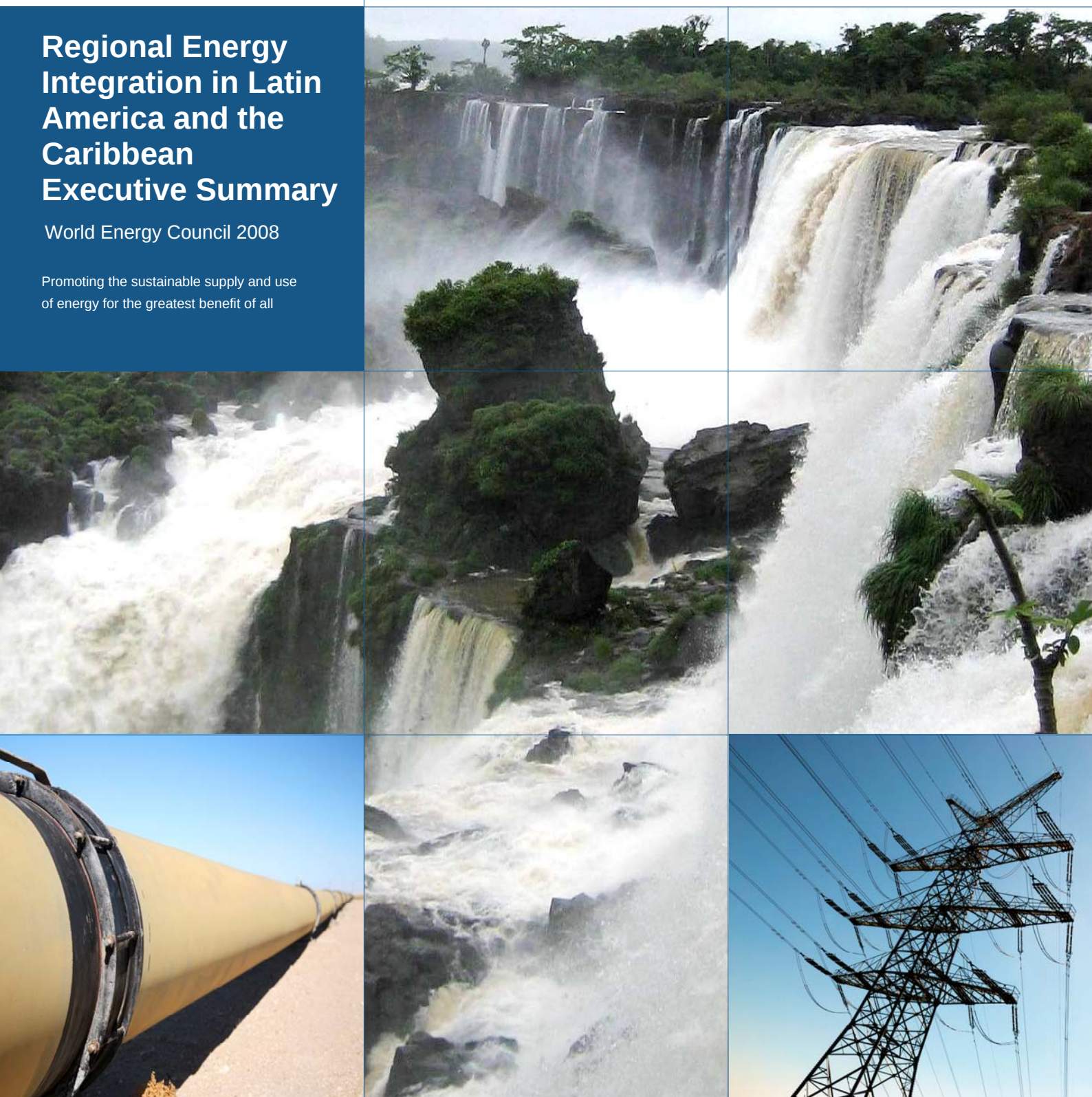


Regional Energy Integration in Latin America and the Caribbean Executive Summary

World Energy Council 2008

Promoting the sustainable supply and use
of energy for the greatest benefit of all



Regional Energy Integration in Latin America and the Caribbean

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Energy crises that have significantly dented economic growth in several Latin American countries could have been relieved if there had been adequate capacity and cooperation in the regional energy system.

Introduction

The current economic dynamism of Latin America and the Caribbean is poised to continue but it is undermined by a lack of infrastructure, and an energy sector framework. Favourable international prices for commodities have boosted exports of farm produce and raw materials from the region, but insufficient infrastructure to move the growing volume of goods and services is a growing problem.

The fast economic growth of China and India, disputes in the Middle East, and the urgent need to minimise greenhouse gas emissions have transformed the international energy market. This has opened a large window of opportunity for Latin America and the Caribbean to use their abundant energy resources as an effective link to the global economy.

Energy crises, past and present, have significantly dented economic growth in several Latin American countries. These crises could have been relieved if there had been adequate capacity in the regional energy system. The Brazilian energy crisis in 2001 could have been mitigated if there had been enough transmission capacity to bring the energy from Argentina into Brazil. Likewise, the current critical state of the energy system in Argentina could be significantly improved if Argentine consumers could have access to the energy available in Brazil.

What is energy security in the regional context? Energy imports and exports between neighbouring countries must not be regarded as energy security

or increasing supply vulnerability. Market integration opens a new, much broader outlook to interpreting supply security, vulnerabilities, and the economic and political aspects of resource management.

Aware of the potential and the pitfalls with developing an integrated regional energy system, the WEC Latin American Member Committees have conducted a regional study entitled "Energy Integration in Latin America and the Caribbean." Having identified that the weak link between existing national energy infrastructures remains a major stumbling block to strengthening regional economic integration, this study aims to propose alternative views - primarily on the integration of electricity and natural gas markets.

Integrating regional energy systems will lower energy prices and increase system reliability.

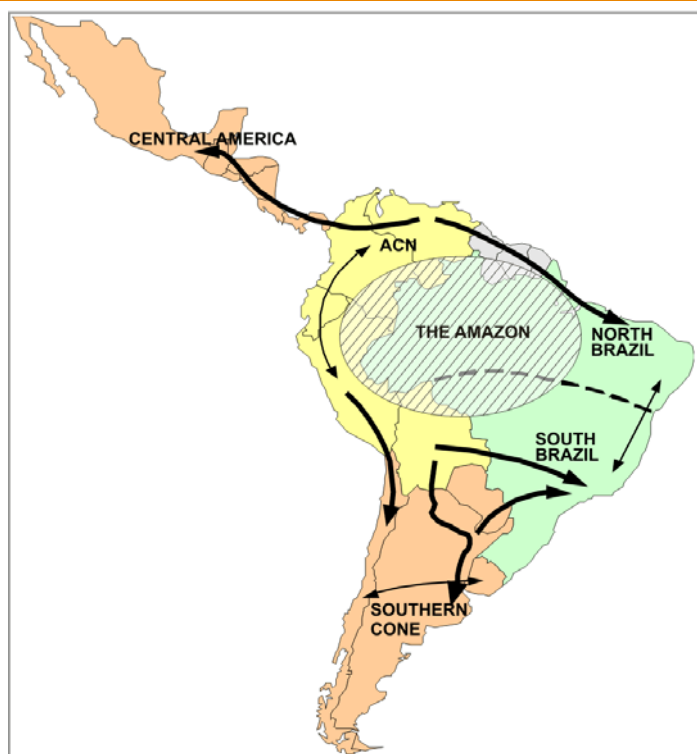
With energy systems integrated across the national economies of all countries in the region, productivity and competitiveness would be increased, and this would further encourage economic growth.

Energy integration would provide a strong pillar of support for deeper integration of Latin America into the global economy.

Integrating the energy systems of Latin America with those of the Caribbean has exceptional

Figure 1
Integration Scenarios

Source: WEC

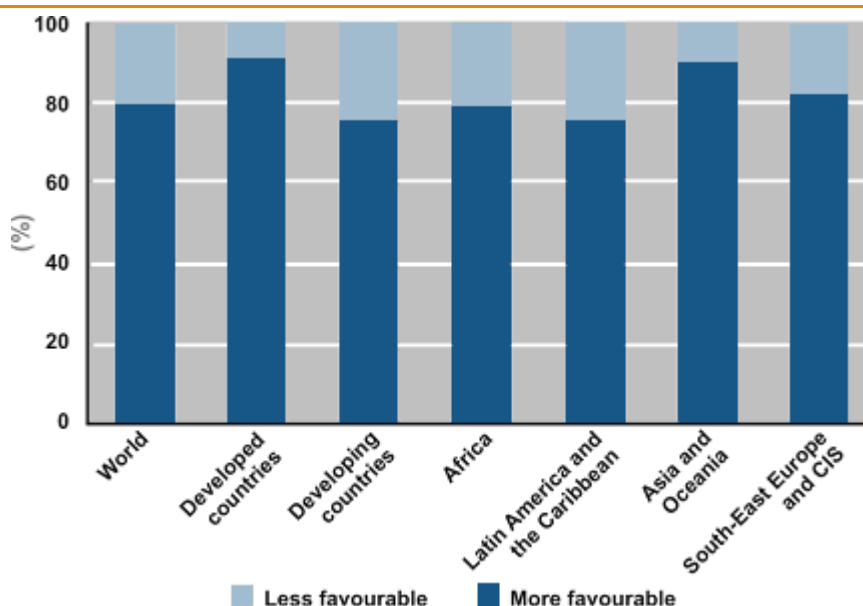


potential for building up a low-cost energy system with a high degree of security for the region's energy supply. The bi-national hydropower plants in the River Plate basin of Brazil form a natural complex to irradiate electricity flows between countries. Gas production in the region can supply a natural gas network extending from the Southern Cone of Argentina north to Central America and further north to Mexico.

Finally, this report, which examines 40 major studies, identifies the challenges and the opportunities for joint developing of energy resources in the region, and highlights projects and processes that offer the most efficient way forward, (see Annex 1). It also pinpoints the regulatory and institutional barriers, which have been drawbacks to regional energy integration and must be addressed.

Graph 1
2005 regulatory changes by nature and region

Source: UNCTAD



Energy integration and the regional economy: what's at stake

Integration of national energy systems in the region would lead to economies of scale, reducing costs and increasing the reliability of supply.

Developing natural gas supply systems in an integrated manner with electricity systems in the region would minimise the use of liquid fuels and thus increase exportable oil surpluses.

Abundant energy resources

The region has abundant energy resources, accounting for 11% of world reserves of oil and 5% of natural gas. Brazil has great potential to develop oil and gas reserves recently discovered off its southeast coast. There are further large not quantified gas reserves concentrated in the sub-regional bloc of the Andean Community of Nations¹, especially in Peru, Bolivia and Venezuela.

Only a small part of the estimated 659.5 gigawatts of the region's hydropower potential is used, leaving significant possibilities for building new hydropower plants.

Nearly all Latin American countries have a power surplus relative to maximum demand, surpluses that could be used in the integration process as electricity interconnections expand.

The main scenarios for future energy integration in Latin America follow one of the three regional configurations, (see Figure 1): Central America/Andean countries, Andean countries/Southern Cone/south Brazil, and Andean countries/north Brazil. In the long term, the Amazon will be interconnected with these three subsystems.

Obstacles to integration

The Latin American and Caribbean economies seem to be less amenable to regulatory change than the world average or other developing blocs, including Asia, Africa, Oceania, southeast Europe and the former Soviet Republics (see United Nations Conference on Trade and Development 2005, Graph 1). This gets to the heart of any ambitious geopolitical project for the integration of South American energy infrastructure.

¹ ACN comprises Peru, Bolivia, Colombia and Ecuador.

Figure 2
Energy sub-regions and inter-regional integration zones

Source: WEC



Energy integration today

How energy integration contributes to the regional economy

As originally conceived by the Initiative for Integration of the South American Regional Infrastructure (IIRSA) nine years ago, IIRSA is a 12-nation, highly politically-motivated project involving governments, the private sector and international financial institutions. This project of regional energy integration is also aimed at transforming competitiveness, environmental protection, institutions, and the quality of life in South America.

Integration also has other important objectives for development of the energy industry: fostering regional harmony, increasing the security of energy supply, reducing the cost of investments, and developing countries in a peaceful and equitable way.

Fulfilling these objectives requires the design of energy integration projects with a focus on the cost efficiency, which takes into consideration political and regulatory risks, as well as the possibility of an amicable disputes resolution for all the countries involved.

Risks to regional integration

Currently, there are around 40 projects to integrate energy markets in Latin America. While some projects have sound objectives, such as increasing security of supply, the major drawbacks to getting these projects off the ground are economic, political, and regulatory risks.

These barriers are particularly evident at the sub-regional level, but become more pronounced with schemes aimed at wider integration. In some cases, where there is a regional project such as the Union of South American Nations (Unasur), an intergovernmental union to integrate customs regulations between the

Mercosur² and Andean Community blocs, economics are heavily determined by the political context.

Domestic energy market protectionism is another obstacle standing in the way of further energy integration to achieve greater economies of scale and reduce costs, which would boost investment opportunities. Domestic protectionism must be eased to further the regional integration of energy markets.

Efficient policies are needed, notably in energy infrastructure to reduce economic disparities.

National regulatory and institutional systems must also strive for greater compatibility to smooth integration of energy markets.

Stumbling blocks to sub-regional integration

To date, most of the energy cooperation projects, implemented or still on the drawing board, are bilateral or trilateral in scope. However, there are early signs of multi-country cooperation at a sub-regional level, which could pave the way for projects with a much wider geographic sweep, although considerable obstacles remain.

Where integration stands by sub-region

Of all the sub-regions in the Latin America-Caribbean sphere, the Central American region

has exhibited perhaps the firmest commitment to integration. However, an absence of critical mass of energy demand and a lack of technical and management competence has delayed a number of natural gas projects.

The Caribbean islands of Trinidad and Tobago are in the vanguard of developing and marketing their vast natural gas resources as liquefied natural gas. These two islands are promoting development of a 500-mile sub-sea pipeline northward to the Caribbean islands of Martinique and Guadeloupe, with the possibility of an extension to Miami.

The bloc, which comprises Bolivia, Colombia, Ecuador, and Peru, shares common features in the energy system structure, making the integration of markets sub-regionally a distinct possibility provided the need to reduce social and ethnic disparities, develop Amazonian resources sustainably, and adequately manage the flow of resources through the Andes mountains is addressed.

Bilateral hydropower projects, interconnection of electricity networks, and trunk gas pipelines to Argentina and Brazil offer opportunities to develop integration processes. However, integration of these markets is currently restricted.

While the Amazon region has almost no energy transport infrastructure, integration projects are either planned or under construction to link north Brazil with the Brazilian Amazon in the east.

² Regional trading bloc of Brazil, Argentina, Paraguay and Uruguay.

Table 1
Main Central American Projects

Source: WEC

Project	Comments
Electricity	
SIEPAC project	Electricity interconnection of the countries in the South American Isthmus (from Guatemala to Panama) for implementing the Regional Electricity Market through a 203 kV line 1830 km long.
Guatemala-Mexico Interconnection	Building a 400 kV transmission line 103 km long with extension of substations.
Panama-Colombia Interconnection	Building a transmission line in HVDC over 500-600 km to join Cerromatoso in Colombia with Panama II,
Natural Gas	
Introducing natural gas	Building a gas pipeline approximately 2,300 km long from Ciudad PEMEX (Mexico) to Panama.

These projects will reinforce the connections of energy markets in the south with the Amazon in the far east. Once connections are made, myriad prospects will exist for the integration of energy markets of the Brazilian Amazon with markets in the Bolivian and Peruvian Amazon.

Where regional integration stands

The Initiative for Integration of the South American Regional Infrastructure (IIRSA) is a highly political project in 12 countries, under Venezuelan direction aimed at integrating and modernizing the physical infrastructure of South America.

The South Gas Pipeline Network comprising Argentina, Bolivia, Brazil, Chile, Paraguay, Peru, and Uruguay involves preparing the regulatory framework for international gas transactions, and extending the network to link production centers with consumer centers in eastern South America.

A tale of two integration projects

Regional electricity market of Central America

The Electricity System of the Central American Countries (SIEPAC) was designed from the start to create a regional electricity market. The project, which is expected to start operations in 2008, is phased so construction of the network follows the setup of a commercial and regulatory structure, and all participating countries move towards harmonizing national regulations. The project involves building the first regional transmission line in Central America. It also opens up prospects for energy integration in the mid-term with Mexico to the north and with Colombia and Andean countries in the south.

A regional electricity market will increase investor security and reduce electricity prices.

MER will become more efficient when transactions increase after Mexico and Colombia are connected, extending the benefits of a regional market.

But first a number of issues must be resolved, including coordinating policies to prevent disparities that distort prices and payments, strengthening regional organizations that will administer MER, and ultimately creating a single regulatory system rather than relying on standardization of national regulations.

Multilateral Energy Security Reservoirs

Although Latin America and the Caribbean have surplus energy, the WEC study found that all energy markets in the region face the risk of energy supply shortages. Two recent examples attest to this: over the past decade, electricity consumption in Brazil, which is heavily reliant on hydropower, has at times been restricted due to a power crisis stemming from water shortages. Brazil, Chile, and Uruguay are currently suffering from an energy crisis due to gas supply problems in Argentina. What is more, since rainfall throughout the region varies considerably, electricity supply in years of severe drought would be insufficient to meet energy demand.

Risks could be minimised through a multilateral agreement for a joint use of natural gas and hydropower reservoirs. Such an agreement would constitute another important project for regional integration.

A reservoir system would move beyond the interrelation of national systems, which do not generate adequate energy flows to ensure transmission lines and gas pipelines are economically viable for integrating national energy markets.

Encourage energy trade

Regular trade of electricity and natural gas between countries in the region is fundamental to regional integration. There are many opportunities to intensify trade in the region, thanks to untapped and substantial hydro and natural gas reserves.

Figure 3
Southern Gas Pipeline Network

Source: WEC



Conclusions and recommendations

Advancing multilateralism

Latin America and the Caribbean have abundant energy resources, which gives the region a strategic geopolitical advantage. The ongoing integration of Latin American energy markets will continue to reinforce energy security in the region.

The benefits of multilateral projects in Latin America and the Caribbean have not been properly explored.

Regional energy markets will be integrated mainly by interconnecting power systems and natural gas networks to create economies of scale, reduce costs, and increase the reliability of national energy systems.

The following is a list of the best projects WEC has identified that are aimed at energy integration and were chosen because of their economic feasibility

and because they would foster deeper regional integration.

The South Gas Pipeline Network

The South Gas Pipeline Network covers seven countries and due to its vast geographic sweep could substantially reduce the political risk of energy integration in Latin America, (see Figure 3).

Opportunities for Central America

To reduce the dependence on oil imports, countries would benefit from a joint strategy to increase natural gas consumption and to create a regional electricity market. For more than 20 years, these countries have been working towards a regional electricity market with little progress, although a transmission line is scheduled to start operation this year.

Due to lack of demand for natural gas in Central America, the project to build a gas pipeline connecting Mexico, Central America, and Colombia will be economically sound only if matched by a strategy to develop the regional electricity sector

and secure additional demand from southern Mexico.

Opportunities for Andean countries

Countries in the Andes region must develop interconnections beyond the current system, which only has enough capacity to deal with temporary supply disruptions. To develop natural gas resource production further, gas transport infrastructure should be developed to export gas to other countries. Opportunities for integration are allied with developing the natural gas industry and supplying countries in eastern South America and Central America.

While integration of the electricity sector is further advanced than for gas, regulatory differences are to some degree restricting cross-border flows. Therefore, multilateral agreements would be more useful at providing economies of scale than bilateral ones.

Opportunities for the Southern Cone³

While a functioning system is in place integrating the electricity systems to balance shortfalls, further development of specific rules is required to optimise trading and the use of interconnections to get full benefit from the complementary structure of national electricity systems.

Multilateral Regional Security Reservoirs (MRSR)

Establishing the MRSR could be the most efficient option for increasing security of supply among Argentina, Brazil, Paraguay and Uruguay. Less investment would be needed to balance short-term supply and demand; less oil would be consumed; energy prices would be less volatile; and the environmental performance of the energy system would be improved.

The WEC study concludes that the MRSR would be feasible through a multilateral agreement among the four countries. Major reserves would be shared via existing interconnections or through those under construction. Each country would commit to share a portion of its reserves at agreed prices and conditions. The price for use of reserves would be in line with the long-term marginal cost.

A member country would access the reserve when faced with a shortage of electricity or when prices are too volatile.

To ensure regional supply security, investments are needed to build up energy reservoirs in the region.

³ Southern Cone includes Chile, Argentina, Uruguay, southern Brazil and parts of Paraguay.

The study recommends the following:

The study clearly demonstrates that Latin America and the Caribbean possess abundant energy resources that can be developed at a low opportunity cost. The region has everything to gain from putting in place low-cost interconnection projects with a high level of security.

- ▶ Promote new energy integration projects as a way to increase direct investment and introduce workable financing models.
- ▶ Attract private sector interest to energy integration projects.

Projects to consider:

- ▶ Study the comparative advantage of the region's abundant energy resources at a perceived low opportunity cost and quantify and qualify the competitive edge of developing these resources.
- ▶ Expand the use of existing natural gas resources.
- ▶ Expand the use of water resources.
- ▶ Reduce consumption of fossil fuels and export the surpluses.
- ▶ Lower regulatory and institutional barriers to make legal systems compatible and to expand regional energy trade.
- ▶ Adopt tax, legal, and trade structures to reduce risks for energy investors, operators and traders.
- ▶ Raise public awareness of the important role energy integration plays in improving quality of life.
- ▶ Study the concept of Multilateral Regional Security Reservoirs to enhance energy security and to establish joint management of natural gas and hydropower resources.

Annex 1

Forty Studies on Latin American Energy Integration

Title	Contents	Area - Date
Study of electric power transactions between the Andean, Central American and MERCOSUR markets Feasibility of their integration – Project CIER 15	In order to analyse the commercial, operational, regulatory and technical aspects for feasibility of electric power transactions between the Central American (MER), Andean Community and MERCOSUR markets.	MERCOSUR, ACN, CENTRAL AMERICA Electricity in progress
Study to define a strategy to introduce natural gas into Central America	In order to analyse the feasibility of introducing natural gas into Central America, including the market study for natural gas supply and demand, infrastructure requirements, and environmental, institutional and regulatory aspects.	CENTRAL AMERICA Natural gas in progress
Regulation of transmission and interconnecting transportation	Presents the most important elements of the national and international power transport business in the ten South American countries members of CIER, with emphasis on the impact on profitability and incentives to expand the systems.	MERCOSUR, ACN Electricity November 2006
Feasibility study for implementing the Southern Gas Pipeline Grid	Analyses the technical-economic feasibility of the infrastructure comprising the Southern Gas Pipeline Grid, basically gas pipelines Humay-Tocopilla (Peru-Chile), Northeast Argentina (Bolivia-Argentina) and Uruguayana-Porto Alegre (Argentina-Uruguay-Brazil)	MERCOSUR Natural Gas November 2006

Title	Contents	Area - Date
Co-operation and energy integration in Latin America and the Caribbean	Analyses the energy co-operation agreements for supply of oil, gas and electricity and their compatibility from the viewpoint of regional integration. It examines the energy integration projects in the hemisphere and sub-regional sphere.	MERCOSUR, ACN, CENTRAL AMERICA & THE CARIBBEAN Energy in general April 2006
Diagnosis of the Energy Sector of Central America	Analyses the status of the energy sector in Central America, the effects of the oil price rise, measures taken and energy options.	CENTRAL AMERICA Energy in general February 2006
Legal and institutional proposal for the Southern Gas Pipeline Grid	IDB financed the consulting studies that permitted the preliminary agreement between the government delegations of the energy sector of Argentina, Brazil, Chile, Paraguay, Peru and Uruguay, on the principles applicable to the legal and institutional framework for implementing infrastructure for the gas interconnection between the countries involved.	MERCOSUR Natural gas November 2005
Central America: Diagnosis of the Oil Industry	Analyses of supply and demand, institutions, structure and price formation of the oil industry of the six Central American countries. It proposes bases for drafting policies and projects to enhance the management of the energy sector at national and regional levels.	CENTRAL AMERICA Hydrocarbons October 2005
Remuneration of manager and design of wholesale markets in South American and Spain. Part of the CIER 08 project.	It addresses a compared list of the different designs of the wholesale markets and economic incentives for generation for increasing the capacity in each national model.	MERCOSUR, ACN Electricity September 2005
Brazil-Argentina Energy Integration	The project analyses the integration process of the energy sector in the Southern Cone countries, looking for alternatives in the regulatory and institutional fields that permit increasing the energy flow between the countries. The main proposal is to consolidate an energy centre that combines the electricity and natural gas transactions between the Southern Cone countries.	MERCOSUR Electricity & Natural Gas May 2005

Title	Contents	Area – Date
Assessment of infrastructure projects for regional integration	Assessment of infrastructure projects for regional integration in relation to the IIRSA initiative, from the viewpoint of its eligibility and financing.	MERCOSUR, ACN General infrastructure April 2003
Energy status in Latin America	Analysis of the structure of the electricity and gas markets, regional energy flows and sector regulation for Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela.	MERCOSUR, ACN Electricity & Natural Gas March 2003
Methodology for implementing the Kyoto flexible mechanisms – Clean development mechanisms (CDM)	The purpose is to contribute to CDM implementation and development between Latin American and European countries. It analyses economic and technical aspects, identifying new risks and challenges for the energy companies in the new international carbon market.	MERCOSUR, ACN Electricity 2003
Financial structures for trans-national infrastructure projects in the IIRSA context.	Analysis of risks, asymmetries and alternatives for financing infrastructure projects for regional integration.	MERCOSUR, ACN General infrastructure December 2002
Regulatory Incentives for Investment and Efficient Electric Power Supply	It presents the transcendental aspects of regulation that encourages the increase in capacity of the systems.	MERCOSUR, ACN Electricity October 2002
Basic conditions for developing an integrated regional energy market	Study on the compatible and harmonious aspects of regulatory and institutional aspects. It refers to contents, new institutions and procedures of agreements required for integration.	MERCOSUR, ACN Energy in general June 2002
Natural gas supply study from Venezuela and Colombia to Costa Rica and Panama	Analysis of supply conditions, necessary infrastructure, gas price and rates for introducing natural gas from South America to Panama and Costa Rica.	CENTRAL AMERICA Natural Gas June 2002
Energy integration in the Andean Pact	Analysis of the national power and natural gas markets of Bolivia, Colombia, Ecuador, Peru and Venezuela, assessing the supply-demand status and regional exchanges, and proposes further integration.	ACN Natural Gas & Electricity June 2001

Title	Contents	Area – Date
Principles for developing a regional energy market	Recommends drafting principles and common rules to facilitate free trade of energy sources, so that the transactions generate resources to pay for the infrastructure required to integrate the markets.	MERCOSUR, ACN Energy in general April 2002
Study on Clean Development Mechanism (CDM) projects in South America	It identifies 47 feasible CDM projects: projects for renewable energy, hydro and non-hydro electric power and power transmissions.	MERCOSUR, ACN Electricity 2002
Study on evolution of the integration process in the LAIA sphere, in its bilateral, sub-regional, regional dimensions, and proposals for reinforcing the role of the Association in the next ten years.	It emphasises the importance of enhancing the regional regulatory framework and the fact that the countries have extended their focus of the regional integration process to beyond the commercial sphere. It recommends considering the priorities set by the countries.	MERCOSUR, ACN General integration December 2001
Institutional and regulatory profile of the South American power sector – Part of the CIER 08 project	Contains a complete survey of the regulatory framework of the power sector in South American countries and Spain.	MERCOSUR, ACN Electricity August 2001
Design of an organisation for co-ordinating the future Regional Electricity Markets in South America – project CIER 07.	It analyses the European experience in integration of energy markets and identifies those institutional, regulatory and organisational elements useful for South America.	MERCOSUR, ACN Electricity August 2001
Regional interconnections for the electricity markets of South America – proposals for increasing the electrical exchanges – Stages I and II – Project CIER 03.	It develops a full group of proposals to promote the increase in electric power trade between the ten South American countries that are members of the CIER, and to reduce the institutional, regulatory and technical restrictions curbing the development of efficient interconnections.	MERCOSUR, ACN Electricity July 2001
Natural gas markets in the Andean Community: development and integration prospects.	It summarises various papers on the natural gas markets in Bolivia, Colombia, Ecuador, Peru and Venezuela. It assesses projects of regional interconnection and the gas trade prospects for 2020.	ACN Natural Gas July 2001

Title	Contents	Area – Date
Inclusion of natural gas in the power interconnection in Central America	It assesses the possibilities of introducing natural gas in relation to the SIEPAC power interconnection project.	CENTRAL AMERICA Natural Gas & Electricity June 2001
Study for integration of the natural gas market in South America	Analysis of the natural gas markets in South American countries, with forecasts of supply and demand for three scenarios: high production in Argentina, exports from Camisea, and low demand.	MERCOSUR, ACN Natural Gas January 2001
Energy integration in extended MERCOSUR	It specifically addresses the electricity markets and drafts proposals for eliminating the regulatory barriers and attracting investments in interconnection projects.	MERCOSUR Electricity 2001
General design of the Regional Electricity Market (MER)	It draws a conceptual and structural design of the Regional Electricity Market for Central American countries, stressing the role of the institutions and requirements for compliance with the regulatory conditions and national systems.	CENTRAL AMERICA Electricity April 2000
The natural gas industry and its regulations in Latin America	Systematisation of the regulatory frameworks of Argentina, Bolivia, Chile, Colombia and Mexico. It stresses the importance of gas in regional energy integration.	MERCOSUR, ACN Natural Gas August 1999
Options for a future natural gas industry in Central America	Taking into account the specific aspects of the region and international experiences, prepares probable scenarios for the structure and operation of the natural gas industry in Central America. It presents proposals for the regulatory framework and structure of the industry.	CENTRAL AMERICA Natural Gas July 1999
Wholesale Markets and Interconnections – Stages I and II – Project CIER 02.	Analysis of the opportunities and obstacles for integrating the power markets of the ten South American countries that are members of the Regional Electricity Integration Committee (CIER).	MERCOSUR, ACN Electricity 1998-1999

Title	Contents	Area – Date
Pre-feasibility study of the Mexico-Central America regional gas pipeline	Pre-feasibility study on the economic, environmental, financial, institutional and technical aspects of the Mexico-Central America regional gas pipeline.	CENTRAL AMERICA Natural Gas January 1998
Study of hydrological complementary aspects in South American countries – Project CIER 01	Study of the impact of extreme hydrometeorological conditions on the reliability of energy supply and development of a hydroenergy information network in the South American region.	MERCOSUR, ACN Electricity 1995

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