

Natural resources

Status and trends towards
a regional development
agenda in Latin America
and the Caribbean



UNITED NATIONS

ECLAC

Contribution of the Economic Commission
for Latin America and the Caribbean
to the Community of Latin American
and Caribbean States

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CONTENTS

Introduction.....	7
A. Natural resources governance and long-term structural change in Latin American economies.....	10
B. Responses of the mining, oil and gas sector to the 2000-2012 price cycle.....	12
 Chapter I	
The mining sector in the CELAC countries: recent trends and developments	15
A. The 2003-2012 mining boom in CELAC countries: surge in prices and exports	15
B. Trends in production, reserves and investment in the period 1990-2012	18
1. Trends in mineral production and reserves in the region	20
2. Mining investment trends in the region	23
C. Evolution of the economic rent of the mining sector, State share and fiscal issues	24
1. State share of rent from the mining sector between 2000 and 2012	25
2. Normative lessons from these findings	29
Bibliography	31
 Chapter II	
Oil and natural gas sector: recent trends and developments in CELAC countries	33
A. Introduction	33
B. Reserves, production, consumption and trend indicators	34
1. Latin America and the Caribbean in the global context	34
2. Reserves	37
3. Production and consumption	44
C. Trade in oil and natural gas.....	46
D. Investment	50
E. Contractual framework, economic rent and fiscal revenue	54
F. State take in hydrocarbon economic rent during the latest price cycle	55
G. Summary	57
Bibliography	58
 Chapter III	
Public policies for development of the hydroelectric power and water and sanitation services sectors in the CELAC countries	63
A. Introduction.....	63

B.	The sustainable development of hydroelectricity	66
1.	The current situation of hydroelectric generation in the CELAC countries	66
2.	The sustainability of hydroelectric power	71
C.	Current situation of water and sanitation services	73
1.	Efficient, equitable and sustainable delivery of services	75
2.	Reform experiences in the sector	79
D.	Public policy proposals	84
1.	Hydroelectric power	84
2.	Water and sanitation sector	88
	Bibliography	91
	Annex	95
Tables		
Table 1	Latin America and the Caribbean (10 countries): characteristics of tax regimes applied to products derived from non-renewable resources	8
Table I.1	Latin America and the Caribbean (15 countries) and selected other major mineral exporters: mining GDP and exports, 2000-2003, 2004-2009 and 2010-2012	19
Table I.2	Latin America and the Caribbean: share of mining production in the world total, 1990-2012	20
Table I.3	Latin America and the Caribbean (15 countries) and selected other major mineral exporters: economic rent of the mining sector as a percentage of GDP and fiscal revenues contributed by the sector as a percentage of GDP, of total fiscal revenues and of mining rent	26
Table II.1	Latin America and the Caribbean (selected countries) compared with world regions: reserves replacement times and development costs	41
Table II.2	World and Latin America and the Caribbean: evolution of oil and natural gas abundance, 1995-2012	43
Table II.3	Latin America and the Caribbean: production-to-consumption ratio of oil and natural gas, 1995-2012	47
Table II.4	Latin America and the Caribbean (selected countries): oil and natural gas sector indicators and fiscal contribution, 2000-2012	56
Table III.1	Community of Latin American and Caribbean States (CELAC): share of fossil fuels and hydropower in the total primary energy supply, 1970-2012	66
Table III.2	Community of Latin American and Caribbean States (CELAC): installed capacity for electricity generation, 2011	67
Table III.3	Community of Latin American and Caribbean States (CELAC): hydroelectric energy potential and installed capacity, 2011	69
Table A.1	Latin America (selected countries): future investment plans in the hydrocarbons sector, to 2017	97
Table A.2	Latin America and the Caribbean (selected countries): fiscal systems for hydrocarbon exploration and exploitation activities, 2012	99
Figures		
Figure 1	Index of international commodity prices, January 2000 to May 2013	7
Figure I.1	Evolution of the international prices of copper, lead and zinc, 1960-2012	15
Figure I.2	Latin America and the Caribbean and the world: share of mineral exports in total exports, 1962-2011	16
Figure I.3	Latin America and the Caribbean: evolution of exports of primary minerals and mineral manufactures, 1990-2011	17
Figure I.4	Latin America and the Caribbean and major mineral exporters: ratio of mineral exports in the primary stage to mineral exports in the manufacturing stage, 1990-2011	18
Figure I.5	Distribution of world mineral exploration budget, by region or country of destination, 2003, 2010 and 2012	21
Figure I.6	Latin America and the Caribbean: major recipient countries for mineral exploration investment, 2010 and 2012	22
Figure I.7	Latin America and the Caribbean: main mineral reserves, 2000, 2010 and 2012	23
Figure I.8	Distribution of mining investments among the top 10 recipient countries, 2000, 2010 and 2013	24
Figure I.9	Latin America (8 countries): share of royalties in total fiscal revenues from mining (taxes and royalties), 2000-2003 to 2010-2012	29

Figure II.1	Latin America and the Caribbean: share in oil and natural gas sectors, 2000 and 2012	34
Figure II.2	Latin America and the Caribbean: rate of change in hydrocarbon reserves, production and consumption in the context of economic growth and the evolution of prices, 2001-2012	35
Figure II.3	Latin America and the Caribbean and the world: evolution of prices, costs and activities in the oil and natural gas sectors, 2000-2012	36
Figure II.4	Latin America and the Caribbean (selected countries): oil and natural gas reserves, 1995-2012	38
Figure II.5	Latin America and the Caribbean (selected countries): evolution of oil and natural gas abundance, 1995-2012	43
Figure II.6	Latin America and the Caribbean (selected countries): production and consumption of oil and natural gas, 1995-2012	44
Figure II.7	Latin America and the Caribbean: oil and natural gas trade balances, 2000 and 2012	48
Figure II.8	Latin America and the Caribbean: investment in oil and natural gas exploration and development, 2005-2012	51
Figure II.9	Latin America and the Caribbean (selected countries): foreign direct investment (FDI) in hydrocarbons, 1996-2012	52
Figure III.1	Community of Latin American and Caribbean States (CELAC): share of hydrocarbons and hydropower in the total primary energy supply, 1970-2012	67
Figure III.2	Community of Latin American and Caribbean States (CELAC): installed capacity for electricity generation, 2011	68
Figure III.3	Community of Latin American and Caribbean States (CELAC) and the world: electricity generation by source	68
Figure A.1	Latin America and the Caribbean and the world: reserves, production and consumption of oil and natural gas, by five-year periods, 1991-1995 to 1996-2010	95
Figure A.2	Latin America (selected countries): drilling activities and oil prices, by crude oil type, 2000-2010	95
Figure A.3	Latin America and the Caribbean and the world: proportion of hydrocarbons in the primary energy consumption matrix, by five-year periods, 1991-1995 to 2006-2010	96
Figure A.4	Latin America and the Caribbean (selected countries): ratio between production and consumption of natural gas and oil, 1995-2012	96
Figure A.5	Latin America and the Caribbean (selected countries): balance of trade in natural gas with the region and with the world, 2005, 2011 and 2012	97
Boxes		
Box II.1	Brazilian pre-salt	39
Box III.1	Adaptation to climate change: the central role of water	65
Box III.2	Major hydropower projects in the CELAC countries	70
Box III.3	Social and environmental conflicts related to the development of hydroelectric infrastructure	73
Box III.4	The human right to water and sanitation	76
Box III.5	Regulation in the public provider model for water and sanitation services	82

INTRODUCTION

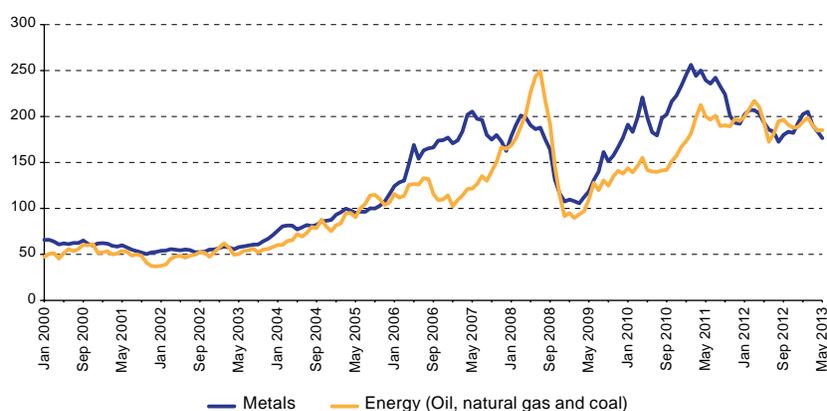
The boom in international prices for metals, oil and other commodities was caused by the rising global demand for these items on the back of the extraordinary growth seen in China's economy and in other emerging economies over the past decade, among other factors. Demand for iron, copper and aluminum, as well as other export minerals, is linked to construction, infrastructure and manufacturing growth (which require inputs such as steel, electrical conductors and industrial metals). These sectors expanded rapidly as emerging economies embarked on a path of accelerated economic development during the last decade. Robust growth in these economies has also fueled global demand for crude oil and other commodities.

From 2003 on, the value of commodity exports in CELAC countries, and in Latin America and the Caribbean in general, rose to unprecedented levels as global prices for metals, crude oil and other commodities climbed to historic highs in 2007 and 2008. The boom in global demand for commodities (minerals, hydrocarbons, soy and other farm commodities) was key to the improvement in the macroeconomic performance and fiscal position of the region's exporting countries from 2003 onwards.

After July and August 2008, when the global financial crisis caused commodity prices to plummet, several commodity-exporting countries in CELAC were able to increase public spending as a stimulus measure, using fiscal savings accumulated during the pre-2008 price boom. In so doing, they demonstrated the benefits of being able to deploy countercyclical fiscal policies, effectively mitigating the impact of the 2008 and 2009 financial crisis on their economies.

Following the 2009 crisis, commodity prices experienced a strong recovery between 2010 and 2012. However, the more recent slowdown in global economic activity, due to the European crisis, sluggish recovery in the United States and more tepid growth in China, has translated into a correction in price levels and a moderation of the upward trend that prevailed in the previous decade. As of mid-2013, however, the price levels of the commodities exported by the CELAC countries are still at record highs compared with their historic levels between 1980 and 2003. In real terms, metal and crude prices between 2010 and 2012 continued to be very positive, compared with the average price of the past 25 years (see figure 1).

Figure 1
INDEX OF INTERNATIONAL COMMODITY PRICES, JANUARY 2000 TO MAY 2013
(Index: January 2005 = 100)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), based on information from the International Monetary Fund (IMF).

From the viewpoint of the State, it is important to ensure public sector participation in the revenue of the extractive sectors¹ but without slowing the momentum of investment in these sectors. In countries with abundant non-renewable natural resources (gas, oil and minerals), the most direct method by which States have converted revenue from commodity exports into fiscal receipts has been by participating in the exploitation of these resources, either through State-owned enterprises or shareholding. In addition, governments have a number of fiscal instruments at their disposal, such as the traditional income tax with differential rates and the royalties charged to companies that extract these resources (see table 1).²

The magnitude and persistence of the latest cycle of high commodity prices has focused increasing political attention on the degree to which State participation in the revenue generated by the commodity export sectors is progressive. In this analysis, State participation is considered progressive when its share becomes proportionally greater during periods of price booms characterized by the generation of extraordinary rents.³

Table 1

LATIN AMERICA AND THE CARIBBEAN (10 COUNTRIES): CHARACTERISTICS OF TAX REGIMES APPLIED TO PRODUCTS DERIVED FROM NON-RENEWABLE RESOURCES

Country and product	Royalties (rates)	Income tax (general rate)	Other taxes on income (rates)	Other levies	Public sector participation
Argentina (oil and mining)	12% for oil; 0%-3% for mining	Corporate income tax: 35%		Export duties: variable and progressive rates based on the international price and the benchmark price for hydrocarbons, and 5%-10% for mining Taxes on liquid fuels, natural gas, gasoline, liquefied gas, naphthas and compressed natural gas Mining duty	YPF (hydrocarbons)
Bolivia (Plurinational State of) (hydrocarbons)	Departmental royalties: 11% National compensatory royalties: 1% National royalties (National Treasury): 6%	Corporate income tax (IUE): 25%	Tax on earnings, beneficiaries abroad: 12.5%	Direct tax on hydrocarbons (IDH): 32% Special tax on hydrocarbons and derivatives (IEHD)	YPFB (hydrocarbons)
Brazil (hydrocarbons)	10% of the value of production (may be reduced to as low as 5% depending on geological risk and other factors)	Tax on income is 15%, plus a surcharge of 10% if profits exceed 240,000 reais per year	Special revenue-sharing: 10%-40% Tax on earnings, beneficiaries abroad: 15% (or 25% for payments to tax havens)	Social levy on net earnings: 9% Contribution and intervention in the economic domain (CIDE): 10%	Petrobras (hydrocarbons)

¹ In most countries, the law provides that the State owns any mineral or fossil resource that is extracted from the subsoil.

² See Economic Commission for Latin America and the Caribbean (ECLAC), *Cambio estructural para la igualdad: Una visión integrada del desarrollo* (LC/G.2524(SES.34/3)), Santiago, Chile, 2012.

³ Extraordinary rents are understood here to mean those cumulative project earnings that clearly surpass the internal rate of return (IRR) normally required by the industry to make investments in exploitation projects in these sectors in international practice.

Table 1 (concluded)

Chile (mining)		Tax on first-tier income: 20%	Tax on income remittances of 35%, and 4% on interest remittances For State-owned enterprises: special tax of 40% on earnings	Specific tax on operating income from mining activity: progressive rates between 0.5% and 14% Tax to finance the budget of the Armed Forces (reserved law): 10% on foreign currency earnings from exports of CODELCO copper production	CODELCO (copper)
Colombia (oil and mining)	8%-25% (oil) 1%-12% (mining)	Corporate tax: 25% Tax on income for equity (CREE): 9% for the period 2013-2015 and then 8%		Oil pipeline transport tax National tax on gasoline and ACPM [diesel fuel] ^a Fees of the National Hydrocarbons Agency (ANH)	Ecopetrol (hydrocarbons)
Ecuador (oil)	12.5%-18.5% (of gross crude oil production)	Income tax: 23%	The State retains 25% of gross income from the contract area as a hedge against a decrease in the international price (sovereign margin)	Labour share: the State receives 12% of earnings (for the decentralized autonomous governments)	Petroecuador (hydrocarbons)
Mexico (oil and mining)		Tax on oil revenues (PEMEX): 30% Tax on income (certain subsidiary companies): 30%	Corporate flat tax (IETU) (certain subsidiary companies): 17.5%	Mining duties Hydrocarbons duties Special tax on production and services (IEPS) (on gasoline) Merchandise import duty	PEMEX (hydrocarbons)
Peru (oil and mining)	5%-25% for oil 1%-12% on operating income for mining	Income tax: 30% (mining)	Dividends and profit sharing: 4.1% (mining)	Special tax on mining (IEM): 2%- 8.4%, and special duty on mining (GEM): 4%-13.12% (on operating income)	
Trinidad and Tobago (oil)	10%-12.5%	Income tax: 35%- 50% of earnings from oil production based on location of deposits	Additional tax on sales of crude oil (rate varies according to the price of oil) Tax for the “green fund”: 0.1% of gross income	Unemployment tax: 5% of income from oil production	Petrotrin (hydrocarbons)
Venezuela (Bolivarian Republic of) (oil)	30% of the value extracted	Oil income tax: 50%		Contribution on extraordinary prices Extraction duty Export record tax	PDVSA (hydrocarbons)

Source: Economic Commission for Latin America and the Caribbean (ECLAC), based on official data from the countries.

^a The category ACPM (Spanish abbreviation that means combustible oil for motors, or diesel oil) refers to a set of products, specified by law, that can be used as automotive fuel.

A. NATURAL RESOURCES GOVERNANCE AND LONG-TERM STRUCTURAL CHANGE IN LATIN AMERICAN ECONOMIES

The governance of natural resources consists of a country's sovereign policies and set of institutions that regulate the ownership, rent appropriation and distribution of natural resources to maximize their contribution to sustainable development. Natural resources governance involves a broad array of public policy and management capacity challenges for CELAC countries, which include the strengthening and review of existing institutions, regulatory frameworks and instruments used to maximize the contribution of natural resources to regional development. The efficient public investment of resource revenues derived from taxing the exploitation of these resources is a foundational requisite for sustainable development. The use of fiscal revenues derived from the exploitation of natural resources, and their distribution among the various stakeholders and levels of government, requires the creation of mechanisms to ensure that these revenues are invested efficiently in projects with high social returns.

Based on the empirical literature that examines the relationship between natural resources and economic development in panels of countries at the international level, a definitive relationship cannot be established. Rather, the consensus seems to be that the contribution of natural resources to development is contingent upon the quality of institutions in the exporting country. The concept of institutional quality refers in this case to the capacity and strength of national institutions to manage the range of macroeconomic and fiscal challenges derived from the exploitation of natural resources (exchange rate appreciation, macrofiscal volatility, profiteering, etc.), including those related to efficient public investment of revenues.

There is a large body of economic literature on managing revenues derived from natural resources. Effective macroeconomic management should emphasize the importance of institutionalizing the use of savings mechanisms such as stabilization funds, investment funds,⁴ macrofiscal rules and reserves to mitigate the negative effects of exchange rate appreciation and create the fiscal space needed to deploy countercyclical policies during price slumps. Specifically, policies are needed to regulate strong inflows of foreign currency and short-term capital flows, in order to prevent negative effects on the exchange rate and the rest of the productive apparatus.

Regarding the exploitation of non-renewable natural resources, the economic literature points up the long-term imperative that countries face to convert this non-renewable natural capital into other forms of lasting capital (such as human capital, economic infrastructure and diversification of the productive and export base) that can sustain national income and the development process beyond the life cycle of these natural resources. Historically, the countries of Latin America and the Caribbean have found it difficult to transform natural resource export booms (in mining, hydrocarbons and agroindustry) into long-term economic development processes with stable growth that would dramatically reduce poverty and increase per capita income.

In order to meet this challenge, States must build the political consensus needed to effectively channel investments of these revenues into human capital, innovation, technological development, infrastructure and other long-term investments for diversifying the industrial and export base, while resisting political pressure to use up surplus revenues in the immediate term. Achieving these long-term public investment objectives is not easy. It means pushing through regulatory, fiscal and macroeconomic management reforms, as well as building capacity for strategic planning and the formulation and implementation of State policies that last beyond electoral terms.

⁴ Trinidad and Tobago is the only country in the region to establish a long-term savings fund that is directly financed by fiscal savings from the hydrocarbons sector, known as the Heritage and Stabilization Fund.

Developing the full potential of the natural resources sectors by maximizing their contribution to social welfare based on sustainability criteria also requires strengthening the public sector's capacity to manage the escalating social and environmental conflicts associated with the development of large projects. In recent years, the increasing number of conflicts of this kind in the region has pointed up the lack of effective mechanisms for expeditiously reconciling the opposing social demands and interests expressed through these conflicts.

Strengthening natural resources governance in the CELAC countries, and in the region in general, requires building political consensus in order to:

- Ensure a more progressive State share in the rents from the exploitation of natural resources, particularly during long-lasting price booms like the current one. To achieve this objective, it may be necessary to make adjustments to the tax system applied to these sectors, in order to introduce progressive fiscal instruments (i.e. windfall taxes).⁵ Closer coordination must also be established between the countries in the region that receive investment in these sectors, in order to prevent fiscal competition, which has the opposite effect of reducing the States' bargaining power to capture a greater percentage of the wealth created through exploitation of their resources.
- Develop institutional mechanisms that ensure efficient public investment of revenues generated by the extraction of natural resources, allocating them specifically to improving human capital (education, health), infrastructure, innovation and technological development. These institutional mechanisms must guarantee the adequate management of the political economy dilemmas implicit in the distribution of revenues and public investment among various social priorities and different levels of government.
- Develop the institutional capacity required to effectively manage the social and environmental conflicts that arise in the development of the natural resources sectors. Most countries have experienced a proliferation of conflicts and litigation associated with energy, mining, transportation and other projects and infrastructure needed for the development of the natural resources sectors. This trend has revealed the weakness of current State policies, institutional capacities, and dispute resolution mechanisms to reconcile the legitimate social demands of affected groups demanding expeditious compensation, with the development of the economic potential of the resources that constitute the region's main comparative advantages in international trade.
- Develop the vision and strategic State policy for long-term productive diversification and structural change, to gradually wean the national economy from an overreliance on the extractive sectors. Structural change involves building new industries with high growth potential associated with innovation and technological development that are able to spur the creation of quality jobs.

The process of economic development and the achievement of higher levels of per capita income and social welfare in the region are associated with a growing concentration of activities with high knowledge and technology content in the productive structure, which means taking steps to close the productivity gaps separating the region's countries from the advanced economies. The natural resources sectors should be evaluated in terms of their contribution —positive or negative— to this process of structural change. In South America, for example, natural resources account for more than 70% of total exports. The excessive concentration of productive activity in natural resource extractive sectors could entail significant risks, in

⁵ The term “progressive” refers here to a proportionately greater State share of resource rents during price boom cycles, when resource exporting sectors generate windfall earnings. In recent years, the IMF has recommended that governments should include instruments that approximate the properties of a tax on the income generated by the resource over its life cycle (resource rent tax), in which the State's share in the flow of cumulative income from the project increases once the project meets, and surpasses, normal internal return rates for the industry. See International Monetary Fund (IMF), *The Taxation of Petroleum and Minerals: principles, problems and practices*, Washington, D.C., 2010.

the sense of undermining or weakening industrial diversification and structural change. At the same time, these risks do not necessarily materialize in all resource exporting countries.

In fact, many countries that specialize in exporting natural resources are making considerable efforts in technological development and learning (revealed by data on patents and research and development) or are making a shift towards sectors that are more knowledge intensive, becoming successful industrial economies with high per capita income. These are countries that are using appropriate policies to sidestep the risks of the supposed natural resources “curse” in their industrial development and economic diversification processes. An industrial structure that is under-diversified and lagging in productivity is not so much the result of a country’s endowment of factors, such as natural resources, but rather the product of a certain type of political economy that does not favour industrial and technological policies.

The risks associated with the possible impact of abundant natural resources on growth and structural change can be mitigated with the right policies. One of the variables in a natural resources boom that affects the productive structure is the real exchange rate. A boom in international commodity prices can lead to appreciation in the nominal exchange rate and put upward pressure on internal prices, for both tradables (imported inflation) and non-tradables (effect of greater aggregate demand). Both movements diminish a country’s competitiveness and can lead to the disappearance of other industrial activities due to the effect (which could be fleeting) of appreciation in the real exchange rate.

Economic development in the context of abundant natural resources also presents major economic policy challenges, tied to the need to properly manage the windfall revenues generated by their exploitation, within a long-term State policy framework and development strategy. A very solid institutional framework is needed for effective macroeconomic and fiscal management of these revenues over a long horizon. These institutions should be able to resist political pressure to use the revenues for short-term current expenditures, instead of public investment in education, infrastructure, technological innovation and other areas that help build long-term productive capacities.

B. RESPONSES OF THE MINING, OIL AND GAS SECTOR TO THE 2000-2012 PRICE CYCLE

A boom in mineral and hydrocarbon exports from 2003 to 2008, and again from 2010 to 2012, occurred in all the countries that export metallic minerals, oil and natural gas in the CELAC region and in Latin America and the Caribbean in general. Despite the apparent similarities in the price cycles of metals and crude oil, there were significant differences between the mining sector and the hydrocarbons sector in the region as regards price, cost, income generation and State participation patterns during those periods.

In the mining sector, the surge in international metals prices created a boom in mining investments in exploration and development, and as a result, the region’s proven mineral reserves expanded and a large number of new megaprojects to be developed in the current decade were announced. In the hydrocarbons sector, with the exception of Brazil and Colombia, the oil price surge did not produce a similar boom in “upstream” oil/gas investment leading to an expansion in reserves, or to an increase in production consistent with the pace of growth in regional demand, or with the opportunity represented by rising global demand. As a result, the ratio between oil and gas production and consumption, and the ratio between reserves and production both fell over the course of the decade, weakening the region’s net export position, except in the case of the Bolivarian Republic of Venezuela.

In the oil and gas sector, both investment costs and operating and maintenance costs show a clear upward trend over the past decade. This trend of rising costs on the supply side, together with the upward pressures on the international demand side, plainly signals the end of the cheap oil era. In the mining sector,

extraction and processing costs have been climbing since 2004, mainly due to hikes in the price of oil and other inputs. However, these cost increases have been dwarfed by the escalation in prices for minerals, which has generated unprecedented earnings for this industry in recent years.

With respect to the price cycle for metals, the region's mining sector was recording windfall profits and private investment at least until 2012, judging by the rapid rise in repatriated earnings and exploration budgets and by the new investment projects that were announced. The share of revenues captured by the State in this boom has been climbing in absolute terms, but is clearly far from being progressive, as the majority of the countries do not yet have in place the fiscal instruments needed to make it so. However, the region's major mining countries achieved State participation levels of approximately 33% in the estimated mining sector rents, approximately in line with international benchmark levels in countries with typical private concession mining regimes, in which the revenue stream is based on corporate income tax and royalties as the main revenue collection instruments.⁶

Among the region's small countries, where mining activity is still inchoate but increasing (Guatemala, Honduras, Nicaragua and others), the growth in mining GDP and revenue after 2003 indicate a growing untapped potential to increase fiscal revenue, particularly considering the relatively low levels of State participation in the estimated sector rents in several countries, including Guatemala and Honduras. This situation is also seen in Brazil.

Oil and gas sector rents and their fiscal contribution also increased in absolute terms as a result of the price cycle. However, the price boom did not spark an investment and development boom like the one that occurred in the mining sector. Nor did the price boom help remedy the structural shortfalls in "upstream" investment required to expand oil production, which have acted as a drag on the sector since at least 1995 in Argentina, the Bolivarian Republic of Venezuela, Ecuador and Mexico. Neither State ownership of oil companies in the region, nor the regulatory and contractual frameworks introduced to encourage private companies' entry into hydrocarbon production, have been able to mobilize the levels of investment in exploration and development required to maintain the ratio between oil/gas reserves and production, and expand oil/gas supply to match the pace of regional consumption.

The challenge is to strike a balance (difficult to achieve thus far) between public and private interests with a view to achieving the level of investment needed to guarantee supply for the domestic markets and maintain the region's export position. This challenge will require institutional, regulatory and contractual innovations that address the myriad structural and cyclical factors affecting today's oil market. There will also be a need to deal with policy distortions (demand subsidies) that militate against the efficiency of domestic consumption in the face of supply constraints that will surely persist in the medium term while the countries find solutions to these dilemmas.

Chapters I and II of this paper take a close look at the trends in the mining and oil/gas sectors, respectively. Both chapters outline the main stylized facts on reserves, production, consumption and trend indicators. The State's share in the rents generated in the region's principal mineral and oil/gas-exporting countries in 2000-2012 is also explored. Chapter III analyses the evolution of the water resources sector, particularly the water and sanitation services sector, from the perspective of its vital contribution to inclusive development in the region, as well as observed trends in hydroelectric development. The paper concludes by highlighting the policy implications drawn from the analyses presented.

⁶ Chile is the only country with a sizable State-owned mining company (CODELCO). Its contribution to the national coffers has been crucial. Specifically CODELCO controls only about one third of national copper production, but has been responsible for generating two thirds of the total revenue appropriated by the Chilean State during the copper price boom period, from 2003 to 2009. The tax rate and dividends paid by CODELCO to the Chilean treasury are significantly higher than those paid by private mining companies.

Chapter I

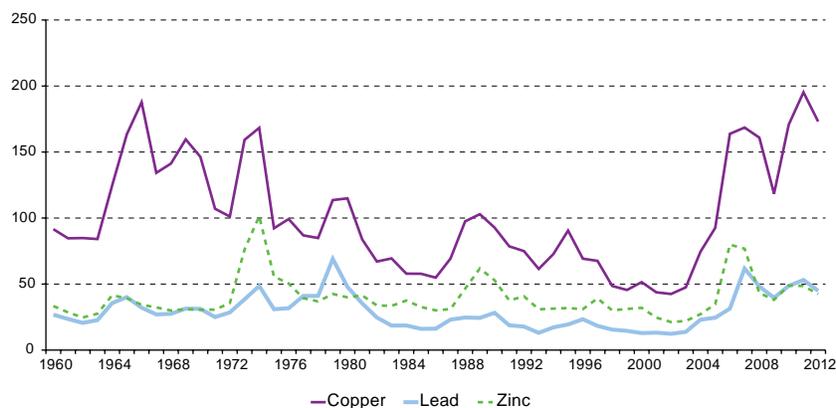
THE MINING SECTOR IN THE CELAC COUNTRIES: RECENT TRENDS AND DEVELOPMENTS

A. THE 2003-2012 MINING BOOM IN CELAC COUNTRIES: SURGE IN PRICES AND EXPORTS

Since 2003, there has been an unprecedented boom in mining exports from the member countries of the Community of Latin American and Caribbean States (CELAC) on the back of growth in international prices for metals, which rose to historic highs in real terms in 2007, even quadrupling in some cases. This surge in prices between 2003 and 2009 reversed the 1980 to 2002 downward trend in the real price of metals that lasted over two decades. Following a downward correction during the high-risk mortgage crisis of 2008 and 2009, the price of metals recovered quickly in the 2010-2012 period.

Since 2012, metal prices have been impacted by the economic slowdown associated with the euro zone crisis and slower growth in China. In the first half of 2013, copper and gold prices fell by 13% and 20%, respectively, while the price of iron sank by 24% and zinc and aluminium prices lost about 10% of their value. These changes suggest that the high metal prices seen between 2007 and 2011 are unlikely to make a comeback, with the current trend being one of moderation and stabilization. However, in real terms, the metal prices seen over the past two years are still well above their average levels of the past three decades (see figure I.1).

Figure I.1
EVOLUTION OF THE INTERNATIONAL PRICES OF COPPER, LEAD AND ZINC, 1960-2012
(Cents per pound, at constant 1982 prices)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of data from the Chilean Copper Commission (COCHILCO) and FRED Economic Data.

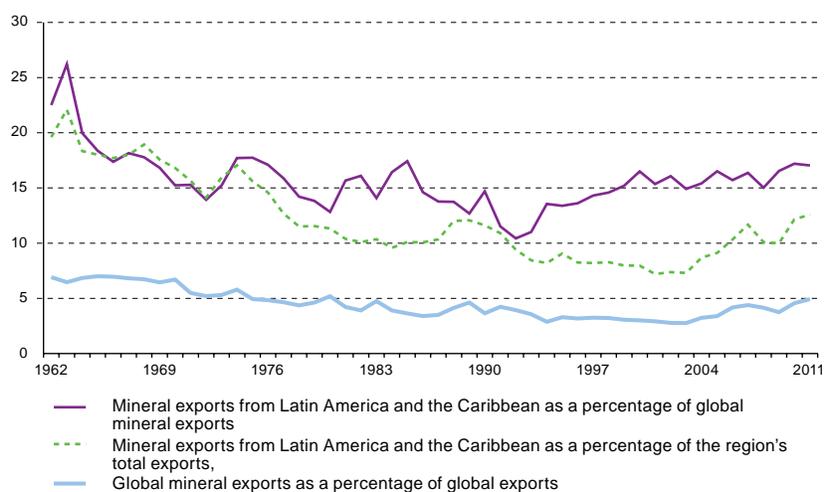
Demand for iron, copper and aluminium, among other export minerals, is associated with growth in the construction, infrastructure and manufacturing sectors (which require inputs such as steel, electrical conductors and industrial metals). These sectors have expanded rapidly in tandem with the accelerated economic development pursued by the large Asian economies since 2000. According to the economic forecasts of several international organizations, Asia's large emerging economies will remain on a medium-term

growth path for the rest of this decade, although the pace of growth is likely to ease. Global demand for the region's mineral exports is expected to relent somewhat, but by and large should continue. Continued demand for these exports implies that a return to the relatively low metal price levels of the 1980-2003 period remains unlikely.

The region's mineral exports responded to the high prices and have accounted for a rising share in total regional exports since 2003. This expansion in exports of minerals and other primary commodities from Latin America and the Caribbean has been described as economic "reprimarization". However, the share of mining exports in total regional exports had fallen steadily since 1964 to less than 10% between the years of 1993 and 2006. Only in 2003 did mineral exports from Latin America and the Caribbean start to surge, tracing a path very similar to the global trend, and beginning in 2006 the sector's share of total regional exports climbed above 10%. In every region of the world, mineral exports have expanded in response to the price boom and the enormous earnings on production (see figure I.2).

The share of mineral exports from Latin America and the Caribbean in world mineral exports had also been shrinking in previous decades, from about 20% in 1964 to 10% in 1993, at which point it began to regain lost ground, climbing back to a 12.8% share in global mining exports in 2000, and maintaining a share above 15% over the past decade. The region has succeeded in recovering a competitive position in the global mining sector, as reflected in the fact that the share of mining exports in the region's total exports continues to be approximately twice the global average (see figure I.2).

Figure I.2
LATIN AMERICA AND THE CARIBBEAN AND THE WORLD: SHARE OF MINERAL EXPORTS^a
IN TOTAL EXPORTS, 1962-2011
(Percentages)



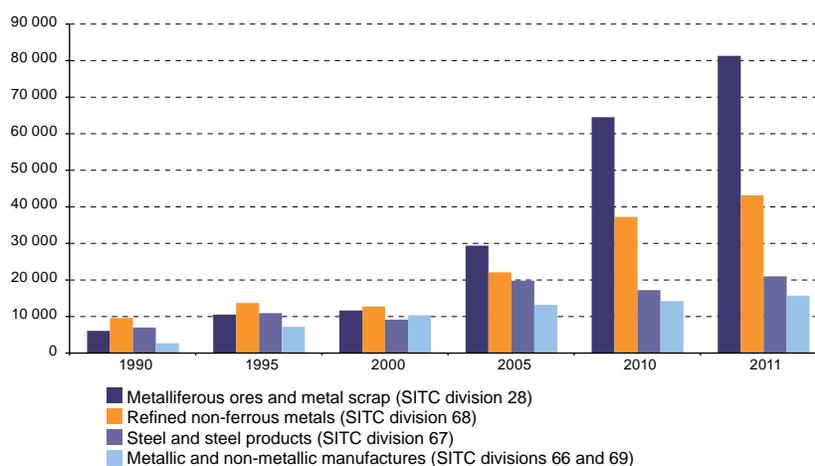
Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of World Bank, World Development Indicators.

^a This includes products corresponding to division 27 (crude fertilizers and minerals), division 28 (metalliferous ores and metal scrap) and division 68 (non-ferrous metals) of the Standard International Trade Classification (SITC), Revision 3.

If the region's mineral exports are disaggregated into exports in the primary stage and exports in the manufacturing stage, most of the growth over the past decade is observed to have been in mineral exports in the primary stage of processing.

As figure I.3 illustrates, between 2000 and 2011, regional exports of metalliferous ores and metal concentrates (in primary stages, included in division 28 of the Standard International Trade Classification (SITC)) have expanded by 17.7% per year, the fastest pace of growth of all categories of mineral exports. Next, exports of refined non-ferrous metals (included in division 68 of the SITC) and steel and steel products (included in division 67 of the SITC), which represent products in the initial manufacturing stage, grew at an annual rate of 9.5%. Last were exports of non-metallic minerals and metals (divisions 66 and 69 of the SITC), corresponding to an advanced manufacturing stage, which posted annual growth of 3.6%, the lowest among the region's mining exports. The performance of mining exports was mainly due to the fact that the increase in metalliferous ore production in the region was not matched by an increase in refining capacity.

Figure I.3
LATIN AMERICA AND THE CARIBBEAN: EVOLUTION OF EXPORTS OF PRIMARY MINERALS AND MINERAL MANUFACTURES,^a 1990-2011
(Millions of dollars, 2005)

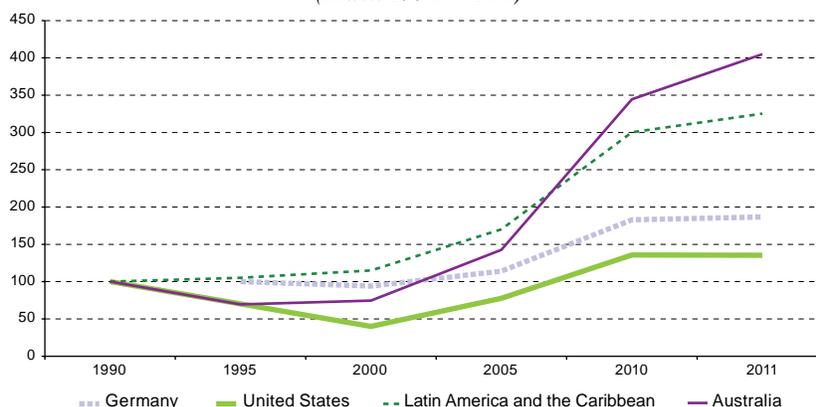


Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of United Nations, Commodity Trade Statistics Database (COMTRADE).

^a Groups of primary metals (division 28), refined metals (division 68), steel and steel products (division 67) and mineral manufactures (divisions 66 and 69), established in accordance with the Standard International Trade Classification (SITC), Revision 3.

This predominance of mineral exports in the primary stage of processing is not exclusive to Latin America and the Caribbean. It has also been a strong trend in Australia since 2003. The following figure shows the evolution of the ratio of mineral exports in the primary stage to mineral exports in the manufacturing stage, expressed as an index with 1990 as the base year (with a value of 100). Clear differences can be seen in the trajectory of this index between Germany, Australia, the United States and Latin America and the Caribbean. Since 2003, higher prices for the principal mineral commodities have tended to increase the relative weight of mineral exports in the primary stage with respect to mineral exports in the manufacturing stage, in all the countries. However, this process of concentration has been especially pronounced in Australia and Latin America and the Caribbean, where the index rose by a factor of 4 and 3.3, respectively, between 1990 and 2011 (see figure I.4).

Figure I.4
**LATIN AMERICA AND THE CARIBBEAN AND MAJOR MINERAL EXPORTERS:
 RATIO OF MINERAL EXPORTS IN THE PRIMARY STAGE TO MINERAL
 EXPORTS IN THE MANUFACTURING STAGE,^a 1990-2011**
(Index 1990 = 100)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of United Nations, Commodity Trade Statistics Database (COMTRADE).

^a The numerator corresponds to exports of metalliferous ores or concentrates of copper, iron, silver, tin, lead, nickel and others (division 28 of the Standard International Trade Classification (SITC)). The denominator corresponds to exports of products that have undergone a significant degree of manufacturing, such as refined non-ferrous metals (cathodes made of refined copper, aluminium and nickel, among others), ferrous metals (steel and steel products) and manufactured products in which metallic elements are used as the principal input. The ferrous and refined nonferrous metals correspond to SITC divisions 67 and 68, and the manufactured products correspond to SITC divisions 66 and 69.

This trend stands in contrast to the much more moderate response that the index shows in countries with a greater degree of specialization in manufacturing, such as Germany and the United States, where metal exports in the manufacturing stage are able to remain relatively competitive. In Latin America and the Caribbean, for example, the production of copper and iron concentrates has expanded significantly, but the refining process (initial stage of manufacturing) is not performed in the region. China is the main destination market for these primary-stage minerals.¹

B. TRENDS IN PRODUCTION, RESERVES AND INVESTMENT IN THE PERIOD 1990-2012

The relative importance of mining varies greatly among the CELAC countries, but three groups of countries can be clearly distinguished. In the first group, consisting of Chile, Peru and the Plurinational State of Bolivia, mining accounts for about 60%, 40% and 30% of the total value of exports, respectively, with a GDP share of 15% in the first case and 9% in the latter two (see table I.1). In Jamaica, mining exports make up 42.5% of total exports, and the sector also generates a relatively large share of GDP, although

¹ According to Sánchez-Albavera and Lardé (2006), the general rule in developing countries is that the production of ore has not been accompanied by a high smelting and refining capacity. As the level of processing advanced, the installed capacity became concentrated in developed countries, and so, for example, countries without mine production, such as Germany and Japan, are among the most important producers of refined minerals in the world, supplying minerals and concentrates to developing countries.

it has been losing ground in this regard (from 3.2% in 2000 to 1.2% in 2012). The second, intermediate group includes Brazil and Colombia, countries where mining accounts for roughly 20% of total exports and generates 1% and 2% of GDP, respectively. They are followed by Guyana, whose mining exports represent 15.6% of total exports.² In the third and final group, consisting of Guatemala, Honduras and Mexico, mining exports account for 12%, 9% and 8% of total exports, respectively, and have GDP shares of 2.3%, 1.0% and 1.3%, also respectively.

Table I.1
**LATIN AMERICA AND THE CARIBBEAN (15 COUNTRIES) AND SELECTED OTHER MAJOR
 MINERAL EXPORTERS: MINING GDP AND EXPORTS,
 2000-2003, 2004-2009 AND 2010-2012**
(Millions of 2005 dollars and percentages)

Country	Mining GDP in millions of dollars, 2005			Mining GDP as a percentage of GDP			Mining exports as a percentage of total exports		
	2000-2003	2004-2009	2010-2012	2000-2003	2004-2009	2010-2012	2000-2003	2004-2009	2010-2012 ^b
Argentina ^c	39 940	55 224	20 626	3.2	4.5	3.4	7.6	8.0	7.0
Bolivia (Plur. State of)	1 263	3 902	3 755	3.2	6.0	8.6	20.1	24.9	29.4
Private mining	-	-	-	-	-	-	0	0	0
COMIBOL	-	-	-	-	-	-	0	0	0
Brazil	16 139	45 628	50 591	0.5	0.7	1.1	18.1	20.5	24.9
Chile (GMP-10 + CODELCO + ENAMI) ^d	25 370	124 907	78 171	7.2	16.0	14.7	43.0	61.0	62.6
Chile (CODELCO + ENAMI) ^d	6 016	116 274	70 522	1.7	14.9	13.2	0.0	0.0	0.0
Chile (GMP-10) ^d	0	0	0				0.0	0.0	0.0
Colombia (mining and coal) ^e	9 767	23 244	16 603	2.0	2.3	2.3	16.4	22.6	20.2
Colombia (mining)	-	-	-	-	-	-	7.6	9.6	5.3
Colombia (coal)	-	-	-	-	-	-	8.8	13.0	14.9
Ecuador ^c	5 126	27 489	19 396	3.7	10.5	12.6	1.3	1.6	1.5
Guatemala	810	2 518	2 289	0.9	1.5	2.3	7.3	8.0	12.3
Guyana	440	829	833	14.9	12.6	18.9	15.5	17.6	15.6
Honduras ^c	213	563	343	0.6	0.9	1.0	10.0	8.8	-
Jamaica ^c	1 992	1 827	276	3.6	2.9	1.2	61.8	60.9	42.5
Mexico ^e	18 171	37 589	34 368	0.5	0.7	1.3	5.9	7.2	7.6
Nicaragua ^c	197	349	369	0.7	0.9	2.1	3.0	2.4	2.0
Peru	11 687	48 088	38 661	4.6	8.5	8.9	32.9	44.4	41.0
Dominican Republic	582	798	355	0.3	0.4	0.3	6.6	13.2	11.9
Suriname	420	1 091	564	5.4	7.7	6.9	0.5	0.5	0.7
Latin America ^{c e}	502 349	1 205 531	604 830	4.6	6.8	6.0	11.7	16.4	21.4

² At the regional level, Guyana is the country whose mining exports generated the highest percentage of GDP (19%), yet exports from this sector account for just 15.6% of the country's total exports, which means that Guyana is less dependent on mining sector exports than Brazil and Colombia.

Table I.1 (concluded)

Country	Mining GDP in millions of dollars, 2005			Mining GDP as a percentage of GDP			Mining exports as a percentage of total exports		
	2000-2003	2004-2009	2010-2012	2000-2003	2004-2009	2010-2012	2000-2003	2004-2009	2010-2012 ^b
Australia	190 871	354 774	233 478	10.1	7.7	7.1			
Canada	26 500	133 490	-	0.8	1.8	-			
United States	121 310	229 900	147 333	0.3	0.3	0.4			
South Africa ^c	47 786	105 597	63 884	7.2	7.5	8.5			

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of national official sources for the GDP of the mining sector as available in each country; and CEPALSTAT database for other variables.

^a Mining exports include divisions 27, 28, 32, 66, 67, 68 and 69 of the Standard International Trade Classification (SITC), Revision 3.

^b In the cases of Colombia, Dominican Republic, Ecuador, Guyana, Honduras, Peru, and Suriname, only data from 2010 and 2011 are included.

^c The mining GDP includes hydrocarbons.

^d The mining GDP corresponds to copper from 2003 onwards. GMP-10 refers to the 10 largest private copper mining companies.

^e Mining exports include coal mining.

1. Trends in mineral production and reserves in the region

Mineral production in Latin America and the Caribbean, and thus in the CELAC region, has developed unevenly among the various countries and by type of mineral. The region's share in global production of gold, copper and silver has grown considerably. Between 1990 and 2012, Latin America and the Caribbean increased its share in the global production of some metals: it doubled in the case of gold (from 10% to 21% of the world total) and mined copper (from 25% to 45%) and rose significantly in the case of silver (from 34% to 48%), refined copper (from 15.7% to 20%) and mined molybdenum (from 16% to 24%). In contrast, there has been very little variation in the region's share in the global production of bauxite, iron, nickel, lead and zinc, and its share in the global production of tin and aluminium dropped during the period (see table I.2).³

Table I.2
**LATIN AMERICA AND THE CARIBBEAN: SHARE OF MINING PRODUCTION
IN THE WORLD TOTAL, 1990-2012**
(Percentages of total world production)

Mineral	Percentage of world total						2012 production (thousands of tons) (except iron, gold and silver)	Three largest producers in the region in 2012
	1990	1995	2000	2005	2010	2012		
Bauxite	22.9	26.7	26.0	27.5	21.5	19.6	50 568.2	Brazil, Jamaica and Suriname
Primary aluminium	9.2	10.4	8.9	7.5	5.5	4.4	2 049.6	Brazil, Argentina and Venezuela (Bolivarian Republic of)
Mined copper	24.9	32.2	43.0	46.5	45.2	44.6	7 626.1	Chile, Peru and Mexico
Refined copper	15.7	23.2	25.1	23.7	21.5	19.0	3 886.4	Chile, Mexico and Peru
Gold	10.3	12.5	14.4	18.1	19.2	21.4	554.7 ^a	Peru, Mexico and Colombia
Silver	34.2	38.3	38.5	41.8	48.7	47.7	11 789.2 ^a	Mexico, Peru and Chile

³ The region's share in the global production of mined and refined tin fell by more than 40%. A similar trend was observed with regional participation in the production of primary aluminium, which plummeted by 50%, probably due to the cost of processing (which is electricity-intensive), compared with in other regions. However, the region has maintained its level of participation in the global production of bauxite.

Table I.2 (concluded)

Mineral	Percentage of world total						2012 production (thousands of tons) (except iron, gold and silver)	Three largest producers in the region in 2012
	1990	1995	2000	2005	2010	2012		
Mined tin	28.3	27.8	26.0	21.2	19.5	20.5	56.6	Peru, Bolivia (Plurinational State of) and Brazil
Refined tin	23.1	15.8	14.9	18.0	16.6	13.7	49.3	Peru, Bolivia (Plurinational State of) and Brazil
Iron	22.6	24.9	26.1	26.0	22.6	21.1	422.6 ^b	Brazil, Mexico and Venezuela (Bolivarian Republic of)
Mined molybdenum	15.8	18.2	35.2	37.3	31.8	23.8	63.1	Chile, Peru and Mexico
Mined nickel	11.5	11.7	14.1	15.1	12.9	11.7	230.6	Brazil, Cuba and Colombia
Refined nickel	9.7	10.1	10.7	13.4	11.6	8.6	163.0	Brazil, Colombia and Cuba
Mined lead	13.3	15.5	14.7	14.6	14.5	11.6	612.4	Peru, Mexico and Bolivia (Plurinational State of)
Refined lead	7.8	7.6	8.4	7.2	7.4	5.0	522.7	Mexico, Brazil and Argentina
Mined zinc	16.8	20.6	19.0	21.0	21.7	19.4	2 600.6	Peru, Mexico and Bolivia (Plurinational State of)
Refined zinc	7.5	8.5	7.3	7.9	7.0	7.4	926.9	Mexico, Peru and Brazil

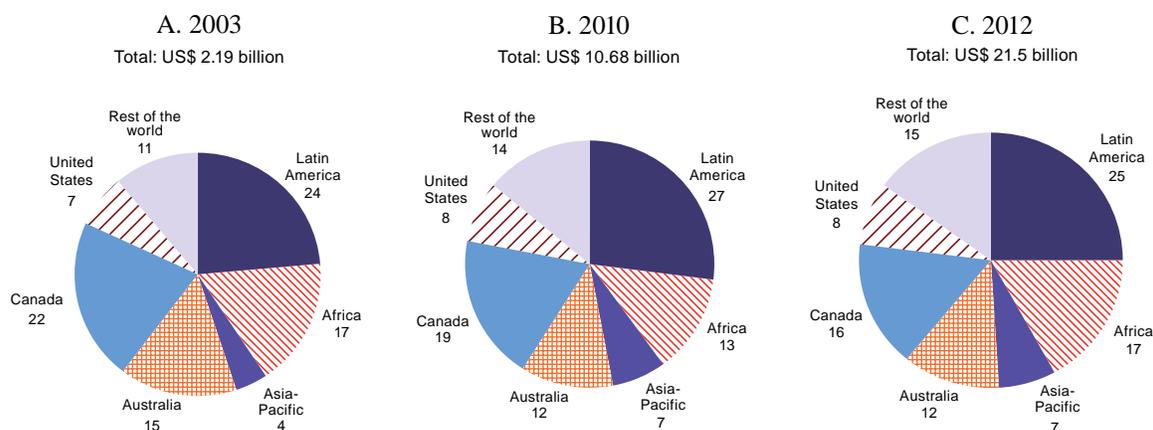
Source: Economic Commission for Latin America and the Caribbean (ECLAC), “Panorama y aporte fiscal del sector minero en América Latina y el Caribe”, J. Acquatella and J. Lardé, Santiago, Chile, unpublished, 2012; World Bureau of Metal Statistics, database; Gold Fields Mineral Services; and United Nations Conference on Trade and Development (UNCTAD).

^a Production expressed in tons.

^b Production expressed in millions of metric tons.

The price surge starting in 2003 drove up investment in mineral exploration around the world. The world budget for non-ferrous metal exploration increased nearly five-fold, from US\$ 2.19 billion in 2003 to US\$ 10.68 billion in 2010, a figure that then practically doubled to US\$ 21.5 billion in 2012 (see figure I.5).

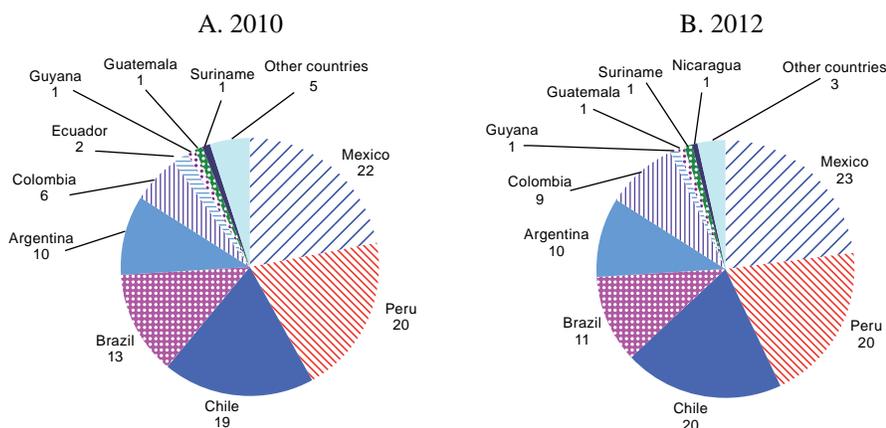
Figure I.5
DISTRIBUTION OF WORLD MINERAL EXPLORATION BUDGET, BY REGION OR COUNTRY OF DESTINATION, 2003, 2010 AND 2012
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Centre for Copper and Mining Studies (CESCO)/Metals Economics Group, *Tendencias en Exploración Mundial*.

Latin America and the Caribbean, as a region, has been the largest recipient of global investment in mining exploration since 1994, in absolute terms.⁴ Between 2003 and 2010, exploration budgets in the region grew from US\$ 566 million to US\$ 3.024 billion. In 2012, the regional exploration budget surpassed US\$ 5 billion. Mining exploration activities have been concentrated in Peru, Mexico, Brazil, Chile and, to a lesser extent, Argentina (see figure I.6).

Figure I.6
LATIN AMERICA AND THE CARIBBEAN: MAJOR RECIPIENT COUNTRIES FOR MINERAL EXPLORATION INVESTMENT, 2010 AND 2012
(Percentages of total exploration budget for the region)



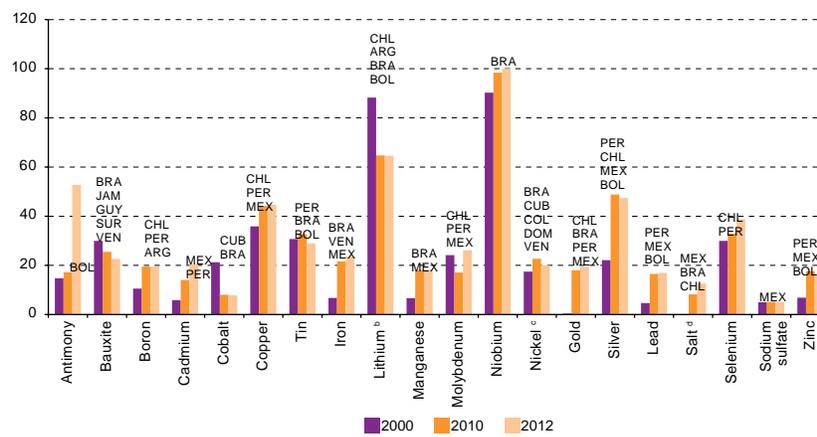
Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Centre for Copper and Mining Studies (CESCO), database; and Metals Economics Group.

As exploration activities intensified in Latin America and the Caribbean, reserves of a number of minerals increased.⁵ For example, gold reserves, which stood at 200 tons in 2000, located mainly in Peru, increased to more than 9,200 tons by 2010, spread across Chile, Brazil, Peru and Mexico. Several Latin American countries possess a major share of the planet's mineral reserves. Specifically, the region has at least 65% of global lithium reserves (Chile, Argentina and Brazil), 49% of silver reserves (Peru, Chile, the Plurinational State of Bolivia and Mexico), 44% of copper reserves (Chile, Peru and, to a lesser extent, Mexico), 33% of tin reserves (Peru, Brazil and the Plurinational State of Bolivia), 26% of bauxite reserves (Brazil, Guyana, Suriname, the Bolivarian Republic of Venezuela and Jamaica), 23% of nickel reserves (Brazil, Colombia, the Bolivarian Republic of Venezuela, Cuba and the Dominican Republic) and 22% of iron reserves (Brazil, the Bolivarian Republic of Venezuela and Mexico), among other minerals. The region's mining potential is estimated to be even greater, considering that the available geological information is still insufficient (see figure I.7).

⁴ In the early 1990s, spending on mineral exploration in countries such as Australia, Canada and the United States was diverted to Latin America, due to the high costs of pursuing this activity in those economies, which could be attributed to several factors including reserve depletion in some mining zones, the elimination of fiscal incentives and stricter environmental requirements. These factors, along with liberalization processes, unleashed vertiginous growth in investment in exploration in Latin America, which became the premier global destination for mining exploration for two decades

⁵ Mineral reserves refer to the portion of identified resources or mining assets for which development is economically feasible, depending on factors such as relative costs and prices, available technology and the physical characteristics of the mine (ore content, grade, tonnage, thickness, depth and location).

Figure I.7
LATIN AMERICA AND THE CARIBBEAN: MAIN MINERAL RESERVES,^a 2000, 2010 AND 2012
(Percentages of world total)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of data from the United States Geological Survey, Mineral Commodity Summaries, January 2011.

- ^a The countries with the largest reserves are indicated above the bars.
^b The Plurinational State of Bolivia has 5.4 million tons of “base reserves” of lithium, but these resources cannot be counted as reserves according to the definition of reserve used by the United States Geological Survey (USGS).
^c The Bolivarian Republic of Venezuela’s nickel reserves were estimated by the USGS in 2010.
^d Sodium chloride.

2. Mining investment trends in the region

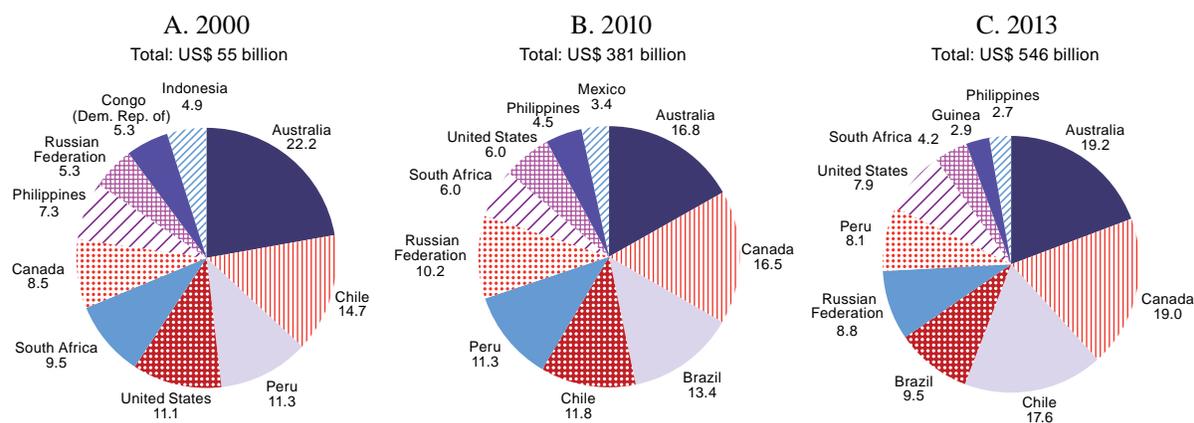
In Latin America and the Caribbean, the 1990s were marked by policy and regulatory reforms designed to attract private investment. In the mining sector, these reforms typically incorporated tax incentives and favourable legal frameworks, which in some countries included long-term fiscal stability contracts. In general, they translated into highly competitive ground rules for mining investment with relatively advantageous fiscal conditions compared with other mining regions in the world.⁶

Between 2000 and 2013, total global investment in mining projects increased nearly ten-fold, from US\$ 86 billion to US\$ 735 billion, of which Latin America captured about 30%, followed by North America (mainly Canada) with 20%, Oceania (mainly Australia) with 17%, Africa with 14% and Asia with 10%. Latin America has become the region with the world’s largest investment portfolio of planned (not executed) mining projects. According to Engineering & Mining Journal’s annual survey, investment projects announced for the region totaled US\$ 180 billion in 2010 and US\$ 210 billion in 2012, i.e., nearly one third of all mining investment projects announced in the world. This survey is an indicator of the countries’ ability to attract mining investment and the expected return on those investments.

⁶ Otto and others (2007) conducted a comparative study of 24 mining countries internationally and found that Chile and Argentina are among the 20% of countries with the lowest effective tax rate and highest private profitability, and the Plurinational State of Bolivia is among the top 33%. Mexico and Peru are closer to the international average, placing 13th and 17th, respectively, in the international ranking.

In 2013, Brazil, Chile and Peru were among the top 10 destinations in the world for mining investment (see figure I.8). The metals that attracted the largest investment amounts were iron (27%), copper (27%), gold (16%), nickel ore (14%) and refined nickel (3%), which together represent 87% of total investment projects in the portfolio.

Figure I.8
DISTRIBUTION OF MINING INVESTMENTS AMONG THE TOP 10 RECIPIENT COUNTRIES, 2000, 2010 AND 2013
 (Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of data published in the *Engineering & Mining Journal*.

C. EVOLUTION OF THE ECONOMIC RENT OF THE MINING SECTOR, STATE SHARE AND FISCAL ISSUES

Countries endowed with sizeable oil and natural gas resources have a long history in the application of fiscal regimes and instruments to ensure that the public sector gets a share of the revenue generated from exploitation of these resources. Direct participation by the State in oil/gas production, whether through State-owned enterprises or ownership of shares is the rule. In the oil sector, it is also common practice to apply windfall taxes when international prices rise above certain thresholds and to use risk and/or production-sharing contracts, among other instruments designed to ensure progressive participation by the State in oil and natural gas revenues during price surges.⁷

In contrast, in mining countries, mineral resources are generally developed under concessions awarded to private firms, and direct State participation in production revenues through State-owned enterprises is the exception, as in the case of Chile's national copper company Corporación Nacional del Cobre (CODELCO). In concession systems, the corporate income tax is the main instrument used by the State to capture revenues generated from mining. The corporate income tax generates the bulk of the government take and is marginally

⁷ Progressiveness is understood here to mean, generally, a proportionately greater State participation in the cumulative revenues of these sectors during price booms. The cited instruments are used to ensure that the State's share becomes progressively greater once the taxed project has surpassed internal return rates beyond the threshold considered as normal investment grade in the mining industry in countries with similar risk premiums; and the project has already fully recovered its sunk costs in exploration and capital investment. Instruments of this nature approximate the theoretical properties of a resource rent tax that would be neutral with respect to investment decisions. See IMF (2010).

supplemented by royalties, which are typically based on production. In some countries such as Colombia, Peru and the Plurinational State of Bolivia, a portion of the revenue collected through royalties is distributed by the central government to the producing regions and subnational government entities (in the provinces, departments and other levels of administration). However the largest share of revenue from the mining sector is captured by the State through the corporate income tax and retained by the national treasury at the central level.

Unlike in the oil sector, the fiscal regimes for the mining sector in Latin America and the Caribbean have not incorporated instruments enabling States to progressively capture more revenue in periods of windfall earnings.⁸ The magnitude and persistence of the most recent price cycle for metals has drawn political attention to the degree to which the State fails to achieve progressive participation in the rent generated by the mineral export sectors.

1. State share of rent from the mining sector between 2000 and 2012

The economic importance of the mining sector and its fiscal contribution during the period running from 2000 to 2012 have varied with the price cycle for metals. For purposes of analysis, these years can be divided into three distinct periods: (i) the period between 2000 and 2003, prior to the start of the price cycle; (ii) the period between 2004 and 2009, marked by a tremendous surge in international metal prices, which rose to historic highs in 2007 but were halted by the global financial crisis in late 2008 and 2009; and (iii) the period between 2010 and 2012, post-crisis years characterized by a recovery in prices and a recent trend toward stabilization at levels 20% to 25% below the earlier records.

Table I.3 illustrates the behavior of the economic rent of the mining sector, and the fiscal revenues taken from the sector as a percentage of GDP during the three periods of analysis. The fiscal revenues captured by the State from mining activity are expressed as a percentage of GDP, as a percentage of total fiscal revenue and as a percentage of estimated mining rent, for a group of 15 countries in Latin America and the Caribbean. The trends observed in the evolution of mining rent and the sector's fiscal contributions are described below.

In Latin America and the Caribbean, the economic rent⁹ of the mining sector, as a percentage of GDP, tripled during the period of the price surge (2004-2009) over the average observed during the previous period (2000-2003), rising from 0.6% to 2.1% of regional GDP (World Bank, 2012). The countries with the largest gains in the estimated economic rent of the mining sector across the two periods were Peru (where sector rent climbed from 0.4% to 7.5% of GDP), the Plurinational State of Bolivia (from 0.1% to 2.4% of GDP), Colombia (from 0.3% to 1.9% of GDP), Chile (from 6.5% to 17.3% of GDP) and Brazil (from 0.9% to 2.3% of GDP) (see the first column of table I.3).

⁸ Perhaps the only exception in the region is the contract for the Pueblo Viejo project, signed between the Government of the Dominican Republic and Barrick Gold Corporation. The Pueblo Viejo contract stipulates that once the project has achieved an internal return rate of 10%, the State will begin to collect 28.75% of net earnings. Together with the 3.2% royalty and 25% income tax, this would bring the Dominican government's share of net flows from the project to around 50%. The contract is called the Special Mining Lease Contract (CEAM) for Pueblo Viejo, which was amended and ratified by both congressional chambers in the Dominican Republic. Additional information can be found in ECLAC (2011). In general, there are different combinations of fiscal instruments that approximate an efficient tax on the rent generated by exports of natural resources (resource rent tax), ensuring a progressive and cumulative share by the States in the earnings produced during boom periods.

⁹ The "pure" economic rent of the mineral resource is the difference between the value of the output in international prices and the cost of production of the ore at the minehead. The following cash streams are derived from this economic rent: (i) the fiscal payments received by the State in the form of taxes, royalties or other levies; (ii) the private earnings of the extractive companies; and (iii) payment of the factors of production used beyond the extraction stage, which mostly consists in remuneration of personnel employed by the extractive companies.

Table I.3
LATIN AMERICA AND THE CARIBBEAN (15 COUNTRIES) AND SELECTED OTHER MAJOR MINERAL EXPORTERS: ECONOMIC RENT OF THE MINING SECTOR AS A PERCENTAGE OF GDP AND FISCAL REVENUES CONTRIBUTED BY THE SECTOR AS A PERCENTAGE OF GDP, OF TOTAL FISCAL REVENUES AND OF MINING RENT
(Percentages)

Country	Mining rent as a percentage of GDP ^a			Fiscal revenue from mining as a percentage of GDP			Fiscal revenue from mining as a percentage of total fiscal revenues			Fiscal revenue from mining as a percentage of mining rent		
	2000-2003	2004-2009	2010-2012	2000-2003 ^b	2004-2009 ^c	2010-2012 ^d	2000-2003 ^b	2004-2009 ^c	2010-2012 ^d	2000-2003 ^b	2004-2009 ^c	2010-2012 ^d
Argentina ^e	0.1	0.4	0.6	0.1	0.3	0.2	0.5	1.0	1.0	112.8	56.0	25.8
Bolivia (Plur. State of)	0.1	2.4	4.9	0.1	0.6	1.3	0.5	2.2	4.2	123.9	27.1	24.5
Private mining	-	-	-	0.1	0.6	1.0	0.4	1.9	3.4	115.0	23.6	20.2
COMIBOL	-	-	-	0.0	0.1	0.2	0.0	0.3	0.7	8.9	3.5	4.3
Brazil	0.9	2.3	2.6	0.1	0.1	0.2	0.3	0.5	0.8	7.8	6.4	9.3
Chile (GMP-10 + CODELCO + ENAMI) ^f	6.5	17.3	16.7	0.9	6.2	4.3	4.3	25.8	19.4	14.4	35.7	25.9
Chile (CODELCO + ENAMI) ^f	-	-	-	0.7	3.8	2.4	3.5	16.0	10.6	11.6	22.2	14.1
Chile (GMP-10) ^f	-	-	-	0.2	2.3	2.0	0.8	9.7	8.8	2.8	13.5	11.7
Colombia (mining and coal) ^g	0.3	1.9	2.3	0.2	0.4	0.4	0.6	1.6	1.6	23.3	22.9	15.7
Colombia (mining)	0.3	0.9	0.9	0.1	0.2	0.1	0.2	0.6	0.4	23.3	17.7	11.2
Colombia (coal)	0.0	1.0	1.5	0.1	0.3	0.3	0.4	1.0	1.2	-	27.4	18.4
Ecuador ^e	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-
Guatemala	0.0	0.3	0.9	-	0.0	0.1	-	0.4	0.9	-	12.2	10.8
Guyana	4.2	7.4	14.6	-	-	-	-	-	-	0.0	0.0	0.0
Honduras ^e	0.1	0.7	0.8	-	-	-	-	-	-	-	-	-
Jamaica ^e	1.6	1.8	1.4	-	-	-	-	-	-	-	-	-
Mexico ^g	0.1	0.4	0.9	0.1	0.1	0.1	0.3	0.8	1.5	129.6	29.5	15.3
Nicaragua ^e	0.1	0.4	0.8	-	-	-	-	-	-	-	-	-
Peru	0.4	7.5	9.0	0.2	1.5	1.5	1.0	8.6	8.3	43.7	20.4	17.2
Dominican Republic	0.6	1.8	0.4	-	-	-	-	-	-	-	-	-
Suriname	3.4	5.0	9.3	-	-	-	-	-	-	0.0	0.0	0.0
Latin America ^{e g}	0.6	2.1	2.6	-	-	-	-	-	-	-	-	-
Australia	1.5	4.2	7.0								26.2	
Canada	0.2	0.5	0.2								36.0	
United States	0.0	0.1	0.15									
South Africa ^e	0.8	2.5	4.0									

Source: World Bank, “World Development Indicators (WDI)” 2012 [online] <http://databank.worldbank.org/ddp/home.do>, for mining rent statistics (as percentages of GDP); national official sources for fiscal revenue from mining as available in each country; and CEPALSTAT database for other variables.

^a In the case of Colombia, Mexico and Latin America, mining rent includes rent from mineral resources and coal. The figure for 2012 was estimated on the basis of the rent for 2011 with reference to the International Monetary Fund’s Metals Price Index and Coal Price Index (coal rent).

^b The figure for Mexico relates to the period 2002-2003 only.

^c For Guatemala, with effect from 2006, only the Mina Marlin project is taken into account.

^d For Bolivia (Plurinational State of) and Colombia, only the period 2010-2011 is taken into account.

^e The share of mining as a percentage of GDP includes hydrocarbons.

^f From 2003 onwards, corresponds to copper as a component of the contribution of mining to GDP. GMP refers to the major copper mining industry, which encompasses the ten major private companies.

^g Fiscal revenue includes revenue from coal mining.

This sharp rise in the mining sector's economic rent during the 2004-2009 period translated into a considerable increase in absolute terms of fiscal revenues from the mining sector. The countries that reaped the largest gains in fiscal revenues from the mining sector were the Plurinational State of Bolivia (where the figure climbed from 0.1% to 0.6% of GDP), Chile (from 0.9% to 6.2% of GDP) and Peru (from 0.2% to 1.5% of GDP). Registering somewhat smaller gains were Colombia (from 0.2% to 0.4% of GDP) and Brazil (from 0.1% to 0.15% of GDP) (see the second column of table I.3).¹⁰

During the most recent period, from 2010 to 2012, mining sector rent continued to grow, albeit at a slower pace, averaging 2.6% of regional GDP. Based on this regional improvement, an attendant increase in the fiscal revenues contributed by the mining sector would be expected across the countries. However, fiscal revenues from mining stagnated in Argentina, Colombia and Peru during the period, and fell sharply in Chile, both as a percentage of GDP and as a percentage of total fiscal revenue. In the case of Chile, fiscal revenue from this sector contracted by 30%, from 6.2% of GDP (2004-2009 average) to 4.3% of GDP (2010-2012 average).¹¹ Among the countries studied, only Brazil, Guatemala, Mexico and the Plurinational State of Bolivia saw their fiscal revenue from mining increase during the most recent period.

A broader analysis of developments in the two periods (2004-2009 and 2010-2012) confirms that the growth in fiscal revenue from mining is not directly proportional to growth in mining sector rent. The evolution of these indicators varied from country to country, reflecting differences in the capacity of the respective fiscal regimes to respond not only to the price boom in the 2004-2009 period, in their varying capacities to effectively tax windfall earnings, but also to the slower growth in mining rent observed in the more recent period, from 2010 to 2012.

For example, in the case of Chile, mining rent tripled between the 2000-2003 period and the 2004-2009 period, from 6.5% to 17.3% of GDP, and fiscal revenues from this sector grew by more than six-fold, from 0.9% to 6.2% of GDP. CODELCO, which generates one third of national production, was responsible for two thirds of this increase in fiscal revenue, with private mining interests contributing the remaining one third, despite controlling over 60% of the country's mining production. In the 2010-2012 period, Chile's estimated mining rent remained constant at around 17% of GDP, but fiscal revenues contracted by 30%, from 6.2% of GDP (average for the 2004-2009 period) to 4.3% of GDP (average for the 2010-2012 period), as indicated above.

Fiscal revenues from mining, when expressed as a percentage of the total estimated economic rent of the sector, are an indicator of how much of the total economic value generated by the mining sector States are effectively able to capture through taxes and royalties (see the last column in table I.3).

The percentage of total mining rent that countries are able to capture as fiscal revenue during price booms is also an indicator of how progressive their tax systems are. Internationally, fiscal regimes for the mining sector do not generally include fiscal instruments designed to capture windfall earnings in times of high prices. Nor is it common practice in the mining sector for States to capture revenues directly through State-owned enterprises.

¹⁰ A comparison of average annual fiscal revenues from mining as a percentage of GDP across the three periods of analysis (2000-2003, 2004-2009 and 2010-2012) reveals that fiscal revenues from this source increased in the case of the Plurinational State of Bolivia from 0.10% to 0.64% and then 1.61% of GDP, respectively; from 0.07% to 0.15% and 0.24% of GDP in Brazil; from 0.17% to 0.43% and 0.44% of GDP in Colombia; 0.07% to 0.11% and 0.14% of GDP in Mexico; and from 0.39% to 2.05% and 2.24% of GDP in Peru. Fiscal revenues from mining became significant in Guatemala (0.1% of GDP) only in the last period (2009-2012).

¹¹ In the case of Chile, due to the economic environment during the 2010-2012 period, the fiscal contribution made by the State-owned company CODELCO shrank by nearly 40% and the fiscal revenues contributed by private mining interests fell by 16%. Further analysis is needed to explain this development, but some related factors would be rising costs in the country's mining sector (e.g. due to high energy costs) and declining ore grades in some deposits. Still, Chile continues to have the highest mining sector rent (16.7% of GDP) of any country in the region.

Oil producing countries around the world tend to achieve higher rates for this indicator (fiscal revenue from the sector as a percentage of its economic rent), ranging from 65% to 75%, than do mining countries, where the rate hovers between 30% and 35%. This broad trend reflects a larger direct share by the State in oil production through State-owned and jointventure companies, as well as the relatively stronger role that oil fiscal regimes have had in the design of fiscal and contractual instruments to ensure that the State takes a more progressive share in sector rent.¹²

During the period of highest prices (2004-2009), the countries with the strongest mining traditions in the region were observed to increase their share, in terms of fiscal receipts, of the sector's total estimated economic rent to rates ranging from 27% to 35%.¹³ This was the case in Chile, Peru and the Plurinational State of Bolivia with metal mining and in Colombia with coal mining.¹⁴ These rates are within the range seen for this indicator in mining countries that are members of the Organisation for Economic Cooperation and Development (OECD), such as Australia (26%) and Canada (36%). In Chile, the State captured 35.7% of the sector's estimated economic rent during this period, a share made possible by the fiscal contribution of the State-owned CODELCO, which at 22.2% was nearly double the 13.5% contributed by the big 10 private mining firms (GMP-10).¹⁵

In Brazil, Guatemala and Honduras, which were among the countries analysed, the State captured fiscal revenues equivalent to just 10% or less of mining rent, less than half the average for the majority of mining countries. This suggests that there is room to adjust upward the fiscal treatment applied to the sector so that the government's share of sector rent converges towards the international average.

Prior to the start of the price surge in 2003, the State's share in the economic rent of the mining sector averaged less than 20% in every country studied with the exception of Colombia, where it was 23.3%, mainly due to the contribution made by coal mining, which has a very different price dynamic than metal mining.

Some countries, including Chile and Peru, reacted to the price boom in the 2004-2009 period by introducing new mining royalties, as they sought additional instruments to increase the revenues collected from mining companies beyond the levying of corporate income taxes. In most countries, the revenue captured through royalties has only marginally boosted the mining sector's total fiscal contribution: by roughly 5% in the case of Chile, by around 10% in Argentina, Mexico and Peru and by about 15% in Brazil (see figure I.9). Only in Colombia and the Plurinational State of Bolivia have royalties made a more significant contribution, accounting for between 40% and 50% of the total.

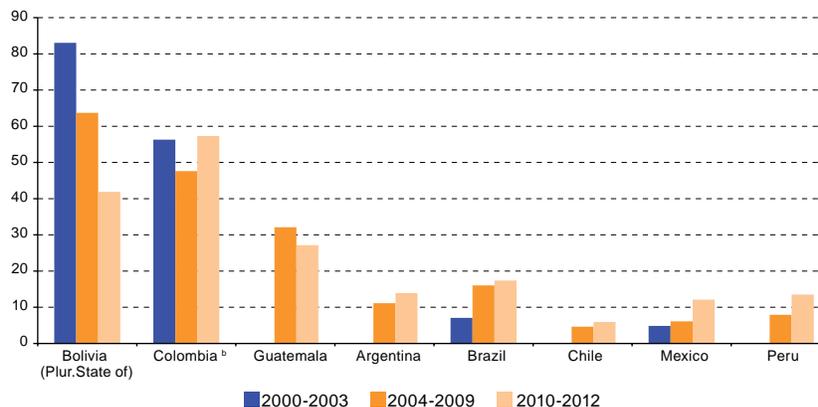
¹² The Extractive Industries Transparency Initiative (EITI) publishes the payments received by governments and those made by extractive industries (mining, oil and natural gas) in the member countries that have voluntarily joined the organization. A review of data published by EITI for 29 member countries (19 in Africa, 4 in Asia and the rest in Europe, the Middle East and Oceania, and Peru as the only country from Latin America and the Caribbean) demonstrates that, overall, the States receive a higher percentage of the total economic rent from the hydrocarbons sector than from the mining sector.

¹³ The economic rent estimated for the sector corresponds to the statistic "mining rent" (as a percentage of GDP) published by the World Bank in its statistical database World Development Indicators (WDI). According to the multiple sources consulted, the international average (benchmark) for this indicator would be around 30% to 33% of the State's share in total sector rent. A proxy for an international average was developed using data published by PricewaterhouseCoopers (2011) on the taxes and royalties paid by the 10 largest mining companies in the world, declared earnings and payment of factors (employees) between 2005 and 2010. The sum total of taxes paid, declared earnings and employee wages serves as a proxy for the sector's economic rent. For these 10 largest mining companies in the world, taxes paid as a percentage of this estimated rent average around 33% in the period running from 2005 to 2010.

¹⁴ If coal is excluded, the State only managed to capture 17.7% of the estimated economic rent of the mining sector in the 2004-2009 period in Colombia.

¹⁵ CODELCO's contribution is all the more significant considering that the State-owned company contributes nearly two thirds of the State's share in the economic rent of the sector while producing only one third of the country's copper.

Figure I.9
**LATIN AMERICA (8 COUNTRIES): SHARE OF ROYALTIES IN TOTAL FISCAL REVENUES
 FROM MINING (TAXES AND ROYALTIES),^a 2000-2003 TO 2010-2012**
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of official fiscal statistics from the countries.

^a Share calculated as the percentage of royalties in the total of taxes and royalties.

^b Corresponds to mining excluding coal.

Despite their inefficiencies, the importance of the fiscal regimes applied to the region's mining sector as a source of fiscal revenue for the State grew steadily over the last decade. In all the countries that were studied, the mining sector's contribution to total fiscal revenues in the 2004-2009 period multiplied by up to four and five times in relation to the average contribution seen in the 2000-2003 period.

The sector's fiscal contribution, expressed as a percentage of the government's total fiscal revenues, is an indicator of the mining sector's importance as a source of fiscal revenue for the State and also suggests the extent to which the countries are fiscally vulnerable to price cycles in mining (see the third column in table I.3).

In the most recent period, from 2010 to 2012, the trend has been towards stabilization of mining's fiscal contribution as a percentage of total fiscal revenues in the case of Peru (around 12%), Colombia (1.6%) and Argentina (1.0%). During this same period, compared with the previous period (2004-2009), the average fiscal take from mining as a percentage of total fiscal revenues continued to rise in the case of the Plurinational State of Bolivia (from 2.2% to 4.2%), Brazil (from 0.5% to 0.8%), Guatemala (from 0.4% to 0.9%) and Mexico (from 0.8% to 1.5%). The baselines for this growth may have been relatively low, but the performance nonetheless reflects the mining sector's rising importance as a source of fiscal revenue in these countries.

2. Normative lessons from these findings

The price cycle during the 2004-2009 period pointed up the inefficiency of the current fiscal regimes for the mining sector in terms of ensuring a progressive share for the State in mining rent during price surges. The fact that the main instrument for collecting revenue from mining companies is the tax on declared income underscores how important it is for governments to have independent mechanisms and specific indicators in place that can be used to clearly ascertain sector earnings and costs throughout the price cycle. This is an area of pending reform for most countries. A State-owned company could partially address this need for

more transparency by revealing changes in sector earnings and costs through the price cycle, and serving as a kind of witness or control enterprise in the sector.

Generally speaking, the fiscal regimes for the mining sector were not prepared to progressively tax windfall earnings during the price boom that occurred in the 2004-2009 period. In Peru, for example, prior to the start of the price cycle, fiscal stability clauses were written into mining concession contracts, which limited the State's capacity to introduce modifications in response to changing conditions. In recent years, a number of international organizations, and the International Monetary Fund (IMF) in particular, have recommended that governments explore the possibility of adjusting their fiscal frameworks to include instruments that ensure a more progressive government take. Such instruments approximate the properties of a resource rent tax, in which the government's take of the cumulative rent flow from the project increases once the project has met and exceeded internal return rates that are deemed normal for the industry (i.e. instruments that approximate the properties of a resource rent tax¹⁶).

The countries should move towards greater regional integration and coordination of actions to introduce progressive innovations to the fiscal regime and harmonize the terms applied to mining investments. In view of the enormous potential for expansion in the region's mining sector over the next several decades, ensuring that the State has a more progressive share in this sector is a critical objective and a task that countries have yet to tackle. In addition, there is a need to build cooperation frameworks between the countries receiving mining investment, in order to prevent perverse fiscal competition, which runs counter to the above objectives by encouraging relatively more lax fiscal regimes than the international average. Fiscal competition to attract investment frequently results in a race to the bottom, in which all countries lose potential fiscal revenue and make concessions which are no longer necessary given the mining investment climate currently prevailing in the region.

In the case of Chile, an examination of the relative fiscal contributions of the State-owned company and private mining interests suggests that the strategy of having a State-owned company seems to have been key for ensuring a larger government take of the sector's economic rent. It also points to the importance of having some type of public mechanism in place to clearly ascertain sector earnings and costs, such as a company that can act as a witness or control, especially under the current fiscal systems, which are based primarily on the self-declared corporate income tax. Given the importance of CODELCO for achieving the fiscal results seen in Chile, the widening investment gap between CODELCO and the country's large private mining companies is troubling. If it persists, this could erode the State-owned company's share in national copper production over the medium and long terms, and thus its capacity to continue to fulfil its important fiscal functions. This trend is contrary to the objective of securing a greater share of mining rent for the public sector, inasmuch as CODELCO provides the bulk of the fiscal contribution from mining in Chile. An inability to ensure an optimal investment portfolio, with the attendant hit to the competitiveness of the State-owned enterprise, is also a common problem affecting State-owned oil companies in the region.

¹⁶ An in-depth discussion of the resource rent tax (RRT) instrument can be found in IMF (2010), and more recent recommendations on the matter can be found in IMF (2012a) and IMF (2012b).

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Chapter II

OIL AND NATURAL GAS SECTOR: RECENT TRENDS AND DEVELOPMENTS IN CELAC COUNTRIES

A. INTRODUCTION

There are a number of different organizational models for the oil and natural gas production sector in the region. In the 1990s, countries such as Argentina, the Bolivarian Republic of Venezuela, Ecuador, and the Plurinational State of Bolivia promoted private participation in exploration and production activities, as well as reforms to the transport, refining and distribution system. Over the last decade, these countries have moved towards greater State control of the hydrocarbon sector, including price controls, contract renegotiations, nationalization of assets and a stronger role for State-owned enterprises in the sector.

In Mexico, the State-owned enterprise *Petróleos Mexicanos* (PEMEX) has had a monopoly on all activity in the sector since it was nationalized in 1938. PEMEX must balance its obligation to finance the public budget—and implicitly to pay down the public debt—with its obligations, among others, to produce oil, maintain its exporter status, satisfy public opinion and make investments, all with limited operational and budget independence. In the framework of the energy reform launched in 2008, which is complemented by the 2012 Pact for Mexico, the plan is for the State to retain control of the company and the sector while the industry modernizes through greater private investment in capital and technology.

Peru, Brazil and Colombia have had policies in place since 1993, 1997 and 2004, respectively, to liberalize prices, promote competition and attract foreign direct investment in the hydrocarbon sector, regulated by a national authority in all three cases. Competitive leases issued for specific areas allow for the participation of both State-owned enterprises (including Brazil's *Petrobras* and Colombia's *Ecopetrol*) and private companies.

In general, in times of high prices—since 2003, for example—countries that have traditionally been exporters or that have favourable geological conditions have tended towards greater State control, whereas importing countries that need to develop their industry and attract investment have leaned towards greater liberalization of the sector.

Due to their limited endowment of resources, many countries in Central America and the Caribbean have undertaken strategies to achieve greater regional integration, market access and energy security through political and trade agreements and initiatives such as the Caribbean Community (CARICOM) and the PETROCARIBE programme.

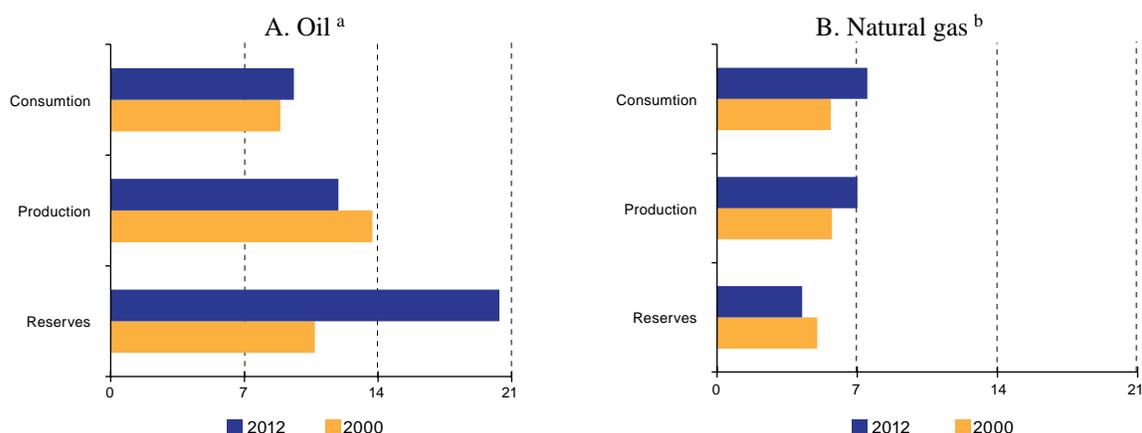
In practice, both the countries that control the resources and reserves and the oil companies that possess the technology and capital, far from acting unilaterally, interact in a global market that is plainly uncertain, dynamic and competitive. In this international context and in the face of constant price volatility, governments attempt to reconcile different objectives, from maximizing their intake of oil rent to attracting investment to develop the sector, supplying the domestic market, and ensuring efficient production of hydrocarbons, among other policy goals. There follows a discussion of the region's relative position in the world in terms of accumulation of reserves, production, consumption, trade and taxation of hydrocarbons.

B. RESERVES, PRODUCTION, CONSUMPTION AND TREND INDICATORS

1. Latin America and the Caribbean in the global context

According to 2012 figures, Latin America and the Caribbean has the second largest oil reserves of any region in the world, after the Middle East, with a global share surpassing 20%. The region's oil and natural gas reserves have expanded since 2008 due to the certification of reserves under the Magna Reserva project, in the Orinoco Belt, by the Bolivarian Republic of Venezuela, and successful prospecting in Brazil, Colombia and Ecuador, mainly (see figure II.1).

Figure II.1
LATIN AMERICA AND THE CARIBBEAN: SHARE IN OIL AND NATURAL GAS SECTORS, 2000 AND 2012
(Percentages of global total)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of British Petroleum, *Statistical Review of World Energy, 2013*, *Statistical Review of World Energy, 2012* and *Statistical Review of World Energy, 2011* [online] <http://www.bp.com/statisticalreview>.

^a In 2012, regional consumption and production of oil came to 8.6 million and 10.3 million barrels per day, respectively, and proven reserves totaled 339.7 billion barrels. Production and reserves include natural gas liquids.

^b In 2012, regional consumption and production of dry natural gas came to 24 billion and 22.7 billion cubic feet per day, respectively, and proven reserves totaled 281 trillion cubic feet.

The region's share of global natural gas reserves diminished over the last decade, falling to 4%. Regions such as North America, Central Asia and the Middle East saw the fastest growth. Among countries, the United States—with its proven reserves of unconventional natural gas—Turkmenistan and Qatar stood out.

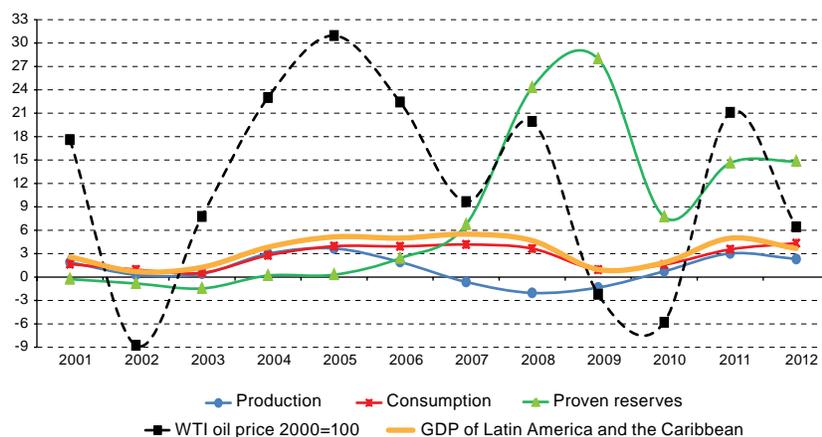
In recent years, regional and global production of hydrocarbons has been growing. However, Latin America and the Caribbean has lost ground in oil production to regions such as North America, Eastern Europe, Central Asia and Africa, where expanded development activity has made it possible to boost production in Canadian oil sands and other deposits in Kashagan (Kazakhstan), Sakhalin (Russian Federation) and Girassol and Mondo I (Angola). However, the loss of regional prominence has not occurred in natural gas production.¹

¹ Both globally and in Latin America, primary solid fuels are gradually being replaced by natural gas, which is less polluting and thus has a much more moderate impact on the environment (see figure A.1 in the annex).

The evolution of the oil market since 2003 has been characterized by rapid growth in demand in emerging markets (such as China and India), which in combination with supply restrictions has driven up oil prices, which climbed as high as US\$ 100 per barrel in mid-2008.² The global economic crisis declared at that time caused a temporary decrease in sector activity in Latin America and the Caribbean, accompanied by a contraction in consumption and production of nearly 1% in 2009.³

However, in general, the increase in international prices has influenced hydrocarbon supply and demand in different ways in the region's countries. In the case of supply, the price hike led to moderate exploration and production activities as compared with global pattern.⁴ Supply was thus expanded, albeit to a limited extent, to meet growth in demand. In the second case, the slow response of demand to rising prices may be related to fuel subsidies provided in some countries in the region. Since 2004, average growth in consumption, at around 3%, and its correlation with the corresponding increase in GDP, has outpaced growth in production (see figures II.2 and II.3).

Figure II.2
LATIN AMERICA AND THE CARIBBEAN: RATE OF CHANGE IN HYDROCARBON RESERVES, PRODUCTION AND CONSUMPTION IN THE CONTEXT OF ECONOMIC GROWTH AND THE EVOLUTION OF PRICES, 2001-2012^a
(Percentages of two-year moving average)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of British Petroleum (BP), *Statistical Review of World Energy, 2013*, *Statistical Review of World Energy, 2012* and *Statistical Review of World Energy, 2011* [online] <http://www.bp.com/statisticalreview>; and CEPALSTAT [online] <http://websie.eclac.cl/sisgen/ConsultaIntegrada.asp>.

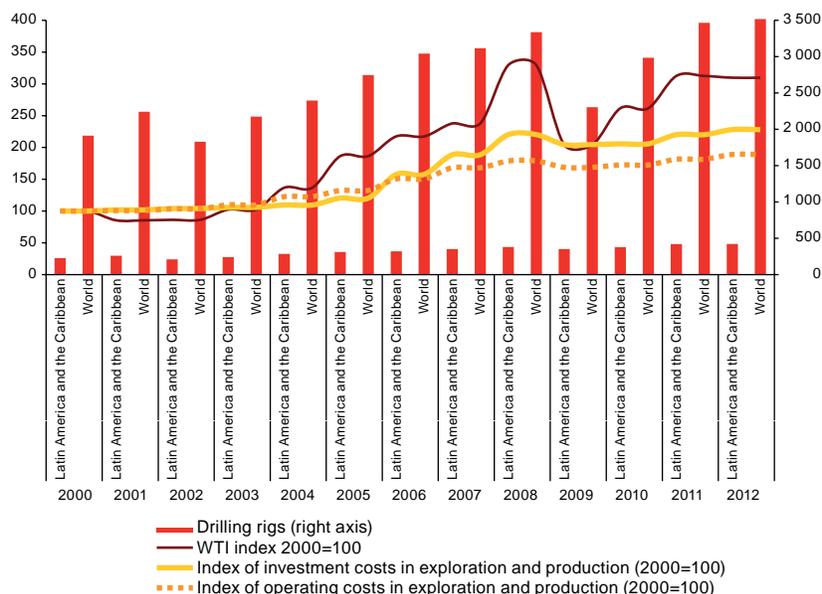
^a This includes oil and natural gas, the latter with a conversion factor of 5,800 cubic feet per barrel of oil equivalent. The West Texas Intermediate (WTI) benchmark oil price is used in constant 2000 terms, with the current value deflated using the United States Consumer Price Index for All Urban Consumers (CPI-U).

² There is evidence that the price hikes are also related to greater presence of financial investors in the commodities markets, in a process known as “financialization,” a situation that in addition to contributing to market distortion through greater volatility, imposes additional hedging costs and generates risks and uncertainties related to the creation of speculative bubbles. In this regard, there is a need for greater transparency and stronger regulation in the international financial markets.

³ The restrictive financing environment, lower oil prices and higher investment and operating costs may have accelerated the rate of decline of production in fields and caused a delay, cancellation or reduction in the exploration and development investment plans of at least 15% over the previous year (IEA, 2009).

⁴ In the region, purchases of drilling equipment and rigs may respond less quickly to price changes than in other regions and countries in the world.

Figure II.3
**LATIN AMERICA AND THE CARIBBEAN AND THE WORLD: EVOLUTION OF PRICES,
 COSTS AND ACTIVITIES IN OIL AND NATURAL GAS SECTORS, 2000-2012^a**
(Numbers and indices with base year 2000 = 100)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Baker Hughes, “International rig counts”, 2013 [online] http://investor.shareholder.com/bhi/rig_counts/rc_index.cfm; IHS, “IHS-CERA: Capital Costs”, 2013 [online] <http://www.ihs.com/info/cera/ihsindexes/index.aspx>.

^a The number of drilling rigs corresponds to the average number of active oil and natural gas rigs, regardless of whether they come from exploratory or production wells. The indices of operating and investment costs consider the nominal costs of a portfolio of exploration and production projects that are globally representative.

With growth in the oil supply failing to keep up with regional demand, an energy supply and security problem could ensue in addition to a shrinking volume available for exports. In those countries in which fiscal spending is closely related to revenue from hydrocarbons, it could increase the risk of fiscal deficit, higher domestic and foreign debt, and a decline in net international reserves.

Moreover, a clear upward trend can be seen in both investment and operating and maintenance costs after 2004 (see figure II.3). This cost increase was not offset by the price hike to the same extent as in the mining sector, where prices rose much faster than mineral extraction and processing costs.⁵

In recent years, the natural gas market has diverged from the oil market. In the United States, what has been termed the revolution of unconventional natural gas (shale gas) is in full swing and has translated into prices that are one third of those being paid in Europe and Asia. Demand for natural gas has recovered in the main regions to surpass the levels recorded prior to the financial crisis. As global trade accelerates and

⁵ Due in part to this situation, regional economic rent from the hydrocarbon sector rose much less than from the mining sector, such that the value of the former went from being nine times to just twice value of the latter (World Bank, 2013).

transport-related limitations diminish,⁶ global arbitrage of natural gas could trigger a convergence in prices and in resource-valuation methods in —more frequent— natural gas markets.

The energy markets are experiencing one of the periods of greatest uncertainty in recent decades, due to the repercussions of the Arab Spring on exploration and production processes and the macroeconomic fallout of the euro zone crisis. The uptick in prices as of 2010 has coincided with the political problems of the Arab countries, especially Egypt, Libya and the Syrian Arab Republic. However, there is also an interplay of structural factors with these political events: the pressure of rising demand in China, a probable increase in demand for electricity (due to a smaller share being generated by nuclear power plants) and climbing oil production costs.⁷

2. Reserves

Two definitions of reserves are used in the industry: deterministic and probabilistic. These definitions are complementary and their estimation is based on geological, technological, economic and legal conditions. In order for a resource to be considered a reserve and classified as proven, development and production over the lifetime of the reservoir must be profitable and commercially attractive for the State or the oil company. Profitability does not depend solely on the price of sale and investment and operating costs but is also subject to legal conditions in force, as shown by exploration and production contracts, sales contracts, and the fiscal regime for taxes and royalties, among other things. Reserve accumulation and certification are based on the resource discovery during the exploration activity —mainly by means of seismic, gravimetric and stratigraphic prospecting and the drilling of exploratory wells— in accordance with the technical-economic and legal conditions already mentioned.⁸

Reserves fell everywhere in the region except the Bolivarian Republic of Venezuela, Brazil, Colombia, Ecuador and Peru. Mexico had total reserves of more than 25 billion barrels of oil equivalent in 2000 but that volume had diminished by over 45% by the end of the decade, a very similar situation to what occurred in Argentina and the Plurinational State of Bolivia.

In 2012, the Bolivarian Republic of Venezuela had the world's largest reserves of oil (298 billion barrels) and natural gas (196 trillion cubic feet), ahead even of Saudi Arabia. With the Magna Reserve project, which began in 2005 and involved the division of the Orinoco region into 27 blocks, reserves were quantified and certified in situ, which translated into an increase of over 270% in oil reserves (see figure II.4). According to some analysts, however, this increase owed more to the certification of existing extra heavy crude resources than to any particularly successful exploration activity (Fundación Bariloche, 2012).

⁶ Higher transport costs for liquified natural gas in the event of a delay in the Panama Canal expansion plan, transit restrictions on liquified natural gas tankers or high investment costs in pipelines, which involve long-term supply contracts, could hinder market flexibility.

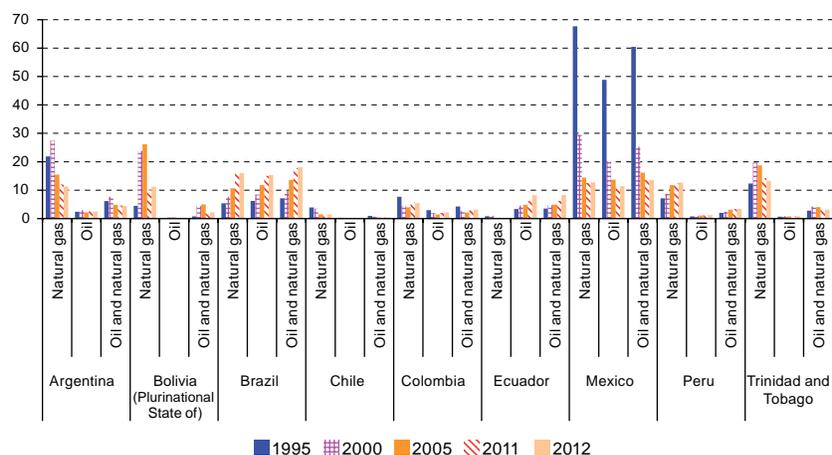
⁷ For example, on 5 May 2011, the price of Brent crude oil fell by US\$ 10 in one day. No analyst would say that this drop in price was due to structural reasons, major changes in the cost of exploration or exhaustion of the resource (in physical units) based on Hubbert's curve. Indeed, none of these explanations were made. Instead, the decline was attributed to something as far removed, in principle, from the oil market —although this is relative, if its effect on economic recovery and aggregated demand is considered— as the European Central Bank's announcement that it would not raise interest rates, which would presumably halt the euro's persistent ascent against the dollar.

⁸ The stock of reserves can increase because of new finds; however, modern oil accounting suggests that this variable can also rise or fall each year because of other flow variables. Consequently, consideration should be given to revisions to earlier estimates (for example, when greater certainty exists about variables such as pricing, costs, the porosity of the reservoir and the recovery rate), enhanced recovery techniques (including the injection of natural gas or CO₂ into reservoirs), the net balance of reserves transactions (upon purchase or sale of rights, shares or concessions to land or areas with oil) and production during the year.

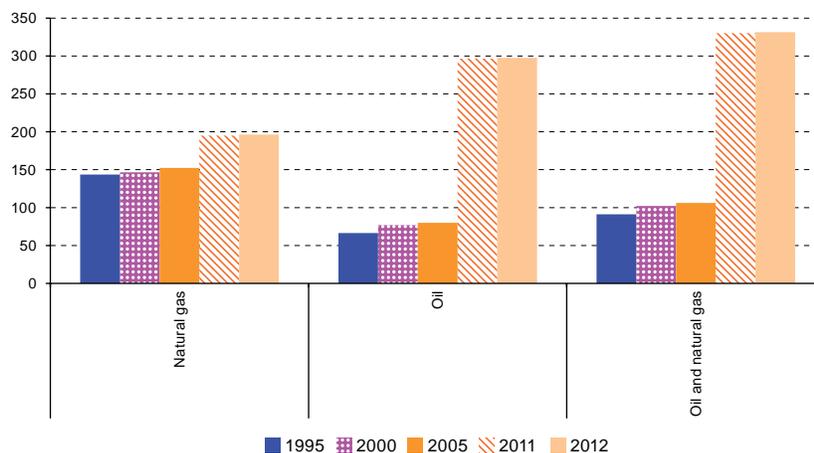
Figure II.4
**LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES):
 OIL AND NATURAL GAS RESERVES, 1995-2012^a**

(Trillions of cubic feet of natural gas, billions of barrels of oil and billions of barrels of oil equivalent for the hydrocarbons total)

A. Argentina, Bolivia (Plurinational State of), Brazil, Chile, Colombia, Ecuador, Mexico, Peru and Trinidad and Tobago



B. Bolivarian Republic of Venezuela



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of British Petroleum (BP), *Statistical Review of World Energy, 2013*, *Statistical Review of World Energy, 2012* and *Statistical Review of World Energy, 2011* [online] <http://www.bp.com/statisticalreview>; ENI, *World Oil and Gas Review, 2012* [online] <http://www.eni.com/world-oil-gas-review/pages/home.shtml>.

^a At the end of each year. In the case of natural gas, a conversion factor of 5,800 cubic feet per barrel of oil equivalent was used.

In the case of Brazil, reserves estimates do not take account of all the resources in the Brazilian pre-salt layer discovered in the Tupi field in 2007 or of others in the Santos reservoir. Together, these are expected to total 50 billion barrels of oil equivalent, and if treated as reserves in future they will almost treble current estimates (see box II.1).

Box II.1
BRAZILIAN PRE-SALT

In 2007, Brazil's State-owned oil company (Petrobras) announced the discovery of substantial oil and natural gas resources in reservoirs under an impermeable salt layer along the country's coast, which were deposited some 150 million years ago. These characteristics, in addition to explaining why these reservoirs are called "pre-salt," point up the challenge involved in exploration and production of these resources, inasmuch as extraction requires maritime drilling to a depth more than 3,000 meters through water, rock and over 1,500 meters of salt, all 300 kilometers offshore.

Recoverable resources are estimated at around 50 billion barrels of oil equivalent, within an area measuring 149,000 square kilometers and extending over three basins: Santos, Campos and Espírito Santo.

As of 2011, over 30% of the pre-salt area was subject to concession in bidding rounds and transfer to Petrobras for exploration and development. The remaining percentage of the area would be offered in future rounds. Some characteristics of the pre-salt blocks are presented below.

CHARACTERISTICS OF BLOCKS IN THE PRE-SALT AREA

Blocks	Recoverable volume of oil and natural gas (in billions of barrels of oil equivalent)	Type of contract	Year	Partners	Declaration of commerciality
Lula (Tupi), Cernambi	8.3	Bidding round	2000	Petrobras 65%, BG 25%, Galp 10%	December 2010
Iara	3.0 to 4.0	Bidding round	2000	Petrobras 65%, BG 25%, Galp 10%	
Sapinhoá and Carioca	2.1	Bidding round	2000	Petrobras 45%, BG 30%, Repsol 25%	December 2011
Parque de las Ballenas	1.5 to 2.0	Bidding round	2009	Repsol 35%, Statoil 35%, Petrobras 30%	
Franco	2.0 to 5.5	Fee-based transfer of rights	2010	Petrobras 100%	
Peroba	1.1 to 1.8	Fee-based transfer of rights	2010	Petrobras 100%	
Entorno de Iara	0.6 to 0.8	Fee-based transfer of rights	2010	Petrobras 100%	
Southern and northeastern Tupi	0.5 to 0.7	Fee-based transfer of rights	2010	Petrobras 100%	
Florim	0.1 to 0.4	Fee-based transfer of rights	2010	Petrobras 100%	
Southern Guar	0.1 to 0.3	Fee-based transfer of rights	2010	Petrobras 100%	
Libra	7.0 to 8.0	Bidding round	2013	Petrobras 40%, Shell 20%, Total S.A. 20%, CNPC 10%, CNOOC 10%	

Source: Petrobras, "Pre-sal panorama e oportunidades", September 2012 [online] <http://www.investidorpetrobras.com.br/pt/apresentacoes/apresentacao-rio-oil-and-gas-pre-sal-carlos-tadeu-fraga.htm>, National Petroleum Agency (ANP), "Desarrollos en el Pre-Sal brasileo", paper presented at the XVII Annual Meeting of the IberoAmerican Association of Energy Regulatory Agencies (ARIAE), Santa Cruz, 23-26 April 2013 and Agncia Estado, "Sem disputa, Petrobrs vence leilo de Libra com Shell, Total e duas chinesas", 22 October 2013.

To date, about US\$ 7 billion has been invested in the area, a figure that is expected to climb to US\$ 90 billion by 2016, according to Petrobras and its partners' development plans. However, in order to discover and develop resources of around 50 billion barrels of oil equivalent —and almost treble current proven reserves with an eventual certification— a greater investment will be needed.

Daily production in the pre-salt area is already at 300,000 barrels of oil (14% of the national total) and 10 million cubic meters of natural gas (21% of the national total), across the 13 current productive fields, which have benefited from existing infrastructure for deepwater operations. According to Petrobras, pre-salt oil production will rise to 1 million barrels of oil per day in 2017 and nearly 2 million in 2020.

Three types of contracts are used in the pre-salt area: (i) concession contracts, which are used in current blocks offered in pre-2007 bidding rounds; (ii) fee-based transfer of rights, which is used in areas that were transferred to Petrobras for nearly US\$ 42 billion during the company's 2010 capitalization; and (iii) production-sharing contracts, which were adopted under the new legal framework in 2010, which will be introduced in the first pre-salt bidding round in 2013.

Source: Prepared by the author.

Reserves estimates do not include, either, the region's unconventional natural gas resources.⁹ Once technology, regulatory frameworks or trade agreements make hydraulic fracturing and horizontal drilling techniques affordable and available in the region, countries such as Argentina, Colombia or Mexico will be able to certify these technically recoverable resources.¹⁰

At the global level, it is estimated that growth in unconventional gas reserves will increase its consumption in the energy mix to the point where it could even equal oil consumption in the next 20 years. This process will also allow natural gas price formation to reflect the costs of developing and producing reserves, regardless of price formation and fluctuations for oil or oil derivatives considered substitutes. Indeed, this phenomenon has already been observed since 2009, with a decoupling between the almost steady price trend for Henry Hub natural gas and the fluctuations in the WTI oil price (Bourland and Gamble, 2011).

(a) Reserve replacement

The effort made by countries to replace reserves is measured by the reserve replacement index.¹¹ An index value below 100 would signify inadequate (or zero) replenishment of reserves, a value of 100 would signify exact replenishment and a value greater than 100 would mean that replenishment was more than adequate given production levels. The optimum situation for a country is to have a ratio of at least 100, so that it is either replenishing reserves by at least the levels of production consumed or is not losing wealth or assets.

In theory, high oil prices coupled with low unit finding and development costs¹² should lead to higher reserve replacement levels. However, in practice, this relationship has been found to vary around the world and between countries in the region.

⁹ Unconventional natural gas is in hard-to-find underground locations and is characterized by high production costs. It is found, for example, in impermeable deposits (requiring tremendous manipulation and substantial investment) or in hydrate deposits. It can also derive from in situ gasification of coal. The category of unconventional natural gas includes: (i) shale gas, which is natural gas found in clayey detrital sedimentary rock that is rich in organic matter and characterized by low permeability and migration; (ii) tight gas, which is the natural gas found in very compact sedimentary rocks of fine-grained sandstone, with low-permeability, low-migration calcareous, ferruginous or siliceous cement, requiring the use of techniques such as hydraulic fracturing; and (iii) coalbed methane, the methane-rich natural gas found in coal deposits (ENI, 2002; IEA, 2012a).

¹⁰ These are discovered and undiscovered in situ resources that are recoverable (economic considerations aside) with current technology. These resources become reserves once they are discovered and commercial. In addition, the sum of reserves, contingent resources and prospective resources is considered to be a remaining recoverable resource (SPE, 2009).

¹¹ $RRIt = (((Rt - Rt-1)/Pt) + 1) * 100 = (((Rt-1 - Pt + DIS + REC \pm REV \pm RES - Rt-1)/Pt) + 1) * 100 = ((DIS + REC \pm REV \pm RES) / Pt) * 100$ where:

RRi = Reserve replacement index

t = Time

R = Reserves

P = Production

DIS = Discoveries and extensions

REC = Improved recovery

REV = Revisions to earlier estimates

RES = Purchase and sales of reserves

¹² The evolution of these costs is shaped by mutually opposing factors, such as the fact that the development and use of new technologies provides access to more resources at lower unit costs but reservoir depletion increases the cost of discovering and producing hydrocarbons. There may also be cyclical variations in costs derived from short-term fluctuations in oil prices that affect the availability of machinery, labour and services in the industry.

Table II.1 presents hydrocarbon reserve replacement indices in various regions of the world and in selected countries for the five-year period from 2008 to 2012, and unit investment discovery and development costs for the five-year period from 2007 to 2011.¹³ The cost figures were taken from available data from international audit firms and specialized agencies.¹⁴

Table II.1
**LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES) COMPARED
 WITH WORLD REGIONS: RESERVE REPLACEMENT TIMES
 AND DEVELOPMENT COSTS**

(Dollars per barrel of oil equivalent and percentages)

		Reserve replacement, 2008-2012 (Percentages)		
		Less than 100	Between 100 and 200	More than 200
Finding and development cost, 2007-2011 (Dollars per barrel of oil equivalent)	Less than 10			Latin America and the Caribbean Middle East Venezuela (Bolivarian Republic of)
	Between 10 and 20		North America Latin America and the Caribbean excluding Venezuela (Bolivarian Republic of) Asia and the Pacific	
		Argentina Bolivia (Plurinational State of) Mexico Trinidad and Tobago	Colombia Peru	Ecuador
	More than 20		Africa Europe and Eurasia Brazil	

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of British Petroleum (BP), *Statistical Review of World Energy, 2013* [online] <http://www.bp.com/statisticalreview>; Ernst & Young, *Global Oil and Gas Reserves Study, 2012* [online] http://www.ey.com/Publication/vwLUAssets/Global_oil_and_gas_reserves_study; International Energy Agency (IEA), *World Energy Outlook 2010* [online] <http://www.worldenergyoutlook.org/media/weo2010.pdf>.

¹³ The formula for calculating the finding and development unit cost is:

$$CDD_t = (G\&G_t + DRL_t + PRO_t) / (DIS_t + REC_t + REV_t + RES_t)$$
, where:
 CDD = Finding and development unit cost or reserve replacement unit cost
 t = Time
 G&G = Geological and geophysical exploration costs
 DRL = Drilling costs for exploration and development activities
 PRO = Cost of purchasing property or areas with reserves
 DIS = Discoveries and extensions
 REC = Improved recovery
 REV = Revisions to earlier estimates
 RES = Purchase of reserves

¹⁴ The reserve replacement unit cost calculated by the audit firm Ernst & Young as of 2011 corresponded to the average five-year investment in various regions of the world by the 75 largest private and State-owned companies that met the public listing financial requirements stipulated by the United States Securities and Exchange Commission. The figures for Brazil, Colombia and Mexico were estimated based on the investment in the region by the national companies representing those countries—Petrobras, Ecopetrol and PEMEX, respectively. The mid-range of finding and development unit costs for Latin America, calculated by the International Energy Agency (IEA) in 2010, served as a parameter for the other countries, with the exception of the Bolivarian Republic of Venezuela, where the cost was estimated using the “extra heavy crude” concept, which alludes to deposits in the Orinoco Belt and Canada’s bituminous sands.

The cost varies between geographical regions due to specific types of geological features in reservoirs, onshore or offshore location and other factors. Unit costs ranging from less than US\$ 10 per barrel of oil equivalent to over US\$ 20—the costs in the Middle East and Africa, respectively—did not prevent countries like the Islamic Republic of Iran and Iraq or Angola and Libya from successfully replacing their reserves, aided by high crude oil prices.

In Latin America and the Caribbean, the Bolivarian Republic of Venezuela has an obvious impact on the replacement rate and cost in the region, due to the significant reserves of extra heavy crude oil that the country began certifying in 2009. If the country and its certified reserves are excluded, the region's position weakens, going from a reserve replacement rate that is more than adequate at a cost of about US\$ 10 per barrel of oil equivalent to an almost exact replacement rate at a cost of about US\$ 20 barrel of oil equivalent.

Replacement rates and costs vary considerably among the region's countries. The inadequate replacement rate in Mexico stands in contrast to the costly replacement of offshore reserves in Brazil. Countries like Ecuador, Colombia and Peru have replacement rates that are more than adequate, but this is not the case in Argentina, the Plurinational State of Bolivia or Trinidad and Tobago, countries that did not seem to take advantage of the price boom and moderate costs to accumulate reserves.

This situation may be caused by different factors, such as the revision of earlier reserve estimates in the Plurinational State of Bolivia in 2010, insufficient investment and financing for exploration activities—exacerbated by the global economic crisis of 2009—and regulatory aspects, such as fixed prices in the domestic market or higher fiscal rates that affected, among other factors, the economic character and valuation of reserves.

(b) Resource abundance: the relationship between reserves and production

Traditionally, the abundance of nonrenewable natural resources has traditionally been measured as the ratio between reserves and production or the estimated life of reserves (expressed as the number of years that reserves would last at the current production rate). This indicator and its underlying measures reflect the abundance or scarcity of oil and natural gas resources over time and are in turn influenced by the evolution of reserve and production levels.¹⁵

The reserve life of oil and natural gas resources in Latin America and the Caribbean climbed over a five-year period to stand at 74 years in 2012, well above the global average of 56 years, owing to two contrary effects, an increase in the abundance of oil and the scarcity of natural gas. Without the certification of the extra heavy crude or associated natural gas from the Orinoco Belt, i.e. without the Bolivarian Republic of Venezuela, reserve life in Latin America would have been just 14 years (see table II.2 and figure II.5).

Among the countries considered in the region, Colombia and the Bolivarian Republic of Venezuela are at opposite ends of the spectrum in terms of scarcity and abundance of hydrocarbons, with reserve lives of 7 and 277 years, respectively. In recent years, however, rising production in Colombia has been balanced by rising reserves, allowing reserve life to be maintained, albeit at a low level. Private- and public-sector investment flows in Colombia are expected to increase this indicator in future.

Even though this situation of hydrocarbon abundance is primarily determined by reserves of oil rather than natural gas, the scarcity of the latter is evident. The challenge for the countries that have traditionally produced natural gas, such as Argentina, Mexico, the Plurinational State of Bolivia and Trinidad and Tobago, is to increase the reserve life of this resource over the current average of 10 years.

¹⁵ The ratio will increase if the increase (decrease) in proven reserves at the start of the year is greater (less) than the increase (decrease) in production for the year.

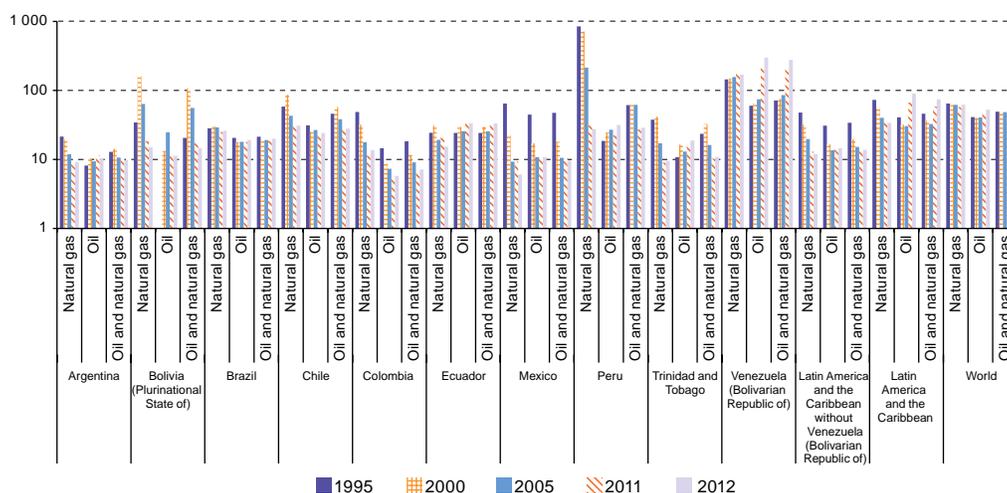
Table II.2
**WORLD AND LATIN AMERICA AND THE CARIBBEAN: EVOLUTION OF OIL
 AND NATURAL GAS ABUNDANCE, 1995-2012^a**
 (Years)

Type / Region or subregion	1995	2000	2005	2011	2012
Oil					
World	41.0	39.7	40.7	45.3	52.6
Latin America and the Caribbean	40.6	31.8	30.3	66.6	89.8
Latin America and the Caribbean without Venezuela (Bolivarian Republic of)	30.9	16.6	13.6	14.3	14.6
Natural gas					
World	64.6	61.7	61.8	57.1	62.1
Latin America and the Caribbean	72.8	55.5	40.2	35.9	33.7
Latin America and the Caribbean without Venezuela (Bolivarian Republic of)	47.6	31.9	19.8	12.9	11.9
Total hydrocarbons					
World	49.1	47.4	48.3	50.0	56.3
Latin America and the Caribbean	46.0	36.2	32.5	58.5	74.3
Latin America and the Caribbean without Venezuela (Bolivarian Republic of)	33.9	19.7	15.1	13.9	13.8

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of British Petroleum (BP), *Statistical Review of World Energy, 2013, Statistical Review of World Energy, 2012 and Statistical Review of World Energy, 2011* [online] <http://www.bp.com/statisticalreview>.

^a Abundance is measured as the ratio between reserves and production or the estimated life of reserves, expressed as the number of years that reserves would last at the current production rate.

Figure II.5
**LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES): EVOLUTION
 OF OIL AND NATURAL GAS ABUNDANCE, 1995-2012^a**
 (Years)^b



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of British Petroleum (BP), *Statistical Review of World Energy, 2013, Statistical Review of World Energy, 2012 and Statistical Review of World Energy, 2011* [online] <http://www.bp.com/statisticalreview>.

^a Abundance is measured as the ratio between reserves and production or the estimated life of reserves, expressed as the number of years that reserves would last at the current production rate.

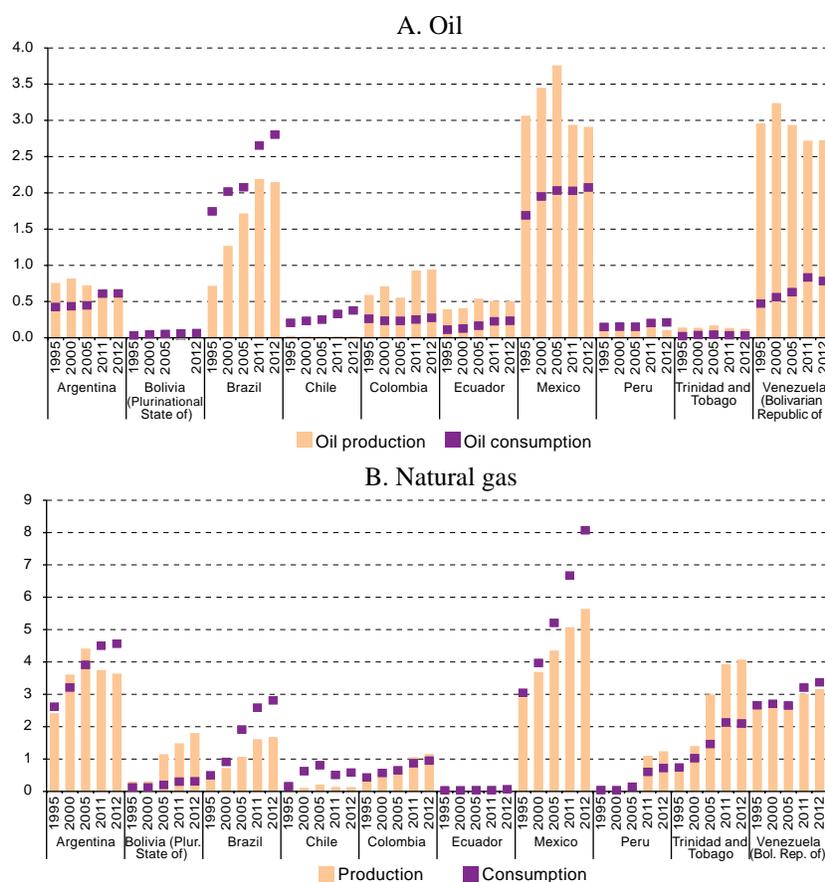
^b Logarithmic scale.

Over the past decade, Peru was the country that experienced the steepest decline in the reserve life of its natural gas resources, to the current level of 28 years, as growth in reserves failed to keep pace with production, owing to the certification and development of reserves in the Camisea block and the increase in production for both electricity generation in the domestic market and liquefied natural gas (LNG) for the export market.

3. Production and consumption

Mexico was the region's largest producer of both oil (2.9 million barrels per day) and natural gas (5.6 billion cubic feet per day) in 2012. The second-largest producers were the Bolivarian Republic of Venezuela for oil and Trinidad and Tobago for natural gas. Although the largest producers have been experiencing falling annual production rates, many have recovered in recent years.¹⁶ Colombia and Brazil have successfully offset the natural decline of fields by scaling up production, with annual gains of 9% and 4%, respectively, over the last five-year period (see figure II.6).

Figure II.6
LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES): PRODUCTION AND CONSUMPTION OF OIL AND NATURAL GAS, 1995-2012
(Millions of barrels of oil per day and billions of cubic feet of natural gas per day)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of British Petroleum (BP), *Statistical Review of World Energy, 2013*, *Statistical Review of World Energy, 2012* and *Statistical Review of World Energy, 2011* [online] <http://www.bp.com/statisticalreview>; ENI, *World Oil and Gas Review 2012* [online] <http://www.eni.com>.

¹⁶ Well or field production decline analysis is based on exponential, harmonic or hyperbolic functions.

In the case of oil, higher prices and greater drilling activity in the Bolivarian Republic of Venezuela and Ecuador were apparently not enough to offset the decline in output from mature fields, a situation that was also influenced by the quotas set by the Organization of the Petroleum Exporting Countries (OPEC), of which both countries are members. The stance of Saudi Arabia, which is one of the leading global producers and thus has substantial influence over OPEC decision-making, has been expressed in pressures not only to limit production but also to increase it in order to stabilize and lower crude prices.¹⁷

Some analysts maintain that a scenario in which prices rise above US\$ 100 per barrel could be a harbinger of economic recession and thus of a reduction in global oil consumption, with potential medium and long-run risks for the fiscal revenues of some producer countries whose economies are heavily dependent on raw materials. Conversely, prices below US\$ 70 per barrel are a disincentive to investment in projects with high development and production costs, such as extra heavy oil projects in the Bolivarian Republic of Venezuela and ultra deepwater projects in Brazil and Mexico, whose unit costs are estimated at more than US\$ 50 per barrel (Bourland and Gamble, 2011).¹⁸

Another reason for production decline in some countries may be the weak and slow publicprivate investment response to higher prices. Other contributing factors are the difficulties created by technological and geological conditions, given the shrinking number of exploitable fields and the challenges involved in the exploitation of unconventional hydrocarbons, deep-water offshore drilling and extra-heavy oil development. Accordingly, some analysts estimate that if the price of oil were to increase by 100%, the supply of hydrocarbons in the region would only expand by 10% to 25%, due to the price inelasticity of supply (Jenkins, 2011).

According to the international classification, the Bolivarian Republic of Venezuela, Ecuador and Mexico produce mainly heavy sour crude, while Brazil and Colombia produce a heavy medium-sour one. These products have to be processed at special refineries, which is the main reason for their lower international price valuation as compared with the light sweet crudes (see figure A.2 in the annex).¹⁹ Many of these countries' investment plans for the coming years are focused on expanding and modernizing local refineries to process and improve the quality of this type of crude. While this will require a considerable investment, it will make it possible to reduce imports of oil derivatives, especially middle distillates.²⁰

¹⁷ Since 2012, OPEC has maintained a maximum production target of 30 million barrels per day, which is distributed among its member countries based on criteria such as reserve levels, output potential and supply for the domestic market. However, the assigned quotas may be larger than the current production of some of the member countries, which means that in practice, deficits can be offset by surpluses from countries with greater capacity to balance the organization's supply, as is the case of Saudi Arabia.

¹⁸ The breakeven price or price needed to recover costs should take into account not only investment costs related to finding, development and operation activities but also the cost of capital, taxes, royalties and profit margins. Thus, in regions where development is in the hands of private oil companies, breakeven prices of between US\$ 70 and US\$ 90 per barrel are needed. If taxes are excluded, the breakeven price might average US\$ 40 per barrel (IEA, 2011).

¹⁹ The denser the oil, the higher its carbon content, the lower its quality and the greater the proportion of heavy products derived from it. The oil produced in the Plurinational State of Bolivia is a special case because while it is a very light, sweet blend, its composition is based mainly on condensate and natural gasoline, and liquid components associated with natural gas.

²⁰ Mexico and Brazil import, respectively, about 300,000 barrels per day of gasoline and about 600,000 barrels per day of middle distillates—such as kerosene, gas oil and diesel oil according to 2011 figures—mainly to assuage their energy shortages. Some of these volumes are supplied and exported to the region by the Bolivarian Republic of Venezuela (ENI, 2012).

By contrast, the production of natural gas in most of the countries brings out other liquid hydrocarbon chains (such as ethanes, propanes and butanes). This is an important parameter in international trade, which operates in terms of energy, as it generates a greater sales value for the region's gas production and opens up the prospect of developing industries such as petrochemicals. Natural gas production has been increasing in nearly all the countries in the region, except in Argentina and Ecuador.

Natural gas and oil consumption in the region has remained virtually unchanged as a share of total energy consumption, although natural gas has been gradually replacing oil for the past 20 years. However, although oil consumption fell from 55% of total energy consumption in the five-year period 1991-1995 to 47% in the five-year period 2006-2010, this was still well above the global average, which was 35% in the latter period (see figure A.3 in the annex).

In Latin America and the Caribbean, the largest consumers of hydrocarbons in 2012 were Mexico and Brazil. In these economies, oil and natural gas are used mainly in the transport and industry sector. The next largest users were Argentina, which consumed about 4.7 billion cubic feet of natural gas per day, and the Bolivarian Republic of Venezuela, which consumed about 800,000 barrels of oil per day. In the former, natural gas is used for electricity generation, transport (using compressed natural gas, CNG) and residential consumption. In Venezuela, oil is used in the transport sector, the main destination for hydrocarbons.

C. TRADE IN OIL AND NATURAL GAS

The countries' energy consumption is primarily met by domestic production, imports net of exports and changes in stocks.²¹

The ratio between hydrocarbon energy production and consumption indicates whether a country is an exporter or an importer. An index value above 1 means that the country or region is an exporter, a value equal to 1 means that domestic production meets local demand and a value below 1 indicates the extent of imports required. The decline in the average ratio from 1.4 to 1.1 in Latin America and the Caribbean over the past 15 years is due to two factors: (i) the drop in (exportable) production levels mentioned in the previous section; and (ii) the growth in domestic demand.

In comparison with what has happened in the rest of the world, growth in domestic demand has responded relatively inelastically to rising international prices for hydrocarbons. This may be related to the various mechanisms used to subsidize fuels for automotive transportation and natural gas for residential consumption, which have dampened the transmission of international price changes to domestic markets in some countries in the region. On average, Latin America and the Caribbean, as a region, is a net exporter of oil and almost self-sufficient in natural gas, although decreasingly so (see table II.3 and figure A.4 in the annex).

The production decline over the last decade was offset by the effect of prices on export values. Whereas in the 1991-2000 period, volume accounted for 78% of annual growth in the value of commodity exports from the region's countries, in the 2001-2010 period that share fell to just 35%. Exports of commodities and manufactured goods based on natural resources (including grains and minerals) accounted for about 60% of total exports at the end of the last decade. This figure leaves little doubt as to the risks associated with the economic reprimarization in the region, greater volatility due to overreliance on primary goods and, potentially, resource extraction contrary to the proper economic, social and environment stewardship needed for the sustainable development of natural resources.

²¹ These, in turn, are the result of the supply of primary and secondary energy (net of secondary production) and international bunkers.

Table II.3
**LATIN AMERICA AND THE CARIBBEAN: PRODUCTION-TO-CONSUMPTION RATIO
 OF OIL AND NATURAL GAS, 1995-2012**

Type / region or subregion	1995	2000	2005	2011	2012
Oil					
Latin America and the Caribbean	1.5	1.5	1.5	1.2	1.2
Latin America and the Caribbean without Venezuela (Bolivarian Republic of)	1.1	1.1	1.2	1.0	1.0
Natural gas					
Latin America and the Caribbean	1.0	1.0	1.0	1.0	0.9
Latin America and the Caribbean without Venezuela (Bolivarian Republic of)	1.0	1.0	1.0	1.0	0.9
Total hydrocarbons					
Latin America and the Caribbean	1.4	1.4	1.4	1.2	1.1
Latin America and the Caribbean without Venezuela (Bolivarian Republic of)	1.1	1.1	1.1	1.0	1.0

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of British Petroleum (BP), *Statistical Review of World Energy, 2013*, *Statistical Review of World Energy, 2012* and *Statistical Review of World Energy, 2011* [online] <http://www.bp.com/statisticalreview>.

China is increasingly a leading destination for the region's commodity and commodity-based manufacturing exports and has contributed about 22% of the increase in the value of these exports in recent years (ECLAC, 2012b). In the case of hydrocarbons, Chinese demand for oil is estimated to have driven between 10.8% and 27.1% of the 185% increase in crude prices in 2002-2007 (Jenkins, 2011). This, together with the larger volumes, deepened energy trade between China and Latin America.²²

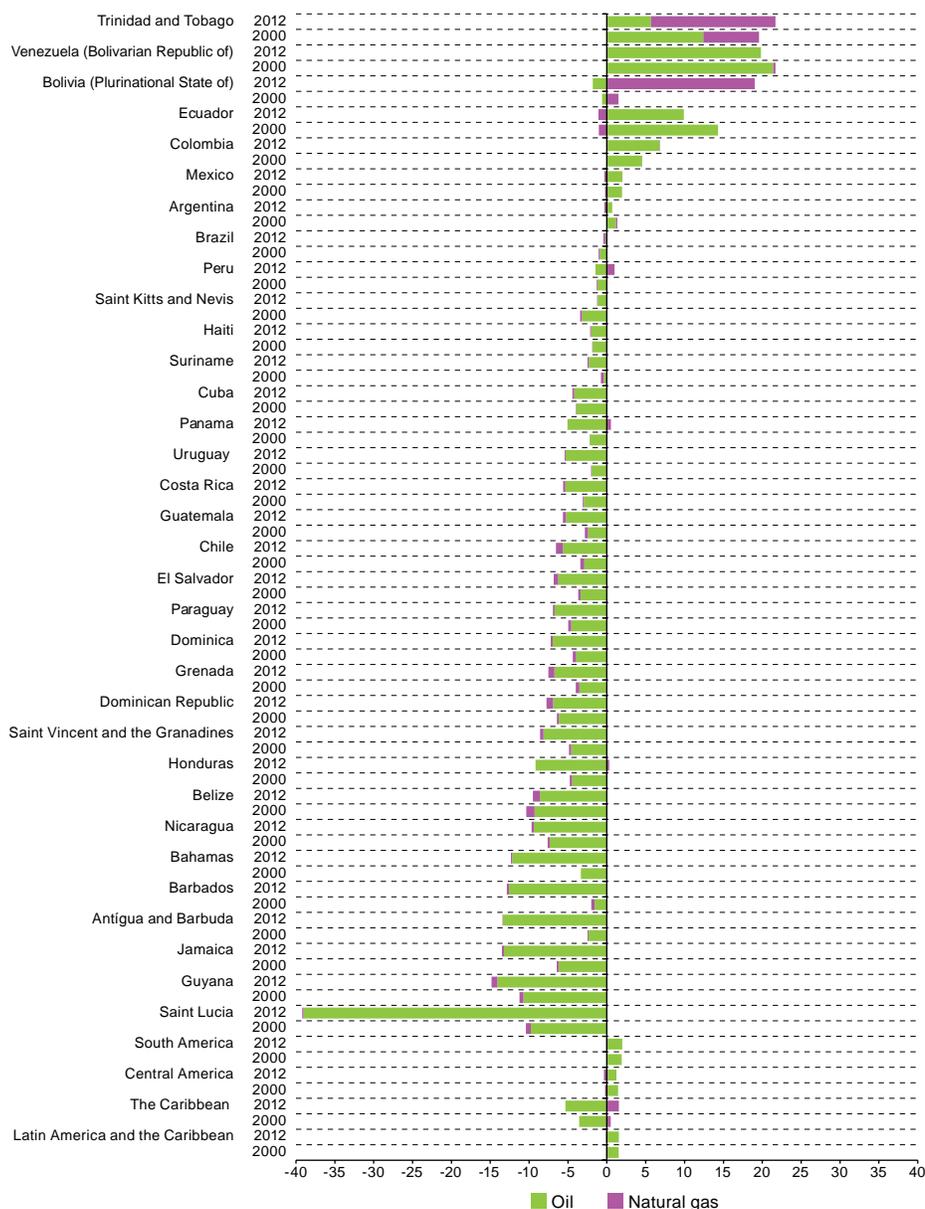
Oil and natural gas exports account for 48% of total exports in Colombia and the Plurinational State of Bolivia, 53% in Ecuador, 65% in Trinidad and Tobago and 81% in the Bolivarian Republic of Venezuela. These volumes have been driven by the price boom, which allowed these economies to improve their terms of trade by between 30% and 68% in the period 2005-2011 (ECLAC, 2012a).

During the last decade, in Argentina, the Bolivarian Republic of Venezuela, Ecuador and Mexico, declining production in some cases and rising consumption of oil derivatives and natural gas in others, led to a decrease in both the production to consumption ratio and the hydrocarbon surplus in proportion to the size of the economies.

Thus, Argentina imported more liquid hydrocarbons and natural gas from the Plurinational State of Bolivia (by pipeline) and from Trinidad and Tobago (in the form of LNG), which resulted in a 0.9 ratio and a trade balance in equilibrium. Meanwhile, in the Bolivarian Republic of Venezuela, Ecuador and Mexico, rising consumption of oil derivatives and natural gas, coupled with the decline of mature oil and gas fields, caused those countries' trade balances to shrink to approximately 20%, 9% and 2% of GDP, respectively (see figure II.7).

²² Although the United States is the region's main oil trade partner, in recent years China has been positioning itself as an important ally and market for an increasing volume of exports from countries such as the Bolivarian Republic of Venezuela, Colombia and Ecuador, a situation that is also shaped by the loans-for-oil programmes with Chinese banks. Moreover, the mid-2013 energy cooperation agreements signed between China, Mexico and Trinidad and Tobago are expected to strengthen trade, energy security and investment paired with technology transfer and capacity-building, amid growing presence and influence of China in the region.

Figure II.7
**LATIN AMERICA AND THE CARIBBEAN: OIL AND NATURAL GAS TRADE
 BALANCES, 2000 AND 2012^a**
(Percentages of GDP)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of the United Nations Conference on Trade and Development (UNCTAD), database, 2013 [online] <http://unctadstat.unctad.org>.

^a The free-on-board (FOB) trade balance of exports minus imports corresponds to the items “petroleum, petroleum products and related materials” and “gas, natural and manufactured.”

In Brazil, despite a production to consumption ratio of about 0.7 and a growing hydrocarbon trade deficit (over US\$ 10 billion, or 0.4% of GDP, in 2012), consumption in the transport sector was offset by ethanol production of about 0.5 million barrels per day.²³ Meanwhile, Colombia, with a ratio of 2.6, strengthened its position as an exporter to the United States and attained the second largest hydrocarbon trade surplus of any economy in the region, with a figure of about US\$ 25 billion in 2012. Peru, although an importer of crude oil and derivatives from Ecuador, is meeting a greater proportion of its consumption from local production every year. However, currency inflows from LNG exports from the Camisea field are not yet enough to offset imports of liquid hydrocarbons.

Thanks to an increase in its natural gas production and exports to Brazil and Argentina and to high natural gas prices (which were indexed to oil derivatives prices), the Plurinational State of Bolivia achieved the highest production to consumption ratio (3.1) and an energy trade surplus of close to US\$ 4.7 billion (17% of GDP). Nonetheless, the country is faced with the challenge of reducing its rising liquid fuel imports, especially diesel oil, by increasing production and cutting its consumption subsidy, estimated at US\$ 1 billion last year.

The hydrocarbon-importing countries were the hit hardest by the price boom. Chile, Paraguay and Uruguay, and many countries in Central America and the Caribbean, posted growing hydrocarbon trade deficits of between 2% and 40% of GDP. In recent years, Chile has been a major importer of oil from Ecuador and LNG from Equatorial Guinea, Egypt and Trinidad and Tobago, as reflected in a ratio of 0.1 and foreign currency expenditures of over US\$ 17 billion in 2012.

The Bolivarian Republic of Venezuela and Trinidad and Tobago, both major regional suppliers, have helped to improve hydrocarbon energy security in countries of Latin America and the Caribbean through the trade initiatives PETROCARIBE²⁴ and CARICOM,²⁵ respectively.

The region has further diversified its natural gas supply sources in the last five years thanks to LNG (see figure A.5 in the annex). The maritime transport supply, while contributing to an increase in world trade, hindered the incipient regional integration process begun by traditional natural gas pipelines. Because of this rise in consumption, natural gas now behaves like a commodity.

Brazil, the main producer and a leading importer of natural gas, has stepped up its imports of gas from the Plurinational State of Bolivia (via pipelines) and of LNG from Trinidad and Tobago and Qatar. The situation regarding the natural gas trade has changed for Argentina and the Bolivarian Republic of Venezuela on the one hand, and Colombia and Peru on the other. Argentina went from being an exporter to Chile to becoming an importer from the Plurinational State of Bolivia and Trinidad and Tobago. Colombia and Peru have moved from a state of equilibrium in their domestic markets to becoming exporters, respectively, of natural gas via pipelines to the Bolivarian Republic of Venezuela and of LNG to Spain and Mexico.

²³ If ethanol production is included in the calculation, Brazil's hydrocarbon production to consumption ratio increases by nearly 0.1.

²⁴ Since its launch in 2004, PETROCARIBE has provided a mechanism for the Bolivarian Republic of Venezuela to supply oil in exchange for preferential financing conditions and foodstuffs from member countries in Central America and the Caribbean. The financing has been characterized by long repayment periods, low interest rates and grace years for debt amortization.

²⁵ During 2008-2012, the CARICOM initiative allowed Trinidad and Tobago to export around US\$ 1.6 billion in hydrocarbons (11% of country's GDP) to the block's member countries (Trinidad and Tobago, Government of, 2012).

The Plurinational State of Bolivia produces the highest proportion of exportable natural gas in long-term contracts with Argentina and Brazil. It has a production to consumption ratio of 6, making it a leading regional exporter of natural gas.

D. INVESTMENT

Investment decisions are based on a country's geological potential, access to favourable markets, the degree of institutional development, legal²⁶ and environmental aspects and a stable and progressive²⁷ fiscal regime, as well as on mutually beneficial relationships between public, private and social actors. Insofar as these factors help to reduce risk, they will have a beneficial effect in attracting investment.

From the standpoint of the State, a good oil contract is one that not only facilitates the development of resources but also generates economic benefits through economic rent, venture capital financing and technology transfer by the private-sector counterpart.

The motivation of the private-sector firm, meanwhile, is to create financial value from globally diversified and profitable projects or assets. In this regard, sales averaging around US\$ 75 per barrel of oil equivalent were reported by a number of State-owned enterprises and foreign companies with operations in the region that are listed on the United States stock exchange.²⁸ This amount enabled them to cover production and exploration costs and depreciation expenditures of US\$ 27, pay income taxes and possibly generate acceptable operating margins (Ernst & Young, 2012).²⁹

The evolution of the international oil price and its decline in 2009 due to the global financial crisis was generally correlated with the regional investment trend in exploration and exploitation activities, both in absolute terms and as a share of the global total. Regional investment rose to its highest level yet in 2012, totalling around US\$ 70 billion, or 11% of worldwide investment, and came mainly from just five State-owned companies—Petrobras, PEMEX, PDVSA, Ecopetrol and YPF (see figure II.8).

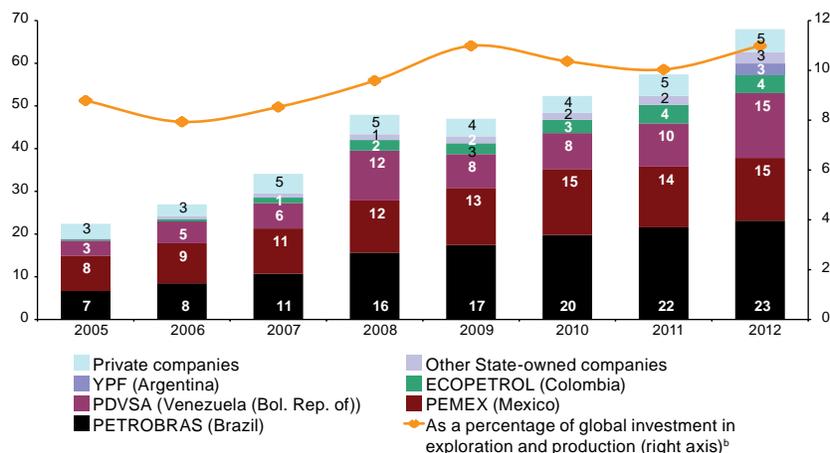
²⁶ The act of determining and defining the ownership of hydrocarbon reserves and production implies that the owner will have independence and sovereignty in the resource's exploitation, capture of economic rent and access to sources of funding. At the same time, reserve accumulation and its effective management may help demonstrate efficiency and credibility in both public- and private-sector governance.

²⁷ A progressive fiscal regime is understood to be a more-than-proportional increase in tax burden (X) as oil rent (Z) increases, the latter being defined as production quoted at international prices net of production costs. A complementary definition of progressiveness is the increase in the effective tax rate ($A = X/Z$) as Z increases.

²⁸ These were Petrobras, Ecopetrol, PEMEX, Repsol, Apache, Shell, British Petroleum (BP) and Occidental, which submit annual financial and accounting statements to the U.S. Securities and Exchange Commission (SEC).

²⁹ The consulting firm Ernst & Young estimated that nearly 20% of these sales corresponded to net earnings in 2011 fiscal year, compared with estimates for the United States (Damodaran, 2013) that put this indicator at 7% and 14% for integrated and nonintegrated oil companies, respectively.

Figure II.8
**LATIN AMERICA AND THE CARIBBEAN: INVESTMENT IN OIL AND NATURAL GAS
 EXPLORATION AND DEVELOPMENT, 2005-2012^a**
(Billions of dollars and percentages of the worldwide total)



Source: Economic Commission for Latin America and the Caribbean), on the basis of Standard & Poor's "Big spenders: Latin America's national oil companies, Petrobras and PEMEX", *Standard & Poor's CreditWeek*, 14 December 2011; 20F SEC filings of Petrobras, PEMEX, YPF and Ecopetrol for fiscal years 2005-2012; Ernst & Young, *Global Oil and Gas Reserves Study, 2012*, December 2012; International Energy Agency (IEA), *World Energy Outlook, 2005 to 2012*; and annual operating reports prepared by the State-owned oil companies PDVSA, YPFB and Petroamazonas.

^a Investment corresponds to regional capital expenditures on exploration and development of reserves by the largest State-owned and foreign companies. It does not include investment for the purchase of property for refining, distribution or marketing at global scale. The category "other State-owned companies" includes investment by the State-owned companies such as YPFB of the Plurinational State of Bolivia, Petrotrin and National Gas Company (NGC) of Trinidad and Tobago and Petroamazonas of Ecuador. The category "private companies" includes investments made by companies such as Repsol of Spain, British Petroleum (BP) of the United Kingdom, Shell of the Netherlands and Apache and Occidental of the United States.

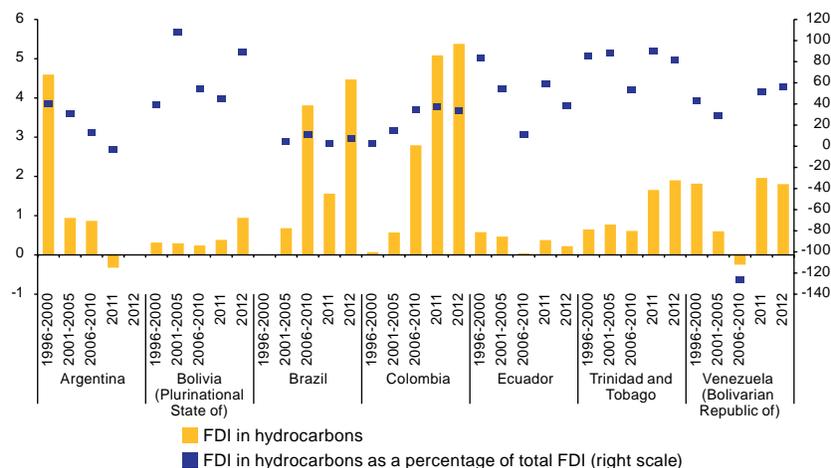
^b Prorated global investment based on a sample of 70 companies and information on investment budgets from the International Energy Agency (IEA).

Although the natural resource sectors such as hydrocarbons and minerals have accounted for nearly 26% of foreign direct investment (FDI) since 2007, the patterns diverge at the subregional level. In the countries of South America (excluding Brazil), the raw materials sectors captured half of FDI, while in Brazil and the countries of Central America and the Caribbean, FDI mainly went to the manufacturing and services sectors. However, a greater level of investment is not necessarily reflected in more employment, considering that in capital-intensive sectors, such as the extractive industry, the creation of direct employment is limited.³⁰

In the various countries, two trends related to policies on foreign capital attraction were observed over the last decade, with differing effects on investment (see figure II.9).

³⁰ It is estimated that one new job is created for every US\$ 2 million invested in the hydrocarbon or mining sector. This is far less than the 14 jobs created in the commerce and construction sectors for a comparable investment (ECLAC, 2013a).

Figure II.9
**LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES): FOREIGN
 DIRECT INVESTMENT (FDI) IN HYDROCARBONS, 1996-2012^a**
(Billions of dollars and percentages of the total)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of official information from the respective countries; United Nations Conference on Trade and Development (UNCTAD), database, 2012 [online] http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx?sCS_referer=&sCS_ChosenLang=en.

^a Investment by foreign companies (foreign direct investment) corresponds to the annual averages for the periods and in some cases may include all industry activities. The amounts include greenfield investment plus mergers and acquisitions of firms or assets by non-residents in the reporting country. As for the type of presentation, Brazil and the Plurinational State of Bolivia consider investment received but not disinvestment in the sector (i.e. withdrawal or repatriation of capital, amortization of loans and sales of shares by foreign investors, etc.). The other countries consider net investment received, which explains the small values for Ecuador and the negative values for the Bolivarian Republic of Venezuela in the 2006-2010 period. No information is given for Peru, owing to incomplete data; for Argentina, no information is available for 2012; for Brazil no information is available for the 1996-2000 period. The data for Ecuador refer to all natural resources.

On the one hand, Brazil and Colombia have adopted measures to attract private capital as a way to secure investments in exploration and thus restore reserve and production levels, which had begun to decline towards the end of the 1990s. These countries allowed greater private participation in production by signing concession contracts with strategic private partners. They awarded contracts for traditional and nontraditional areas at international auctions (in which State-owned oil companies like Petrobras and Ecopetrol also competed), implemented fiscal reforms that incorporated sliding-scale royalties and issued exploration permits with longer terms. As a result of these measures, these two countries were the largest recipients of FDI in the region.³¹

³¹ In the nine bidding rounds that were carried out in Brazil until 2008, a significant flow of local and foreign investment came in the form of signing bonuses, minimum exploration commitments and local content in goods and services. The average amount collected from signing bonuses was US\$ 289 million per round and investors' expectations peaked in 2007—the year of the pre-salt discovery—as reflected in offers of nearly US\$ 39,000 per square kilometre. On average, US\$ 500 million per round was committed for exploration activities, with the largest commitment made in 2007 at US\$ 25,000 per square kilometre. The average percentage of local content was about 57% per round for exploration, development and production activities.

On the other hand, Mexico has maintained a State monopoly since 1932 that has limited private capital participation in the industry. Other countries undertook nationalization processes or expanded State control, as was the case in the Plurinational State of Bolivia in 2006, Ecuador in 2010, the Bolivarian Republic of Venezuela in 2000 and Argentina in 2012.³² These processes have been characterized by the establishment of State ownership in production and oil assets, contractual renegotiations resulting in operation, services and mixed contracts as well as greater participation by State-owned companies and growing fiscal burdens. These factors do not, in any case, appear to have inhibited the attraction of foreign investment to many of these countries.³³

A number of companies —especially in the United States and Europe— have sold their stakes in the region, while State-owned companies from China, India and other emerging economies are showing a growing interest in investing.

Given the possibility of a drop in international prices (and/or an increase in costs) and the urgent need to develop hydrocarbon resources, the challenge for the region is to balance the possible deterioration in economic variables with strengthened institutional and legal frameworks, focused on diminishing investor risk.

For example, partnerships between State-owned and private companies in projects related to unconventional hydrocarbons in Argentina, Mexico and Colombia, pre-salt deposits in Brazil and extra heavy crude in the Bolivarian Republic of Venezuela, among others, face challenges related to financing and executing a considerable investment budget of over US\$ 400 billion for the fiveyear period 2013-2017, which is nearly 50% greater than the budget executed in the previous period (see table A.1 in the annex).³⁴ In this regard, proper governance of natural resources is aided by an efficient, transparent and independent administration and control of these investments by State-owned companies, in alliance with stakeholders where socioenvironmental and economic aspects are concerned.

A pro-investment policy should focus not only on quantity but also on quality, in order to strengthen technology transfer and value and knowledge creation, while addressing the countries' development agendas.

In Colombia, the limited capacity of the transport system, along with less physical security, could delay execution of exploration and development investments and restrict the volume of exports that can be sent to the United States. Furthermore, the energy trade balance between the two countries could be influenced by the importation of oil services and investment with technology transfer from the United States for the development of unconventional hydrocarbons in Colombian oil and gas fields, all new possibilities under the free trade agreement signed in 2012.

Brazil hopes to replicate the investment success it had during previous bidding rounds with the new contractual regime —which will enter into effect in the first bidding round for pre-salt areas in late 2013— characterized by production-sharing contracts with an initial minimum 30% quota for Petrobras in a scenario of broader State control.

³² Although the nationalization of Repsol's 51% share in YPF Argentina took place in 2012, the transaction was not recorded in FDI flows for 2012 (as disinvestment) because no agreement had yet been reached on compensation.

³³ In the 2006-2010 period, the Bolivarian Republic of Venezuela had negative FDI flows as foreign companies repatriated accumulated earnings from previous periods, but in 2011 the country started to receive significant inflows to the sector, at around US\$ 2 billion.

³⁴ For comparison, it is estimated that the sustainable development of natural gas in the region will require an investment of nearly US\$ 800 billion over the next two decades, with US\$ 500 billion and US\$ 150 billion going to exploration and production of conventional and unconventional natural gas respectively, and US\$ 150 billion for distribution, refining, marketing and infrastructure for LNG (IEA, 2012a).

In Mexico, new opportunities for foreign investment could arise in the medium term as the country moves forward with its planned energy reform. Under the reform proposal, the State will retain ownership of hydrocarbons and PEMEX assets but will seek to increase production through more active exploration and production contracts, in addition to other new measures.³⁵

Inasmuch as infrastructure and oil-sector activities are financed and tied to production and future oil delivery—for example, under programmes like the oil-for-loans agreements that Colombia, Ecuador and the Bolivarian Republic of Venezuela have signed with Chinese banks and oil companies—risks could emerge due to future public deficit and debt crises caused in part by the volatility in oil prices and capital markets.³⁶ Aggressive oil extraction practices, influenced by financial constraints, could also turn the spotlight on aspects of oil valuation under conditions of uncertainty, its availability, the sustainable generation of future benefits for society and the vulnerability caused by reliance on limited export markets.³⁷

E. CONTRACTUAL FRAMEWORK, ECONOMIC RENT AND FISCAL REVENUE

In creating tax incentives³⁸ designing fiscal regimes,³⁹ development policies for the hydrocarbon sector must consider the resource potential and safeguard efficient production, with due regard for the volatility of market conditions. Moreover, the government should maximize its take in periods of high prices and demonstrate flexibility by providing incentives for public-private investment during recessionary phases.

Mechanisms used to make a system progressive include sliding-scale royalties based on production volume or value, taxes tied to windfall prices or profits, or even a share of the State-owned enterprise in earnings, with a profitability ratio, in service or production-sharing contracts. Applying fixed royalties and high levels of taxation that are inelastic to price or profitability might make the system fiscally regressive.⁴⁰ All this means that fiscal systems face serious challenges and are complex to design.

³⁵ The energy reform, which was announced in 2012 as part of the Pact for Mexico, is also expected to promote economic competition in the refinery, petrochemicals and transport segments, among others.

³⁶ Aggressive lending, generally driven by the international banking sector, could jeopardize commodity-exporting countries, so mechanisms for hedging oil prices should be sought in order to reduce inherent risks (Humphreys, Sachs and Stiglitz, 2007).

³⁷ In 2012, around 80% of Ecuador's crude exports were sent to Chinese brokers. It is estimated that by 2015 nearly half of the Bolivarian Republic of Venezuela's exports may go to the Chinese market, given the terms and conditions of PDVSA loans made to fund the mixed contract's activities in the Orinoco Belt area (Business Monitor International, 2013).

³⁸ Such as the use of accelerated depreciation as an income tax deduction, tax holidays, etc.

³⁹ The fiscal regimes applied to oil fall under two major categories: (i) the concession system; and (ii) the contract system. These two systems differ from one another in aspects associated with the ownership of production, the type of tax instruments applied and the profit share of the State-owned enterprise. Under the concession system, the government collects revenue by levying royalties and taxes, but the private operator owns production. Under the contract system, the State is the owner of production and not only collects royalties and taxes but also, via the State-owned enterprise, shares in the earnings from the business with the private sector. The contract system includes service contracts, under which contractors are paid in cash, and production-sharing contracts, under which they are paid in oil or natural gas production. Service contracts can be further divided into two types: pure service contracts and risk service contracts. Payment is fixed in the former, whereas it varies based on profitability and market conditions in the latter.

⁴⁰ There is also regional and global evidence that applying the same fiscal conditions to small and large fields, onshore or offshore, whether at the start or at peak production, makes the system fiscally regressive. Consequently, both royalties and taxes ought to be lower for small, offshore and newly producing fields. See Khelil (1995).

With a view to maximizing appropriation of economic rent, States may require producing firms to pay taxes or duties in addition to those payable under the general regime. Instruments for taxing hydrocarbon production rent can be divided into two categories: (i) those applied to gross production (or gross revenue) from oil or gas fields; and (ii) those applied to profits.

The main advantage of the first group (which royalties generally fall into) is ease of collection. However, fixed rates may not be conducive to efficient field development because they impose a fiscal burden regardless of profits. In investment-decision making based on probabilistic analysis,⁴¹ the modelling of a fixed royalty in a potentially successful reservoir or field may turn the project's net present value negative, leading to its development being cancelled or postponed.

Conversely, instruments applied to profits tend to encourage efficient field development, as market conditions and production costs are taken into account. The problem in this case, though, is the difficulty of overseeing and auditing information on operators' cost structures (Medinaceli, 2010).

Some countries, such as Brazil, Colombia and Peru, have sought to combine the benefits of both mechanisms by applying variable royalty rates based on easily verifiable criteria, such as production level, well location and depth, type of hydrocarbons or other variables related to the cost structure. In addition, countries including the Bolivarian Republic of Venezuela, Brazil, Colombia and Trinidad and Tobago apply taxes, duties, shares or contributions tied to windfall earnings or prices (see table A.2 in the annex).

Oil rent is determined by three variables: the price at which the hydrocarbon is sold, the volume of production that can be achieved at a given time and extraction costs (capital and operating costs). It follows that the higher hydrocarbon prices and production volumes are, the greater a country's oil rent will be. Conversely, rent will decline as extraction costs rise. In summary, different combinations of price, production volume and extraction costs give rise to different levels of oil rents. Over the last decade, the price increase has been the main driver of oil rents, exports and fiscal revenues in some countries of the region.

F. STATE TAKE IN HYDROCARBON ECONOMIC RENT DURING THE LATEST PRICE CYCLE

Hydrocarbon production and trade are important for creating value added, generating economic rent and financing the State budget. Since the start of the prices boom—which began in 2003 and resumed in 2010—a larger contribution by the sector to total exports and GDP was observed in the region's producing countries. In countries such as the Bolivarian Republic of Venezuela, Ecuador, the Plurinational State of Bolivia and Trinidad and Tobago, the sector accounts for over half of total exports (see table II.4).

⁴¹ Decision tree or real options analyses that take the exploratory risk into account.

Table II.4
**LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES): OIL AND NATURAL GAS SECTOR INDICATORS
AND FISCAL CONTRIBUTION, 2000-2012^a**
(Percentages)

Country	1 Share of hydrocarbon GDP in total GDP ^b		2 Share of hydrocarbon exports in total exports ^c		3 Share of hydrocarbon rent in total GDP ^d		4 Share of hydrocarbon fiscal revenue in total GDP ^e		5 Share of hydrocarbon fiscal revenue in total general government revenue ^f		6=(4/3) Share of hydrocarbon fiscal revenue in total economic rent ^g							
	2000- 2003	2004- 2010- 2012	2000- 2003	2004- 2009 2012	2000- 2003	2004- 2009 2012	2000- 2003	2004- 2009 2012	2000- 2003	2004- 2009 2012	2000- 2003	2004- 2009 2012						
Argentina	4.0	4.5	3.3	16.9	12.0	7.3	6.1	9.7	5.3	1.9	2.2	1.8	8.7	7.9	10.5	30.9	22.1	33.6
Bolivia (Plurinational State of)	3.5	6.0	6.2	27.0	53.5	52.4	5.6 ^h	14.1 ^h	15.8 ^h	2.7	8.5	9.9	11.9	28.9	31.8	47.1	60.8	62.6
Brazil	0.9	1.4	2.1	3.9	7.7	10.2	2.0	3.0	2.5	0.7	1.0	0.9	2.3	3.5	3.0	32.7	34.3	36.8
Colombia	3.6	4.2	7.6	29.2	28.3	46.8	5.6	7.1	8.2	1.4	2.6	3.4	5.4	9.6	13.1	25.6	36.5	41.6
Ecuador	3.7	10.5	12.6	43.2	57.5	55.2	15.2	24.7	23.2	5.8	8.0	14.4	30.0	33.5	42.7	38.4	32.3	61.9
Mexico	4.3	7.1	7.7	9.4	14.9	14.6	4.5	7.7	7.2	2.9	5.2	5.6	19.8	33.4	35.1	63.7	68.1	78.4
Peru	0.8	1.5	1.9	6.4	8.2	11.1	1.5	2.5	2.6	0.5	1.0	1.4	3.2	5.5	7.3	35.5	38.6	51.6
Trinidad and Tobago	16.8	24.3	22.8	60.4	65.9	62.2	33.2	54.1	37.2	7.9	15.7	13.0	31.6	51.5	40.7	23.7	29.1	35.1
Venezuela (Bolivarian Republic of)	18.1	13.6	11.2	74.2	82.4	84.4	27.1	35.5	26.3	10.3	12.4	10.3	48.0	47.8	41.5	38.2	35.0	39.2

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of official information from the countries, World Bank, World Development Indicators and the United Nations Conference on Trade and Development (UNCTAD), database, 2013 [online] <http://unctadstat.unctad.org>.

^a Information calculated on cumulative values for the periods, in constant 2005 dollars.

^b Corresponds to the value-added of the sector.

^c Includes oil and natural gas.

^d Economic rent calculated by the World Bank, which represents oil and natural gas production quoted at the international price net of extraction costs. This is distinguished from the actual economic rent of countries, based on effectively-traded prices and country-based costs, in accordance with specific physical and economic conditions.

^e Fiscal revenues include hydrocarbon production tax and non-tax revenues. This indicator is a measure of the countries' tax and non-tax pressures.

^f General government revenue is the total revenue net of the contribution to social security. In the case of Argentina, Ecuador and Colombia, the information corresponds to the nonfinancial public sector (NFPS).

^g Represents the share of theoretical economic rent collected by the State through fiscal revenue. This is an approximate measure of the effective fiscal (tax) rate.

^h Estimates based on available official data.

In many countries, high prices buoyed the sector's potential economic rent. However, in others, such as Argentina, the Bolivarian Republic of Venezuela and Mexico, the effect of the price surge may have been dampened by declining production in main fields, which would have slowed growth, or even resulted in negative growth, in economic rent in both absolute and relative terms. For example, Argentina has had high GDP growth rates over the past decade, but growth in hydrocarbon rents does not seem to have kept pace, as reflected in their diminishing contribution to GDP from 9.7% in the 2004-2009 period to 5.3% in 2010-2012. In any case, analyses based on potential economic rent—calculated on the basis of international rather than effectively-traded prices—should be specific to each country and caution should be exercised in generalizing and using them.

Over the last decade, the economies became more vulnerable with respect to the sector due to their reliance for general government revenue on receipts from taxes (especially income tax) and nontax instruments (royalties and others) applied to the use and production of oil and natural gas resources. In the 2010-2012 period, the sector contributed over one third of the total revenues needed to finance public expenditures in countries like the Bolivarian Republic of Venezuela, Ecuador, Mexico, the Plurinational State of Bolivia⁴² and Trinidad and Tobago, which represented an average fiscal pressure of around 10% of GDP. The apparent reduction in hydrocarbon fiscal revenues observed in the Bolivarian Republic of Venezuela and Trinidad and Tobago, as compared to 2004-2009, could have been influenced by lower production from declining fields, inflation, reduced regulatory capacity and, possibly, an increase in production, investment and financing costs that diminished both corporate earnings and tax collections.⁴³

In all the countries, fiscal revenues increased in relation to potential economic rent over the last decade, which is characteristic of progressive fiscal regimes. The government take as a percentage of potential economic rent in the region ranges from 34% to 78% for Argentina and Mexico, respectively. In the former, the bulk of revenue comes from export taxes and corporate income tax, while in the latter, revenue is raised mostly through non-tax instruments, such as the hydrocarbon rights that PEMEX deposits in federal government accounts.

Although in Brazil the average fiscal collection is around 37% of the potential economic rent, its increase over the past decade has not been driven solely by traditional royalty and income tax related to the country's current concession system, but also by the windfall profits tax, or special share, which contributes nearly 40% of total fiscal collection from the hydrocarbon sector.

G. SUMMARY

- i) Rising prices and trends in the industry in the region had different impacts in each country but in general were not enough to sustain an increase in reserves and production in response to consumption growth. Declining output and continuous consumption growth could lead to a drop in export volumes and restrict trade. Regional consumption is showing signs of being less elastic to price changes, particularly in countries like the Bolivarian Republic of Venezuela, Ecuador, Mexico and Argentina.

⁴² In this country, fiscal revenue from hydrocarbons as a percentage of general government revenue rose from 11.9% in the 2000-2003 period to 28.9% in the 2004-2009 period, an increase of over 100%. This performance is related to changes in the tax regime (i.e. the creation of a direct tax on hydrocarbons and revision of royalties) as well as higher prices and greater contractual natural gas volumes exported to Argentina and Brazil. The sector's contribution to general government revenue increased slightly in the 2010-2012 period.

⁴³ A high level of depreciated investments and large interest payments as a result of debt financing are some of the factors that drive down corporate earnings and income tax collection:

- ii) Further incentives must be sought to boost quality investment (both public and private) in exploration and production activities. Brazil and Colombia were two of the countries that were the exception to this regional trend, having succeeded in attracting investment for exploration and production activities.
- iii) In Latin America, with the exception of the Bolivarian Republic of Venezuela, Brazil and Ecuador, the decline in reserves-to-production ratios (abundance) and the inadequate rate of reserve replacement over the decade jeopardize the region's resource availability and its future export position. Argentina, Colombia, Mexico, the Plurinational State of Bolivia and Trinidad and Tobago, as well as having a short abundance of around 10 years, face the challenge of increasing reserve life through public-private investment.
- iv) A pending task is to create regulatory, technological and investment conditions that allow for the development of unconventional reservoirs in Argentina and Mexico, pre-salt deposits in Brazil, extra heavy crude in the Bolivarian Republic of Venezuela and conventional resources in other countries. Facing these challenges requires efficient, transparent and autonomous State-owned oil companies that are capable of successful management and corporate governance in relation to financing large investment commitments, managing resources, creating value and generating economic and social benefits.
- v) General government revenue has become more dependent on tax and non-tax fiscal revenue from oil and natural gas resource exploitation. Indeed, between 2010 and 2012, the sector generated over one third of total fiscal revenue in many countries in the region. The challenge thus remains to seek greater diversification of sources of income and funding in order to prevent so-called fiscal laziness and macroeconomic imbalances associated with reliance on volatile commodities.
- vi) Although some countries apply sliding-scale royalties and windfall profit (and price) taxes, in accordance with progressive fiscal systems, some aspects related to tax control and regulation may need to be strengthened. The achievement of equitable economic development requires an energy supply that is powered by both renewable and nonrenewable sources; therefore complete independence from fossil fuels such as oil and natural gas would not appear feasible. Accordingly, producing countries' public-policy agendas must include the sustainable development of hydrocarbon resources—encompassing economic, social and environmental aspects.

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Chapter III

PUBLIC POLICIES FOR DEVELOPMENT OF THE HYDROELECTRIC POWER AND WATER AND SANITATION SERVICES SECTORS IN THE CELAC COUNTRIES

A. INTRODUCTION

The countries of the Community of Latin American and Caribbean States (CELAC) occupy just 15% of the world's landmass but receive nearly 30% of total precipitation and generate 33% of surface runoff. Considering that this region is home to some 570 million people, which is less than 12% of the planet's population, the supply of water per capita in the CELAC countries, at nearly 28,000 cubic meters per person per year, is well above the global average.

Although this region is among those with a great abundance of water, its distribution is very uneven and water resources are subject to myriad pressures, such as increasing water contamination, catchment degradation and the unsustainable use and exhaustion of aquifers, as a result of demographic growth, socioeconomic development and growing interference by society in the hydrologic cycle.

In addition, about 71% of the surface water in the region is found in shared basins, which cover 55% of the region's landmass. In South America, transboundary basins contain 75% of the surface water, while in Mexico and Central America, they hold 24%. In relation to these areas, the countries of CELAC have maintained and strengthened a longstanding tradition of cooperation in the area of transboundary water resources, which has largely taken the form of a number of large-scale hydroelectric projects.

Moreover, precipitation distribution in the region that encompasses the CELAC countries is highly uneven, with both very arid areas (such as Baja California in Mexico and the Atacama Desert in Chile) and regions with copious water resources. Seasonal distribution and annual variation of precipitation are also irregular, with some areas receiving excessive water in certain seasons and drought in others.

Despite the relative abundance of water in the region, water governance is inadequate in many countries. This issue was analysed in the fourth edition of the United Nations World Water Development Report (2012), which concluded that there is insufficient capacity in the region to establish institutions that are able to manage water resources in a context of increasing scarcity, uncertainty and conflict (WWAP, 2012).

The consensus at the international level is that water management should consider the interests, interrelationships and impacts of all uses and users in the decision-making process, which is known as integrated water resources management (Solanes and Jouravlev, 2005).

For sector development in the decades ahead, the new realities emerging from rising competition for multiple uses of water and the challenges imposed by climate change must be considered. In addition, new challenges and issues should be considered, such as water and energy efficiency in sector applications; management of new water sources (desalinization); protection of catchment areas—which in many cases is associated with payment for environmental services—and greater integration and coordination of the actors involved in water resource management.

The climate change challenge facing the CELAC countries is particularly important in this context: "Projections indicate that there will be a steady increase in extreme weather events [...]. A significant increase in heat waves is projected for the entire region, and particularly the Caribbean, southeastern South America and Central America" (ECLAC, 2010). The poorest countries of Central America, the Caribbean

and the Andes, which have relatively weak capacity for water resources management, face an elevated risk of undesirable impacts associated with climate change (WWAP, 2012).

Forecasts of shrinking glaciers and a reduction in available water resources are cause for real concern, especially for the Andean countries, since the Andes contain 90% of the world's glaciers, which produce 10% of the planet's freshwater. The high Andean and glacier ecosystems mostly drain into the Amazon. A change in these flows will naturally have major repercussions for some of the CELAC countries in terms of access to water sources, hydroelectric power generation and agriculture, as well as the conservation of the associated ecosystems. Planning is needed without further delay given the boom that some glacial watersheds may experience in the coming years due to the effect of deglaciation, and the water scarcity that will ensue in dry or low-water periods after peak levels have been reached. For example, in the last three decades, the total area covered by glaciers in the Peruvian Andes shrank by 22%, and the area covered by the smaller glaciers decreased by up to 80%, reducing available freshwater in the coastal region, where 60% of Peru's population lives, by 12% (Andean Community, 2008).

Changing climate patterns are especially problematic given the export structure of most of the region's countries, which need water to run their production processes. As an inevitable result, it is imperative for the CELAC countries to adopt water resources management and economic development strategies that explicitly recognize the seriousness of the growing scarcity of water, promoting an integrated approach and strengthened water governance, with the participation of all stakeholders and sufficient institutional capacity to anticipate and resolve emerging conflicts in this area.

Hydroelectric power has started to acquire greater prominence on the public agendas of the CELAC countries, given the high availability of water with hydroelectric potential (technically and economically exploitable) and the future scenario of volatility in hydrocarbon prices, as well as the fact that the region has only developed roughly 30% of its hydroelectric capacity (IDB, 2013). The region has 156,852 megawatts (MW) of installed capacity for hydropower generation, with potential capacity of 694 gigawatts (GW). Much of this capacity is in Brazil, although the Bolivarian Republic of Venezuela, Colombia and Peru also have considerable, albeit more modest, hydroelectric potential. Meanwhile, the Caribbean countries' hydropower options are much more limited compared with the rest of CELAC.

Weak and inadequate institutional environments—in terms of legal frameworks, implementing agencies and governance systems—make it hard to channel and coordinate the economic, social and environmental needs of the different users and interested parties, which generates instability with respect to water use for hydroelectric energy generation. This situation is exacerbated by water laws that do not take into account increasing competition for the resource, especially in highly altered watersheds with concentrated economic development, which has led to, for example, an increase in social and environmental conflicts around major hydroelectric and mining projects.

Likewise, with citizens increasingly asserting their right to water and sanitation, some pressing demands have emerged that must be addressed in the region's countries. The biggest challenges are related to the quality and coverage of water and sanitation services, as well as to wastewater treatment. The CELAC countries have experimented with various institutional options as they attempt to provide these services efficiently, equitably and sustainably.

The next section of this paper reviews the situation of hydroelectric energy generation and the provision of water and sanitation services and proposes corrective measures to address pending challenges.

Box III.1
ADAPTATION TO CLIMATE CHANGE: THE CENTRAL ROLE OF WATER

With the effects of climate change, water-related risks and uncertainties will be exacerbated. In some areas, there may be excess water compared with availability in the past. In others, the opposite may be true, with acute shortages and droughts ensuing. Increases in the spatial and temporal variability of rainfall and changes in run-off patterns can be expected. In this context, a review of some of the fundamental elements of water institutions is called for, in order to identify possible alternatives for adapting to a change in circumstances. Some of the elements worth studying in greater detail include:

- Improving information on water availability, its uses and users, and the expected impacts of climate change both on the water cycle as well as on water use and users.
- Improving information, and its public availability, on the impacts of the general economic system on the different uses and users, as well as its effects on efficiency, sustainability and equity.
- Defining clear channels for taking this information into account in water management decision-making processes. For example, it may be worthwhile to reconsider the manner in which long-term water availability should be evaluated for the purpose of water resources planning.
- Given that the water availability of the future will not be the same as that of the past, the criteria for designing, executing, and operating water infrastructure intended to last for several decades will need to be revised. Studies are required on the sensitivity of water systems to possible future variations in climatic conditions.
- Establishing clear criteria to determine the scope of water rights during shortages and improving possibilities for imposing conditionalities, favouring environmental sustainability and resiliency objectives.
- Defining, more precisely, preferences and priorities in water allocation, especially during shortages.
- Improving the identification of consumptive uses.
- Achieving better integration between the management of surface and groundwater, between water allocation and pollution control, between management of water supply and demand and between the management of water resources, land use and related ecosystems.
- Improving disaster prevention and response systems given the effects of increased variability, with an emphasis on risk management.
- Planning the gradual, step-by-step implementation of adaptation measures, clearly establishing their trigger thresholds, as well as the related faculties of public authorities and the rights of private parties.
- Creating, preferably at the watershed level, forums of water users, public authorities and other relevant stakeholders for consultation and coordination and possible decision-making.
- Facilitating water reallocation mechanisms within and among user sectors, with effective controls and compensation for externalities.
- Determining minimum safety margins in order to keep essential public services operational.
- Reaching agreements on adaptation measures between neighbouring countries sharing cross-border resources and establishing corresponding criteria.

And the most important task is “to put the house in order” before the arrival of the storm, which means consolidating, formalizing and strengthening a water resources management system capable of addressing current and future challenges, and giving it authority and resources commensurate with its responsibility.

Source: Andrei Jouravlev and Miguel Solanes, “Editorial remarks”, *Circular*, No. 35, Network for Cooperation in Integrated Water Resources Management for Sustainable Development in Latin America and the Caribbean, Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), 2011.

B. THE SUSTAINABLE DEVELOPMENT OF HYDROELECTRICITY

1. The current situation of hydroelectric generation in the CELAC countries

As a group, the CELAC countries have a great opportunity to integrate renewable energies into their energy mix. These energies have clear advantages over energies from other sources, chief among them being the relative availability of resources, the ease with which they can be exploited and the fact that they continue to be available in nature over time. In this context, as stated previously, hydropower has started to rise on the public agendas of the CELAC countries.

Following a global trend, the region's countries have experienced an increase in demand for energy. Over the last two decades, total electricity consumption climbed from 489 terawatt-hours (TWh) in 1990 to 1,073 TWh in 2010, with average annual growth of 4% (OLADE, 2012).

Regarding the production of primary energy, hydrocarbons continue to play an important role in the CELAC countries. Between 1970 and 2012, their share in the energy mix fell slightly (4%) while their composition changed noticeably. Whereas in the 1970s, oil represented 65% of the supply of primary energy, in 2012 its share had fallen to nearly 53%. In contrast, over this same period, the share of natural gas in the primary energy supply rose from 15% to 24%. And coal has been acquiring a larger and larger share too, from just over 1% in 1970 to nearly 6% in 2010, despite the decline seen in 2012 (ECLAC/IILA, 2010). Hydroelectric energy, meanwhile, climbed from 3% in 1970 to 7% in 2012 (see table III.1 and figure III.1).

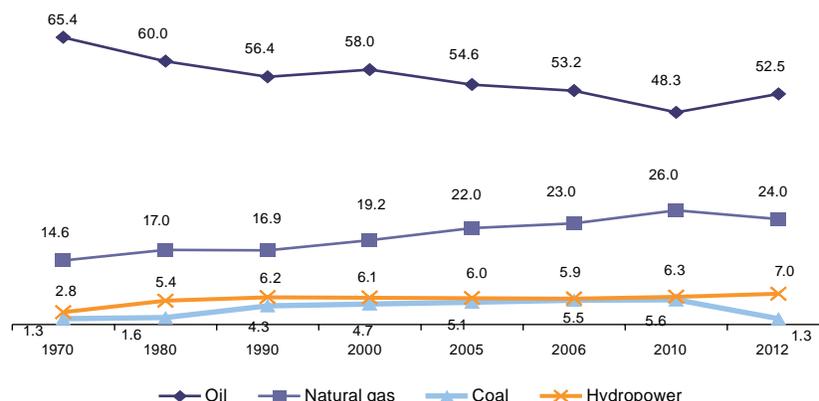
Table III.1
COMMUNITY OF LATIN AMERICAN AND CARIBBEAN STATES (CELAC): SHARE OF FOSSIL FUELS AND HYDROPOWER IN THE TOTAL PRIMARY ENERGY SUPPLY, 1970-2012
(Percentages)

Energy source	1970	1980	1990	2000	2005	2006	2010	2012
Oil	65.4	60.0	56.4	58.0	54.6	53.2	48.3	52.5
Natural gas	14.6	17.0	16.9	19.2	22.0	23.0	26.0	24.0
Coal	1.3	1.6	4.3	4.7	5.1	5.5	5.6	1.3
Hydropower	2.8	5.4	6.2	6.1	6.0	5.9	6.3	7.0
Total	84.1	84.0	83.8	88.0	87.7	87.6	86.2	84.8

Source: Prepared by the author on the basis of Economic Commission for Latin America and the Caribbean/Italian-Latin American Institute (ECLAC/IILA), *America Latina e Caraibi: la sfida dell' energia*, Hugo Altomonte and others, Rome, 2010, and Latin American Energy Organization (OLADE), *Energy-Economic Information System (SIEE)*, 2012, [online] <http://siec.olade.org/SIEE>.

Considering the principal sources of energy production in the region; hydraulic and thermal energy account for nearly 97% of the installed generating capacity, while geothermal energy accounts for the smallest portion of the installed generating capacity in the CELAC countries. Among power generation sources, nuclear power is generated only in Argentina, Brazil and Mexico.

Figure III.1
**COMMUNITY OF LATIN AMERICAN AND CARIBBEAN STATES (CELAC):
 SHARE OF HYDROCARBONS AND HYDROPOWER IN THE TOTAL
 PRIMARY ENERGY SUPPLY, 1970-2012**
(Percentages)



Source: Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE), 2013 energy review.

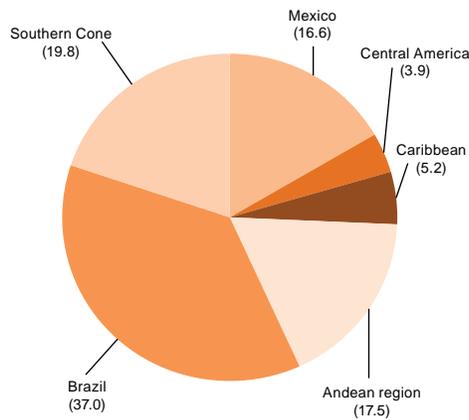
Table III.2
**COMMUNITY OF LATIN AMERICAN AND CARIBBEAN STATES (CELAC): INSTALLED
 CAPACITY FOR ELECTRICITY GENERATION, 2011**
(Megawatts)

Country or subregion	Hydro	Thermal	Geothermal	Nuclear	Other	Total
Mexico	11 542	38 631	887	1 365	87	52 512
Central America	5 086	6 305	552	0	517	12 460
Caribbean	859	15 449	0	0	87	16 395
Andean region	30 521	23 716	0	0	1 143	55 381
Brazil	82 458	31 243	0	2 007	1 426	117 134
Southern Cone	26 385	34 420	0	1 018	1 042	62 865
CELAC Total	156 852	149 764	1 438	4 390	4 302	316 745

Source: Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE), 2012 [online] <http://siec.olade.org/SIEE>.

Table III.2 shows the installed capacity for electricity generation in the region. Brazil is also the country with the most installed capacity for electricity generation from hydropower (53%), nuclear power (46%) and other energies (33%). Meanwhile, Mexico has the most installed capacity for thermal power generation (26%).

Figure III.2
**COMMUNITY OF LATIN AMERICAN AND CARIBBEAN STATES (CELAC): INSTALLED
 CAPACITY FOR ELECTRICITY GENERATION, 2011**
(Percentages)



Source: Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE), 2012 [online] <http://siee.olade.org/SIEE> and Energy Information Administration (EIA), "International Energy Statistics" 2012 [online] <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm>.

In the composition of installed capacity for electricity generation among the CELAC countries, which totals 316,745 MW, hydropower accounts for around 50%, while thermoelectric plants account for about 47%. Nuclear power contributes just over 1%, and the remaining 1% is classified as nonconventional renewable energies.

Considering the participation of the various sources of electric power generation and given the large shares corresponding to hydropower and natural gas, this process is cleaner in CELAC than in the rest of the world (see figure III.3).

Figure III.3
**COMMUNITY OF LATIN AMERICAN AND CARIBBEAN STATES (CELAC) AND THE WORLD:
 ELECTRICITY GENERATION BY SOURCE**
(Percentages)

A. CELAC, 2011

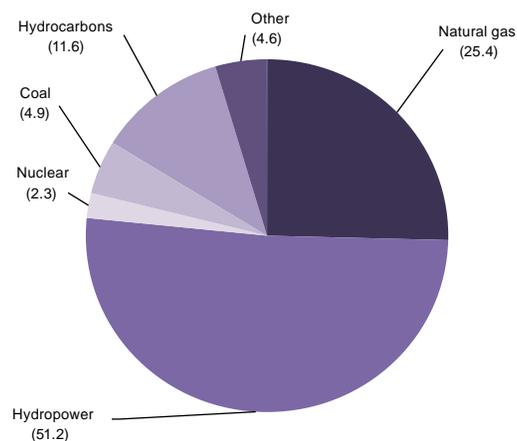
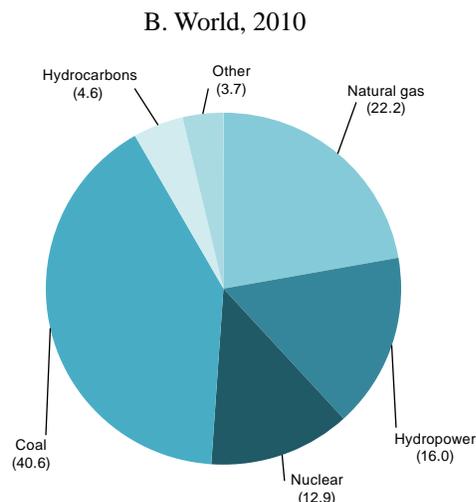


Figure III.3 (concluded)



Source: Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE), 2012 [online] <http://siec.olade.org/SIEE> and Energy Information Administration (EIA), "International Energy Statistics" 2012 [online] <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm>.

Table III.3 shows that the Andean region and Brazil have 76% of the hydropower potential (38% in the Andean region and 38% in Brazil), while Central America and the Caribbean together fall shy of 6%, the Southern Cone has 12% and Mexico has 8%.

Table III.3
COMMUNITY OF LATIN AMERICAN AND CARIBBEAN STATES (CELAC): HYDROELECTRIC ENERGY POTENTIAL AND INSTALLED CAPACITY, 2011
(Gigawatts and percentages)

Country or subregion	Potential	Share	Installed capacity	Share
Mexico	53	7.6	12	7.6
Central America	25	3.6	5.0	3.2
Caribbean	13	1.9	1.0	0.6
Andean region	263	37.9	31	19.8
Brazil	260	37.5	83	52.9
Southern Cone	80	11.5	26	16.6
CELAC Total	694	100.0	156.9	100.0

Source: Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE), 2012 [online] <http://siec.olade.org/SIEE>.

The CELAC region is using 22% of its hydropower generation potential (see table III.3). The Southern Cone and Brazil have the highest rates of use of potential, at 33% and 32%, which are above the regional average. The Caribbean has both the least hydropower generation potential in CELAC and the lowest rate of use. Meanwhile, the Andean region has the most potential in the region but is only using 12% of it, which points to a real gap. Lastly, Mexico is using 22% of its hydroelectric potential, near the CELAC average.

Considering the hydroelectric potential in the CELAC countries, especially in the Andean region and Brazil, making better use of their water resources could provide solid support for the region's economic development, by providing an option that would meet increasingly strict requirements in terms of the impacts—social and environmental—that will be tolerated by society. Box III.2 presents some important hydropower generation projects in several CELAC countries.

Box III.2

MAJOR HYDROPOWER PROJECTS IN THE CELAC COUNTRIES

Brazil, with hydroelectric projects that will generate 26,638 MW in 2020, is taking great strides forward. Among other initiatives is the construction of the Belo Monte plant on the Xingu River, a tributary of the Amazon River, which will have installed capacity of more than 11,000 MW, making it the third largest hydroelectric plant in the world. Other large-scale plants include the two projects on the Madeira River: Santo Antônio, with 3,150 MW, and Jirau, with 3,300 MW.

Peru has announced plans for the generation of over 2,000 MW in hydropower. In addition, under a June 2010 energy agreement with Brazil, multiple Brazilian companies would build up to 15 dams and manage them for 30 years (80% of the power generated would belong to Brazil). Plans call for using the waters of the Marañón River to generate 12,400 MW of electric power, which would constitute a “true energy revolution” that would sustain the country's growth through 2050. At present, the agreement is being reviewed by the two countries' legislatures for ratification.

Colombia, with hydroelectric projects in the pipeline that would generate nearly 5,200 MW by 2020, also plans to boost the participation of renewable energies in its energy mix. At present, it is building the El Quimbo hydroelectric plant in the department of Huila, with 400 MW of capacity. Two other major projects have also been announced: Sogamoso, which will add 820 MW to the system, and Pescadero-Ituango, with 2,400 MW.

Argentina has plans for investments in hydroelectric projects that will generate over 2,600 MW by 2020. Also, the Yacretá plant, which the country shares with Paraguay, was recently expanded, increasing its capacity by 67%, from 1,350 MW in 2004 to 2,250 MW in 2010. Moreover, work is proceeding on construction of the La Barrancosa-Cóndor Cliff plant, in Argentina's Patagonia region, which will add over 1,700 MW to the grid.

Ecuador is working on projects that will generate over 2,540 MW. These include the construction of eight hydroelectric plants, among which are Coca Codo Sinclair (1,500 MW), Sopladora (312 MW) and Toachi Pilatón (253 MW), already under construction. An additional five projects will be built in the next several years: Minas San Francisco (276 MW), Delsitanisagua (115 MW), Quijos (50 MW), Mazar Dudas (21 MW) and Villonaco (15 MW). These projects are intended to double the country's electricity production by 2016. Once the eight plants come online, an estimated 93% of the energy mix will be from hydroelectric sources.

Costa Rica is taking the lead in Central America, with the hydroelectric projects Reventazón, with 305 MW, and El Diquis, with 650 MW.

In Mexico, the Law on the Use of Renewable Energies and the Financing of the Energy Transition has been amended to include hydroelectric projects in the category of renewable energy when they meet certain criteria. Specifically, hydroelectric plants with generation capacity of up to 30 MW will be classified as a renewable source when they meet the generation density levels applied by the United Nations Framework Convention on Climate Change (UNFCCC) to determine if a plant meets the requirements set for the Clean Development Mechanism.

Source: Prepared by the author.

A notable characteristic of hydroelectric development in recent years is the prevalence of run-of-river or small-scale hydroelectric generation and the emphasis on small-capacity dams intended solely for generating electricity (unlike in other eras, when a multiple-use approach prevailed). Compared with the period 1976-2000, between 2001 and 2011 more dams were built (50% more per year), though with individual storage capacity equivalent to less than one third than in the earlier period (ICOLD, 2013). Brazil has 92% of the region's new dams and 84% of the storage capacity. That country's hydroelectric potential has been developed alongside significant technological advances and increasing concern about environmental and social impacts.

2. The sustainability of hydroelectric power

The CELAC countries, like the rest of the world, are looking for energy alternatives that are safe and more economical, as well as socially and environmentally sustainable. Undoubtedly, the emergence of phenomena that were unknown a couple of decades ago, such as climate change, has forced them to take a closer look at the costs and benefits of the different energy sources.

The largest existing hydroelectric installations in South America are the hydroelectric plants of Itaipú (jointly operated by Paraguay and Brazil) and Yacyretá (operated by Paraguay and Argentina). The Salto Grande plant (operated by Argentina and Uruguay) is somewhat smaller.

It has traditionally been argued that hydroelectric reservoirs regulate water flow and make it more constant downstream, thus ensuring an adequate supply of water in dry periods, controlling spates, allowing fertile land to be farmed and making navigation and water sports possible, as well as generating electricity (Mekonnen and Hoekstra, 2012).

However, the regional experience of the past decade shows that initiatives to build infrastructure for hydroelectric power generation are subject to intense controversy among social actors directly or indirectly affected, which has blocked the development of works that were all but guaranteed. This has occurred with numerous energy projects that while delivering benefits to a large part of the country, entail economic, environmental and social costs for the local communities. The proliferation of social conflicts and the emergence of arguments against the construction of hydroelectric dams have started to weaken the prevailing consensus on the benefits of hydropower generation projects.

The forced migration of communities (often indigenous people), the flooding of natural areas that have endemic flora and fauna (sometimes including vulnerable or endangered species), the generation of greenhouse gases as biomass buried by the reservoirs decomposes, and the interruption of water flow during dam construction, among other effects, have sparked social conflicts that have delayed work schedules in many cases and brought hydropower infrastructure investments to a halt in others.

In addition, many CELAC countries have ratified International Labour Organization (ILO) Convention No. 169 on indigenous and tribal peoples in independent countries, which obligates States to consult the peoples concerned on legislative or administrative measures that may affect them directly. These measures include concessions for use of natural resources, such as construction of a hydroelectric power plant.

By contrast, run-of-river or small-scale hydroelectric generation has been vigorously promoted as a source whose social, economic and cultural impacts are much smaller than those of large dams. The main advantage is that there is less diversion of the natural flow of water, making it unnecessary to flood large areas and avoiding the loss of land. It is also argued that this type of generation is more environmentally friendly, making it a green or low-impact source. At the same time, it must be borne in mind that the installed capacity of projects of this type is normally far less than that of major power plants.

Nonetheless, run-of-river hydroelectric generation also has impacts. For example, it involves the construction works (for which it is often necessary to temporarily divert the flow of water), clearing of land and installation of electrical connections (to feed the energy produced into the grid), which can affect ecosystems, the movement of sediments and flooding patterns (IUCN, 2012). As with large dams, run-of-river hydroelectric generation has social impacts associated with the distribution of water between different uses. Thus, in watersheds where multiple activities are carried out (farming, industry, cultural activities, energy, fishing, tourism and human consumption), tensions tend to arise either over the allocation of water or over land ownership and use.

The sustainability of water, in this context, is seriously compromised by three factors. One is the lack of formal institutions to deal with the problems of water allocation, control of water contamination, management of conflicts over use, financing and the influence of the political and macroeconomic cycles, which at certain junctures can contribute to overuse of the resource. A second factor is climate change, the effects of which are expected to result in major restrictions or alterations in water availability in some watersheds in the CELAC countries. A third factor is the lack of integrated management of the catchment areas and glaciers that carry water downstream.

Unless institutional problems are dealt with, measures implemented to adapt water management systems to climate change and its associated ecosystems, water resources may become a source of economic, political and social conflict. In order for the development of hydroelectric generation to be sustainable, these problems must be properly addressed.

Political and social conflicts over major hydroelectric projects are symptomatic of the complexity of the debate around these types of project. Debate has turned on how to meet higher energy demand while giving careful consideration to environmental conditions in the ecosystems where works are planned, so the social and environmental impacts they generate are acceptable not only to society but especially to the communities that are directly affected.

These conflicts are not specific to the CELAC countries but rather a global phenomenon. The negative effects of large dams are increasingly regarded as unjustifiable (WCD, 2000). There is a growing conviction among the general public that the authorities must not take decisions about major hydroelectric projects and impose them on the community. With this change in perception comes a need for more rigorous methodologies for assessing options, managing works, obtaining public acceptance and sharing out benefits.

Another of the problems with large dams is how little they contribute, once construction is complete, to the local communities where they are placed. These installations are usually located a considerable way from the centres of demand, so that the energy produced using local resources is transferred to those centres and most of the financial returns go into the fiscal coffers or to shareholders in the form of dividends. Here, criticism has focused not on water use but on the distribution of profits obtained from the generation of energy. This is a legitimate complaint that ought to be resolved politically by the authorities of each country. Payments for environmental services and transfers from the electricity sector are one way to compensate communities adjacent to power plants. Several countries in the CELAC region, including Brazil, Colombia, Costa Rica and Mexico, have moved forward with this process.

Another challenge for hydroelectric generation is that it competes for water with other basin users. Perhaps the most common complication arises with those who rely on the annual flow of water being stored in reservoirs for distribution over time. In many places, for example, hydroelectricity generation competes with other water uses because it manipulates flows to meet energy demand, which tends to be out of step with the seasonal needs of other users, mainly for irrigation.

These conflicts are often associated with weak regulatory frameworks for water resource management. The most common problems are a lack of transparency in water allocation systems, limited protection for existing rights, weak accountability mechanisms and lack of governance. The result can be a strategic advantage for hydroelectric generation because of the amount of investment it brings and the strength of its bargaining position relative to other uses. To prevent these conflicts, hydroelectric generation should be considered in the framework not just of energy policy but also of integrated water management and environmental policy in the countries.

Box III.3 describes some important social and environmental conflicts in CELAC countries that are related to the development of hydroelectric infrastructure works.

Box III.3

SOCIAL AND ENVIRONMENTAL CONFLICTS RELATED TO THE DEVELOPMENT OF HYDROELECTRIC INFRASTRUCTURE

In Peru, construction of the 2,200 MW Inambari plant has been delayed until problems resulting from the inundation of 41,000 hectares of forest and the displacement of 15 communities have been resolved. The Paquizapango project, with 2,000 MW of potential capacity, is pending approval by the Congressional Foreign Affairs Commission of Peru owing to controversy about the impact that the project could have on over 10,000 people (including 10 Asháninka indigenous communities) and the Otishi National Park. Lastly, Odebrecht, the company holding the concession for the 1,280 MW Tambo 40 plant, bowed to pressure by the Ene River Asháninka Federation, an indigenous organization representing Asháninka communities, and abandoned the project.

In Colombia, construction of the El Quimbo plant has come up against various actions by a community that is organizing to stop the project owing to the impact it would have on more than 8,500 hectares of tropical dry forest and fertile and productive lands and the displacement of at least 427 families. Similarly, construction of the Ituango plant, with 2,400 MW of potential capacity, is just 15% complete, due to complaints by the local community of its environmental impacts, which would affect 3,800 hectares of land that would go to the reservoir.

Brazil, despite its level of hydroelectric development, is not beyond the reach of organized groups opposing the development of hydroelectric projects. It is estimated that approximately 60% of generation and transmission projects that were to have been executed in the 2011-2012 fiscal period were delayed by environmental problems or conflicts with third parties, including some communities. The Belo Monte plant is an emblematic case. With potential capacity of 11,230 MW, it would require the inundation of 500 square kilometers of land and the displacement of about 16,000 people, mostly indigenous people who make a living from fishing and hunting. Although the dam is under construction—it is expected to come online in 2015—there is rising discontent among the local indigenous population.

In Chile, following a complaint filed in 2012 by the National Forestry Corporation against the Department of Water for having issued use rights on rivers in the Chiloé and Puyehue national parks, the Supreme Court of Justice upheld the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere (1940) and prohibited the use of those waters for hydroelectric purposes. The relevance of the decision lies in the fact that the Hidroaysén project would require the inundation of areas within Laguna San Rafael National Park, Bernardo O'Higgins National Park and Cochrane Lake Forest Reserve.

In Mexico, residents of the municipio of Olintla have protested on several occasions since December 2012 against the Grupo México hydroelectric project, which has yet to obtain the necessary permits due to the potential environmental implications of the project and its effect on indigenous communities.

In the Plurinational State of Bolivia, the planning phase has been completed for the El Bala project, which is expected to begin operating in 2022. However, opposition to the project among local residents must first be addressed. The project would require the relocation of 1,000 people, most of whom are members of traditional Amazonian cultures—Chimané, Tacana and Mositén. A reservoir measuring between 1,200 and 2,505 square kilometers would be created.

Source: Prepared by the author.

C. CURRENT SITUATION OF WATER AND SANITATION SERVICES

According to the most recent data from the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, 94% of the population in the CELAC countries—some 536 million people—has access to improved sources of water. Some countries have exceptional coverage: Barbados and Uruguay have 100% coverage; Argentina and Belize have 99% coverage; and Antigua and Barbuda and Chile have 98% coverage (JMP, 2013). At the other extreme, with coverage below 90%, are the Dominican Republic, Honduras, Nicaragua, Peru and the Plurinational State of Bolivia, with Haiti trailing far behind with a coverage rate of just 64%.

In terms of sanitation, 82% of the region's population —some 467 million people— has improved systems. Chile, Puerto Rico and Uruguay lead the region with coverage above 99%, while the Plurinational State of Bolivia and Haiti have the lowest indicators, at 26% and 46%, respectively. Of the 18% of the population without access to improved sanitation facilities, 4% —nearly 22 million people— do not have access even to basic sanitation facilities.

An evaluation of water and sanitation coverage levels should consider water quality and service continuity, which are weak. In fact, the figures on access do not take into account the quality of service in terms of potability, interruptions, pressure or the technological solutions used, aspects in which significant differences are observed between countries in the region and between rural and urban areas. Moreover, wastewater treatment is deficient, with coverage below 30%, although there has been a rapid expansion in the past decade.

If the criterion of safe and adequate access to water and sanitation services is considered, the picture looks less positive. Actual coverage may be between 15% and 20% lower than the official figure for improved access to water, and between 20% and 40% lower in the case of sanitation coverage (McGranahan and Lloyd Owen, 2006).

The reality in the CELAC countries is that the quality of services, including in large swaths of major cities, is not always adequate. With the exception of Chile, and Uruguay and Brazil to a lesser extent, wastewater treatment levels are low or nonexistent. In many countries, most wastewater is discharged untreated into waterways, polluting rivers, lakes and coastal waters. These problems are further exacerbated by the lack of effective control measures for demand at the user level, and high system losses, approaching 40% of the treated water distributed by mains in many cities (CAF, 2013).

In order to improve access to water and sanitation services, the member States of the United Nations, through target 7C of the Millennium Development Goals, made a commitment to halve the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015, compared with 1990. With respect to safe drinking water, great strides have been made in the CELAC countries in expanding coverage, and the respective MDG has already been met at the regional level. Nevertheless, there are gaps in the levels of progress between rural and urban areas and between different cities, provinces, states, regions and municipalities, as well as between groups with different income levels. Overall, an estimated 46% of the CELAC countries have already met the target and an additional 31% are on schedule, but 23% are unlikely to meet the target by 2015 (Jouravlev, 2013). The largest relative delays are seen in Haiti, Dominican Republic, Jamaica, Saint Lucia and Peru.

In terms of sanitation, the CELAC countries have made progress in expanding coverage, and if this trend continues, they may meet the target at the regional level. However, the distribution of services is highly uneven between and within countries. The largest advances have been made in urban areas. Greater efforts are needed to meet the sanitation target, especially in rural areas and in poor urban communities. Overall, 36% of the countries have already met the target and 10% are on track to do so, but 54% are unlikely to meet the target by 2015 (Jouravlev, 2013). Haiti, Nicaragua, the Plurinational State of Bolivia, Saint Lucia, Jamaica, Panama, Peru and Colombia, in that order, are experiencing the largest relative delays.

1. Efficient, equitable and sustainable delivery of services

(a) Contribution of services to economic development, social equity and environmental sustainability

The water and sanitation sector is an integral part of the current and future development of the CELAC countries. There is evidence of the positive effects that these services can have on key factors of social and economic development, such as public health, poverty levels, social inclusion and cohesion, foreign trade, irrigation agriculture, tourism, the gender gap and social harmony, as well as the negative effects that can ensue if these services are unavailable or lacking in quality (Lentini, 2011; Hantke-Domas and Jouravlev, 2011).

From an economic perspective, investing in the sector leads to higher family income by diminishing the incidence of diseases, reducing absenteeism from work and school (particularly among women) and cutting supply costs. The effect of all this is to reduce poverty and indigence¹ and free up time for other activities, such as leisure, education and work, which increases a country's productivity (Hantke-Domas and Jouravlev, 2011).

Where health is concerned, consuming polluted water increases morbidity and mortality. For the CELAC countries, an estimated 3% of the loss of disability-adjusted life years is due to deficient water and sanitation services, and in some countries, the impact is as high as 7.7% (Prüss-Üstün and others, 2008).

The worst affected are the poorest groups and children. Children fare the worst in terms of both morbidity, which affects their attendance and success at school, and mortality caused by waterborne diseases. Polluted water is also a direct cause of malnutrition, as diarrhoea and other dietary infections prevent nutrients from being properly absorbed by the intestine (Lentini, 2010). In addition, there are costs in terms of participation in the labour market, treatment, and the heavier burden placed on health-care systems.

By investing in sanitation and treatment, wastewater can be discharged in an environmentally sustainable way. This constitutes a competitive advantage for a country, inasmuch as it increases sanitary safety by improving the quality of water for irrigation agriculture, among other applications. This produces positive effects, as sanitary security makes it easier to gain access to demanding foreign markets, while improving and expanding domestic commerce. It is also a competitive advantage for the countries as tourism destinations (Hantke-Domas and Jouravlev, 2011).

Large-scale access to quality water and sanitation services reduces political instability and contributes to social harmony. This is because of the essential role these public services play in people's lives. Expectations are frustrated when people do not have access to these services, whether because they are unavailable or lacking in quality, unaffordable or inefficient due to weak regulatory systems and or capture by special interest groups. These frustrations can sometimes lead to political and social explosions, to which the region has not been immune (recall the "water war" in Cochabamba in 2000 or the social conflict in Tucumán in 1997) (Hantke-Domas and Jouravlev, 2011).

¹ In Lima, being connected to the public drinking water system is associated with a rise of 5% in the incomes of families in extreme poverty (Garrido-Lecca, 2010). Since non-discretionary costs take up as much as 50% of nominal incomes, however, this represents an increase of 10% in disposable incomes. Furthermore, there are additional health-care savings (owing to the disappearance of episodes of acute diarrhoea) of about 4% of disposable income, giving an overall disposable income increase of 14% each month.

For all the reasons presented, it is no coincidence that the broad consensus is that access to water and sanitation is a basic human right protected by international law. This was the affirmation made in resolution 64/292 adopted by the United Nations General Assembly in 2010 (see box III.4). This was also the assertion made by the XXVII Ordinary Assembly of the Latin American Parliament (PARLATINO) in 2011, when it said that the right to water is a fundamental, inalienable right inherent to human life, integrity and dignity, inasmuch as water is a universal common good that is natural, tangible and vital for the survival of biological diversity on the planet, and that the people of Latin America and the Caribbean have a fundamental right to water in sufficient quantity and quality and to systems for providing it. In accordance with these trends in international rights, several CELAC countries, including Costa Rica, Ecuador, Mexico, Nicaragua, Paraguay, the Plurinational State of Bolivia and Uruguay, have explicitly recognized the human right to water and sanitation in their legal frameworks.

Box III. 4

THE HUMAN RIGHT TO WATER AND SANITATION

The human right to water and sanitation entails the observance, in all cases, of certain parameters of availability, quality and accessibility (physical, economic and informational) both in the supply of water for personal consumption and traditional uses related to subsistence, and in the collection and removal of excrement. This imposes direct conditionalities on sector policy.

The need to ensure these standards gives rise to a series of international obligations for States, which are classified by the degree of satisfaction of the right that is enforceable. A distinction is thus made between basic obligations—which are those that are immediately enforceable and are used to ensure a minimum degree of enjoyment of the right—and progressive obligations, which are met by demonstrating that effective actions are being taken that will gradually lead to full enjoyment of the right.

There are two major types of basic obligations: one is to guarantee—not simply endeavor—that protected rights can be exercised without discrimination; and the other obligates the State to ensure the satisfaction of at least essential levels of the right (e.g., a minimum quantity for consumption per person).

Along with the duty to present basic achievements, recognition of the right to water and sanitation imposes an immediate obligation to implement measures that gradually lead to full exercise of the right. To this end, there is a duty to allocate—through efficient means—the maximum resources available (institutional and financial) and to avoid regressive measures. In addition, there must be a guarantee of genuine participation—free, effective, meaningful and nondiscriminatory—for the local population in the formulation and execution of sector strategies.

Lastly, it is important to note that recognition of the human right to water and sanitation does not mean that services are universally free of charge, but rather that the price of services can be paid by the majority of residents. Those who are able to should pay rates that reflect the total efficient cost of the service, and conversely, those who cannot afford the full cost should have access to a system of progressive subsidies that guarantees that they receive basic minimum levels of service.

However, the human right to water and sanitation is not satisfied simply by a subsidy but rather also requires the establishment of efficient and stable regulatory institutions. Efficiency in the provision of services is essential to the observance of this right, since lower costs make it possible to increase the availability of the service. Indeed, when costs are high due to the inefficiency of providers, whether public or private, the human right to water and sanitation is jeopardized.

Source: Economic Commission for Latin America and the Caribbean (ECLAC), “Editorial remarks”, Circular, No. 31, Network for Cooperation in Integrated Water Resources Management for Sustainable Development in Latin America and the Caribbean, Santiago, Chile, 2009 and Juan Bautista Justo, “El derecho humano al agua y al saneamiento frente a los Objetivos de Desarrollo del Milenio (ODM)”, Project Documents, No. 536 (LC/W.536), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), 2013.

(b) Public policies for efficiency, equity and sustainability

The water and sanitation sector produces positive externalities, so maximizing these should thus be a public policy goal. Economic regulation is the best-known mechanism for achieving this.

Drinking water and sanitation services are a natural local monopoly. The characteristics of the technology used in the production process make provision by a single service provider in a given geographical area the most efficient solution. Without proper oversight, the service provider, whether public or private, will tend not to do its utmost to provide a high-quality service at the lowest possible cost. In addition, experience shows that service providers are extremely vulnerable to capture by interest groups, be these unions, political groups, bureaucracies or investors. Thus, this sector needs to be regulated to ensure that providers make services available at the lowest possible cost (productive efficiency) and consumers are given access to these services at rates that accurately reflect those minimum costs (allocative efficiency).

Sector performance, in general, and the effectiveness of economic regulation, in particular, are shaped by exogenous and endogenous factors. Exogenous, or external, factors include general macroeconomic policies, the prioritization of the sector in government policies, management of water resources and institutional quality. Endogenous, or internal, factors include the institutional, industrial and ownership structure, the regulatory framework and financing, rate and subsidy policies (Lentini, 2011).

(i) Importance of factors external to the sector

The provision of drinking water and sanitation services is part of the whole functioning of a country and is therefore not immune to a variety of external events that may influence the sector's policies and performance. Thus, for example, macroeconomic stability combined with socioeconomic growth normally results in higher incomes for a country's inhabitants. In turn, the greater availability of financing means that States can invest in infrastructure and people can pay for essential services. The overall performance of the economy also affects service operating and maintenance costs and financing policies. Service provision starts to be underfunded and to deteriorate when costs increase and people are unable to afford them, so that the deficit has to be met by the State. All this makes the sector more dependent on political decision-making and the public finances (Lentini, 2010). The usual result is that technical decisions become highly politicized, which undermines the economic regulation function and the productive efficiency of service providers.

Poverty and indigence are another exogenous influence on the sector, because poor families cannot afford services. If States do not subsidize services for low-income groups living in situations of extreme vulnerability, service providers are unable to finance themselves, which means they lose the financial capacity to provide a high-quality service and expand their coverage. This produces a vicious circle, as lack of financing results in the State failing to meet its obligation to enforce the human right to water and sanitation by doing its utmost to provide services to the entire population. This explains why processes to adjust rates to self-financing levels should be preceded by the creation of subsidy mechanisms, as has been done in Chile through direct consumer subsidies and in Colombia through cross subsidies, for example.

The efficacy of sector policies, as well as the performance of the sector as a whole, is closely associated with institutional quality. By extension, the provision of services is essentially dependent on public sector institutions (the State, the provinces, states or departments, the municipal and public agencies, etc.) and the private sector (national and transnational companies, cooperatives and neighborhood associations). A related factor that should be considered is control of corruption and capture, due to the effect that they have on service efficacy and efficiency by diverting or misusing sector resources.

Other issues include the political priority assigned to the sector by the government and the stability of public policies over the long term. In many CELAC countries, the efficiency and financial performance of the water and sanitation sector are not high enough on the political agenda. If the necessary support is not forthcoming, then investment, regulation, oversight, efficiency and quality of service are sidelined by the day-to-day pressures that service providers face. The low priority given to the sector could be seen as a failure to guarantee the human right to water and sanitation, as it means the State is not doing everything in its power to universalize the service and guarantee its quality.

(ii) Regulatory conditions and incentives for efficiency

Water and sanitation services in the CELAC countries are in different phases of institutional development. Some countries have adopted specific institutional frameworks in which they have separated the functions of service provision and system operation, of sector policymaking and oversight, inspection and regulation. In the vast majority of the countries, service providers are part of the public sector and operate at the national level (Costa Rica and Uruguay), at the regional, provincial or federal state level (Argentina and Brazil) or at the municipal level (Colombia, Ecuador, Guyana, Peru and the Plurinational State of Bolivia), but vary considerably from one country to the next. Meanwhile, sector policy is generally made at the ministerial level, and oversight, inspection and regulation functions are assigned to autonomous agencies.

During the 1990s, the sector underwent radical reforms designed to attract private sector investment and management, with the twofold objective of releasing public funds for other areas and improving efficiency through private sector operation. However, many of these reforms ignored the structural limitations of the national economies and the relevant principles in terms of public interest and regulation of public services. In many cases, these problems have been aggravated by an overly mercantilist view that tends to shape the objectives, commitments and procedures set out in treaties to protect foreign investment, to the exclusion of consideration of socioeconomic conditions.

Since the 2000s, the sector has undergone a new transformation as private sector participation has ceased to be pursued in a number of countries, which in some cases previously privatized companies have been taken back into State hands. Against a backdrop of changing economics and corporate strategies, policy and regulatory conflicts have arisen, fueling this renationalization process. Consequently, legal frameworks that were originally designed to regulate the behaviour of private providers have ended up being applied to public operators. However, in the vast majority of cases, this process has not been accompanied by the regulatory adjustments that are needed to support the incentives and political economy of the sector under the public provider model.² As a result, efficiency has suffered and regulatory agencies have become weaker in some cases.

It is important to note that in this decade, there is a more in-depth discussion under way about the model for providing and regulating services, as well as instruments for managing the water and sanitation services sector. To a certain extent, sector authorities and professionals are abandoning the biased assumption that private management is superior to public management and beginning to discuss the regulation of state or municipal companies dedicated to providing public services (Rozas, 2013).

² Exceptionally, the regulatory framework of the Metropolitan Area of Buenos Aires has been amended and contains some interesting components such as an emphasis on efficiency, insofar as this is consistent with equity, and the application of regulatory tools such as regulatory accounting (Bohoslavsky, 2011).

2. Reform experiences in the sector

The various restructurings of the water and sanitation sector that were carried out in the 1990s with the goal of creating the conditions necessary to attract private sector investment, especially foreign private sector investment, mainly took place in the countries of South America. The rationale for this strategy was to create an environment of legal certainty for private investors to be able to take control of drinking service providers, contributing management and investment capacity. Underlying this rationale was the widespread perception that public sector delivery of services was weak.³

The dominant ideology at the time that the sector was being restructured was the supposed superiority of private sector provision over the public model. To bring in the private sector, models primarily from outside the region were used, albeit in a simplified form and with light regulation. There were a number of structural reasons for this. The first is related to a prejudiced view of the governments, which were seen as irremediably inefficient and prone to corruption and capture, so their powers should be limited, while private sector participation was seen as a goal to be achieved at any cost, as it would be immune from these difficulties.

The second reason is that in a number of cases, the political priority was to sell off assets, as this was considered an essential macroeconomic tool for economic stabilization, which meant that regulatory frameworks—the main goal of which should be to ensure efficiency in the delivery of services—were not a priority for governments.

Third, in a number of countries the development of regulatory frameworks and the incorporation of the private sector occurred in a context of weak or poor-quality institutions and structural problems with State finances. For this reason, governmental structures had little negotiating power vis-à-vis the transnational economic groups that, it was hoped, would provide substantial funding for the sector.

Fourth, there was the belief, associated in many cases with an orthodox and inflexible application of ideological models, that in modern systems regulators could manage with relatively limited and basic information, so there was no need for them to measure the rate base or rate of return. It thus followed that there was no need to develop the information access methods commonly applied in countries with a long tradition of regulation. Another factor was the belief that competition (e.g. through contract tendering) would reduce the level of regulation required, so that there would be no need to worry about developing traditional regulatory procedures.

In this context, several countries opted to introduce economic regulation even though most service providers were still in the public sector orbit. This was the case in Argentina, Brazil, Chile, Colombia, Nicaragua, Panama, Paraguay, Peru, the Plurinational State of Bolivia and Uruguay. In Argentina, Chile and the Plurinational State of Bolivia, the decision was taken to privatize the main service providers. Later, during the 2000s, with the exception of Chile and some provinces in Argentina, private-sector operators pulled out of all these countries (as well as the Bolivarian Republic of Venezuela and Uruguay, where private sector participation was much more limited), whether because of social or political conflicts, disruption of

³ Although there are many arguments to suggest that private sector water and sanitation firms ought to be more efficient than their public sector counterparts, the evidence from empirical studies on the efficiency effects of type of ownership is debatable (Renzetti and Dupont, 2003). The most important conclusion is that when the level of competition is low and firms are heavily regulated, as is inevitably the case in this sector, there are not many empirical elements to justify, in general terms, a preference for one type of ownership or the other (Vickers and Yarrow, 1988). In other words, efficiency in this sector depends more on institutional and structural conditions in the environment than on ownership type. The region's experience corroborates this conclusion: there are some cases in which different models of provision, public and private, function reasonably well and without major conflicts, and others in which, for whatever reason, neither model seems able to deliver acceptable performance in the medium or long run.

the economic and financial balance of contracts, strategic global decisions by controlling groups or changes in national sector policy (Ducci, 2007).

Many of the countries were not successful in their bid to largely privatize the delivery of water and sanitation services. In these countries, private sector participation was confined to a few cities or municipalities, as in Brazil (several municipalities), Colombia (public-private joint ventures in several cities), Ecuador (Guayaquil), Mexico (a few municipalities) and Peru (Tumbes), and to build-operate-transfer (BOT) contracts, especially for wastewater treatment and desalinization of seawater. In several cases, leasing and management contracts were signed, which typically do not entail investment obligations and are limited to the operational aspects of service management. Some countries, like Colombia, succeeded in attracting local entrepreneurs.

In many cases, service provision was decentralized to the municipal level. This trend reflected the belief that local matters —such as water and sanitation services— should be resolved locally, with communities themselves taking decisions about matters benefiting or affecting them, the idea being that this would result in greater efficiency, accountability and social acceptance (Lentini, 2010).

The experience with decentralization has not been entirely positive (Vergès, 2010; Jouravlev, 2004). Investment and operating costs for water and sanitation services are very high and require considerable management capacity, making it hard for small communities to finance them or run them to even a moderately high standard. Furthermore, decentralized service operation results in efficiency losses that can only be made good if service providers integrate or merge with one another to take advantage of economies of scale, which are very substantial in this sector (Ferro y Lentini, 2010).

Based on the reform experience, decentralization tends to make local governments dependent on financial transfers from other levels of government (national, provincial or regional). Among the exceptions to this trend are providers in large municipalities with considerable revenue or a high level of political importance, such as Medellín in Colombia and Porto Alegre in Brazil. These exceptions notwithstanding, municipal providers are not well placed to provide an efficient service, and this situation has often caused serious problems. Conversely, the most successful experiences —such as those of Chile and Uruguay in South America and of Costa Rica in Central America— are those in which services are provided on a more aggregate scale (nationally or by administrative region). In addition to being able to take advantage of economies of scale, a more aggregated industrial structure —which better addresses the economic characteristics of the sector— has a number of factors that contribute to more efficient and sustainable delivery of services:

- It facilitates regulatory and oversight activities, compared with a system in which there are a multitude of municipal companies.
- It ensures greater financial sustainability, inasmuch as providing service in an area that is larger (and more socioeconomically diverse) facilitates the use of cross-subsidies.
- Larger providers tend to have more and better access to technical and human resources, and they tend to be less vulnerable to political interference in decisions of a technical nature.
- It favours national and social integration and cohesion: a more consolidated structure helps minimize geographical differences in coverage, rate level and service quality.
- It prevents the provision of services from being contingent on a relationship with the local governments, which has often led to serious problems involving the politicization of decisions that are essentially technical in nature, as well as to the misuse of public resources.
- It sends clear signals to companies in terms of protection of sources of water, its optimal use and development, and control of water contamination.

(a) Regulatory frameworks in countries with a predominantly public provider model

In the CELAC countries, as in the rest of the world, water and sanitation services are provided mainly by public sector agencies or enterprises, with the exceptions noted in the previous section. Economic regulation is indispensable even when the public sector is the provider. However, this regulatory function becomes more complicated when the service provider is a State entity or a municipality that is subject to inspection and potentially to sanctions by another public sector entity.

The threat of inspection and sanctions is likely to be less credible and effective when the public sector is overseeing itself.⁴ Conversely, many public-sector service providers, or their institutional owners, are reticent to charge rates that reflect the true costs of provision, due to political considerations (Ducci and Krause, 2012). At the same time, a great many regulators have lacked the technical and financial resources and the authority needed to exercise effective oversight of service providers.

Some of the problems that a regulator faces with a private company are reproduced and manifested in a similar way in the case of a public sector provider. For example, when providers offer scarce, low-quality information, it makes it hard for regulators to perform their functions properly and for governments to make public policies that effectively address the nature of the problems associated with the provision of services. Furthermore, the general public is unable to get a complete picture of provider performance. These problems have sparked serious conflicts, which ultimately only harm the users.

At the same time, the political power of certain service providers (particularly those operating on a large geographical scale), sometimes with support from other parts of the executive, has enabled them to simply ignore regulators' instructions (Ducci and Krause, 2012). In some cases, similar conflicts arise due to municipal autonomy, which can be exacerbated by the fragmented array of providers. There are also weak providers, particularly the smallest ones, which are so under-resourced that in practice they are unable to comply with regulators' instructions.

Another common problem is the rigidity of the legal regime to which public sector service providers are subject because they handle State funds. Understandable though the aims of fiscal protection rules may be, they are counterproductive to the extent that they trammel the efficiency of service management.

It is paradoxical that renationalization of providers in some countries may have led to the abandonment of economic regulation, greater political power for service providers, information opacity and a loss of accountability, while in some cases even affecting financial sustainability. The challenge that emerges in terms of regulatory design is to change the nature of the relationship between regulator and regulated, that is, to determine how to control, supervise and incentivize a public provider (agent) with privileged access to political power—and its institutional owner (principal)—so that it does not lapse into inefficiencies, thus harming users (see box III.5). One possible solution is to promote the independence, autonomy and self-financing of providers, which thereby reduces political and budgetary dependence. A complementary measure would be to create a competitive investment fund to which service providers would submit their projects for financing, sending signals that would promote the efficiency of these initiatives.

⁴ It is essential for sanctions to be substantial enough for the risk of being subjected to them to outweigh the advantages of rule-breaking. To be effective in the case of public-sector enterprises, penalties have to be personal and not institutional (Solanes, 2007). Otherwise, the consequences of the improper act benefit the perpetrator but the costs are met by the State. There is also a place for moral or reputational sanctions, such as the publication and dissemination of comparative performance indices, which can be a good incentive to efficiency and help draw public attention to the sector's problems.

Box III.5

REGULATION IN THE PUBLIC PROVIDER MODEL FOR WATER AND SANITATION SERVICES

The main conclusion of the study by Berg (2013) on best practices in regulating State-owned and municipal water utilities is that for effective regulation, there must be utilities that can in fact be regulated. The central elements of the proposal are as follows:

- (i) Independent directors:
 - Efforts must be made to reduce political interference by government (municipal) authorities with the directors and ensure their independence in the long run.
 - Having representatives from different professions (lawyers, engineers, accountants) is recommended.
 - The most important factor determining the orientation of candidates for director and their potential capture by special interests is where they come from and where they will be going after their term.
- (ii) Managerial commercial orientation of the provider:
 - If the provider is embedded in the structure of a ministry or municipality, it is unlikely that its managers will have a commercial orientation.
 - Incentives for efficiency depend on a commercial orientation and the goal of achieving financial sustainability.
 - Concern about meeting social needs must not be used as a justification for inefficiencies.
- (iii) Clarity of roles within the company:
 - Roles and responsibilities within the provider must be clearly defined.
 - At the same time, interactions and learning between the different units must be promoted.
 - Everyone's work should be user-oriented.
- (iv) Coherent and consistent objectives:
 - It is important to prioritize the different objectives of the provider.
 - A development plan should be prepared that reflects the provider's objectives and is designed to meet user needs.
- (v) Internal efficiency incentives:
 - Internal systems for incentivizing efficiency should be created.
 - Information and monitoring systems are needed to detect areas of good (and poor) performance.
- (vi) Integrated information systems:
 - Efficiency in technical decision-making depends on the availability of reliable and consistent information.
 - Analysing the evolution of indicators over time makes it possible to detect performance trends.
- (vii) Business or development plans:
 - These plans should be based on the provider's objectives, performance results and revenue and spending projections.
 - This element of corporate governance serves as a reality check for decision-makers.
 - The business or development plan also helps strengthen the commercial orientation of management.
- (viii) Staff participation:
 - A top-down approach is not an effective management strategy for service providers.
 - Staff input is needed in defining the management objectives, incentives systems and development plans, among other tools.
 - Staff training and development are essential to improving performance.

Source: Sanford Berg, "Best practices in regulating state-owned and municipal water utilities", *Project Documents*, No. 542 (LC/W. 542), Santiago, Chile, Economic Commission for Latin America and the Caribbean (ECLAC), 2013.

It is also imperative to strengthen the position of the regulator, particularly in its dealings with an empowered public sector provider, and for this it needs to be given sufficient information-gathering, inspection and sanction powers. Industry benchmarking can be an essential tool, as it allows both institutional owners

and users to understand precisely what kind of service is being provided. This information generates reactions among users, who may then be motivated to approach their political representatives to press for improved performance by service providers. Accountability is another mechanism that could be strengthened, both for the regulator and for the service provider, to a much more sophisticated level than is currently the case in the region. An annual public report is an empty gesture unless it is based on objective and consistent information and openly discusses why decisions were taken and how problems are to be solved in future through explicit commitments with the different actors involved.

(b) Regulatory frameworks in countries with a sustainable private provider model

As indicated above, many of the CELAC countries, especially in South America, tried various strategies to attract private sector participation to the provision of water and sanitation services during the 1990s. After the general exodus from the region of international private sector operators, this public policy option continued to be applied only in Chile.

In the case of Chile, the structure of the sector is the outcome of a long-term public policy with goals and targets around which a political consensus has formed, so that it has survived a number of changes of government. Since this policy was shaped into a regulatory framework (amended substantially on only one occasion, in order to strengthen it after the sector was opened to private providers), efforts have been made to apply it objectively and based on technical criteria. Because the new model was phased in gradually over time, the economic regulator was able to consolidate and strengthen itself institutionally while it conducted oversight of the public sector enterprises concerned, before private capital was brought in (Lentini, 2011).

The high quality of the State machinery in Chile, together with the low level of political intervention in the management of the enterprises, has allowed the public sector service providers to consolidate and improve their efficiency. These providers have enjoyed reasonable autonomy in applying technical criteria, which has strengthened their professional teams and served as a safeguard against high staff turnover and politically motivated appointments. In addition, human resources management has been effective because professional managerial staff can be selected, resulting in a high level of expertise and specialization.⁵

The stability of the regulatory framework has been combined with an adequate level of technical and financial specialization of the regulator, conferring predictability upon the system (Lentini, 2011). Furthermore, although there is room for improvement, the rate calculation process has made it possible to keep reasonably efficient service costs consistently in alignment with the rates charged to the consumer. Thus, the rate model, based on micro-measurement and economic regulation, sends signals to users to use water rationally and to the service provider to manage it efficiently. Meanwhile, direct demand subsidies have been used to address social justice and equity issues.

Prior to privatization, the goals and targets to be pursued through private sector involvement were defined, and the regulatory framework was strengthened accordingly. The regulator has performed its supervision activities professionally, with more emphasis on incentives for efficient performance than on operational oversight. Another factor that has enhanced the model has been the transparency of the general information available to the regulator. In addition to all this, a system of regulatory accounting was introduced. However, there is considerable information asymmetry, which is increasingly manifested in the regulatory process, especially in rate calculations.

⁵ A virtuous effect of stability in managerial and professional positions is that it preserves institutional memory, professionalizes the business and ensures that long-term objectives are kept in view (Bohoslavsky, 2011). Stability of employment is a guarantee designed to benefit the organization and its goals more than the individual, as its purpose is to protect employees against external pressures and subject them to the standards that guide the work of the service provider in the public interest

An important characteristic of this experience is that the privatized State enterprises were already reasonably efficient and profitable providers with close to universal coverage (Jouravlev, 2010). Consequently, there has been good information available on the state of the infrastructure and its operation, which is not usually the case when service providers are inefficient or in serious financial difficulties. This has meant, first, that investors can prepare rational and sustainable offers and there is less risk and thus a lower cost of capital and less need for future renegotiations. Second, the amount of information available has meant that the regulator is well placed to set rates that reflect efficient costs. Rate impacts have been tolerated by the consumers, although rates have risen steadily and perhaps more than strictly necessary.

However, the Chilean model has a number of failings that need correcting. The constant evolution of commercial and financial practices, both among providers and in the market generally, means that the regulatory capacity of the State needs strengthening (Espinosa, 2008). The rate-setting process needs to be made more transparent, as there is still considerable information asymmetry favouring service providers (Jouravlev, 2003). Also essential is the implementation of a system of transfer price controls for transactions between related enterprises, to prevent inefficient costs or the costs of a provider's other activities from being passed through to users, and to protect free competition in related markets (Hantke-Domas, 2011b). As for investment, there need to be stronger incentives for service providers to renew infrastructure, particularly infrastructure that they took possession of when they acquired ownership of the former State-owned providers (Espinosa, 2008). Lastly, the model enterprise system used to regulate the sector has shortcomings, both because of its complexity and considerable information asymmetry and in terms of its incentives, which do not always promote greater efficiency (Jouravlev, 2003).

An important lesson to be drawn from the Chilean experience is that the central government began to strengthen its presence in the sector in 1931, in a gradual process that culminated in the early 1990s with the transformation of State-owned providers into corporations, organized by administrative regions. This stands in contrast to the public policies pursued by many CELAC countries, which have decided to favour the role of municipalities in the provision of services. Chile has opted for a corporate structure for the sector based on regional companies that serve large geographical areas. This model, in addition to taking advantage of sizeable economies of scale and scope, has several other important advantages, as explained above.

D. PUBLIC POLICY PROPOSALS

1. Hydroelectric power

There is broad consensus that economic development, understood as the expansion and deepening of opportunities to fully maximize individual and collective potentialities, cannot be achieved without a fluid supply of energy.

The functioning of modern societies depends entirely on having enough available energy for productive and non-productive (but equally important) activities alike. Indeed, in its resolution 65/151 declaring an "International Year of Sustainable Energy for All", the United Nations General Assembly recognizes that, "access to modern affordable energy services in developing countries is essential for the achievement of the internationally agreed development goals, including the Millennium Development Goals, and sustainable development, which would help to reduce poverty and to improve the conditions and standard of living for the majority of the world's population".

Three additional requirements have been incorporated in recent years into the discussion on the rising demand for energy:

- (i) Make clean energy available, adding renewable energy sources to the energy mix, in order to prevent (and minimize) the impacts of global warming, which tends to broaden the array of available energy options, forcing an in-depth analysis of the potential offered by alternative sources;
- (ii) Meet high standards for a safe energy supply; and
- (iii) Ensure that the price of energy is as competitive as possible, within existing market conditions, given the impact of energy prices on the profitability of investment projects, especially energy intensive ones.

Generating energy from renewable sources, including water resources, offers the possibility of meeting the stringent requirements that society is putting on the various energy sources that are presently available. However, hydropower associated with medium and large power stations has lately received strong criticism that has led to its virtual exclusion from the renewable energy context, not because hydropower is an inherently nonrenewable source of energy but because of its social and environmental impacts.

Generally speaking, there are four major arguments against high-capacity hydroelectric power stations with large dams (ECLAC, 2013):

- (i) Emissions of greenhouse gases (methane gas, in particular) caused by decomposition of flooded vegetation;
- (ii) The displacement of communities as a result of the construction of dams and the flooding of vast stretches of land;
- (iii) The reduction of the speed of currents, which produces changes in biota that can promote the spread of pathogenic vectors; and
- (iv) Changes in the transport of sediments that adversely affect coastal regions situated downstream of the dam.

It should be noted in this context that the Economic Commission for Latin America and the Caribbean (ECLAC) has been promoting the use of renewable energies in the CELAC region in recent decades, a commitment that has been manifested in the myriad studies it has produced in support of policymaking and its ongoing presence in national and international forums dealing with the issue, such as the World Conference for Renewable Energy (Bonn, 2004). ECLAC has been working in international forums, and particularly among the CELAC countries, to support the measures enjoined by the World Summit on Sustainable Development (Johannesburg, 2002) and, more recently, the commitments assumed at the United Nations Conference on Sustainable Development (Rio+20) (Rio de Janeiro, 2012), particularly with respect to the development of renewable energies. ECLAC has also worked with the Latin American and Caribbean Initiative for Sustainable Development, which set itself a regional target of raising renewable energy consumption to at least 10% of the total by 2010, a target that can be regarded as fulfilled in the CELAC region inasmuch as 18% of the total energy supply in this group of countries is generated from renewable sources.

Despite the efforts they have made to make their energy mix more sustainable, the CELAC countries are challenged to generate energy consumption that is integrated and even, attempting to overcome subregional differences that still persist in terms of: (i) uneven store of natural resources, as well as energy supply and consumption structures; and (ii) institutional consolidation and baseline conditions for advancing policies to promote and incorporate renewable sources.

In response to these problems, ECLAC (2004) put forth an integrated vision and policymaking guidelines based on four important focal points and initiatives: (i) a revaluation from an environmental and social perspective of hydropower according to the demands of sustainable development; (ii) the contribution

of renewable sources to the integrated development of rural communities; (iii) the rational use of fuelwood; and (iv) the role of biomass and biofuels.

In terms of hydroelectric energy generation, with all due consideration for the arguments against large hydroelectric power plants, this energy source nonetheless offers great potential, especially given the region's specific topography and rainfall patterns. Failing to properly consider this situation in the framework of efforts to expand renewable energy sources could be a major drag on development.

Given the renewable character of water resources, in the case of hydroelectric power stations, perhaps it is not as important to establish a ceiling for their inclusion as modern renewable facilities (usually only small power plants are accepted, with capacities that vary between 10 MW and 30 MW), as it is to set a floor for categorizing them as sustainable, based on economic, social, environmental and local indicators.

As mentioned, hydroelectric power generated by run-of-river plants (which do not require reservoirs) is not generally associated with significant environmental impacts. Reservoir plants, by their nature, will always cause impacts of one kind or another, but the assertion of a direct correlation between hydroelectricity and environmental problems is simplistic and often mistaken. Although negative impacts from hydroelectric power stations have been observed and in some cases are irreversible, these are not necessarily intrinsic to the technology. In a good number of cases, the damage is minor or can be mitigated. On an extremely important note, there are hydroelectric facilities that lend themselves to multiple uses and can provide interesting advantages: apart from the generation of electricity, they contribute to fishing, water supply, irrigation, stream flow management (reduction of flooding and alleviation of droughts), river transportation, tourism, use of local resources, etc.

Perhaps no other electrical generation technology offers such concrete and proven opportunities for integration and synergies with activities that are not related to energy. In fact, many hydroelectric power stations around the world, and specifically in the CELAC countries, have had significant beneficial impacts in terms of promoting local development, improving agricultural productivity and helping root communities in rural areas. The key point is to ensure that such projects adhere to the principles of sustainability and make rational use of an available resource, which in the case of this group of countries is in relatively abundant supply.

In effect, acceptance of hydroelectric projects involving large reservoirs, and thus bank financing of them, has been stymied by the way in which they have been developed, which has involved the displacement of communities, the destruction of forests and the flooding of extensive areas of farmland, as well as by amortization periods that are too long in relation to the terms of purchasing contracts established by law in certain countries. Thus, along with an objective critique, a social reappraisal of these types of project is needed so they can be viewed as the positive initiatives that they are in the current regional and global context.

Accordingly, from the perspective of national policymakers, electric companies and project developers, hydroelectricity generation projects would do well to adopt the principles stated by the World Commission on Dams (WCD, 2000). These principles reflect basic values of human rights and sustainability and include: conducting comprehensive assessments of existing options; respecting the rights of affected communities through the negotiation of legally binding agreements; securing the free, prior and informed consent of indigenous peoples; guaranteeing that affected communities will be the first to benefit; solving problems caused by existing projects before building new ones; providing environmental flows that maintain downstream ecosystems and livelihoods; and developing solid compliance plans that can be executed.

Along these lines, complying with the following conditions can help to significantly improve the development of infrastructure for generating hydroelectric energy:

- No dam should be built without the demonstrable acceptance of the affected persons and without the free, prior and informed consent of the affected indigenous and tribal peoples.
- Complete participatory diagnostic assessments should be conducted of the water and energy needs of the people, as well as the different options for meeting those needs, before proceeding with any project.
- Efforts should first be made to maximize the efficiency of existing water and energy systems, before new projects are constructed.
- Periodic participatory reviews of existing reservoirs should be conducted to evaluate factors such as safety and the possibility of decommissioning them and restoring, to the extent possible, local conditions as they existed prior to construction.
- Mechanisms should be developed to pay damages or provide retroactive compensation to people who have been harmed by existing dams, and to restore damaged ecosystems.

This brief evaluation of hydroelectricity in the region underscores the need to give suitable consideration to renewable energies and to properly define the concepts of sustainability and renewability in the context of the CELAC countries, where in addition to solar energy (such as radiation or biomass) and wind power, hydroelectric energy should have a prominent role.

Based on the considerations presented, ECLAC (2004) has prepared elements of proposals for the CELAC countries, including the following:

- Conduct a comprehensive environmental assessment of hydroelectric projects. Above and beyond their effect in terms of reducing greenhouse gas emissions, these projects must be evaluated also in terms of their indirect contribution to forest management, not only on account of how they are built but also due to their contribution to the livelihood of the neighbouring communities.
- Establish a code of conduct for communities. It is both urgent and necessary to spell out a number of rules that are accepted universally and supervised both nationally and internationally so as to commit the project developers to adopting a fresh approach to those communities affected by the hydroelectric plants.
- Establish fees for environmental services. One way of supporting the communities—as has happened in Brazil, Colombia, Costa Rica and Mexico—is to have payments established for project developers for forest-related environmental services so that they can be channeled as incentives to those who live in these areas.
- Modify the terms and conditions set forth in energy purchasing contracts. One way of recognizing the value of the hydroelectric projects is to modify the regulations so as to lengthen the allowable terms of contracts for purchasing electricity produced by hydroelectric plants, so better financing terms can be obtained.
- Create mechanisms that highlight the synergy between wind power and hydroelectric projects. At present, the rules established in the electricity markets are for individual power stations and not for comprehensive energy and capacity packages. Given the synergy between wind and hydroelectric projects, these rules should be revised and amended as necessary so as to recognize this synergy and make these projects more profitable and with more competitive costs.
- Develop a comprehensive vision for watershed management. The multiple uses and effects of water are typically contained within the watersheds in which water is captured and flows out to sea. Accordingly, hydraulic systems should be viewed precisely as watersheds in which it is essential to optimize benefits and minimize the negative effects of temporary and territorial shifts in water

flows. This calls for establishing systems for measurement, monitoring and decision-making and requires concerted efforts to ensure interagency coordination between central government agencies and regional governments.

- Meet social obligations and resolve existing conflicts. It is necessary to finish fulfilling the obligations to the communities that have resulted from the construction of dams, as well as to disentangle and resolve major conflicts related to the construction of hydroelectric plants, at least those that are considered acceptable under this new vision.
- Conduct public outreach and promote transparency of information. For a social reappraisal of these types of project, the initiative must include an intensive public relations effort in order to cast these types of project in the positive light in which they should be seen in this day and age.

Lastly, it must be noted, for the proper governance of natural resources, including water resources for hydroelectricity, revenues generated based on their use must be fairly distributed among all stakeholders, including adequate compensation for communities that live adjacent to installations.

2. Water and sanitation sector

The CELAC countries have adopted a variety of institutional solutions in their water and sanitation sectors, with varying results. On the one hand, coverage of both water and sanitation services has been expanded. On the other hand, weaknesses persist in terms of service quality and sustainability, and there are significant gaps between and within countries, which must be corrected. These problems disproportionately affect low-income groups and rural areas. Given the challenges that the countries face in this sector, there are a number of considerations that should be taken into account:

- Prioritizing the water and sanitation sector, in terms of both funding and efficiency-oriented public policies, could yield high social, economic and environmental returns for the CELAC countries, not only because of its decisive influence on public health, but also as a powerful tool in the fight against poverty and indigence, efforts to foster inclusion and social harmony, the promotion of economic development (especially with new opportunities for export-oriented agroindustries and tourism) and environmental protection.
- Regarding investment, the fact that large-scale funding is needed to attain universal coverage and improve service quality, particularly for the most vulnerable groups, means that the CELAC countries need to make a real, long-term commitment, in terms of both financing and the development of strong, stable institutions. Accepting this responsibility will not only bring about the hoped-for universalization of services but also will serve as an important tool for invigorating the national economies and combating poverty and indigence.
- With a large volume of public money committed to water and sanitation projects, particular attention must be paid to supervision and oversight of budgetary appropriations, as the infrastructure sector is affected by a considerable level of corruption and capture by special interest groups, as well as high transaction costs, particularly in procurement, contracting control and coordination processes.
- The economic value of water should be taken into account in user decisions, in order to generate awareness of how scarce and essential this resource is. The most effective mechanism for preventing waste is to charge for the (opportunity) cost of water. Thus, the CELAC countries should mobilize public policy to make the provision of services a self-financed undertaking by moving towards charging rates that internalize most of the costs, including the environmental costs. This transition should be implemented gradually, considering the poverty and coverage rates in the region.

- Given that some groups will be unable to afford water bills at self-financing rates, States need to devise subsidy mechanisms that enable these users to meet their basic needs. Subsidies thus become a vehicle that enables the States to fulfill their obligation to promote observance of the human right to water and sanitation and in so doing maximize the positive externalities of these services.
- As regards institutions, the CELAC countries should work towards an organizational structure for the sector in which institutional responsibilities are clearly demarcated, in addition to creating effective incentives for all actors in order to establish affordable, efficient, high-quality universal services. This can be achieved by separating service delivery, regulation and public policymaking into three different and independent spheres. Practice shows that this type of institutional arrangement makes it possible to establish the formal structures that are needed to create efficiency incentives for service providers.
- As regards the public model, the regulatory agencies overseeing and inspecting service providers at the state and municipal levels should initiate an appraisal process to ascertain the effectiveness of their incentive instruments (comparative results, fines, publicity and personal sanctions, among others). For their part, public sector providers need to become more independent of other public entities that control them financially and politically. But progress should also be made towards what has been called the “open firm” (Bohoslavsky, 2011), an approach that is designed to prevent distortions in the operation of a business and abusive behaviour by the authorities through measures to guarantee the independence of regulatory and oversight bodies and, in particular, through user participation in the internal management of firms and in the external functions of planning, regulation and oversight.
- User participation should be expanded at all levels and in all roles at both the regulatory agency and the service provider when the latter is a public enterprise. Promoting entities that represent water and sanitation users is a good initiative, as it allows them a say in policy and gives greater weight to their concerns and interests.
- Where economic regulation is concerned, the CELAC countries should enshrine in their legal frameworks (and not just in contracts with providers) the general principles governing that regulation, fair and reasonable profit, good faith, due diligence, the obligation of efficiency and the transfer of efficiency gains to consumers. Likewise, there is a need for regulatory accounting systems that give regulators access to reliable and consistent information on technical and operational performance, the administration of property, business management and the quality of economic and financial decision-making in the regulated concern, aspects that are not covered by the financial information that conventional accounting provides to the market. A troubling weakening of regulatory agencies in some countries and the need to adjust regulatory frameworks to the specific requirements for regulating public providers should be mentioned in this regard.
- It should also be noted that the scale of service providers is important in promoting efficiency, which ultimately means lower prices and better service quality for users. There is ample empirical evidence that clear economies of scale can be obtained by small service providers (serving fewer than 100,000 customers), while for large providers (serving between 100,000 and 1,000,000 customers, and as many as 4,000,000 in some cases) there is a tendency for economies of scale to remain constant (Ferro and Lentini, 2010). Furthermore, creating a more consolidated organizational structure in this sector provides a great many other benefits in terms of financial sustainability, social cohesion, improved operations, management of catchment sources, reductions in transaction costs and improvements in regulation and oversight. This assertion runs counter to many of the decentralization initiatives that have been undertaken in the CELAC countries. However, given

the soundness and abundance of the evidence supporting it, the recommendation is to promote aggregation and consolidation in the organizational structure of the sector.

- Similarly, emphasis should be laid on the urgent need for full, accurate, comparable, consistent, relevant and timely information. It is urgent for CELAC countries to have accurate and reliable information, and accordingly each country should allocate the necessary resources for this. Information should be open and available to all actors, as should the decisions of regulatory agencies and public policies. The region has already made progress in this direction, but all remaining areas of opacity and non-disclosure need to be dealt with as a matter of urgency.
- In particular, management indicators should be adopted to measure the performance of providers in the water and sanitation sector with a view to evaluating their efficiency and detecting best (and worst) practices. If possible, a region-wide performance comparison exercise should be carried out, both within firms over time and with other providers. “Historical comparison within a firm allows the ongoing service impact of management decisions to be visualized, while comparison with other providers replicates the conditions of a competitive marketplace and makes it possible to identify areas in which management can be improved and, potentially, to identify and analyse best practices so that they can be implemented for the purpose of improving services, subject to whatever adaptation is required by the circumstances of each particular case” (ADERASA, 2012).
- Likewise, the CELAC countries should be urged to link the management of water resources to mechanisms for the economic regulation of water and sanitation services. In most cases in the region, the work of sustainable water management (involving, for example, the protection of ecosystems and management of forests and surface waterways) is dissociated from the work of regulating water and sanitation. It is also dispersed across a multitude of agencies. This separation should be dealt with as soon as possible. Service users should gradually begin to internalize the cost of water production in ecosystems, since otherwise they will find themselves in a situation of scarcity sooner rather than later, not because of management problems but rather problems of physical availability.
- At present, with competition rising for different uses of water resources, it is essential to link the water and sanitation sector with the management and protection of associated ecosystems, thereby ensuring not only the sustainability of enormous investments but also the very existence of human settlements. In other words, failing to guarantee the sustainability of ecosystems and water sources puts any investment to expand coverage at risk, with a high social and economic cost. Specifically, legislation based on the concept of integrated water resources management is needed that adequately addresses the nature of the problems surrounding use of this resource and is aligned with societal views and practices. A water authority is also needed that is independent of sector uses and has powers, authority and resources to match its level of responsibility.
- Inasmuch as water and sanitation services benefit from the positive externalities generated by ecosystems —such as water-based environmental services— they should also help finance their preservation, as should all other activities that benefit, such as irrigation agriculture and other economic activities (industry, tourism, hydroelectric generation, etc.). In the CELAC countries, there are a number of watershed protection initiatives that are based on payment for environmental services, e.g. in Brazil, Colombia, Costa Rica, Ecuador, El Salvador and Peru. In Colombia, for example, an environmental fee is included in the rate paid by consumers for water and sanitation services, which is used to protect and clean up watersheds and water sources. In Chile, the cost of acquiring the water rights needed to meet demand for water services is incorporated into the user rates.

These considerations, together with the progress that has already been made, will provide a foundation for tackling future challenges faced by the CELAC countries as they work towards the Millennium Development Goals and the post-2015 development agenda, which will involve not only commitments but also imperatives to protect and deliver on the human right to water and sanitation. These efforts, moreover, are part of a renewed focus in the region to deepen sustainable development and the fight against poverty and indigence. This process is supported by the valuable prior experience of several CELAC countries, as well as experiences from around the world, which should serve as an invaluable point of reference for developing regulatory and operating models for the provision of adequate water and sanitation services.

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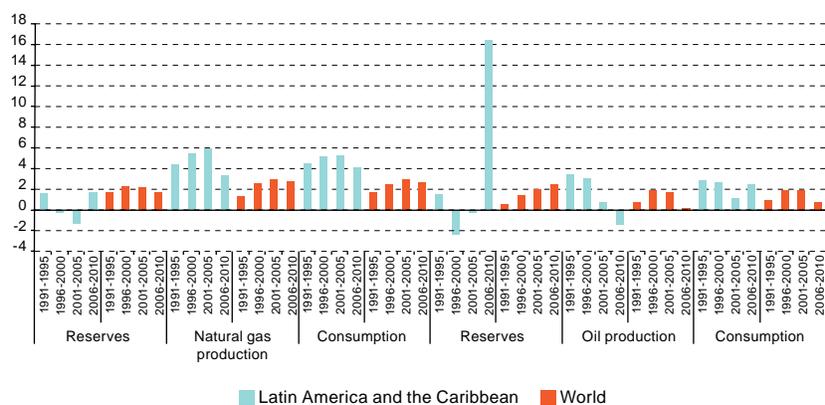
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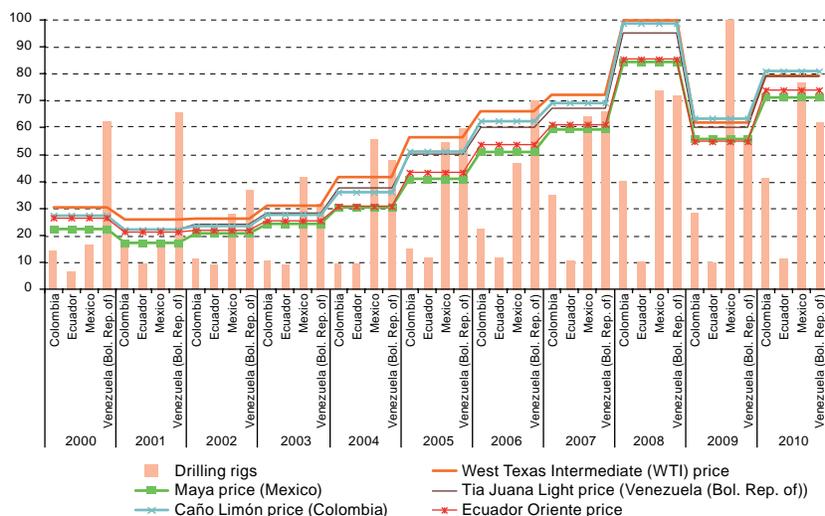
ANNEX

Figure A.1
LATIN AMERICA AND THE CARIBBEAN AND THE WORLD: RESERVES, PRODUCTION AND CONSUMPTION OF OIL AND NATURAL GAS, BY FIVE-YEAR PERIODS, 1991-1995 TO 1996-2010
 (Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of British Petroleum (BP), *Statistical Review of World Energy 2011*, 2011 [online] <http://www.bp.com/statisticalreview>; ENI, *World Oil and Gas Review 2010*, 2010 [online] <http://www.eni.com/world-oil-gas-review/pages/home.shtml>.

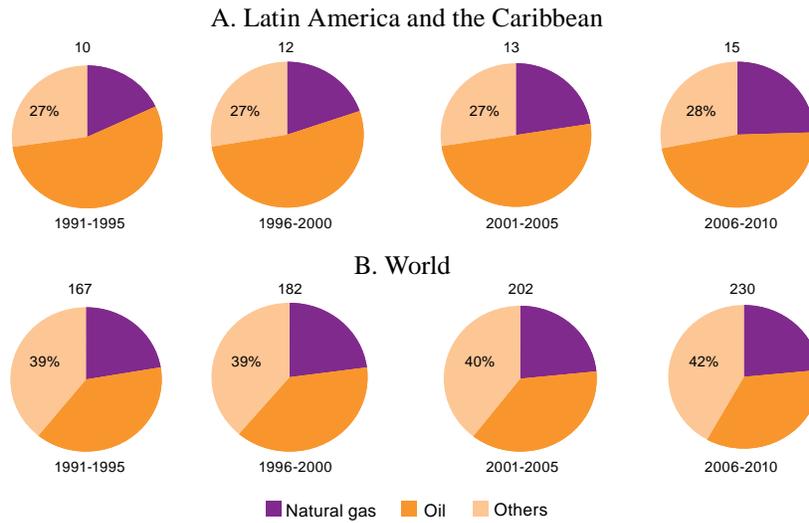
Figure A.2
LATIN AMERICA (SELECTED COUNTRIES): DRILLING ACTIVITIES AND OIL PRICES, BY CRUDE OIL TYPE, 2000-2010^a
 (Number of drilling rigs and dollars per barrel of oil)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of Baker Hughes, "International rig counts", 2012 [online] http://investor.shareholder.com/bhi/rig_counts/rc_index.cfm; Energy Information Administration (EIA), "Country analysis briefs", 2011 [online] <http://www.eia.gov.us>.

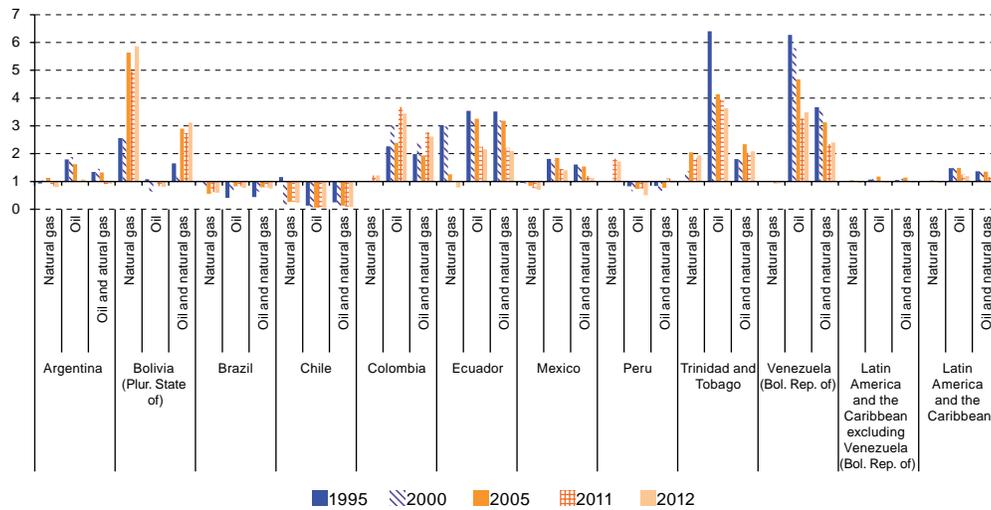
Figure A.3
LATIN AMERICA AND THE CARIBBEAN AND THE WORLD: PROPORTION OF HYDROCARBONS IN THE PRIMARY ENERGY CONSUMPTION MATRIX, BY FIVE-YEAR PERIODS, 1991-1995 TO 2006-2010

(Millions of barrels of oil equivalent per day and percentages)



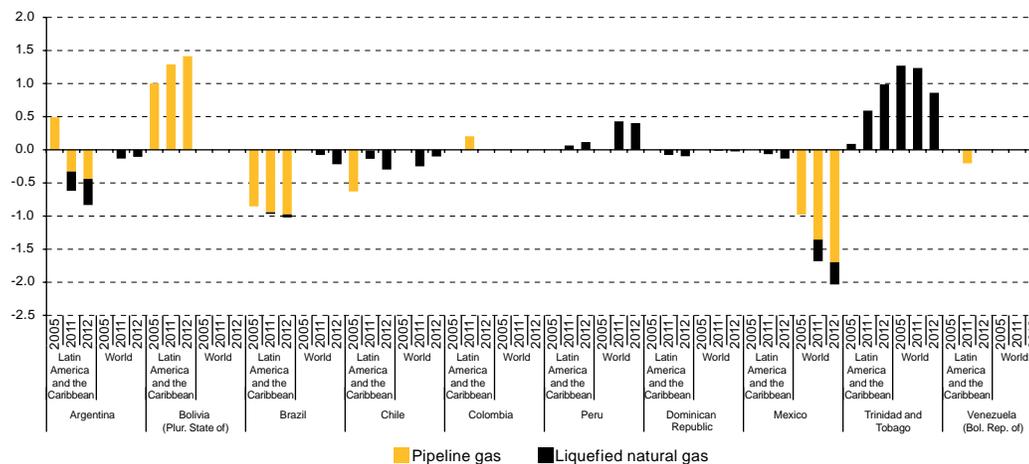
Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of British Petroleum (BP), *Statistical Review of World Energy*, 2011, 2011 [online] <http://www.bp.com/statisticalreview>.

Figure A.4
LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES): RATIO BETWEEN PRODUCTION AND CONSUMPTION OF NATURAL GAS AND OIL, 1995-2012



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of British Petroleum (BP), *Statistical Review of World Energy*, 2011 and 2012 [online] <http://www.bp.com/statisticalreview>.

Figure A.5
LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES): BALANCE OF TRADE IN NATURAL GAS WITH THE REGION AND WITH THE WORLD, 2005, 2011 AND 2012^a
(Billions of cubic feet per day)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of British Petroleum (BP), *Statistical Review of World Energy 2013*, *Statistical Review of World Energy, 2012*, *Statistical Review of World Energy, 2011* and *Statistical Review of World Energy 2006* [online] <http://www.bp.com/statisticalreview>.

^a The trade balance refers to the difference between exports and imports.

Table A.1
LATIN AMERICA (SELECTED COUNTRIES): FUTURE INVESTMENT PLANS IN THE HYDROCARBONS SECTOR, TO 2017^a
(Billions of dollars)

	Exploration and production		New production to 2020 ^a	Refining, transport and liquefied natural gas (LNG)		New refining capacity to 2020 ^a	Partners
	Item	Value		Item	Value		
Argentina	Development of unconventional resources (794 tcf of natural gas) in Neuquén, Chubut and Santa Cruz. Recovery of mature wells.	28 from YPF	0.2 MMbpd (increase of 29%) in oil and liquids 24 MMcfd (increase of 23%) in natural gas	Northeast Argentine gas pipeline Full utilization and expansion of refineries	9 from YPF	20 MMcfd in transport capacity 37% increase in refined naphtha and diesel oil production	YPF CNOOC Chevron Petrobras Sinopec
Bolivia (Plurinational State of)	Development of Caipipendi, Itaú and Incahuasi fields. Exploration in Itaguazurenda, Camiri and elsewhere. Gran Chaco and Río Grande liquid separation plants.	4-6	0.04 MMbpd (increase of 80%) in oil and liquids 30 MMcfd (increase of 70%) in natural gas	Urea and ammonia petrochemical plant Expansion of transport networks Refinery expansion and construction	3-4	1,000 t of urea de urea and ammonia 0.04 MMbpd (increase of 80%) in refining capacity	YPFB Petrobras Repsol Total S.A.
Brazil ^b	Development of presalt crude and natural gas fields (50,000 MMboe of crude and natural gas) in the Campos, Espírito Santo and Santos reservoirs.	118 from Petrobras (including between 50 and 70 for pre-salt)	3 MMbpd (increase of 140%) in oil and liquids 70 MMcfd (increase of 150%) in natural gas	LNG regasification plants at Ceará and Río de Janeiro Refineries for presalt crude	95 from Petrobras	1.1 MMbpd (increase of 58%) in refining capacity	Petrobras BG Exxon Mobil Statoil Repsol Sinopec Shell British Petroleum (BP)

Table A.1 (concluded)

Colombia ^c	Ecopetrol, with over 16 million hectares of exploration concessions. Exploration and development in the Llanos, Catatumbo and Magdalena reservoirs, the latter with unconventional crude potential.	27 from Ecopetrol	0.25 MMbd (increase of 30%) in oil and liquids 7 MMcfd (increase of 22%) in natural gas	Expansion of refineries in Cartagena and Barrancabermeja Expansion of transport systems: Caño Limón-Coveñas, Llanos Orientales, Bicentenario, Oleoducto Central S. A. (OCENSA)	6 from Ecopetrol	0.2 MMbd (increase of 60%) in diesel and gasoline 0.8 MMbd (increase of 67%) in transport capacity	Ecopetrol Pacific Rubiales Gran Tierra
Ecuador	Drilling at Auca, Shushufindi and Cuyabeno. Improved recovery in mature fields.	3	0.1 MMbd (increase of 20%) in oil and liquids	Construction and expansion of refineries at Manabí and Esmeraldas	n/a	0.3 MMbd	Petroecuador Petroamazonas ENI Repsol
Mexico	Exploration in the southeast basins, Tampico-Misantla (new reserves of 5,600 MMB of crude), in deep waters of the Gulf of Mexico and in natural gas basins such as Burgos-Sabinas and Veracruz. Potential of unconventional hydrocarbons in these basins. Best practices, secondary and improved recovery in mature fields. Development of new extra heavy crude fields. Projects at Cantarell, Ku-Maloob-Zaap, Burgos, Ayatsil and Tsimin.	107 from PEMEX	0.3 MMbd (increase of 12%) in oil 16 MMcfd (increase of 10%) in natural gas	Expansion at the Salamanca refinery and new capacity at Tula for Maya crude and residual oil, as well as projects to improve fuel quality. Expansion of transport systems. Expansion of petrochemical capacity.	40 from PEMEX	0.47 MMbd (increase of 36%) in oil by-products, primarily gasolines. 1.3 MMt (increase of 36%) in petrochemical products.	PEMEX with partners with full-service contracts such as Petrofac Facilities, Dowell Schlumberger and others
Peru	Development of fields: Lot 67 (Paiche, Dorado, Piraña), Camisea, block Z 2B (offshore) and blocks 39, 143, 76 and 64, among others.	8-10	0.3 MMbd (increase of 200%) in oil and liquids 20 MMcfd (increase of 70%) in natural gas	South Andean gas pipeline North Andean gas pipeline Expansion of Talara refinery Petrochemicals	7	Modernization at the Talara gasoline and diesel refinery and increase of 0.03 MMbd (increase of 45%)	Petrobras Perenco Hunt Oil Repsol Pluspetrol Petroperú Talisman
Venezuela (Bolivarian Republic of) ^d	Development of the Orinoco Belt in blocks of the Junín and Carabobo areas. Offshore development of natural gas fields in the Deltana Platform and Mariscal Sucre areas.	110 from PDVSA	2 MMbd (increase of 75%) in oil and liquids 35 MMcfd (increase of 40%) in natural gas for LNG	Expansion of heavy crude refining capacity at the Cabruta, Santa Inés and other refineries LNG in the Mariscal Sucre and Deltana Platform areas (postponed).	33 from PDVSA	0.8 MMbd (increase of 60%) in refining capacity	PDVSA CNPC ENI Chevron Repsol Statoil Total S.A. Consortiums with Russian and Indian companies

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of official information from the countries, companies and print media.

^a Tcf: trillion cubic feet; MMb: million barrels; MMbd: million barrels per day; MMboe: million barrels of oil equivalent; MMcfd: million cubic feet per day; MMt: million tons.

^b The Petrobras data correspond to the amount allocated to Brazil of a total of US\$ 250 billion, as established in the 2010-2015 global investment plan.

^c The Colombia amount corresponds to Ecopetrol only, although it is significant as the firm controls about 70% of the Colombian market. No information is available for other operators.

^d The 2011-2015 PDVSA investment total stands at US\$ 143 billion for all industry activities. Because the activities are not disaggregated, it is estimated that about 77% of the total (2011-2012 worldwide average) will be allocated to exploration and production activities, with the rest going to refining, distribution and marketing.

Table A.2
**LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES): FISCAL SYSTEMS
 FOR HYDROCARBON EXPLORATION AND EXPLOITATION ACTIVITIES, 2012**

Country	Contract type	Conventional payments to the State	Purpose	Taxable event	Tax base	Rate	Other taxes
Argentina	Contracts are of the concession type, so a firm wishing to undertake a venture has to pay a bond to the State when the exploration contract is signed or when the production stage begins.	Royalties	To compensate the State financially for the exploitation of its nonrenewable natural resources.	Hydrocarbon production, considering only computable amounts.	Computable production at the wellhead price.	General rate of 12%, although it can be higher in some provinces.	There is a profits tax of 35%, as well as a stamp duty of 0.5%, a bank account tax of 1.2%, a personal assets tax of 1.25% and a value-added tax (VAT) of 21%.
		Exploration fees or duties	To tax exploration and prospecting for hydrocarbon reserves.	Exploration in concession areas.	Square kilometres allocated in each concession.	The economic value per square kilometre is determined each year.	
		Export duties	To tax sales of hydrocarbons to the external market. These are not offset against the value of production for royalty payments. They are used to reduce the export parity price, with this obligation being deducted from the international benchmark price.	Exports of liquid and gaseous hydrocarbon production.	Quality-adjusted final export price.	Rates are variable and progressive in relation to the benchmark price of crude. There are two steps in applying them: (i) The nominal rate is calculated on a regulated benchmark price of US\$ 60.90 per barrel. When the international price is below this benchmark, the nominal rate applied is 45%, and when the international price falls below US\$ 45 per barrel the rate will be determined in 90 days. When the international price is higher than the benchmark, the rate is set by obtaining the percentage difference and adding this to the 45% minimum rate applicable. (ii) The effective rate is calculated using the following formula: $1-(1/(1+\text{nominal rate}))$, and the result is applied to the tax base. Starting in the fifth year, 20% of exportable production from unconventional reservoirs is exempt from this fiscal obligation.	

Table A.2 (continued)

Country	Contract type	Conventional payments to the State	Purpose	Taxable event	Tax base	Rate	Other taxes
Bolivia (Plurinational State of)	Production-sharing, operating and partnership. There are currently 44 operating contracts for exploration and exploitation activities. There are also public-private joint venture contracts in exploration areas.	Royalties and levies payable to the National Treasury.	To compensate the State financially for the exploitation of its nonrenewable natural resources.	Exploitation and production of hydrocarbons.	For the domestic and external market: total amount produced times the weighted average selling price in the market, times the percentage share of such sales in the total.	A rate of 18% is applied to the value at the point of inspection: (i) 11% for the producing department; (ii) 1% for the departments of Beni and Pando; (iii) 6% for the National Treasury.	There are also licensing fees, value-added tax (VAT) (13%) and the transactions tax (3%) for sales in the domestic market.
		Direct hydrocarbon tax			Same tax base as royalties	A rate of 32% is applied to the tax base (the value of output at the point of inspection).	
		YPFB share	The provide the State firm with a share of the profits generated by operating contracts.	Exploitation and production of hydrocarbons.	Profits to be distributed in accordance with annex F of the contracts.	A percentage that is variable and progressive with respect to prices and the operator's revenue and cost factor (factor B). The higher the operator's output, the lower the percentage.	
		Licenses	Exploitation of Bolivian-owned hydrocarbons.	Exploitation of Bolivian-owned hydrocarbons.	Area of exploitation.		

Table A.2 (continued)

Country	Contract type	Conventional payments to the State	Purpose	Taxable event	Tax base	Rate	Other taxes
Brazil	Three systems are used: The concession system, entitling private investors to explore and exploit the resource, and oil areas are put out to tender or auction.	Royalties	To compensate the State financially for the exploitation of its nonrenewable natural resources.	Exploitation and production of hydrocarbons.	Value of production at wellhead, payable on the basis of market prices for the oil, natural gas or condensate concerned, product specifications and field location.	Between 5% and 10%, depending on the geological risks, the production outlook and other factors that have to be considered by the National Petroleum, Natural Gas and Biofuels Agency (ANP), which sets the definitive value in the concession contract. A rate of 15% for production-sharing contracts.	
	Fee-based transfer of rights to Petrobras beginning in 2010. Production-sharing contracts will be introduced in the first presalt bidding round in 2013. These contracts will establish a minimum production quota of 30% for Petrobras and exemption from certain fiscal obligations.	Special levies	To impose a special levy on highly productive or highly profitable fields.	Profits above the threshold set by the ANP.	Value of production after discounting royalties, investment in exploration, production costs, depreciation and other taxes. As in the previous case, the exact amount will be established in the concession contract. Progressive rates will be applied to the net output of each field in accordance with its location, the number of years in production and the volume of output.	Between 0% and 40%. Exempt for production-sharing contracts and fee-based transfer of rights system for Petrobras.	
		Contract award payments, minimum program of work and local content	Amounts and percentages offered by concession-holding firms to obtain the right to exploit the hydrocarbon resources in the tendered areas.	Award of areas put to tender.	Financial amount offered at the tendering stage to obtain the natural gas or oil concession.	The rate cannot be less than the value set by the ANP in its call for tenders. Contract award payments offered by the bidder and not subject to bidding in production-sharing contracts.	
		Area occupation rate	Payment for use of the land specified in the concession.	Resource exploration and exploitation activities.	Square kilometre awarded in each concession.	Expressed in reais per square kilometre at the exploration and production stages, as set out in each contract. Exempt for production-sharing contracts.	
		Payment to the landowner	Payment for use of the land specified in the concession.	Hydrocarbon production on Brazilian territory.	Gross oil and natural gas production.	1%	
Chile	Special oil operation contracts (CEOP), either exclusively or in partnership with the State-owned enterprise ENAP. Contractors acquire ownership of the hydrocarbon once it has been produced. However, marketing is subject to regulation by the State, which pays the contractor a fee for its services, in cash or production, once development has started.	Corporate income tax	To tax annual profits from the exploitation and production of hydrocarbon derivatives.	The earning of profits by CEOP signatories in Chilean territory.	The sum that results from deducting total expenses from total revenues (reported in the annual results as taxable earnings).	17%	The Sales and Services Tax Act, contained in Decree Law No. 825 of 1974, also applies; this sets the VAT rate at 19%.

Table A.2 (continued)

Country	Contract type	Conventional payments to the State	Purpose	Taxable event	Tax base	Rate	Other taxes
Colombia	Partnerships contracts. Exploration is carried out at the private-sector partner's expense and risk and takes place over a period of joint commercial exploitation of 22 years, in cases where Ecopetrol decides to participate in the exploitation of fields. Concession contracts, with Ecopetrol also able to participate in the block auction or tendering process.	Royalties	To compensate the State financially for the exploitation of its nonrenewable natural resources.	Production of liquid or gaseous hydrocarbons.	Wellhead value of the hydrocarbons.	Tiered rate of between 8% and 25%, depending on the volume of oil produced. Natural gas royalties, likewise tiered, are calculated as a percentage of oil royalties and depend on the origin of production (onshore or offshore, for example) and reservoir depth. 40% discount on royalty and tax payments for producers of unconventional hydrocarbons.	
		Duties for use of the subsoil.	Use of Colombian territory for exploration and exploitation operations.	At the beginning of each exploration phase and half-yearly during the exploitation stage.	Dollars per unit of surface area.	The fixed amount payable is published annually.	
		Windfall duty.	To tax operations exceeding margins and operations exceeding production parameters.	When cumulative output of liquid hydrocarbons from each area, including the volume associated with royalties, exceeds 5 million barrels and in the event that the crude price exceeds the base price or when gas has been produced for export for five years and the United States Gulf Coast Henry Hub price exceeds the base price.	Production net of royalties.	Variable rate between 30% and 50%.	
		Duty calculated as percentage share of output.	Bidders are asked at the time of the tender to specify a percentage of hydrocarbon production. This is an important factor when concessions are awarded.	Any type of production, including extended production tests carried out at the exploration stage.	Production net of royalties.	Fixed or variable depending on what the private sector firm offered in the tendering process.	
Ecuador	Service contracts and marginal field reactivation contracts. Service contracts call for payment of a fixed rate to companies actively partnering with the State-owned companies Petroecuador and Petroamazonas.	Royalties	To compensate the State financially for the exploitation of its nonrenewable natural resources.	Hydrocarbon production.	Value of production at wellhead, as invoiced, with calculations differentiated by hydrocarbon quality.	Variable rate between 12.5% and 18.5%.	
		Sovereign margin	To guarantee a minimum stream of revenue in case of periods of low prices.	When the price of crude is lower than budgeted.	Value of production at wellhead.	25%	

Table A.2 (continued)

Country	Contract type	Conventional payments to the State	Purpose	Taxable event	Tax base	Rate	Other taxes
Mexico	There is a State monopoly all along the chain. However, PEMEX subcontracts drilling, construction and other oil services.	Tax on oil production.	To tax net earnings from oil operations except exploration and production.	Earnings by PEMEX and subsidiaries.	The amount resulting from subtracting total authorized deductions from total income.	30%	Income tax at a rate of 30% and 28% in the future. Corporate tax at a flat rate of 17.5%. Tax of 3% on cash deposits. Special tax on production and services.
		Hydrocarbon duties: - Ordinary	To tax the sale of hydrocarbons.	Sale of oil by PEMEX.	Value of sale less investments and other tax payments.	74% in 2008 71.5% in 2012	
		- Stabilization fund	To tax prices above the benchmark level.	Sale of oil by PEMEX.	Sales price less benchmark price.	Progressive, from 1% on a surplus of over US\$ 22 to 10% on a surplus of over US\$ 31.	
		- Extraordinary on oil exports	To tax surplus revenue from oil exports.	Oil exports at surplus prices.	Weighted price of oil less the price estimated in the National Revenue Act.	13.1%	
Peru	License contracts, involving a concession for hydrocarbon exploration and exploitation, entered into between PERUPETRO and the contractor.	Royalties	To compensate the State financially for the exploitation of its nonrenewable natural resources.	Production of liquid or gaseous hydrocarbons.	Wellhead value of officially verified hydrocarbon production.	Sliding scale from 5% to 25%, depending on the methodology chosen by the contractor (production scale or financial result) and estimates of investment and potential costs in the area specified by the contract.	Corporate income tax, applied at a rate of 30% to the operation's profits.
Trinidad and Tobago	Concession and production-sharing contracts.	Royalties	To compensate the State financially for the exploitation of its nonrenewable natural resources.	Production of liquid or gaseous hydrocarbons.	Wellhead value of officially verified hydrocarbon production.	Variable as established in the contracts. Historically, between 10% and 12.5% for oil and between 0% and 15% for natural gas.	Income tax, rates between 35% and 50%, depending on whether the reservoir is located offshore or onshore, respectively.
		Unemployment tax	To compensate unemployed citizens.	Collection of oil earnings.	Taxable earnings	5%	
		Additional/supplementary oil tax	To tax windfall profits.	Sales of oil but not natural gas.	Gross revenue net of incentives, based on the scale of average crude prices.	0%-64%	
		Oil production tax	To tax additional production.	Oil production above 3,500 barrels per day.	Minimum of between 4% of sales revenues and the proportional share in the oil subsidy.		
		"Green fund" tax	To contribute resources to the fund.	Hydrocarbon sales.	Gross revenues.	0.1%	

Table A.2 (concluded)

Country	Contract type	Conventional payments to the State	Purpose	Taxable event	Tax base	Rate	Other taxes
Venezuela (Bolivarian Republic of)	Basic Law on Hydrocarbons and reforms establishing the public-private mixed contract model with a PDVSA equity stake of at least 60%. Basic Law on Gaseous Hydrocarbons. There is no limit on private-sector quotas in natural gas exploration and exploitation contracts.	Royalties	To compensate the State financially for the exploitation of its nonrenewable natural resources.	Production of liquid or gaseous hydrocarbons.	Value of production at wellhead, with adjustments for gravity and sulfur content.	The royalty rate on oil is currently 30%, but a lower rate of 20% can be applied in the case of mature fields or the Orinoco Belt. The rate for natural gas is 20%.	
		Surface tax	Payment for non-use of the area awarded for exploration and exploitation operations.	Non-use of areas awarded after signature of the relevant contracts.	Unexploited area of the concession.	One hundred tax units (about US\$ 1,767) per year and square kilometre. This increases annually if the situation persists.	
		Extraction tax	To tax the exploitation and production of liquid and gaseous hydrocarbons.	Production of hydrocarbons in Venezuelan territory.	Value of production at wellhead, with adjustments for gravity and sulfur content.	Rate of 33.33%, subject to deduction with payment of royalties and special benefit.	
		Export registration tax	To tax operations that generate higher revenues for concession-holders.	Hydrocarbon exports.	Value of all hydrocarbons exported from any port in the country, on the basis of the actual selling price.	One per 1,000 (0.1%)	
		Special benefit	To obtain 50% of gross revenues generated through the sale of hydrocarbons.	Production of liquid or gaseous hydrocarbons in delimited areas.	Annual payment of the difference between 50% of gross revenues and fiscal payments by public-private joint ventures (in the form of royalties, special levy, corporate income tax, extraction tax, export registration tax and investment in endogenous projects, among others).		
		Special levy on extraordinary and exorbitant prices in the international hydrocarbons market.	To tax the difference between the international crude price and the budgeted price or maximum benchmark price.	Export or transport abroad of liquid hydrocarbons or sale of these to PDVSA or any of its subsidiaries for more than the amount budgeted.	Volume of hydrocarbons exported, after deduction for imported hydrocarbons used in the production process.	Dollar amount per barrel, calculated as a proportion of the difference between the international price and the budgeted price or the maximum benchmark price (US\$ 70/bbl). The share is calculated cumulatively by applying tiered rates ranging from 20% to 95% of the price differentials established using ranges and assumptions for extraordinary and exorbitant prices. The higher the international price, the larger the share of the price difference to be levied.	

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

