileno".

[12] Chilean Ministry of Mining.

Because distribution and transmission are natural monopolies, the law establishes procedures for setting tariffs (or "tolls") that must be paid by network users. In contrast, economies of scale are not significant in generation, so competition is possible.

TABLE 3
FUNCTIONS AND RESPONSIBILITIES OF THE KEY PARTIES IN THE ELECTRICITY SECTOR IN CHILE

Entity	Main function	Main responsibilities
Ministry of Energy	Sectoral policies	• Prepare plans and policies for the energy sector, working within the framework of the national development plan, and present them to the President of Chile for approval; • Study and prepare forecasts of national energy supply and demand deriving from the periodical revision of sectoral plans and policies; • Enter into contracts with natural or legal persons —whether public or private, national or foreign— to prepare general studies associated with the integral development and operation of the sector, as well as pre-feasibility and feasibility studies necessary for formulating and executing energy plans and policies; • Draw up, coordinate, propose and issue regulations applicable to the energy sector as needed for complying with general energy plans and policies, as well as policies on energy efficiency; • Establish, through legal resolution, the minimum energy efficiency standards required for products, machinery, instruments, equipment, articles, appliances and materials that use any type of energy resource, for their commercialization in the country; • Through the Unconventional Renewable Energy Division: Develop sectoral policies analysing and promoting unconventional renewable energy markets.
Ministry of Economic Affairs	Tariff regulation	• Set electricity distribution tariffs; • Set node prices; • Resolve conflicts between CDEC members; • Award final concessions based on a prior report from the SEC.
National Energy Commission (CNE)		• Formulate and coordinate the necessary plans, policies and guidelines for the smooth functioning and development of the national energy sector; • Advise government entities on all issues related to energy. Calculate regulated prices established in the legislation (technical reports); • Report to the Ministry of Economic Affairs when there are differences of opinion between CDEC members, so that the Ministry can resolve the issue;
Centre for Renewable Energy (CER) / Production Development Corporation (CORFO)	Information and promotion	• Provide support for Unconventional Renewable Energy Projects; • Address the concerns of market participants, generating technical documents, organizing working groups and guiding the development of future initiatives. Promotion and diffusion of Unconventional Renewable Energy Projects: • Diffusion of Unconventional Renewable Energy Projects at the national level, via courses, workshops, seminars, training sessions, meetings and related activities, with the goal of building skills and educating the community. Information Centre • Archiving and generation of information related to the unconventional renewable energy market, technology and development

(continued)

Table 3 (conclusion)

Entity	Main function	Main responsibilities
Superintendency of Electricity and Fuels (SEC)	Safeguard the smooth functioning of electricity, gas and fuel services, in terms of security, quality and price.	• Oversee compliance with the legal regulatory framework; • Grant provisional concessions for gas production plants, electric energy generation plants, electrical substations, transmission lines and distribution lines; • Resolve conflicts, grant right of way, reprimand as needed, apply fines and so on.
Economic Load Dispatch Centres (CDEC)	Coordination of the wholesale electricity market	• Unincorporated organizations comprising the main generating companies in each electricity system, which regulate the coordinated operation of the generating plants and transmission lines in a given interconnected system. • Responsible for planning the optimal operation of the system and economically evaluating the energy transfers produced between all the generators.
Private generation, transmission and distribution companies		

Source: Prepared by the authors.

Current Chilean legislation on the setting of electricity prices stipulates that tariffs must reflect the real costs of electricity generation, transmission and distribution associated with an efficient operation.

One of the general criteria is free-market pricing in segments featuring competitive conditions. In contrast, markets that are characterized by a natural monopoly (for example, between end users whose connected load is less than or equal to 2,000 kW) are subject to price regulation.

For suppliers of end users whose connected load is greater than 2,000 kW, the law stipulates free-market pricing, on the assumption that the parties have the ability to negotiate and can switch to another form of electricity, such as self-generation or direct supply from generation companies. The former group is termed a regulated client; the latter, a free client. Clients whose connected load is greater than 500 kW can choose either the regulated or free-market regime.

In electricity systems with an installed generation capacity of over 1,500 kW, the law identifies two levels of prices that are subject to regulation:

1. Generation-transmission prices, called node prices, which are set for all generation-transmission substations from which energy is supplied. Node prices have two components: the energy price and the peak power price.

2. Distribution-level prices. These prices are based on the sum of the node price, established at the point of connection with the distribution facilities, a value added for distribution and a set fee or toll for the use of the trunk transmission system.

Generators can sell their energy and power in three markets:

1. The large consumer market, at a freely negotiated price;
2. The distribution company market, at the node price (this is electricity destined for regulated-price clients); and
3. The Economic Load Dispatch Centre (CDEC) of the respective system, at an hourly marginal cost.

The price that distribution companies can charge users in their distribution area, for the provision of electricity distribution services, is calculated as the sum of the node price, the value added of distribution and the toll for the use of the trunk system.

D. Colombia

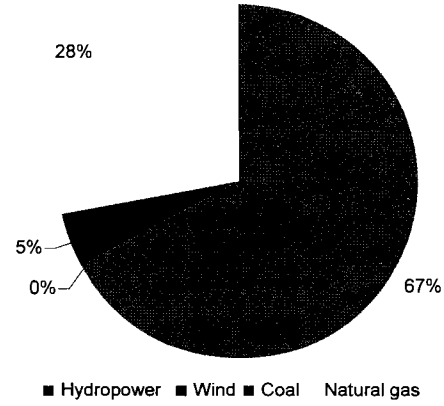
1. Electricity market segmentation

A new regulatory framework for the electricity sector was approved in 1994 through laws that enabled the participation by private companies and created public agencies to regulate the sector.

Law 143 opened the possibility of private participation in the electricity business, creating a wholesale electricity market and establishing the procedures and mechanisms for regulating activities in the sector. The electricity industry was divided into four segments (generation, transmission, distribution and commercialization), each of which was subject to a specific regulatory framework. The generation and commercialization segments were defined as competitive (or potentially competitive), while transmission and distribution were defined as monopolies subject to regulation. The general rule was the introduction of competition where possible and the regulation of monopolistic activities.

Colombia thus reorganized its electricity market from a public provision scheme to a model based on strong private competition in generation and commercialization, while transmission and distribution, as natural monopolies, are regulated through government agencies created for this purpose. The government's role thus became centred on sectoral regulation, with the creation of a regulatory agency (the Energy and Gas Regulation Commission, or CREG) and a supervisory agency (Superintendency of Residential Public Services, or SSPD).

FIGURE 4
ELECTRICITY GENERATION IN COLOMBIA BY SOURCE, 2009



Source: Ministry of Mining and Energy.

As shown in figure 4, the majority of electricity generation in Colombia is based on hydropower, followed by natural gas and coal. Wind and other sources (including combined-cycle power plants) account for a much smaller share.

2. The functions and responsibilities of the different interested parties

Colombia has a number of public and private entities that participate in the electricity sector. The Ministry of Mining and Energy encompasses the agencies in charge of sectoral planning and regulation, while participants in the wholesale market are primarily from the private sector. Table 4 outlines the main functions and responsibilities of these and other actors in the electricity sector.

TABLE 4
FUNCTIONS AND RESPONSIBILITIES OF THE KEY PARTIES IN THE ELECTRICITY SECTOR IN COLOMBIA

Entity	Main function	Main responsibilities
Ministry of Mining and Energy	Sectoral policies/Direction	Direct policies on generation, transmission, interconnection and distribution; Establish technical standards on electric energy, the rational energy use and the development of alternate sources.
Mining and Energy Planning Unit (UPME)	Planning	Identify the mining-energy needs of the country's population and economic agents; Establish how to satisfy these needs, taking into account the existing mining-energy resources, both conventional and unconventional; Develop and update the National Mining Plan, the National Energy Plan and the Expansion Plan for the electricity sector; Carry out diagnostic exercises that support the formulation of plans and programmes for the mining-energy sector; Design and establish, as a matter of priority, plans, programmes and projects related to energy savings, conservation and efficient use; Develop plans for expanding the National Interconnected System.
Energy and Gas Regulation Commission (CREG)	Sectoral regulation and price setting	Prepare bills to submit to the government for consideration, and make recommendations on the adoption of regulatory legislation as needed; Oversee compliance with the regulatory guidelines on the part of private firms that provide public services; Define efficiency criteria and develop indicators and models for assessing the financial, technical and administrative performance of public service companies; Set quality standards on service provision to be adopted by public service companies.
National Operations Council	Market operators	Work out the technical aspects to guarantee the safe, reliable and economical operation of the National Interconnected System; Act as executor of the Operating Regulations.
Superintendency of Residential Public Services	Control and supervision	Oversee and enforce the following: That residential public service providers comply with current laws; That public service companies comply with performance indicators issued by the Regulatory Commissions; That all works, equipment and procedures comply with technical standards issued by the Ministries.

(continued)

Table 4 (conclusion)

Entity	Main function	Main responsibilities
XM Compañía de Expertos en Mercados S.A ESP	Planning and coordination of operations and resource use in the National Interconnected System	Provide planning services and operations coordination for the resources in the National Interconnected System and manage the Commercial Exchange System for electricity in the wholesale market; Handle the administration and settlement of charges for using the networks in the National Interconnected System.
Commercialization Advisory Committee (CAC)	Consulting on monitoring and revision of commercial aspects of the wholesale electricity market	Advise the Energy and Gas Regulation Commission on: Monitoring the Commercial Exchange System, including performance indexes for the system administrator; Conduct an annual review of the procedures used in the Commercial Exchange System; Analyse and recommend changes to the commercial rules in the stock exchange and sales activities in the wholesale market; Carry out general monitoring of litigation, arbitration or any other process affecting the Commercial Exchange System.
Generation, transmission, distribution and commercialization companies		

Source: Prepared by the authors.

From the perspective of the regulatory framework, the Energy and Gas Regulation Commission (CREG) treats generation and commercialization companies as competitive firms and transmission and distribution companies as monopolies.

Electricity tariffs are regulated by CREG, via legal resolutions that in principle are in force for five years. The tariffs are stated in pesos per kilowatt hour ($/kWh), and they are based on the calculation of the unit cost of supply, which takes into account the summation of the unit cost of generation, transmission, distribution, commercialization and system losses. The unit cost also takes into account whether the consumer is residential or industrial. For residential consumers, the cost of electricity is tiered, so as to subsidize the cost for low-income consumers through surcharges on higher-income and higher-use consumers.

Electricity services are provided by four types of company (generation, transmission, distribution and commercialization) that face different market conditions, so the regulator considers special criteria for each in terms of defining the unit cost. Tariffs are updated in accordance with price indexes established by the CREG.

E. Mexico

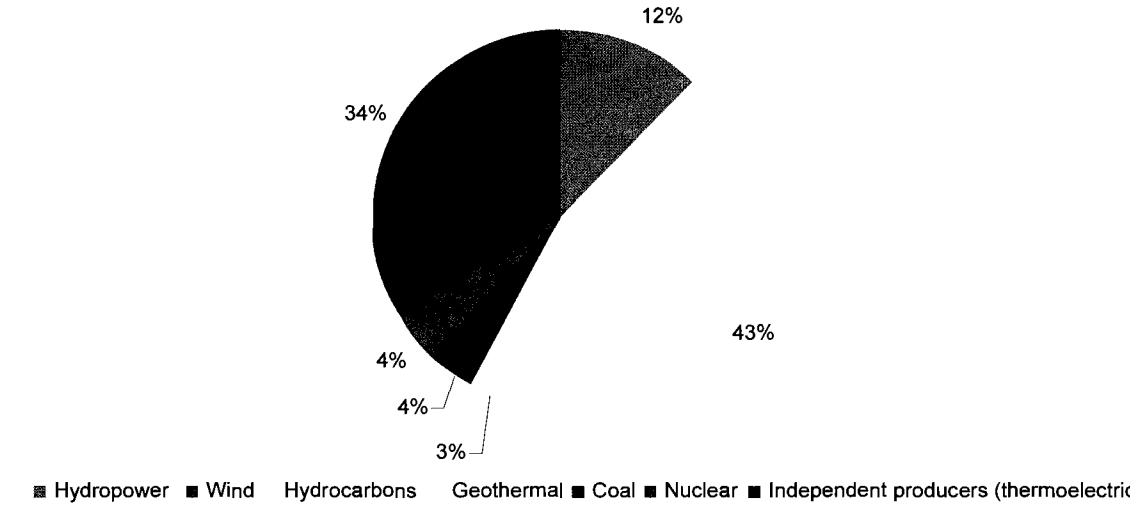
1. Electricity market segmentation

Although private participation in the Mexican electricity sector increased following the reform of the Public Electricity Service Law, the state continues to account for the largest share of the sector through the Federal Electricity Commission (CFE), which was created in 1937 to organize and direct a national system of electricity generation, transmission and distribution.

The state-owned electric companies (CFE and LFC) account for 76 per cent of installed capacity, while private participation (PIE, self-supply and cogeneration) is on the order of 20 per cent. In total, external producers account for 23.9 per cent of installed generation capacity in Mexico, including PEMEX. Prior to the modification of the Public Electricity Service Law in 1993, private participation

was extremely limited, with an installed capacity of approximately 600 MW in 1992. Since then, the growth of the Mexican electricity sector has been based on private participation.

FIGURE 5
ELECTRICITY GENERATION IN MEXICO BY SOURCE, 2011



Source: Federal Electricity Commission.

2. The functions and responsibilities of the different interested parties

The Mexican electricity sector has a small, well-defined set of participants. As shown in table 5, the Secretariat of Energy is in charge of sectoral policies, while the Energy Regulatory Commission (CRE) is responsible for regulating private electricity producers. The Federal Electricity Commission (CFE) is a state-owned company that generates, transmits, distributes and commercializes the majority of the country's electricity. The CFE is also the federal agency in charge of planning the national electricity system. Independent energy producers account for 22.68 per cent of installed capacity in the country, with the rest pertaining to the CFE.

TABLE 5
FUNCTIONS AND RESPONSIBILITIES OF THE KEY PARTIES IN THE ELECTRICITY SECTOR IN MEXICO

Entity	Main function	Main responsibilities
Secretariat of Energy	Sectoral policies	Approve the instruments for regulating import and generation permit holders and public service providers; Award permits for electricity generation; Participate in tariff setting for the supply and sale of electric energy; Approve the methodologies for calculating guarantees for the acquisition of electric power and for electricity conduction, transformation and delivery services.
Energy Regulatory Commission (CRE)	Electricity sector regulator	Regulate private energy producers in the natural gas and electricity industries.
Federal Electricity Commission (CFE)	State-owned electric company	Generate, transmit, distribute an commercialize the majority of the country's electricity.
Independent energy producers	Electric companies	Generate electricity.

Source: Prepared by the authors.

Electricity tariffs are subject to monthly adjustments, with the exception of residential rates (except high-use households), agriculture and public services. These are calculated based on fixed factors, whereas other tariffs are based on variable factors.

The fixed factors are authorized through specific agreements and take into account the expected inflation trend. Variable adjustments are based primarily on the price of fossil fuels.

The main institutions involved in the development of renewable energy projects are the CRE and the CFE, although the private sector can implement projects under the rubric of self-supply, according to their terms and interests.

The CFE's works and investment programme[13] outlines a 15-year plan for capacity and transmission requirements to meet national energy demands. The plan identifies the technologies that the CFE will need in the different regions where demand is expected to grow. The current plan indicates that a total of 540 MW of geothermal power and 809.2 MW of wind power is in the bidding, feasibility or pre-feasibility phase.

F. Peru

1. Electricity market segmentation

Like many countries in the region, Peru began restructuring the electricity sector in the early 1990s. Specifically, the Electricity Concessions Law N° 25844 opened the sector to privatization in the areas of electricity generation, transmission and distribution.[14] With these changes, the state's role was redefined to centre on regulation, supervision and tariff setting. A regulatory agency was created called OSINERG (now OSINERGMIN, as mining was added to its domain), which is in charge of regulating the tariff structure.[15]

Power generation in Peru is primarily based on hydropower and thermal power, as shown in figure 6.

In the last five years, energy demand has grown at an average annual rate of 8 per cent, due in part to the strong growth of the mining and manufacturing industries. Consequently, new project implementation needs to be accelerated to ensure the supply of power.[16]

Transmission is carried out by the National Interconnected Electricity System (SEIN). A small part of the country (1.9 per cent) is supplied by isolated systems in which private electric companies are in charge of generation, transmission and distribution.

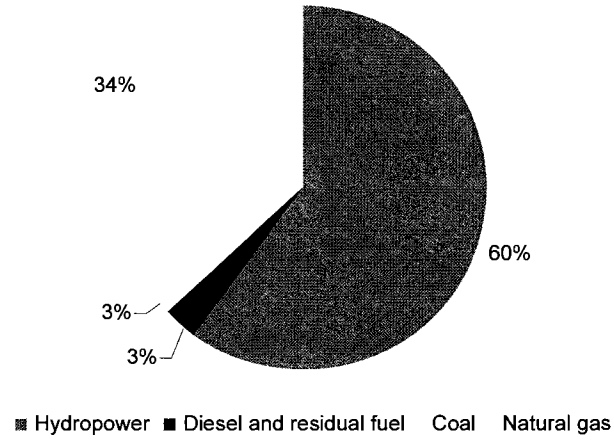
[13] Available online at http://www.semarnat.gob.mx/temas/ordenamientoecologico/Documents/documentos%20pacifico%20norte/1sesion_ot/pre_sector_electrico_2010_2024.pdf.

[14] Pacific Credit Rating (2009). "Informe Sectorial. Peru: Sector Eléctrico." Available online at http://www.bnamericas.com/cgi-bin/getresearch?report=152652.pdf&documento=1104128&idioma=E&login=(accessed on 15 August 2011).

[15] Equilibrium Clasificadora de Riesgo (2008). "Análisis del sector eléctrico Peruano." Available online at http://www.equilibrium.com.pe/sectorelectricojun08.pdf (accessed on 15 August 2011).

[16] Peruvian Ministry of Energy and Mines (2009). "Documento Promotor: Sector Eléctrico 2009." Available online at http://www.minem.gob.pe/minem/archivos/file/Electricidad/publicaciones/BROCHURE%20electricidad%202009.pdf (accessed on 4 September 2011).

FIGURE 6
ELECTRICITY GENERATION IN PERU BY SOURCE, 2010



Source: OSINERGMIN, 2010.

The energy market is regulated for 56 per cent of users (which have a monthly power demand of less than 2,500 kW), with free-market pricing for the remaining 44 per cent (large energy consumers such as large mining, commercial and industrial complexes, whose power demand is equal to or greater than 2,500 kW).

2. The functions and responsibilities of the different interested parties

The Peruvian electricity sector is administered by three agencies. The Ministry of Energy and Mines is in charge of sectoral policies; the Supervisory Agency for Energy and Mining Investment (OSINERGMIN) is responsible for regulating and supervising the energy and mining sectors; and the Committee for the Economic Operation of the National Interconnected System (COES) is the technical regulatory agency (see table 6).

TABLE 6
FUNCTIONS AND RESPONSIBILITIES OF THE KEY PARTIES IN THE ELECTRICITY SECTOR IN PERU

Entity	Main function	Main responsibilities
Ministry of Energy and Mines	Sectoral policies	Issue the general regulatory guidelines; Formulate and promote policies for the development and technical upgrading of electricity, hydrocarbons and mining; Coordinate and promote technical assistance in electricity, hydrocarbons and mining; Be the environmental authority for the energy-mining industry; Promote the efficient use of energy and the exploitation and development of renewable energy resources.
Supervisory Agency for Energy and Mining Investment (OSINERGMIN)	Regulation and supervision of the energy and mining sectors	Regulate, supervise and oversee compliance in the following areas: Legal and technical guidelines associated with the electricity, hydrocarbons and mining industries; Legal and technical standards for environmental conservation and protection in the development of activities in these sectors.

(continued)

Table 6 (conclusion)

Entity	Main function	Main responsibilities
Committee for the Economic Operation of the National Interconnected System (COES)	Regulatory agency	Propose and evaluate sectoral policy: Propose and/or issue the necessary regulatory guidelines for the sector; Promote the development of power generation, transmission and distribution; Contribute to carrying out the state's role in fostering the sustainable development of the electricity industry.

Source: Prepared by the authors.

G. Uruguay

1. Electricity market segmentation

The state-owned utility, UTE, is the only electricity transmission and distribution company in Uruguay. It also owns almost all the generation capacity in the country, including hydropower and Río Negro (593 MW) and thermal power (875 MW). Biomass and wind generation plants (215Mw and 20Mw, respectively) are in the hands of private companies, although UTE has 10Mw of wind generation. UTE also manages the Uruguayan part of the binational Salto Grande hydroelectric plant (945 MW).

2. The functions and responsibilities of the different interested parties

The Ministry of Industry, Energy and Mining (MIEM) is responsible for energy policy in Uruguay, together with the National Energy Department. The Energy and Water Services Regulatory Agency regulates the electricity sector (as well as other segments of energy and water); it operates under the executive branch (through the MIEM), but it has technical autonomy. The ADME acts as the electricity system operator.

UTE was originally called the State Power and Telephone (*Usinas y Teléfonos del Estado*), but the telecommunications segment was separated out and privatized. It is now exclusively an electric company, and it is the main company operating in the market. UTE is the only transmission and distribution company, and it owns all the generation capacity with the exception of the binational hydroelectric plant with Brazil and new renewable generation plants.

TABLE 7
FUNCTIONS AND RESPONSIBILITIES OF THE KEY PARTIES IN THE ELECTRICITY SECTOR IN URUGUAY

Entity	Main function	Main responsibilities
Ministry of Industry, Energy and Mining	Sectoral policies	Identify and quantify the existing primary energy sources in the country; Formulate energy policy and implement the resulting actions.
Energy and Water Services Regulatory Agency (URSEA)	Regulation	Regulate, supervise and consult on the energy sectors; Monitor activities related to the efficient use of energy and the security of electric products.
ADME	Administration of the wholesale electricity market	Operate and administer load dispatch centres; Enable contract fulfilment; Dispatch electricity to meet demand.

(continued)

Table 7 (conclusion)

Entity	Main function	Main responsibilities
UTE	State-owned electric company	Generate, transmit and distribute almost all the electricity in the country
Private generators	Biomass and wind generation	Generate electricity for self-use or for sale to UTE

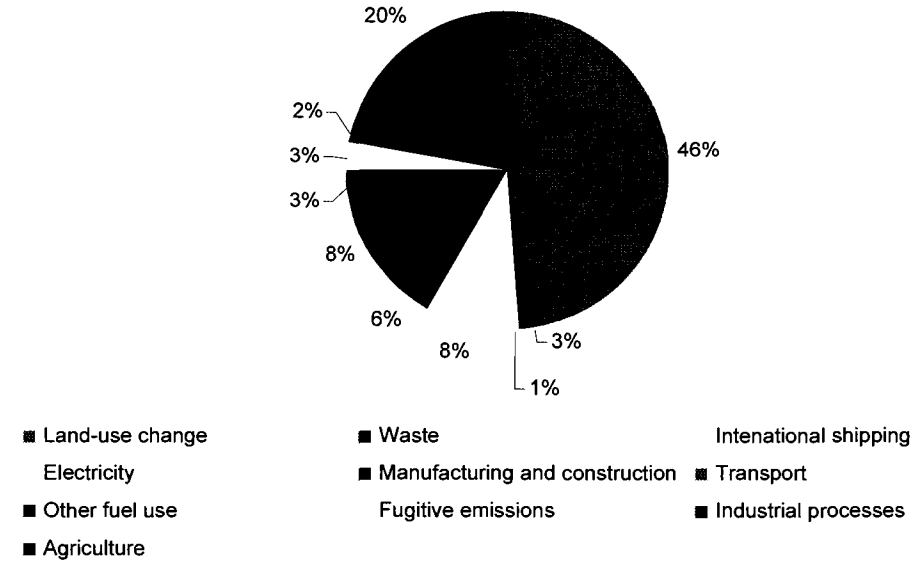
Source: Prepared by the authors.

III. Social and environmental benefits of using renewable energy

A. Climate change

Greenhouse gas emissions in Latin America and the Caribbean are growing at an average annual rate of 1.2 per cent, which is around the world average. As shown in figure 7, land-use change is the main cause of emissions, followed by agriculture, electricity generation and transportation. Emissions are concentrated in the larger countries: Brazil accounts for 52 per cent of regional emissions, while Brazil, Mexico, Venezuela and Argentina together account for 79 per cent.[17]

FIGURE 7
SHARE OF GREENHOUSE GAS EMISSIONS IN LATIN AMERICA, BY SECTOR, 2005



Source: ECLAC.

[17] Idem.

While Latin America's greenhouse gas emissions are lower than other world regions, climate change is a priority on the region's public agendas. The region is already experiencing some effects from the changes in rainfall and temperature, the increase in extreme meteorological events, the rising sea level and the reduction in frozen water reserves, as shown in table 8.

TABLE 8
EXAMPLES OF THE EFFECTS OF CLIMATE CHANGE OBSERVED IN LATIN AMERICA AND THE CARIBBEAN

Sector/area			
Agriculture, forestry and ecosystems	Water resources	Human health	Human settlements, industry and infrastructure
Increase in extreme meteorological events throughout the region in the last 40 years, such as the El Niño episodes of 1982–1983 and 1997–1998, and the arrival of hurricane Catarina to Brazil (2004), something that had never before happened in the region			
Increase in temperatures (South America and the Caribbean)	Decrease in rainfall (southern Chile, southeast Argentina and southern Peru)	Increase in illnesses such as dengue fever and malaria (various regions)	Economic losses from extreme meteorological events (US$80.0 billion in 1970-2007)
Changes in soil productivity (higher yields in soybean in South America, lower yields in maize in Mexico and Central America)	Increase in rainfall (southern Brazil, Paraguay, Uruguay, northeast Argentina, northeast Peru and Ecuador)	Increase in morbidity and mortality rates (Bolivia)	Heightened vulnerability of human settlements affected by extreme meteorological events (Bolivia, Peru, Mexico)
Increase in soil degradation due to land-use changes (all countries)	Rising sea level (2-3 mm in Argentina in recent years)	Increased risk of food and water shortages; greater risk of malnutrition and water-borne diseases	Rural-to-urban migration of people from vulnerable regions (Mexico and Central America)
Increase in the desertification rate (deforestation in Central America)	Recession of glaciers (Bolivia, Peru, Ecuador and Colombia)		Water shortages for domestic, industrial, agricultural and community purposes; reduction of hydroelectric power generation; potential population migration
Shrinking rainforest (losses of 17.2 million hectares in the Amazon in 1970-2007)			
Increase in the number of endangered species in Mexico and Peru (4%), Ecuador (up to 10%), Colombia (11%) and Brazil (3%)			

Source: Prepared by the authors, on the basis of data from the Summary for Policymakers of the Intergovernmental Panel on Climate Change (IPCC), 2007, and "Cambio climático y desarrollo en América Latina y el Caribe: una reseña," Economic Commission for Latin America and the Caribbean, 2009.

While higher temperatures will probably raise agricultural yields in cold or temperate regions and lower them in hot or tropical climates, some important crops and livestock will suffer adverse consequences that could reduce the food supply, mainly due to the effects of economic adaptation to the new climate conditions[18].

The Intergovernmental Panel on Climate Change (IPCC) indicates that energy costs could rise as a result of climate change. The impact on the industrial sector could affect the price of consumer goods. Hydroelectric power is the main source of electricity for the majority of the countries in Latin America, which makes the region highly vulnerable to deviations in rainfall levels. In fact, the combination of higher energy demand and drought triggered the virtual disintegration of hydroelectric power generation throughout much of Brazil in 2001, leading to an energy crisis that contributed to a 1.5 per cent reduction in GDP.[19] The recession of glaciers alone can affect the water volume of rivers that feed dams in Andean countries such as Bolivia and Peru.

Unconventional renewable energy sources do not produce greenhouse gas emissions. They are thus in line with policies for mitigating these effects of climate change at the local, regional and international levels.

B. Access to modern energy

Access to clean, modern forms of energy is critical for a country's human and economic development. While access alone does not guarantee human development, it is virtually impossible to improve living standards in the absence of an affordable and reliable energy supply. In Latin America and the Caribbean, 70 million people do not receive modern electric services.[20]

As shown in figure 8, per capita electricity consumption in Latin America and the Caribbean is greater in countries with a higher per capita gross domestic product (GDP). In the figure, the countries are grouped by income level (high, medium, and low), where Trinidad and Tobago has the highest per capita GDP and Haiti has the lowest.

In addition to providing access to electricity, unconventional renewable energy has a number of other benefits: for example, it can be used remotely in communities that are not connected to the national electricity supply networks, drawing on energy sources that are locally available, free and inexhaustible and that do not generate pollution. Solar energy, in particular, is an attractive renewable option for serving distant communities since it is a naturally decentralized technology based on a resource that is widely available in geographic terms and that is immune to the supply problems and price uncertainty associated with traditional fuels.[21]

Moreover, the choice of renewable energy sources for electrification, especially in rural areas, contributes to a country's energy security by diversifying the national energy matrix and curbing the increase of foreign fuel imports. The reduction in energy costs has a larger impact on low-income communities.

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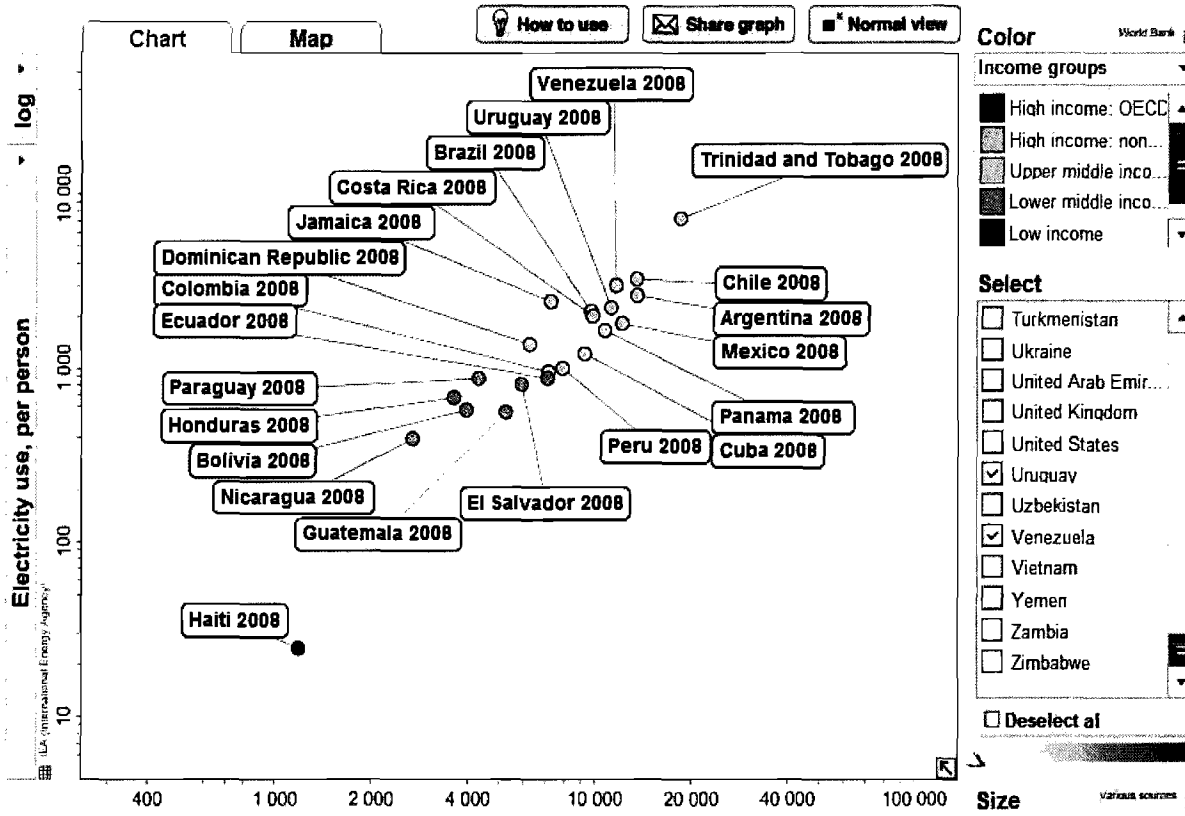
[18] Econcomic Commission for Latin America and the Caribbean - ECLAC (2009), "Cambio climático y desarrollo en América Latina y el Caribe: una reseña".

[19] M.L. Parry and others (2007), "Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007". Cambridge University Press.

[20] Alvarez, A. and Bidart, M. (2007), "Situación de los Mercados Energéticos de América Latina desde la Perspectiva de la Regulación y las Políticas de Competencia". Working paper prepared for the meeting of the Intergovernmental Group of Experts on Competition Law andPoicy, UNCTAD, Geneva, 17-19 July 2007.

[21] Deichmann, U. and others. (2010),"The Economics of Renewable Energy Expansion in Rural Sub-Saharan Africa", World Bank.

FIGURE 8
PER CAPITA ELECTRICITY CONSUMPTION TO PER CAPITA GDP IN LATIN AMERICA AND THE CARIBBEAN, 2007



Source: www.gapminder.com.

IV. Public-private partnerships in renewable energy

Electric energy infrastructure is essential for a country's human development and more efficient economic growth. In the last two decades, Latin America attracted half of all public-private partnerships (PPP) forged in developing countries. In the early 1990s, private companies supplied just 3 per cent of the telecommunication and electricity services in the region, while virtually none of the water companies were in private hands. In 2003, private companies administered 86 per cent of telecommunications, 60 per cent of electricity and 11 per cent of water services[22].

In a context of strong economic and population growth, the Latin American and Caribbean region faces a tremendous challenge —and, in many ways, an obligation— to integrate sustainable components into its development plans, despite the fact that these projects often imply higher investment costs.

Renewable energy projects are generally characterized by high investment and maintenance costs, complex construction issues and economic returns that are not always high. These factors create a big challenge in the development of renewable energy projects and the penetration of the technology in the region. It is therefore necessary to explore mechanisms that can help overcome the challenge, particularly in the financing phase. One way to narrow the gap in financing is to incorporate private capital through public-private partnerships (PPP).

During the privatization process of the 1980s and 1990s, many Latin American countries welcomed private sector participation in order to increase investment in infrastructure and improve the quality of services that had traditionally been in the hands of the state. The state then took on the role of regulating the largely private electricity generation, transmission and distribution market. While some of the privatizations of the period were successful, others were not, resulting in frequent renegotiations and conflicts among the parties.

Traditionally, PPPs were defined as a legally binding contract between the government and private firms for the provision of goods and services, with the majority of the responsibilities and risks transferred to the private partner. Currently, however, PPPs are being transformed into a model in which the public and private sectors are both involved in all phases of the project, including construction, financing and operation. This makes the arrangement more attractive to the private sector, since the risks are shared by the government.[23]

[22] Multilateral Investment Fund (2005), "MIF Cluster Action Plan. Supporting Competitiveness through Public Private Partnerships",available online at http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=1660978 (accessed on 20 August 2011).

[23] Idem.

A. PPP definitions and models

There are several definitions of PPPs. Table 9 presents some of the more common versions, together with the source. The basic idea is that a PPP scheme is one in which the national government and/or other public sector entities (state governments, district councils, municipalities, official and independent agencies, etc.) work with actors outside the public sphere to jointly implement projects.[24]

TABLE 9
DIFFERENT DEFINITIONS OF PPPS AND THEIR SOURCES

Definition	Source
In a PPP, a private individual or company (large or small, formal or informal) provides a service (such as garbage collection, water supply, etc.), which can be paid for by the local government or by consumers through user service fees.	United Nations Development Programme
Mixed enterprises, with capital contributions from the public and private sectors.	International Monetary Fund
A contract or set of contracts through which a private entity makes a commitment to a public partner to guarantee the development of an activity aimed at satisfying a collective need, in which the financing, investment responsibility and operations are the total or partial responsibility of the private partner.	Technical University of Lisbon
A range of possible relationships between local government, private firms, civil society, non-governmental organizations and local communities, to jointly undertake the provision of basic services.	Public-Private Partnerships for Service Delivery Programme
A relationship based on the authority and credibility of the public sector and the financing and business capabilities of the private sector.	The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)
A legally binding contract between the government and private firms for the provision of goods and services, with the majority of the responsibilities and risks allocated among the different partners. In a PPP scheme, the government participates actively throughout the project life cycle. The private sector is mainly responsible for commercial aspects such as design, construction, financing and operations.	Government of British Columbia

Source: United Nations Economic and Social Commission for Asia and the Pacific (2011).

PPPs can be implemented for various purposes. For example, they might be used for technology research and development, large-scale projects, the creation of firms (such as energy service companies, or ESCOs) and the promotion of small producers.

There are several different PPP models, as outlined in table 10. This list is not exhaustive, however, as the public and private sectors might find different, innovative models for working together that are not necessarily included in the table.

[24] Sovacool, B. (2011), "Developing Public-Private Renewable Energy Partnerships to Expand Energy Access". Draft Report for the United Nations Economic and Social Commission for the Asia Pacific, Bangkok, Thailand. Vermont Law School and the National University of Singapore.

TABLE 10
MODELS OF PRIVATE PARTICIPATION IN INFRASTRUCTURE AND THEIR MAIN CHARACTERISTICS

Type	Description	Level of risk to the private sector	Contract duration (years)	Capital investment	Property ownership	Most commonly financed sectors in developing countries
Service contract	Contracts out services that support the operation of the infrastructure	Low	1-3	Public	Public	Water services Railway service
Management contract	Contracts out all or part of operations management	Low/ Medium	2-5	Public	Public	Water services
Lease contract	Contracts out the management of specific renovations and operations	Medium	10-15	Public	Public	Water services
Build-operate-transfer (BOT)	Contracts out the investment and operation of a specific component of the service or infrastructure	High	Varies	Private	Public/ Private	Energy sector highways Water purification/ desalination plants
Concession	Contracts out the financing, operation and execution of specific investments	High	25-30	Private	Public/ Private	Airports, sea ports and railways Electricity transmission network
Privatization	Contracts out or transfers ownership of the public infrastructure to the private sector	Total	Indefinite	Private	Private	Telecommunications

Source: World Bank.

The risks involved in a PPP are mainly related to a country's macroeconomic stability and the general and specific legal frameworks for this type of relationship. An important factor in the negotiations for a PPP contract is the degree to which risks are transferred from the public sector to the private sector and at what price. Some of the risks associated with PPPs are described in table 11.

TABLE 11
TYPICAL RISKS IN PPP SCHEMES

Risk	Description	Risk bearer	Instruments for allocating risk
Construction	Risk of cost overruns or construction delays	Private sector	Project contract
Force majeure	Risk of natural disasters	Private sector	Project contract
Commercial	Risk of insufficient demand and/or unfulfilled supply contracts	Private sector (sometimes the host country, in part)	Project contract (sometimes with minimum income guarantees)
Financial	Risk of interest rate fluctuations, financing, etc.	Private sector	Project contract or structured finance facilities
Political	Risk of expropriation, license revocation, confiscation of goods, currency inconvertibility or transfer restrictions, war, disturbances, etc.	Host country or guarantor	Insurance against polictial risk
Regulatory	Risk of changes in laws or regulations, tariff-setting rules, taxes, or unfulfilled public purchase contracts	Host country or guarantor	Project contract and partial risk insurance
Foreign exchange risk	Risk of currency devaluation or depreciation	Host country (sometimes the private sector)	Project contract, foreign exchange guarantees or structured financing

Source: World Bank.

B. Global survey on PPPs for sustainable energy

To explore the outlook for PPPs in the renewable energy sector, this section presents the results of an important project carried out in 2010 by the e8 (Global Sustainable Electricity Partnership) and the UN-Energy group, which involved implementing and analysing a worldwide survey on the obstacles, impacts, benefits and outlook of public-private partnerships in the implementation of sustainable energy initiatives and projects (renewable energy sources, energy efficiency and cleaner technologies).[25]

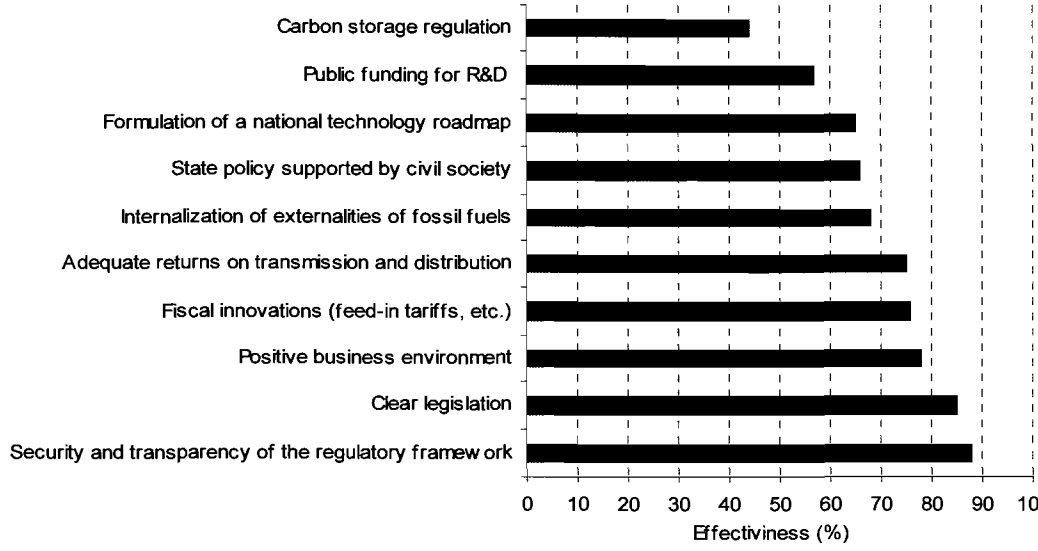
In the summer of 2010, the e8[26] asked a large number of firms, associations, multilateral organizations and business groups to respond to a survey on their experiences with PPPs in sustainable energy. The international/multilateral organizations that participated in the survey included EPRI, GEF, GVEP, IDB, ADB, REEEP, TERI, the World Bank, the UN Foundation, WEC, WBCSD and the World Energy Forum. Among the international companies were AES, Duke Energy, EDF, EDP, the Enel group, Kansai, Pacific Hydro, Tractebel and Tepco. The survey also covered important firms and agencies tied to the Latin American energy sector, such as Isagen (Colombia), the Eletrobras group (Brazil), the National Secretariat of Energy (Panamá), the Ministry of Energy and Mines (Peru) and BNDES (Brazil).

[25] e8, UN-Energy (2011), "Strenghthening Public Provate Partnerships to Accelerate Global Electricity Technology Deplopyment".

[26] The e8 is a non-profit organization dedicated to promoting sustainable electricity generation and use. The e8 comprises 12 of the largest electric companies in the world, namely AES, Duke, EDF, Eletrobras, Enel, HydroQuebec, Kansai, RusHydro, REW, Tepco, SGC and Eskom. Mexico's CFE has recently joined the e8 at the partner level.

The objective of the survey was to identify best practices in the areas of public policies and public-private initiatives, in order to promote the development of long-term sustainable energy projects. The survey received responses from 78 entities, including 38 electric companies, eight non-governmental organizations (NGOs), six technology promoters, five financial institutions and five energy associations.

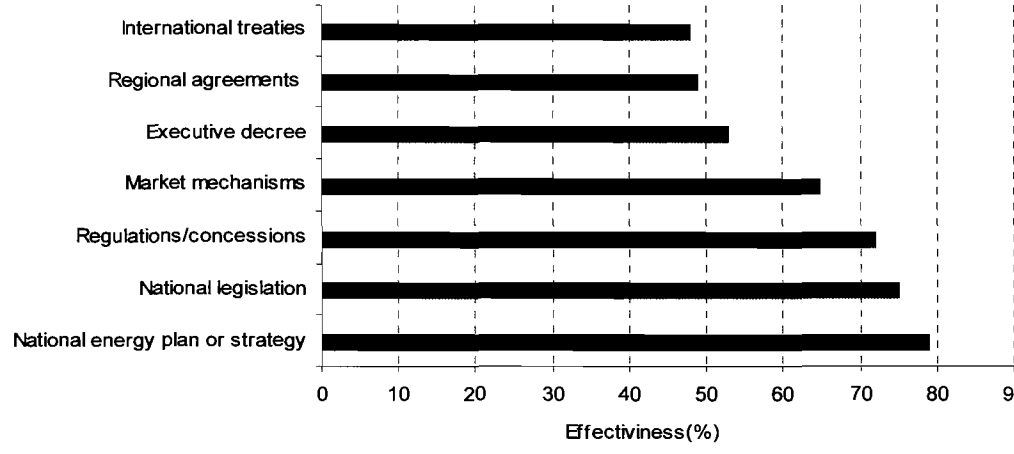
FIGURE 9
POLITICAL FACTORS THAT REDUCE THE RISK OF PROMOTING SUSTAINABLE ENERGY (RENEWABLE & EE)



Source: e8 & UN-Energy (2011).

Figure 9 provides a graphic illustration of the results of the e8/UN-Energy study, published in 2011. The results show that a strong legislative framework is considered necessary for eliminating barriers, stimulating investment through appropriate incentives, establishing stable regulations, deploying an environmental policy on clean energy sources and supplying special incentives for financing new technologies. This focus on good governance, together with strong community participation, helps improve the probability of project success.

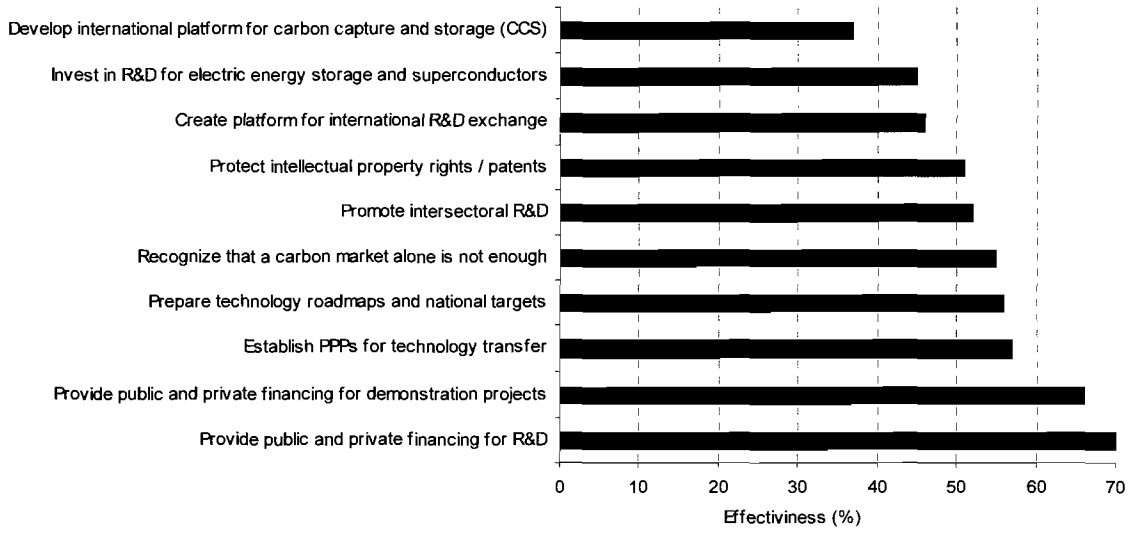
FIGURE 10
INSTRUMENTS FOR IMPLEMENTING EFFECTIVE SUSTAINABLE ENERGY POLICIES



Source: e8 & UN-Energy (2011).

As shown in figure 10, the survey results further indicate that national energy development plans or strategies are essential for ensuring and later directing the distribution of financial resources for zero-emissions technology projects, in particular renewable energy.

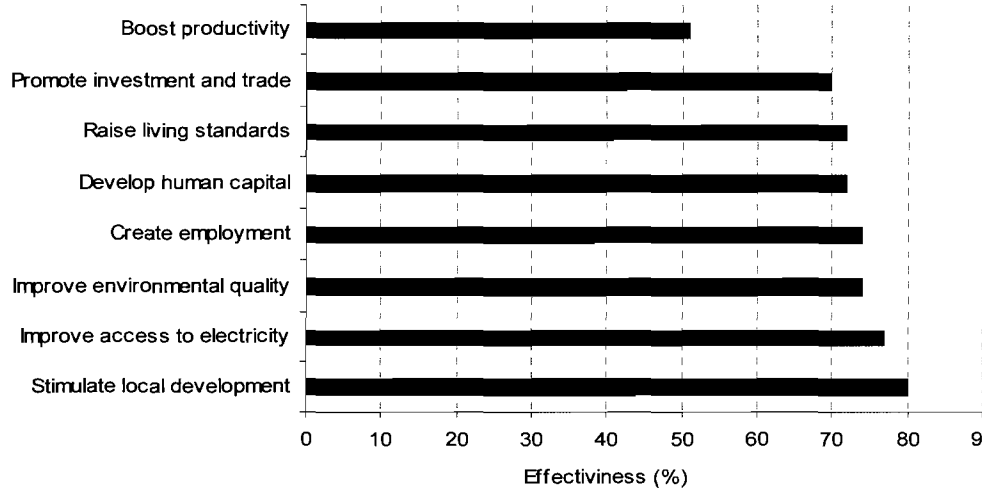
FIGURE 11
HOW CAN PPPS SUPPORT THE DEPLOYMENT OF RENEWABLE ENERGY PROJECTS?



Source: e8 & UN-Energy (2011).

With regard to how PPPs can support the deployment of sustainable energy projects (figure 11), the survey results indicate that the best way for public-private partnerships to support research, development, demonstration and deployment (RDD&D) of clean energy projects is through stable, efficient financing (both public and private) for these types of activities.

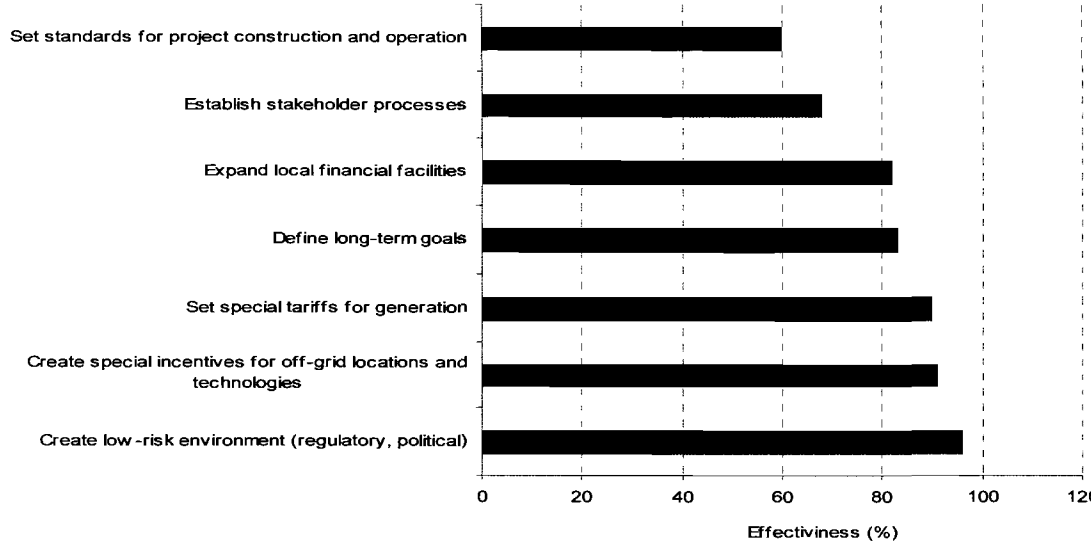
FIGURE 12
BENEFITS OF PPPS FOR SUSTAINABLE ENERGY



Source: e8 & UN-Energy (2011).

Figure 12 shows that the majority of the survey respondents believe that the biggest benefits of PPPs are improving access to electricity and stimulating local economic and social development. Increased access to electricity allows new businesses to enter areas that were previously considered unsuitable or unprofitable. As new businesses expand into these areas, they bring more jobs, while the newly electrified communities gain access to additional medical care, clean water and education, which fosters their economic and social development.

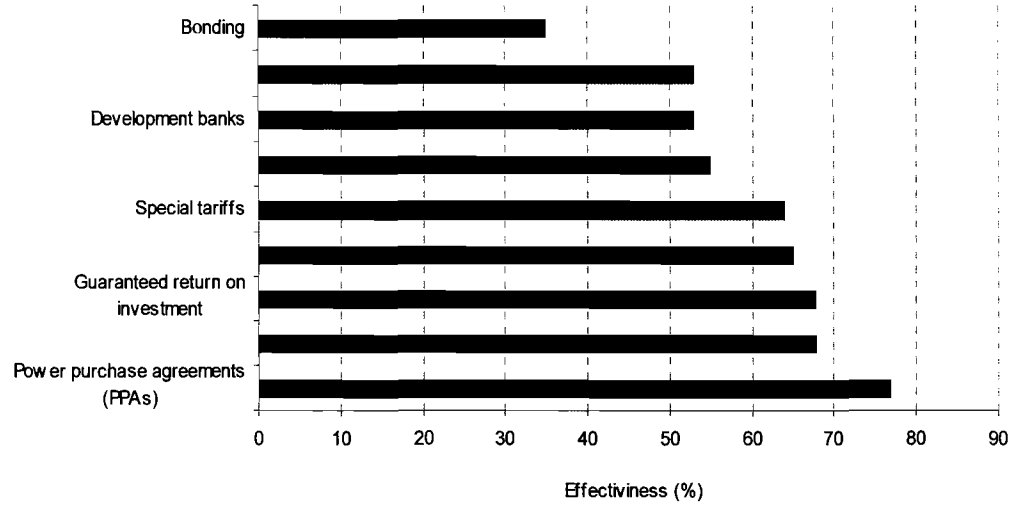
FIGURE 13
EFFECTIVE WAYS FOR THE PUBLIC SECTOR TOPROMOTE AND STRENGTHEN PPPS



Source: e8 & UN-Energy (2011).

Figure 13 reveals a solid consensus among survey respondents that the public sector's strongest contribution is to reduce the risks in the political, legal and regulatory environment. This then allows the relevant authorities to define electricity development goals and to establish long-term plans and programmes for the deployment of clean energy technology.

FIGURE 14
EFFECTIVE WAYS TO PROMOTE THE DEPLOYMENT OF SUSTAINABLE ENERGY PROJECTS



Source: e8 & UN-Energy (2011).

As could be expected, a large share of the respondents indicated that guaranteed long-term income streams are the most effective way to promote sustainable energy projects and that power purchase agreements (PPAs) are the most secure and preferred instrument for that purpose. With these mechanisms, the public sector must act as an intermediary with multilateral development banks and other financial institutions, to ensure that timely payments are made as negotiated under these agreements.

V. Case studies of PPPs for renewable energy in the region

As already indicated, the Latin American and Caribbean region has a broad experience with public and private participation in the electricity sector, in particular through the privatizations carried out in the 1980s and 1990s. However, there are far fewer examples of unconventional renewable energy projects and even fewer that are large scale.

This section describes the most important programmes for promoting unconventional renewable energy in the region (in Argentina, Brazil, Chile, Colombia, Mexico, Peru and Uruguay), identifying the public and private actors and outlining their roles. These programmes have in common the participation of the state in the role of regulator, promoter and, in some cases, guarantor and financial backer; while the private sector plays the basic role of executing and operating the project.

To include more PPP models, the paper then discusses some concrete cases of projects in which state-owned firms and private companies have united to implement research and development (R&D) and/or the construction and operation of renewable energy projects.

A. Incentive programmes for renewable energy in the region

a) National Law 26,190 - Argentina

Law 26,190 of 2007, on the national plan for the promotion of the use of renewable energy sources for electric energy production, establishes the goal of increasing the share of renewable energy sources to 8 per cent of national electric energy consumption, over a period of 10 years from the start date of the current plan. This goal should therefore be reached in 2016.[27]

This law gives firms the option of receiving an early return of the value added tax (VAT) on the project's amortizable assets (except vehicles) or choosing accelerated amortization of the income tax on investments made.

[27] Secretariat of Energy. Available online at http://energia3.mecon.gov.ar/contenidos/verpagina.php?idpagina=2974 (accessed 20 August 2011).

The company Empresa Energía Argentina S.A. (ENARSA) was created in 2004 with a majority share of state capital. Argentina's Secretariat of Energy instructs ENARSA, as a market agent, to carry out energy projects, including renewable energy initiatives.[28]

Under the framework of the law and through National and International Public Tender EE N° 001/2009, ENARSA issued a public call for tenders to supply electric energy from renewable sources. In September 2010 ENARSA awarded a total of 895 megawatts (MW) of power to be produced from unconventional renewable sources. The technologies featured in the winning bids included wind (754 MW); biofuel thermal (110.4 MW); small hydropower (10.6 MW); and solar photovoltaic (20 MW).[29]

The process was implemented through a public call for tenders in which companies offered a sales tariff for renewable energy generation. The state provides a contract (or PPA) that guarantees the purchase of energy generated by the awarded companies, at the offered price, for a period of 15 years. While the call for tenders was issued for different types of technologies, it was flexible in terms of what the companies could offer, in contrast to other cases. Thus, wind power captured the largest share of the awards, since that was the most common technology offered. This flexibility is important in that it provides a mechanism for adapting to companies' investment interests.[30]

Cost-benefit analysis was used to choose among the tariffs offered. The energy delivered by these projects enters the wholesale electricity market, to be sold to users at the single market rate. If there is a difference between the market rate and the price of green energy, it is absorbed by the federal government, which currently provides a subsidy for electricity.[31]

The government has also created a fiduciary fund for renewable energy, administered by the Federal Council on Electric Energy (CFEE). The fund's objective is to pay a compensation of 0.9 pesos per kilowatt hour (kWh) to solar photovoltaic generators and up to 0.015 pesos per kWh to generation companies using wind, geothermal, biomass, biogas and small hydroelectric plants of up to 30 MW of power, for a maximum period of 15 years. The resources for this fund come from a tax of 0.30 pesos per megawatt hour (MWh) on the tariffs of distribution companies and large users in the wholesale market.

This scheme encompasses the following public and private participants:

Public Secretariat of Energy: Designs of the legal framework for the promotion of renewable energy;

Federal Council on Electric Energy (CFEE): Administers the fiduciary fund for renewable energy;

ENARSA: Is in charge of the tender process for tariff offers for electric energy generation.

Private Companies that take part in the tender process.

Since the auction called for bidders to submit a tariff offer for the sale of energy, the exact investment costs of the projects are not known, although they are estimated to be on the order of US$2.5 billion for the first tender round. The initiatives have a range of financing sources, in particular commercial banks or investment banks.[32] The first tender process has been concluded, and the successful bidders have yet to start their respective projects.

[28] Meeting with Mr. Francisco Elizondo and Ms. Mónica Servant on 30 August 2011, at the Secretariat of Energy.
[29] ENARSA. Available online at http://www.enarsa.com.ar/nota30.htm (accessed 25 August 2011).
[30] Meeting with Mr. Francisco Elizondo and Ms. Mónica Servant on 30 August 2011, at the Secretariat of Energy.
[31] Idem.
[32] Idem.

The framework can be summarized as follows:

- A specific regulatory framework was created in 2007 to promote the use of renewable energy sources for electric energy production.
- This law aims to generate 8 per cent of national electricity production using renewable sources by 2016.
- The law includes tax incentives.
- The ENARSA energy company (with a majority share of state capital) held the first auction for an electricity supply based on renewable sources.
- In September 2010, contracts were awarded for a total of 895 MW of power to be produced from unconventional renewable sources.
- The state provides a contract that guarantees the purchase of the renewable energy produced for a period of 15 years at the offered tariff of the winning companies.
- A tax on electricity tariffs was introduced to finance a fiduciary fund that will be used to amortize the extra costs of green electricity generation.
- Investments are estimated at US$2.5 billion and come from diverse sources, in particular commercial banks and investment banks.
- The first tender round has been concluded, and the winning companies will now start their respective projects.

b) PROINFA - Brazil

The Alternative Energy Sources Incentive Programme (PROINFA) was launched in 2002 to promote electricity generation based on renewable sources in Brazil. The programme was created via Law 10,438/02 and revised via Law 10,762/03 and Law 11,075/04, under the Ministry of Mines and Energy. The initial objective is to promote the installation of 3,300 MW capacity based on renewable sources, which will be integrated into the National Interconnected System, and thus to cover 6 per cent of electricity generation using renewable sources (excluding large hydroelectric plants) by 2006, expanding to 10 per cent within 20 years.

The Brazilian Development Bank (BNDES) supports the programme through project financing. Specifically, the BNDES provides a special line of credit to corresponding investment projects under this framework, financing up to 70 per cent of the project.

The investors, in turn, must guarantee at least 30 per cent of the financing with own capital. The financing terms are the long-term lending rate plus a 2.0 per cent administrative spread and a 1.5 per cent risk spread; no monthly payments for up to six months after entry into operations; amortization over ten years; and no interest payments during the plant construction phase.

The BNDES had an allocation of 6 billion reais for financial support for PROINFA. Moreover, in 2006 the project credit limit was increased to 80 per cent financing, amortizable over 12 years.

The national electric company (Electrobras) guarantees the purchase of up to 70 per cent of the energy generated by these projects, under a 20-year contract (or PPA). In the short term, any difference between the energy generated and the energy contracted is sold on the market. To support national technological development and employment, the law requires that a minimum of 60 per cent of project costs are local.

This scheme encompasses the following public and private participants:

Public	Eletrobras: Large Brazilian electric company, with majority ownership by the federal government; responsible for administering PROINFA;
	Brazilian Development Bank (BNDES): Provides lines of credit for partial financing of projects awarded under the framework of this programme;
	National Electric Energy Agency (ANEEL);
	Energy Research Company (EPE).
Private	Companies that take part in the tender process.

Article 3 of Law 10,436 of 2002 establishes the contract guidelines:

- The contracts are written by the company ELETROBRAS, which guarantees the purchase of energy for a period of 20 years.
- The purchase price will be set on the basis of the technology used in a given project. The value is determined by the National Executive Branch, with a floor of 50 per cent (biomass production), 70 per cent (small hydroelectric plants) and 90 per cent (wind) of the average tariff paid by the end consumer in the last 12 months. The administrative costs incurred by ELETROBRAS are transferred to users (except low-income consumers).
- Generation equipment manufacturers (or their managers) must guarantee a minimum of 60 per cent of national value added in the first phase and 90 per cent in the second phase.
- Once the initial objective of incorporating 3,300 MW is achieved, the second phase consists in reaching 10 per cent of total generation using independent renewable sources within 20 years.
- In the second phase, the 20-year contracts written by ELETROBRAS will be valued at the competitive energy price, defined as the weighted average cost of new hydroelectric plants with potential production of over 30 MW and natural gas thermoelectric plants, as calculated by the Executive Branch.

The PROINFA Annual Plan published by ANEEL[33] indicated that the contracts signed as of 2010 represented a total of 3,137.50 MW, which is very close to the 3,300 MW target set by the programme for 2006. However, it has yet to be seen whether these contracts will result in concrete projects that generate electricity using renewable sources.

It was not possible to find updated information on finished projects that are now in operation, but Greenpeace Brazil has reported on the status of projects deriving from PROINFA as of May 2008, based on data from Electrobras (see table 12).

[33] Available online at http://www.aneel.gov.br/cedoc/areh2010930_3.pdf.

TABLE 12
STATUS OF ALL PROJECTS CONTRACTED UNDER PROINFA AS OF MAY 2008

	Small hydroelectric	Biomass	Wind	Total
In commercial operations				
Units	16	19	6	41
Per cent	25.4%	70.4%	11.1%	28.5%
MW	299.34	504.34	218.5	1022.18
Per cent	25.1%	73.6%	15.4%	31%
Finished and awaiting entry into commercial operations				
Units	1	0	0	1
MW	22.50	0	0	22.50
Under construction				
Units	42	1	15	58
Per cent	66.7%	3.7%	27.8%	40.3%
MW	812.7	10	123.83	946.53
Per cent	68.2%	1.5%	8.7%	28.7%
Construction not started				
With EPC [a] **Engineering, Procurement and Construction**				
Units	1	1	28	30
Per cent	1.6%	3.7%	51.9%	20.8%
MW	18	30.5	839.89	886.39
Per cent	1.5%	4.5%	58.9%	26.9%
Without EPC				
Units	2	2	5	9
Per cent	3.2%	7.4%	9.3%	6.3%
MW	28.7	61	242.7	332.4
Per cent	2.4%	8.9%	17.1%	10.1%
Total				
Units	3	3	33	39
Per cent	4.8%	11.1%	61.1%	27.1%
MW		91.5	1.080.59	1.218.79
Per cent	3.9%	13.4%	75.9%	36.9%
Sub judice/contract finalization				
Units	1	4	0	5
Per cent	1.6%	14.8%	0%	3.5%
MW	10	79.4	0	89.4
Per cent	0.8%	11.6%	0%	2.7%
Total contracted				
Units	63	27	54	144
MW	1,191.24	685.24	1,422.92	3,299.4

Source: Greenpeace Brazil.
[a] Engineering, Procurement and Construction.

As shown in table 12, PROINFA achieved 30 per cent of its objective in terms of installed power capacity between the programme launch in 2002 and 2008. This implies nearly seven finished

and operating projects per year in the period. The 2011 PROINFA Annual Plan[34] presents more precise data, which indicate not only the energy produced by the concession projects, but also the total installed power capacity. Table 13 presents the results, broken down by type of technology.

TABLE 13
INSTALLED CAPACITY BASED ON RENEWABLE SOURCES DERIVING FROM THE PROINFA PROGRAMME

Source	Number of projects	Installed capacity (MW)
Biomass	19	533.34
Wind	43	1,199.79
Small hydropower	62	1,181.24
TOTAL	125	2,914.37

Source: ANEEL.

As the table shows, relative to the initial estimates, the majority of the projects that had not started construction in 2008 are now in operation.

At first glance, the targets established by PROINFA appear to be very ambitious, and they were not met within the specified time frame. However, the programme is producing results, and the first target of 3,300 MW is close to being met.

At the start of the programme, the required investments were estimated at US$6.4 billion. Based on this figure, the total investment in renewable energy achieved thanks to PROINFA can be estimated at approximately US$5.652 billion as of 2011.[35]

Some of the problems that arose during the implementation of PROINFA include legal and market issues. The legal complications stemmed from imprecise wording in the text of the relevant laws and decrees with regard to the regulations on the guaranteed purchase of electric energy, the definition of the roles and responsibilities of the public agencies involved, the call for tenders and the setting of the energy price. Some of these points were addressed through subsequent decrees and resolutions, although others apparently have not been clarified.

The market-related issues included the limited availability of own resources among the bidding companies, which affected their ability to obtain financing, and the difficulty of complying with the local cost requirements, which in the case of wind projects impeded the entrance of international wind generator manufacturers.

The investors indicated that the most critical issue with the programme was the difficulty of accessing credit, given the investor profile of the projects.[36] The majority the tenders were submitted by small and medium-sized companies, with low financing capacity (especially compared with large energy companies) and, in some cases, little experience in the sector.

Many of these projects were not implemented because the companies could not provide the collateral required by the BNDES and because of the high level of own investment needed from the project investors. Some of these weaknesses were corrected starting in 2005, when the payment period was extended from 10 to 12 years, the projects' entry into operations was pushed back from 2006 to

[34] Available online at http://www.aneel.gov.br/cedoc/areh20101101_3.pdf.

[35] This figure is calculated by applying the estimated investment for 3,300 MW of installed capacity to the actual installed capacity as of 2011. The calculation indicates that approximately 88 per cent of the total estimated investment at the start of the programme have been made.

[36] Baltelo, R. (2008), "A caminho da sustentabilidade energética como desenvolver um mercado de renováveis no Brazil", Greenpeace Brazil.

2008 and the share of financing by the BNDES was raised from 70 per cent to 80 per cent of the total project.

The PROINFA programme ended in 2011, because the majority of the new wind projects since 2009 have been developed outside the programme, under the framework of Brazilian government's regular auctions for the provision of electricity.

The framework can be summarized as follows:

- A specific regulatory framework was established in 2002 to promote the use of renewable energy.
- The objective was to cover 6 per cent of electricity generation with renewable sources by 2006, expanding to 10 per cent within 20 years.
- Power purchase agreements (PPAs) guaranteed the purchase of energy for 15 years.
- Since its launch, the programme has achieved the operation of approximately 88 per cent of the target plants and power production defined for the first phase, albeit not within the specified time frame.
- A minimum of 60 per cent of the project costs had to be local, which impeded the entry of international wind generator manufacturers.
- The programme was affected by legal and market-related weaknesses, especially with regard to BNDES financing.
- The limited availability of own resources for loan collateral and project investment was identified as the biggest barrier to the success of PROINFA.
- Total investment under the framework of this programme is estimated at US$5.652 billion as of 2011.

c) Laws 19,940/04 and 20,257/08 - Chile

The changes to the General Law on Electricity Services (LGSE) introduced by Law 19,940 of 2004 improved the viability of small unconventional renewable energy projects by allowing any independent generator to sell energy and power on the wholesale market and by providing a total or partial exemption from the payment of trunk transmission for unconventional sources below 20MW.

Additionally, Law 20,257, which entered into effect on 1 April 2008, requires electric companies that generate more than 200 MW to supply 5 per cent of their energy using unconventional renewable sources between 2010 and 2014 and to increase by 0.5 per cent a year starting in 2015 to reach 10 per cent in 2024.[37] This requirement applies to generation companies that supply energy to the Central Interconnected System (SIC) and the Norte Grande Interconnected System (SING) and that connected to the system after 1 January 2007.

This legal framework also conferred the right to sell power and energy on the wholesale market to any generator, independent of size, and secured greater price stability by allowing the setting of long-term prices (for up to 15 years).[38]

There is also a programme of incentive mechanisms to accelerate the incorporation of renewable energy into the energy matrix (Article 3). The incentives consist of an additional payment per kWh for generators that supply the network with electric energy from renewable sources. This

[37] National Energy Commission and Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (2009). "Las Energías Renovables No Convencionales en el Mercado Eléctrico Chileno".

[38] Tirapegui, W (2006), "Introducción a las Energías Renovables No Convencionales (ERNC)", Empresa Nacional de Electricidad S.A. Chile.

fund is financed through a 1 per cent duty levied on fossil fuel imports used in electricity generation and a surcharge to end consumers of 1 per cent of the net value of their electricity bill.[39]

To date, the Renewable Energy Law does not appear to have met the targets set for 2010. The share of renewable energy in the network did not reach the 5 per cent required by law for 2010, but rather held at approximately 2 per cent.[40] The three main technologies that have been developed to date are small hydropower, wind and biomass.

The National Energy Commission and the Production Development Corporation (CORFO) also promote the development of a portfolio of projects through the Programme for the Promotion and Attraction of Investment for Energy Generation Based on Renewable Sources, and the government has committed to granting subsidies for carrying forward with this project portfolio. This benefit is given to private companies that propose projects of less than 20 MW, with costs from US$400,000 to US$2.0 million. CORFO estimates that with cofinancing for project studies of up to US$1 million, a project portfolio of between US$200 million and US$250 million could be raised.[41]

This scheme encompasses the following public and private participants:

Public

Ministry of Energy;

National Energy Commission;

Renewable Energy Centre (CER)/Production Development Corporation (CORFO).

Private

Renewable electric energy generation companies;

Private companies that propose investments in renewable generation projects.

In the case of solar thermal energy, Law N° 20,365, published in the *Official Gazette* on 19 August 2009, establishes a subsidy through a tax break on solar thermal collectors for heating domestic water, as follows:[42]

- The subsidy is effective through December 2013 and covers the purchase and installation costs of solar thermal systems for heating domestic water in new homes throughout the country.
- The subsidy covers 100 per cent of the investment for small homes, 40 per cent for medium-sized homes and 20 per cent for large homes.
- The tax benefit is given to construction companies, which deduct the amount from their required monthly income tax payment or from any other tax or withholding.
- The tax benefit applies to new homes (houses and apartments) that have a building permit specifying the solar thermal system and that received final municipal acceptance after the regulation was published.
- The installed systems have a five-year guarantee and are subject to inspections.

[39] Unión Argentina de Entidades de Servicios - UDES (2008), "Marco de Referencia para elaborar una estrategia de fomento de las Energías Renovables y la Eficiencia Energética". Available online at http://www.ambiente.gov.ar/archivos/web/energetico/File/marco_referencia.pdf (accessed on 3 September 2011).

[40] "Impacto de las ERNC en los costos de generation," presented by Carolina Galleguillo, General Manager of the Chilean Renewable Energy Association, at the conference "Financing Low-Carbon Electricity in Latin America", Santiago, Chile,22-23 August 2011.

[41] Clima de Emprendimiento Organizado – CEO, available online at http://www.ceo.cl/609/article-69036.html (accessed on 10 September 2011).

[42] Commnication from a representative of the Chilean Ministry of Energy.

- The benefit is available only for solar systems that incorporate collectors and accumulators and that are from authorized dealers who comply with the certification defined in the regulation.

Business consortia have been formed to promote biofuel research, with the participation of public entities (such as universities) and private sector businesses and with support from the Ministry of Energy and the CORFO Centre for Renewable Energy.

The framework can be summarized as follows:

- A specific regulatory framework was established to promote the use of unconventional renewable energy. Small-scale renewable energy projects have been promoted since 2001, and since 2008 generators are required to incorporate a quota of 5 per cent from renewable sources.
- As of 2008, electric companies that generate more than 200 MW are required to supply 5 per cent of their power using unconventional renewable energy sources between 2010 and 2014, with an increase of 0.5 per cent a year starting in 2015 to reach 10 per cent in 2024.
- The sales price of renewable energy in the wholesale market can be set for a period of up to 15 years.
- Subsidies have been established to carry forward this portfolio of projects. This benefit is granted to private firms that propose projects for under 20 MW, with costs from US$400,000 to US$2.0 million.
- Mechanisms were established to promote renewable energy, such as an additional payment per kWh to generation companies that supply the network with electric energy from renewable sources.
- The incentive mechanisms are financed through a duty levied on fossil fuel imports used for electricity generation and a surcharge to end consumers of 1 per cent of the net value of their electric bill.

d) Renewable energy law (LAERFTE) - Mexico

Mexico has a specific legal framework for renewable energy. The 2008 Law for the Use of Renewable Energy and the Financing of the Energy Transition (LAERFTE) establishes, among other provisions, that the Secretariat of Energy must develop a Special Programme for Renewable Energy Use, as well as a National Strategy for the Energy Transition and the Use of Sustainable Energy.[43] The Special Programme for Renewable Energy Use [44] includes objective indicators for the share of renewable energy in Mexico's generation capacity. Unlike the Energy Sector Programme, the indicators for this programme do not include hydroelectric projects of over 30 MW, in accordance with the stipulations of the LAERFTE. The Special Programme indicators show that for 2012, renewable energy sources are expected to account for 7.6 per cent of total national capacity and between 4.5 per cent and 6.6 per cent of total generation.[45]

In general, and in accordance with the current legal framework, the programme mainly promotes local or remote self-use schemes (using the country's transmission network) and the sale of energy through competitive tenders at fixed energy prices. Additionally, a preferential price scheme is being developed to make small-scale projects viable, since they have not been bankable to date due to the low energy prices paid by the network. This scheme is currently in the design phase and will include targets for these small-scale projects (less than 30 MW).

[43] http://www.sener.gob.mx/res/0/Estrategia.pdf.
[44] http://www.sener.gob.mx/res/0/Programa%20Energias%20Renovables.pdf.
[45] Communication from a representative of the Mexican Secretariat of Energy.

The most recent revisions and schemes, published after the documents cited above, include preferential prices on transmission costs for remote self-use projects and new developments under the open season mechanism, through which high tension lines are being extended in order to facilitate the installation of renewable energy projects in Mexico. This scheme seeks to identify potential investors in renewable projects to reinforce the existing transmission capacity or build new electricity transmission infrastructure. The last initiative of this sort, carried out 2006, resulted in the development and modernization of transmission infrastructure to accommodate almost 2500 MW of power from wind projects on the Tehuantepec Isthmus.[46] That initiative was possible thanks to the involvement of government agencies, which coordinated the project; the state-owned electric company (CF), which implemented the works; and the substantial wind resources in the region, which allowed the project developers to pay a proportional share of the infrastructure estimated at almost US$ 250 million (for transmission and substations only).

The only tax incentive currently in place is accelerated depreciation. Other forms of support are embodied in regulatory mechanisms and contract models that facilitate financing for renewable energy projects. The incentive and financing mechanisms for promoting renewable energy in Mexico include the following[47]:

- Fund for energy transition and the use of sustainable energy: a fund with annual resources of 3 billion Mexican pesos, aimed at promoting the national energy sector through projects, programmes and actions that lead to improved use and utilization of renewable energy sources and clean technologies.
- Accelerated depreciation of fixed assets: allows the depreciation of 100 per cent of investments in machinery and equipment for energy generation using renewable sources.
- Energy sector fund for energy sustainability: a fund that is supported through a tax on hydrocarbons and that aims to promote scientific and applied technology research, as well as the adoption, innovation, assimilation and technological development in the areas of renewable energy sources, energy efficiency, the use of clean technologies and diversification of primary energy sources.
- Support mechanisms for renewable energy projects.
- State Bank of Mexico (NAFIN): responsible for supporting small, medium-sized and large firms in the country through financing, guarantees, training and technical assistance. The mechanisms established to support renewable energy projects are as follows:

(i) Funds: Resources from international financial organizations, including multinational credit lines from institutions such as the Inter-American Development Bank (IDB), World Bank, German Development Bank (KfW) and International Financial Corporation (IFC), which seek scalable pilot programmes for low-carbon technology transfer.

(ii) Risk taking on a level playing field: debt financing for renewable energy projects under construction or in operation. NAFIN will provide up to 25 per cent of the total financing.

(iii) Capital issue and debt placement: Depending on the amount of the investment and the project risk level, resources can be obtained in the securities market through the issue of long-term debt.

[46] Idem.
[47] Idem.

(iv) New support schemes: schemes (to be evaluated on a case-by-case basis) to support project liquidity in case of replacement of the off-taker or lack of resources stemming from a drop in tariffs.

(v) Zero duties: Some inputs for the development of renewable energy projects (for example, machinery, equipment, instruments and materials) are exempt from the general import or export tax.

As of August 2011, the CRE has granted a total of 117 permits for renewable energy projects with a capacity of 3,645.1 MW, of which 1,121.4 MW are already in operation.[48]

The framework can be summarized as follows:

- A specific legal framework for promoting renewable energy has been in effect since 2008.
- Energy is sold through competitive auctions for fixed prices.
- The government invests in the expansion of the electricity distribution network to facilitate the development of renewable energy projects throughout the country.
- There are fiscal incentives (accelerated depreciation), tax incentives, regulatory incentives and contract models for promoting renewable energy projects.
- The State Bank of Mexico (NAFIN) has mechanisms for supporting renewable energy projects, including funds for pilot projects and investment risk taking.
- A fund was created for research and promotion.
- There are 1,121.4 MW of installed power based on renewable sources.

e) Legislative Decree 1002 – Peru

In Peru, the use of renewable energy resources is promoted through a special regulatory framework comprising Legislative Decree 1002 of 2008, which aims to stimulate the use of renewable energy resources through the promotion of investment for electricity generation, and Executive Decree N° 050-2008-EM, which regulates electricity generation based on renewable energy.[49]

Under this regulatory framework, the Peruvian state, through the Ministry of Energy and Mines, specifies an amount of energy to be generated from renewable energy resources, excluding hydroelectric plants. This amount can reach a maximum of 5 per cent of total electricity production in each year in the first five-year period.

To cover the specified percentage of electricity generation using renewable sources, the Supervisory Agency for Energy and Mining Investment (OSINERGMIN), under the Ministry of Energy and Mines, issues a call for tenders, inviting interested companies to bid a quantity and cost of electric energy. The Agency sets a ceiling on generation and cost per unit of energy produced (the latter is not published) for each technology: solar, wind, geothermal, etc.

The government gives the supplier a guaranteed income for the energy produced for a period of 20 years, through PPAs. These generators inject the green electric energy into the interconnected system, where it is sold in the spot market together with electricity from other sources. At the end of the year, the generator's income from the electricity market is netted against the generator's offer in the auction. If the difference is negative, the government compensates the generator by paying a

[48] "Regulación para atraer Inversión: Renovables en Mexico," presented by Francisco Xavier Salazar Diez de Sollano, President of the Mexican Energy Regulatory Commission (CRE), at the conference "Financing Low-Carbon Electricity in Latin America," Santiago, Chile, 22-23 August 2011.

[49] OSINERGMIN (2010). "Boletín de comunicación de Julio 2010 (No.3, año 14)." Available online at http://www2.osinerg.gob.pe/Publicaciones/pdf/Informativo/INFO-A14N03.pdf (accessed 25 July 2011).

premium (guaranteed income), and if it is positive, it is credited to the government as a balance for the coming year. This premium is transferred to the user through the transmission toll, so the government does not subsidize this mechanism. As mentioned in the last paragraph, at the time of the auction, the generators offer a cost per unit of energy generated, which has a ceiling stipulated by the government (but not published in the call for tenders) in order to minimize the impact of the premium on consumers. The Committee for the Economic Operation of the National Interconnected System (COES) is in charge of clearing the settlements with the generators.[50]

The total investment to be made by the winning companies in the first tender round is US$812.56 million, split among hydropower (270.38 million), wind (255.60 million), biomass (46.58 million) and solar (240.00 million).[51]

The government only allocates national funds for rural electrification, leaving all other sectoral investment in the hands of the private sector. The General Office for Rural Electrification directs some programmes that provide incentives for renewable energy use. For example, the Euro Solar Programme,[52] financed by the European Commission, aims to reduce poverty by giving access to renewable electric energy sources to 130 isolated rural communities that lack access to electricity. Renewable energy is also featured in rural electrification programmes in areas that are difficult to reach.

Public	Ministry of Energy and Mines;
	Supervisory Agency for Energy and Mining Investment (OSINERGMIN), in charge of the tender process;
	Committee for the Economic Operation of the National Interconnected System (COES), in charge of clearing settlements with generators.
Private	Companies that take part in the tender process.

The project can be summarized as follows:

- A specific regulatory framework to promote renewable energy use has been in place since 2008.
- The government gives the supplier a guaranteed income for the energy produced over a period of 20 years, through PPAs.
- The additional costs (if any) of electricity generation based on renewable sources are transferred to the user through the transmission toll.
- For the auction, the government sets a ceiling on the unit cost of energy generated, so as to limit the increase in the price to consumers.
- The first tender round awarded projects totalling US$812.56 million.
- There are some incentive programmes to promote renewable energy use, through international funds.

[50] Telephone interview with Mr. Ricardo Vásquez of the General Electricity Office, 1 September 2011.
[51] Communication from the Ministry of Energy and Mines.
[52] http://www.programaeuro-solar.eu/home.php.

f) "Renewable" decrees - Uruguay

In August 2008, the executive branch approved a new 2030 Energy Policy, which became state policy in 2010 after being approved by the other political parties. This policy has four components:

Institutional component

- The executive branch sets and coordinates energy policy within a stable, transparent regulatory framework, with leadership from public companies and regulated participation by private companies.

Supply component

- Energy diversification, aimed at reducing the weight of oil and increasing the share of renewable energy sources, is promoted through incentives but not subsidies, fostering the development of local capacities.

Demand component

- Energy efficiency is promoted in all sectors, for all forms of energy and all branches of economic activity (transportation, construction, manufacturing), with an emphasis on cultural change.

Social component

- Adequate access to energy is defined as a human right (in terms of price, quality and security) and an instrument for achieving social integration.

Decree N° 77 of March 2006, which preceded the above policy, was the first concrete measure developed at the local level to increase the share of wind, biomass and mini-hydropower in the country's energy matrix. The initial auction resulted in the awarding of a total of 20 MW of wind energy, 20 MW of biomass energy and 20 MW mini-hydropower.

The development of renewable energy deriving from this decree served as a learning experience, both for the state and for the companies. An important conclusion of this process was the need to adopt specific instruments for each energy source.

In the case of wind energy, a subsequent call for tenders was issued. Thus in August 2009, Executive Decree N° 403 was approved to create the framework for incorporating 300 MW of wind energy by 2015 and to specify the conditions for the first auction of an additional 150 MW (average annual demand in Uruguay is 1,050 MW).

This call for tenders received bids for 945.6 MW, when the auction was for contracts totalling 150 MW (a ratio of about 6:1). The bids included minimum percentages of national components that equalled or exceeded the minimum specified in the tender guidelines. The prices in the contracts awarded in this first tender round were in the range of 80-85 US$/MWh.

The call for tenders issued in Decree 403/009 was followed by another, similar auction announced in Decree 159/011. This second auction did not differ from the first in the areas of interest for this report, and it resulted in the lowest price for unconventional renewable energy seen at the time. Bids were received for 1,047 MW in an auction of 150 MW (a ratio of about 7:1), while the bid prices reached 62 US$/MWh.

Decree 367/010 on the incorporation of biomass energy supply was approved in 2010. This decree established a "feed-in tariff" (long-term contracts to renewable energy producers, in general based on the generation of each technology) without subsidies. The price paid for energy and power under this contract scheme was follows (with small upward revisions in the case of bids with more than 50 per cent national component): (i) Non-dispatchable energy price: 92.00 US$/MWh (ii) Available usable power price: 48.00 US$/MW-h (iii) Maximum price of energy used: 59.00 US$/MWh.

g) PROURE – Colombia

In Colombia, the development of unconventional renewable energy has been limited, mainly due to the wide availability of hydroelectric and fossil fuel resources in the country. However, while the expansion of renewable energy sources is not supported through subsidies or guarantees, there are some specific programmes that have benefited a few projects.

Small hydroelectric projects, defined as plants with less than 10Mw of power capacity, are the most common, with 169Mw of installed capacity. Although there is no direct support for these projects, the plants are given priority for entering the electricity dispatch system.

In the case of wind, only one farm has been built, with 20Mw of capacity. This project, which entered into operation in 2004, benefited from German bilateral cooperation (GTZ) and the Colombian Innovation and Development Fund (Colciencias), qualifying for support as technological innovation in the county. The project was implemented by the company EPM as an exploratory venture, which has not been pursued further.

The National Development Plan includes support for renewable energy, which has yet to be formulated: "The diversification of the energy matrix through alternative energy sources will be conceived as a process of research, learning and innovation in the use of clean technologies, based on the different potential resources of each region" (PND 2010 - 2014).

Through Resolution 180,919 published on 1 June 2010, the Ministry of Mining and Energy adopted a Draft Action Plan for 2010-2015 to develop the Programme for the Rational and Efficient Use of Energy and Forms of Unconventional Energy (PROURE).

Among the various goals for energy savings and the efficient use of resources, Article 7° of the Resolution establishes targets for electricity generation using unconventional energy sources of 3.5 per cent for 2015 and 6.5 per cent for 2020. Thus far, these targets are only recommendations, and compliance is not obligatory.

B. Examples of PPP projects in renewable energy in the region

The examples presented in this section derive from projects developed outside the programmes outlined above. They represent concrete initiatives promoted jointly by the government and private firms (that is, PPP-type schemes), in some cases with support from international organizations.

a) National Geothermal Company - Chile

Chile's Geothermal Energy Concessions Law N° 19,657, which went into effect on 7 January 2000, allows the state-owned national oil company, ENAP, to participate in this industry through corporations operating in the sector, where ENAP owns a share of less than 50 per cent.

Under this legal mechanism, in April 2005 ENAP forged a strategic alliance with the Italian company Ente Nazionale per l'Energia Elettrica (ENEL) to develop geothermal exploration and production projects in Chile. This partnership was formed when ENEL acquired a 51 per cent share of the National Geothermal Company (Empresa Nacional de Geotermia S.A., ENG), a corporation in which ENAP holds the remaining 49 per cent.

In March 2006, this strategic alliance was extended when ENEL acquired 51 per cent of the corporation Geotérmica del Norte S.A. (GDN); the remaining shares are controlled by ENAP (44 per cent) and CODELCO (5 per cent).

Between 2006 and 2009, ENG and GDN mainly focused on participating in concession tenders for geothermal exploration and exploitation, carrying out research and pre-feasibility studies in the areas of interest. The activities involved in obtaining concessions and conducting these studies

required a substantial investment by the companies, in terms of both human and financial resources (estimated at tens of millions of dollars). The results of the field studies underscored, in particular, the high geothermal potential of the El Tatio Geyser Field in the northern Atacama Desert. More detailed technical and scientific studies began in the area, both on the surface and at depth.

In September 2009, GDN came under fire for a leak in one of the exploration wells near the El Tatio Geysers National Park, which produced fumaroles more than 60 metres high. The exploration project was subsequently rejected by the community and local authorities, who accused GDN of environmental damage and the destruction of natural heritage and tourism potential. These events caused GDN to cease exploration activities in the region and to search out areas with a lower environment/tourism impact.

In May 2011, the General Manager of ENAP announced the decision to sell the company's shares of 49 per cent of the National Geothermal Company (ENG) and 44 per cent of Geotérmica del Norte (GDN), thereby pulling out of the geothermal business. The announcement further stated that the sale would be handled by the investment bank BNP Paribas and estimated that the process would take six months to complete.

Despite these announcements, that same month the directors of Geotérmica del Norte reported the initiation of environmental procedures for installing a geothermal plant about 200 kilometres north of the disputed El Tatio region.

The project, called Cerro Pabellón, is located in the Pampa Apacheta area, in the community of Ollagüe (II Region). Project investment is estimated at US$180 million, according to the environmental impact report filed by GDN. The project involves a production capacity of 50 MW of power, which will be injected into the Norte Grande Interconnected System (SING) via a 220 kV transmission system. In addition to the generation facilities, the plan includes 11 drilling rigs for production wells and reinjection wells, a pipeline network, an internal road network and auxiliary works.

The geothermal plant, in addition to contributing to energy diversification in the country and particularly in the Antofagasta Region, would be the first 50 MW plant in South America, turning the region into a model for the development of this clean, constant, renewable energy.

The next stages of the project (in 2012) include analysing the fluid composition and reservoir data from the geothermal fields and drilling additional wells for both production and reinjection of geothermal fluids, followed by plant construction (in 2013), operation and commercialization of the energy produced. The plant is expected to enter into operation in the first quarter of 2014.

Based on these concrete developments, ENAP is re-evaluating its decision to pull out of GDN and, hence, the geothermal business. If the company decides to keep its share, the Chilean government would retain its strategic presence in the development of an important energy resource for the country, at the same time that it could effectively recover the investments made —with fiscal resources— in risk activities associated with geothermal exploration.

b) Wind project on the Galapagos Islands - Ecuador

With financing from the e8 (an organization comprising the largest electric companies in the world), the United Nations Fund (UNF) and the Government of Ecuador, a wind farm was built on San Cristóbal Island, the most populated island in the Galapagos archipelago, Ecuador.

The project aims to reduce the use of diesel fuel, which is the current source for electricity generation on the island, and to promote the introduction of renewable energy in the Galapagos. This will not only reduce the environmental risks associated with transporting diesel fuel, but also lower the cost of electricity generation, which is strongly subsidized by the national government.

Implementation of the project began in 2005 with the creation of the San Cristóbal Wind Corporation (EOLICSA), through a business trust set up by the e8 companies and the Galapagos

Provincial Electric Company (Elecgalápagos S.A.), a government subsidiary that provides electric service to the islands.

Fondos Pichincha, an Ecuadorian company specialized in managing businesses and investment funds, acts as the business trust administrator, while Industry and Energy Associates, a United States company, serves as the project director.

The tariff set for electricity produced by the San Cristóbal wind farm is US$0.1282/kWh. This tariff is guaranteed for a period of 12 years through a contract signed by Elecgalápagos S.A. and EOLICSA, in accordance with Regulation 004/04 ("Prices of Energy Produced with Unconventional Renewable Energy Resources") issued by the National Electricity Council (CONELEC). This rate is lower than the rate paid for diesel fuel generation (US$0.16/kWh), which receives a government subsidy to bring the cost of diesel to US$0.91/gallon.

Project financing was mixed and included public and private capital, as detailed in table 14. The estimated cost of the project was US$11.25 million.

TABLE 14
APPROXIMATE FINANCING OF THE SAN CRISTÓBAL WIND PROJECT IN GALAPAGOS, ECUADOR

Source of financing	Amount (US$)
Donations from e8 members	6 800 000
Dentations from the United Nations Fund (UNF)	1 000 000
Capital subsidy from the Ecuadorian government	3 200 000
2004 income tax through the San Cristóbal municipal government	250 000
TOTAL	11 250 000

Source: EOLICSA.

The per unit cost was approximately US$4,100/kW, which is relatively high compared with larger projects developed on the continent. This reflects the small scale of the project and the logistical difficulties stemming from the geographic location. This was anticipated, however, so it did not cause unforeseen complications in the implementation phase.

c) CORFO consortia for biofuel research and development - Chile

The Production Development Corporation (CORFO), created in 1939, is the Chilean state agency in charge of promoting national production and implementing government policies on entrepreneurship and innovation. The main services provided by CORFO include (i) specialized financing (unreimbursed resources); (ii) expert consulting throughout the innovation cycle; and (iii) the development of innovation support networks.

The Entrepreneurship and Innovation Division of CORFO runs the InnovaChile Committee, whose objectives include promoting entrepreneurial and innovative values, supporting the development of businesses with a large economic and social impact, and facilitating access to tools that allow businesses and organizations in Chile to learn about and adopt best practices in innovation.

InnovaChile and the National Energy Commission issued a call for tenders to create business technology consortia for research and development on second-generation biofuels produced from algae. Three consortia were awarded contracts: Desert Bioenergy, AlgaeFuels and BAL Biofuels S.A. With a total investment of US$31.6 million, including both contributions from the state and investments from participating private companies, these consortia have been working since 2010 on the production of algae-based biofuels and the creation of a sustainable energy model to strengthen the country's scientific and technological capacities and competencies. Table 15 lists the consortia formed, their members and the corresponding capital contributions.

TABLE 15
CONSORTIA FORMED FOR BIOFUEL DEVELOPMENT, WITH PUBLIC AND PRIVATE PARTICIPATION

Project	Description	Developer	Co-developers	InnovaChile's contribution	Consortium's contribution
Desert Bioenergy S.A.	R&D consortium for the microalgae fuel industry	Universidad de Antofagasta	Universidad de la Frontera Electroandina S.A. Prodalmar Ltda. Molinera Gorbea Ltda. Cicitem Copec S.A.	$2.49 million	$3.56 million
Algaefuels S.A.	Business technology consortium for algae biofuels in the north of Chile	Bioscan S.A.	Edelnor S.A. Copec S.A. Rentapack PUC	$3.24 million	$6.84 million
BAL Biofuels S.A.	Biotechnolology R&D consortium for the production of biofuels from kelp (macrocystis pyrifera)	BAL Chile S.A.	Bioarquitecture Lab Inc. (USA) ENAP Refinerías S.A. Universidad de los Lagos AVS Chile S.A. Pontificia Universidad Católica de Chile Universidad Católica del Norte Walbusch S.A. Sociedad las Vegas del Mar Ltda. Nofima Marin AS Pesquera San José S.A.	$3.77 million	$5.42 million

Source: CORFO.

d) Photovoltaic project in the state of Bahía - Brazil

This project plans to install a 400 kW solar photovoltaic generator (pico) on the roof of the Salvador city football stadium in the state of Bahía and connect it to the state's electricity network.

This project not only offers significant scientific and technological benefits for Brazil's energy sector, but also has strong economic and social impacts. The use of photovoltaic systems that are directly connected to the network has not yet been developed in Brazil, so the project opens the possibility for being replicated in other regions.

The PPP structure of the project is as follows: the public sector is represented by Eletrobras, the State Government of Bahía and Federal University of Santa Catarina (UFSC), while the private sector participants are the Bahia State Electric Company (Coelba), Neoenergia (one of the largest companies in the Brazilian electricity sector, which operates all along the electric energy production chain), GIZ/Germany and the Instituto Ideal.

Coelba, the State of Bahía and GIZ are responsible for financing the total investment of R$5,557,510.70, as follows: Coelba (66 per cent), State of Bahía (32 per cent) and GIZ (2 per cent). Coelba will invest fresh capital through the ANEEL regulation on energy efficiency projects, providing funds for project development, system acquisition and installation. The Government of Bahía will invest in reinforcing the stadium infrastructure, while GIZ will pay for consultants and travel expenses.

The PPP set up for this project represents an interesting pilot case, as it shows how to maximize the advantages of distributed generation from solar photovoltaic systems integrated in buildings, located in urban areas and close to the consumer. Given the stadium's high public profile, the project will help raise local public awareness of the need to expand the energy supply using renewable sources.

More generally, this type of PPP can have a positive influence on the long-term development of policies and regulations that support the effective integration of renewable energy into the network, not only in Brazil, but in other countries in the region.

e) The Wiwili mini-hydropower project – Nicaragua

This project plans to install a 1.48 MW hydroelectric plant in the Municipality of Wiwili, with an expansion of the distribution network in north Nicaragua.

The PPP structure of this project is as follows: the public sector is represented by the EMEEAW Municipal Company and the Ministry of Energy and Mines, while the private sector participant is the e8 (Global Sustainable Electricity Partnership).

The country's energy policy supports the development of renewable energy projects and small hydroelectric plants through various incentives, such as tax exemptions during construction and the first years of operation and subsidies for rural electrification. The Wiwili project was thus financed through a combination of public funds (loans and grants), which were provided under the framework of the national rural electrification programme financed by the World Bank, private sector funds and a grant from the Inter-American Development Bank (IDB). The participation of an internationally respected group of firms (the e8) in the PPP was key for getting development financing organizations like the World Bank and the IDB on board.

This project illustrates the importance of the division of roles and responsibilities among the PPP partners: the private partners contribute know-how and financial facilities, while the public partner can facilitate the process by liaising with different segments of society (communities, local authorities, etc.) and offering incentives (tax exemptions and subsidies) to support the local development of the population. It also shows that a more precise definition of roles and responsibilities and the long-term commitment of all the PPP partners should be established and agreed before the project is launched.

f) Figuerópolis & Ludesa hydroelectric plants – Brazil

This project encompasses two small hydroelectric plants, one in Figueirópolis (20 MW) and one in Ludesa (30 MW).

The PPP structure of the project is as follows: for the public sector, Eletrobras (the largest electric company in Latin America) owns a 52 per cent share of both projects, while the private sector participants are the Companhia Hidroelétria Figueirópolis S.A. and the Ludesa Energética S.A., respectively.

The government's energy policies strongly influenced the decision-making process in this project, because the current guidelines and regulations have a significant impact on the internal rate of return (IRR) of energy projects developed in the country, whether from conventional or renewable sources.

The project partners used a long-term financing scheme with the Brazilian Development Bank (BNDES). In the case of the Figueirópolis plant, the PPP partners qualified for resources from the Midwest Constitutional Financing Fund (FCO), which were channelled through the Bank of Brazil. The FCO is an important instrument aimed at stimulating business in the midwest region of the country in order to foster social and economic development. The two PPPs offered guarantees to the financing agencies in the form of power purchase agreements, under the scheme established by the Brazilian government's PROINFA programme.

This project illustrates the extent to which investment for this type of venture depends strongly on the existence of incentive programmes (such as PROINFA), since they allow the partners to establish long-term contracts with attractive financial compensation. Moreover, these projects can only be replicated if this type of incentive programme is maintained over time.

C. Discussion

The renewable energy incentive programmes studied in this report reveal a relatively positive scenario, in that they include clear actions on the part of the countries and promising results thus far.

As mentioned earlier, establishing a clear, stable and transparent legal framework appears to be an essential condition for attracting private capital in renewable energy generation. This point, in particular, and access to financing were mentioned repeatedly in the informal talks and presentations presented by private sector renewable energy professionals at the conference, "Financing Low-Carbon Electricity in Latin America," organized by the e8 and ECLAC, held in Santiago, Chile, on 22-23 August 2011.

All the cases studied here feature such a regulatory framework. While each regulatory framework reflects the particular situation of the given country, they also have several points in common. In particular, they are all official governmental policies, which makes them more stable in the face of changes in government.

Because these projects are characterized by high investment costs and substantial risk, governments need to establish financing mechanisms and agreements through which the purchase of the power generated is guaranteed for a long period and an agreed price. The majority of the programmes studied feature contracts for the energy generated (or PPAs). PROINFA is perhaps the most prominent example, given its long history and the magnitude of the investments involved.

The featured programmes are giving rise to numerous unconventional renewable energy ventures, including small hydroelectric plants. These ventures can be considered PPPs because the risks —and in some cases the costs— are shared by both the public sector (through PPAs and sometimes the availability of credit) and the private sector (through project investment and operation).

Access to financing is another critical point for this type of projects, again due to the high investment costs and risks involved. The programmes presented herein provide insights in this area, as well. The loans offered by the Brazilian Development Bank (BNDES) in the context of PROINFA were crucial for attracting the participation of the private sector. However, the guarantees required by the bank excluded many small and medium-sized enterprises from participating in the tender process. The rules of the game must thus be crystal clear, with the authorities spelling out the restrictions imposed and the incentives offered and with the private companies demonstrating the project's short- and long-term sustainability.

The transmission of the renewable energy generated is another important challenge in which the participation of the state can be a decisive factor. The Mexican government, for example, uses this as a mechanism for promoting the installation of renewable energy projects. In addition to reducing investment costs, which are already high in renewable energy projects, the expansion of transmission networks enlarges the potential geographic area for locating renewable projects, making them more attractive for private companies and possibly reaching a larger segment of the population, including remote communities.

Many of the programmes also emphasize the inclusion of a national component in the project. Ensuring the participation of local suppliers and workers can help promote price competitiveness and the development of local technical knowledge and skills.

Renewable energy incentive programmes should also include a strong energy efficiency component, promoting and publicizing rational energy use at the residential, commercial and industrial levels.

With the exception of PROINFA in Brazil, which is the oldest and largest programme in the region, most of the other initiatives are in their initial implementation phase, although many have already awarded concessions so that the companies can begin installation of the renewable energy plants.

As the case studies show, the private sector has responded positively to government participation and the incentives provided. It is equally important to honour the signed contracts and ensure the continuity of the established programmes and specific policies, so as to generate an environment of confidence and mutually beneficial arrangements for the public and private sectors. The credibility of the government and the transparency of the processes is crucial for the success of this type of programme.

D. Obstacles to developing renewable energy projects under PPP schemes

As the previous sections describe, the Latin American and Caribbean region has recently initiated a strong process to promote the use of renewable energy through regulatory frameworks and favourable conditions for projects featuring these technologies. This demonstrates a real interest in these energy sources, in the face of favourable economic growth expectations that will, without fail, lead to increased energy demand.

The state plays a decisive role in the programmes that are currently operating, as does the private sector, which in most cases is responsible for investment, construction, maintenance and operation of the infrastructure. While there is still room to improve these programmes and processes, they clearly show the need for the participation of both the public and private sectors.

The Multilateral Investment Fund (a member of the IDB Group) commissioned the Economist Intelligence Unit to carry out a study on "Evaluating the environment for public-private partnerships in Latin America and the Caribbean: The 2010 Infrascope."[53] Using a range of variables, the study created an index (from 0 to 100) to rate the environment for PPP in some of the countries of Latin America and the Caribbean. This study looks at PPPs in general and does not focus on the specific case of renewable energy. Table 16 presents the results for the countries and categories included in the study.

Table 16 shows that the region scores highest (indicating a favourable situation) on the investment climate and financial facilities. The rest of the variables received lower scores, in particular subnational adjustment.

With regard to the investment climate, the Multilateral Investment Fund report indicates that most countries in the region are characterized by political interference in the development of PPP schemes. Chile, Colombia and Peru have a strong political will and consensus for PPPs in most productive sectors, as well as strategies and initiatives to increase the number of PPP infrastructure projects.

Brazil, Mexico and most of the Central American countries have favourable attitudes and political strategies for PPPs, although some of the project implementation processes are slow. In addition, while there are risks of non-compliance with PPP contracts and/or concessions, several countries in the region have improved their political stability, which in turn improves the investment climate.

[53] Available online at http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=35434944.

TABLE 16
EVALUATION OF THE ENVIRONMENT FOR PPP SCHEMES IN SOME COUNTRIES IN LATIN AMERICA AND THE CARIBBEAN. INDEX FROM 0 (WORST) TO 100 (BEST)

Country	Regulatory framework	Institutional framework	Operational maturity	Investment climate	Financial facilities	Subnational adjustment	General ranking	No.
Argentina	21.9	33.3	16.7	19.0	33.3	50	27.5	12
Brazil	71.9	75.0	87.5	58.8	72.2	75	73.2	2
Chile	84.4	75.0	72.2	85.4	97.2	50	79.3	1
Colombia	50.0	50.0	46.7	72.4	55.6	50	53.7	5
Costa Rica	34.4	25.0	42.1	40.7	41.7	0	32.3	9
Ecuador	6.3	0.0	33.0	17.9	16.7	25	14.2	18
El Salvador	28.1	33.3	25.1	40.3	47.2	0	30.6	10
Guatemala	53.1	50.0	35.4	52.9	22.2	25	42.4	6
Honduras	15.6	33.3	35.1	47.1	11.1	0	24.6	14
Jamaica	25.0	25.0	25.3	35.9	16.7	25	25.4	13
Mexico	56.3	58.3	54.0	56.1	72.2	50	58.1	4
Nicaragua	21.9	25.0	13.1	15.6	8.3	0	16.0	17
Panama	37.5	25.0	13.1	58.1	63.9	0	34.6	7
Paraguay	25.0	25.0	15.6	31.4	25.0	25	24.5	15
Peru	75.0	75.0	53.6	75.2	61.1	50	67.2	3
Dominican Republic	21.9	8.3	14.0	49.1	30.6	25	23.7	16
Trinidad and Tobago	25.0	25.0	9.5	39.9	58.3	25	29.9	11
Uruguay	34.4	33.3	19.3	43.7	30.6	25	31.8	9
Venezuela	0.0	0.0	0.6	10.5	16.7	0	4.2	19
Average	36.2	35.5	32.2	44.7	41.1	26.3		

Source: Prepared by the authors, on the basis of "Evaluating the environment for public-private partnerships in Latin America and the Caribbean: The Infrascope 2010," carried out by the Economist Intelligence Unit for the Multilateral Investment Fund (FOMIN) of the IDB Group.

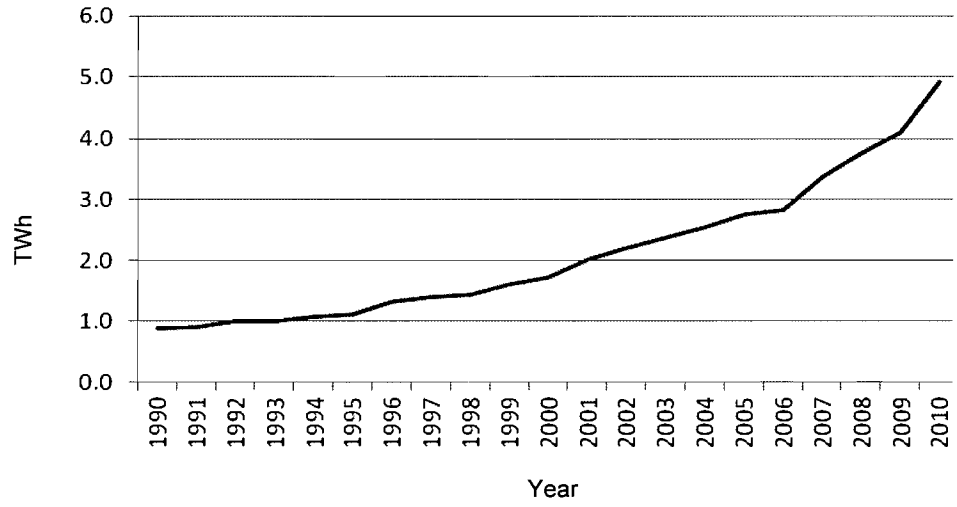
With regard to financial facilities, the report indicates that subsidies for the electricity sector are currently focused more on the end user and less on the generator. However, the case studies presented earlier show that this is not the case for renewable energy, where favourable conditions are given to generation companies or project implementers, and the additional costs are often passed on to the end consumer.

E. Best practices

The use of unconventional renewable energy in Latin America has increased substantially (15 per cent) in the last four years, as shown in figure 14. This increase coincides with the creation of specific programmes to promote the use of unconventional renewable energy in the region. Many of these programmes were launched in 2003 or later and have achieved or are achieving some degree of success.

While each country must adapt its renewable energy inventive programmes to its own reality, the initiatives currently in place offer important experiences for the design and administration of programmes that are better tailored to the region.

FIGURE 14
QUANTITY OF ELECTRICITY GENERATED FROM UNCONVENTIONAL RENEWABLE SOURCES IN LATIN AMERICA AND THE CARIBBEAN (1990 – 2010)



Source: BP Statistical Review of World Energy, 2011.

More generally, the best practices for PPPs recommended in the e8/UN-Energy report cited earlier, "Strengthening Public-Private Partnerships to Accelerate Global Electricity Technology Deployment,"[54] are particularly valuable in that they are derived from a survey of various public and private actors operating in the electricity sector, carried out by the e8 and UN-Energy (see box 1).

BOX 1
RECOMMENDED BEST PRACTICES FOR PPP SCHEMES PROPOSED IN THE E8 / UN-ENERGY REPORT

Policies to support PPPs:

- Establish a formal national energy development plan protected by a strong legislative framework, with targets for clearly identified and defined PPPs. These policies help stimulate investment, establish stable regulatory and legal frameworks and provide incentives and financing for these technologies.
- Provide cost recovery guarantees on invested capital through national energy plans backed by legislation and regulation that establish a commitment to the promotion of renewable technologies.
- In the PPP policies, include a component for the shared funding of research and development of emerging renewable technologies to complement the production chain.

Definition of PPP applications:

- Bring electric service to remote communities to foster economic growth and raise living standards.
- Optimize the private sector's ability to attract financing to design, build, maintain and operate electric works. Expand the private sector's options for financing renewable energy projects.
- Set long-term goals. One of the key strengths of the public sector is the ability to develop long-term, low-risk policies that can attract invetors and developers to renewable energy projects.
- Maintain strong partnerships between the public and private sectors through effective communication, well-defined roles and responsibilities and a continuous commitment.

Financing:

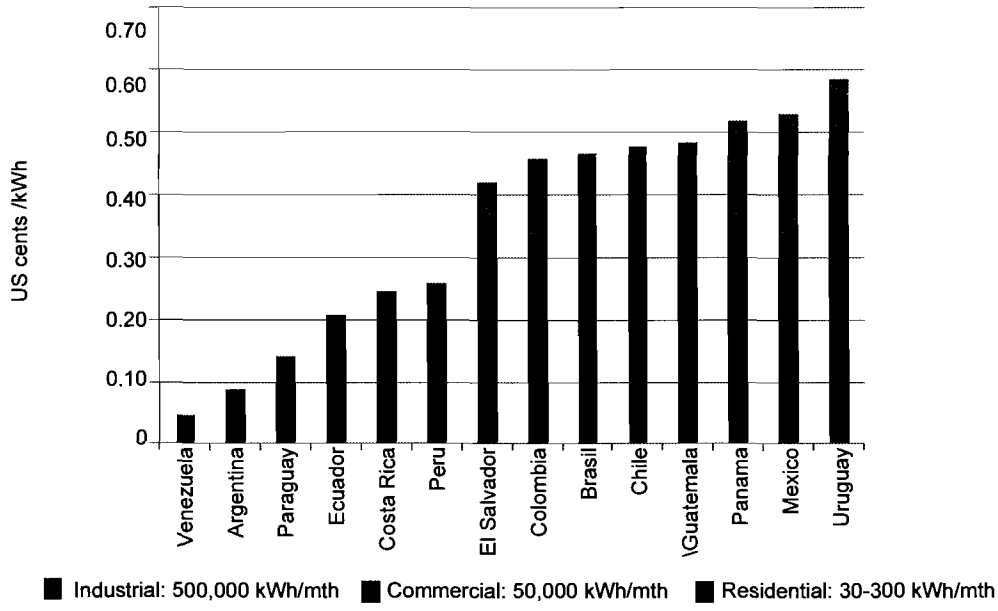
- Use PPAs with the private sector to reduce the uncertainty of long-term investments.

On 22-23 August 2011, the E8 and ECLAC held the conference "Financing Low-Carbon Electricity in Latin America" in Santiago, Chile. This event provided a forum for private companies and public sector representatives to discuss how to promote these technologies. The two issues that were most commonly brought up by the private sector were access to financing for the infrastructure and the commitment of public agencies through a specific, transparent and consistent legal framework.

With regard to the specific legal framework, the Latin American public sector appears to have acted (and continues to act) correctly in terms of the guidelines identified in the e8 / UN-Energy study, in that the renewable energy incentive programmes described earlier include a specific regulatory framework. The fact that these legal frameworks are established by law indicates that they were created with an eye to the future and the political will to maintain them over time.

With regard to financing, an important example is the facilities provided by the PROINFA programme, channelled through the Brazilian Development Bank, although there is still room for improving the processes. Brazil has a GDP of over US$2 trillion[55] so it is capable of providing this type of financing. This does not appear to be the case of other programmes, however, where financing for infrastructure remains in the hands of private institutions. With regard to subsidizing the green electricity generated, these technologies are competitive in countries such as Chile and Uruguay, where the cost of electricity is high (see figure 15).

FIGURE 15
ELECTRIC ENERGY COSTS IN SOME LATIN AMERICAN COUNTRIES BY INDUSTRIAL, COMMERCIAL AND RESIDENTIAL SECTOR (2011)



Source: OSINERGMIN.

Based on a cost of US$0.20 per kWh for electricity from unconventional renewable sources[56], a large number of countries in the region already have electricity rates that are compatible with renewable sources, particularly for the commercial and industrial sectors.

[55] World Bank, http://data.worldbank.org/country/brazil, accessed on 30 August 2011.
[56] Cost estimate from the Energy Information Administration (2009). Available online at http://www.eia.gov/oiaf/aeo/pdf/2016levelized_costs_aeo2010.pdf (accessed 14 September 2011).

Generally speaking, the low electricity costs in some countries is due to state subsidies. Electricity is usually perceived by society as a public good, so the social impacts of the subsidy programmes tend to prevail over economic efficiency parameters.[57]

While these subsidies represent an important form of support for the poorest segments of the population, they imply a high public cost, they are subject to fuel price fluctuations and they often extend to sectors that do not really need the subsidies.

Argentina recently began to reduce its electricity subsidy to neighbourhoods with above-average income in the city of Buenos Aires. The subsidy can also be voluntarily withdrawn through a simple Internet procedure.

If this subsidy-reduction policy is maintained, it would bring Argentina's electricity prices closer to the regional average. Renewable energy projects would thus become more feasible, and interest in investing in them would rise, simply due to the higher electricity prices. This would benefit not only private investors, but also the government, which would not have to administer the different costs of traditional and renewable energy.

[57] Pantanali, C. and Benavides, J. (2006), "Subsidios Eléctricos en América Latina y el Caribe: Análisis Comparativo y Recomendaciones de Política." Inter-American Development Bank. Washington D.C.

VI. Conclusions

General overview

- In Latin America and the Caribbean, electricity production is largely based on fossil fuels, which cause greenhouse gas emissions and frequently are not available locally.
- Hydroelectric plants are the most common renewable energy source (especially in Brazil), while unconventional sources make only a marginal contribution to the region's energy matrix.
- A significant number of countries in the region currently have electricity prices that are compatible with the costs of renewable energy generation, particularly for the commercial and industrial sectors.
- The use of unconventional renewable energy in Latin America has increased substantially (15 per cent) in the last four years.

Social and environmental issues

- In Latin America and the Caribbean, 70 million people do not have access to modern electricity service.
- Because of their ability to generate electricity without greenhouse gas emissions and the possibility of decentralizing generation, unconventional renewable energy is critical for complying with strategies and policies related to climate change and universal access to electricity.

Barriers

- Renewable energy projects are generally characterized by high investment and maintenance costs, complex construction issues and economic returns that are not always high. These factors create a big challenge in the development of renewable energy projects and the penetration of the technology in the region.

Promotion programmes

- Several countries in the region, particularly in South America, have implemented programmes to promote the use of unconventional renewable energy in electricity

production. These programmes have in common the participation of the state in the role of regulator, promoter and, in some cases, guarantor; while the private sector executes and operates the project.

- These countries have a specific legal framework, which is crucial for attracting private participation.
- Argentina, Brazil and Peru guarantee the purchase of unconventional renewable energy through PPAs, for a period of 15 to 20 years.

Public-private partnerships (PPP)

- The projects deriving from the unconventional renewable energy incentive programmes, including small hydroelectric plants, can be considered PPPs because the risks —and in some cases the costs— are shared by the public sector (through PPAs and sometimes the availability of credit) and the private sector (through project investment and operation).
- PPPs can be implemented for various purposes: technology research and development, large-scale projects, the creation of firms and the promotion of small producers.
- The risks involved in a PPP are mainly related to a country's macroeconomic stability and the general and specific legal frameworks for this type of relationship. An important factor in the negotiations for a PPP is the degree to which risks are transferred from the public sector to the private sector and at what price.
- The investment climate and financial facilities in the region are undoubtedly favourable for the creation of PPPs.

Investment

- The existing programmes for promoting unconventional renewable energy in the region have attracted a total combined investment of around US$9.00 trillion for these technologies to date. Approximately US$3.84 trillion has already been invested, while the remainder is tied to contracts that have yet to start construction of the infrastructure and its subsequent operation.
- Two aspects are crucial for attracting private investment, whether local or international: (i) access to financing for the project and the associated infrastructure; and (ii) the commitment and credibility of public agencies through a specific, transparent and consistent legal framework

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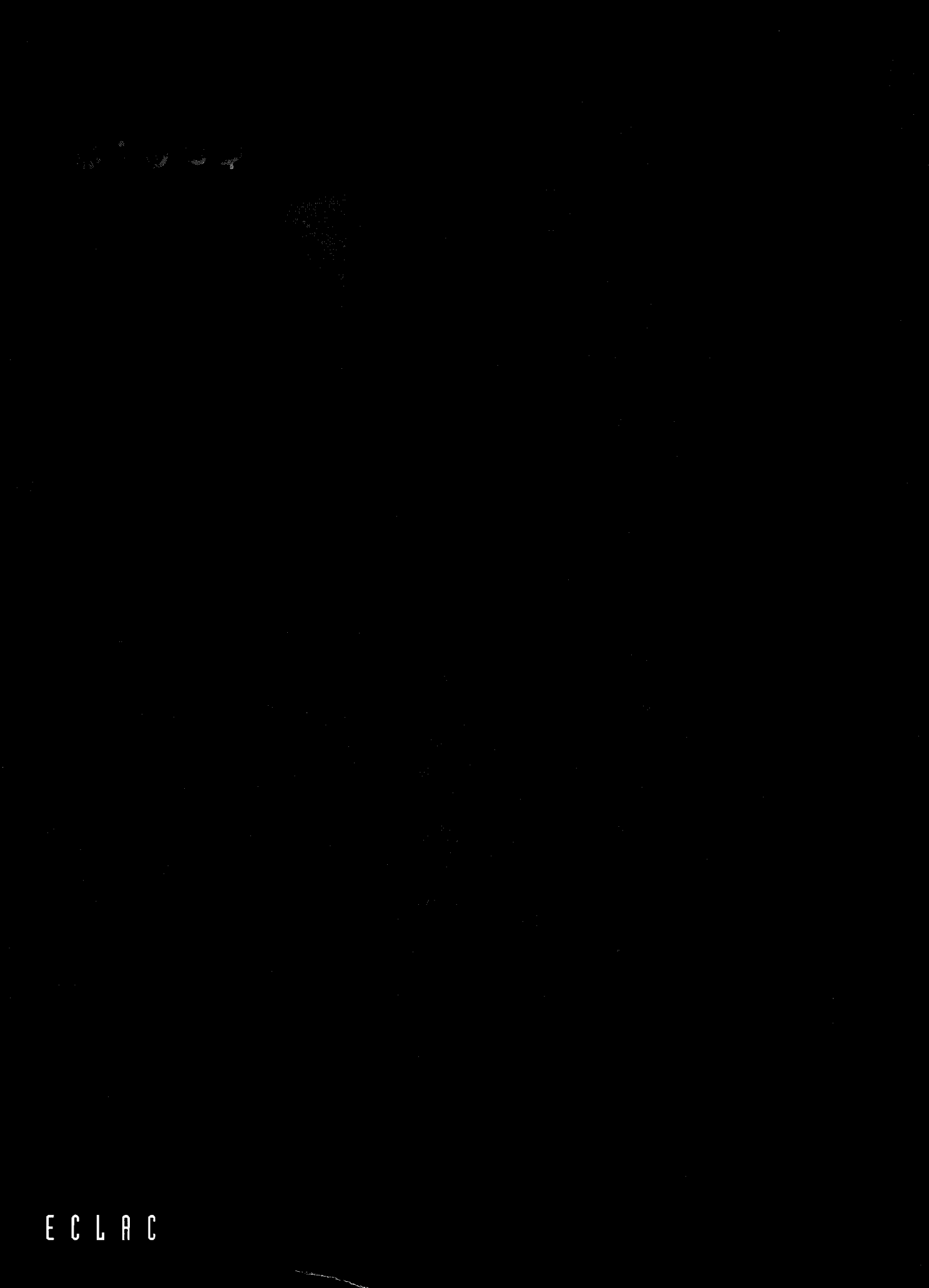

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