

TERRITORIAL PLANNING AND LA PLATA BASIN BORDERS



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VI ENERGY TRANSITIONS AND REGIONAL INTEGRATION IN SOUTH AMERICA

Silvina Carrizo & Sébastien Velut

ABSTRACT

South American countries have very different energy mixes but, with the exception of Brazil, these are not very diversified. The dependence on fossil fuels remains strong even in this continent rich in agricultural and other energy resources. In this sense, diversification possibilities are wide. States are concerned about new energy sources promotion, but there is no shared vision of a common energy future. On the contrary, integration is rather seen as a means to ensure the existing functioning by limited exchanges, rather than as a genuine transition instrument.

KEYWORDS Energy, integration, South America, transition, regulation.

INTRODUCTION*

In South America, abundant energy resources – oil, gas, coal, uranium, hydro, geothermal, wind, sun and biomass– are distributed all over the continent. Although regional energy production represents about 5% of the world total¹ (Enerdata 2017), it stands out as the world region with the highest share of renewable energies in electric production, thanks to hydropower. It is also a leader in biofuels production, with Brazil as the main world producer of sugarcane bioethanol and Argentina as a big exporter of biodiesel from soy oil. These two products have occupied energy niches, reached by technological leaps (Reddy and Goldemberg 1990). Compressed natural gas (CNG) in Argentina and oil produced in Brazilian deep waters also illustrate regional capacity to advance with new production and service spaces, created and adapted by local economies (Guyer 2004). Each country found those niches and innovated to respond to the challenges of reducing oil imports dependences (Droulers and Carrizo 2011). Both countries have built powerful national-industrial models in those four sectors, which became references at international level. Moreover hydroelectricity, biofuels and CNG favour a relatively low CO₂ emission rate². Greenhouse gases balances are acceptable in the region in spite of high level of energy consumption compared to population and GDP (Acquatella, 2008).

South American countries are facing different types of problems regarding energy supply. In some of them, problems arise from the low production capacity, dependence on imports of oil and gas and uncertainties about supplies. For instance Argentina and Brazil, two countries with large non-conventional resources, depend on gas imports. Ecuador or Peru have low levels of consumptions and are exporting hydrocarbons, but they must import fuels because they do not have an adequate refining capacity. In countries with substantial endowments of energy resources, rejection by local communities of large scale new energy projects, such as oil and gas production – particularly of non-conventional resources – or the building of power facilities also triggers social protest. Another set of problems are mainly related to

* The article was written in 2017 and it does not account for the events that affect South American integration processes in 2018.

¹ In 2016, world total primary production was 13,909 Mtoe. Latinoamerica produced 7% of world total (1,018 Mtoe) and in South America, Argentina (78 Mtoe), Brazil (287 Mtoe), Chile (12 Mtoe), Colombia (125 Mtoe) and Venezuela (174 Mtoe) together contributed with 4,8% of it.

² Average emissions are of 5,5 tons of CO₂ equivalent per capita excluding emissions from land use change and forestry (CEPAL, 2010).

the technological options, transport, increase of industrial capacity, quality and extension of energy services, consumption inefficiency and energy poverty.

Countries are facing a set of issues related to energy that might encourage them to reinforce energy transition and increase the level of integration within the region. This paper explores the connection between these two dimensions. On the one hand governments are eager to develop energy offer relying on conventional and non-conventional sources, shifting the countries' energy mix to make them more secure and sustainable. On the other hand they have been engaged in a complex process of regional integration in which energy integration is seen as one fundamental pillar.

Governments conceive new norms and legal frameworks, offer incentives and assume international commitments. They tend to facilitate investments in their energy systems and favour an energy transition towards new energy sources and patterns of consumption. Private or public-private initiatives for the inclusion of new sources and technologies emerge. They are part of national endeavours to make energy systems more distributed, more diversified and socially equitable.

This paper addresses the issue of energy transitions and regional integration in South America, as changes carried out by States and influential economic groups, to develop energy networks. While private companies often respond to global strategies, governments try to preserve national sovereignty in dealing with firms and with neighbouring countries. But they must also overcome existing deficits and provide services to households and industries, while private companies must deal with political uncertainty and legal inconsistency. Cooperation between states and private companies opens spaces for large-scale projects, but these face many obstacles due to the lack of a regional framework for energy integration. Differences between countries in resources availability complicate the whole integration process, because national interests might diverge. At the same time, they open more opportunities for complementarities. Nevertheless national programs to incorporate new energy sources do not consider these regional options.

To discuss these topics, this paper is structured in three parts. The first one presents the main characteristics of national energy mixes which, with the exception of Brazil, show a low level of diversification. The second part refers to changes that facilitate the incorporation of renewable energies and the adoption of more rational and efficient use of resources. The third part analyses regional integration processes from the perspective of a transition towards new models.

ENERGY OUTLOOK: FACING NATIONAL ENERGY CHALLENGES

All South American countries are dependent on hydrocarbons and have abundant hydro power. Three groups can be identified: the first includes countries exporting oil and gas; the second, countries able to cover national needs with their own production; and the last one, countries that rely on oil and gas imports. According to this simple criteria, countries show a higher diversification of the energy mix and exhibit different attitudes towards foreign companies. Countries are presented according to the level of energy consumption.

- Brazil is the main energy consumer in the region and the eighth in the world (297 Mtoe, BP 2017). It has achieved self-sufficiency; energy diversification with long-term policies contributed to it. Dependence from imported oil in the 1970s led the State to support the development of renewable energies as well as oil production.

Brazil became the main producer of oil and the second regarding oil reserves (mainly located offshore and in Amazonia) in the region. PETROBRAS – a company under State's control – dominates the activity. It has received strong support from the national governments since the 1990s, gaining priority access to offshore concessions and receiving funding through the National Bank for Development (BNDES). This helped PETROBRAS to become a world-reference in deep-water technology, allowing the company to produce more oil and gas and discover the fields of the *presal*, a ultra deep deposit. The rise of national production of oil and gas production makes possible to loosen the dependency from Bolivian gas exports.

Since 1975 and for more than three decades, the State supported the *Proalcool* programme, which promoted bioethanol production. Thanks to this, Brazil became the main producer of ethanol in the world, overcome in 2009 by the United States, which produces it from corn. A better use of the waste – the bagasse – burnt to generate electricity, makes the whole process more energy-efficient and price competitive.

The national interconnected system is unique due to its dimensions: 2,500 generating stations, 115,000 MW of installed power and 100,000 km of high-tension lines. It stretches from the south boundary, with Uruguay, up to the city of Belém, in the north, covering 50% of the national territory. The remaining part

of the country, with little population, is supplied by isolated systems, with 350 generating plants that provide 3.4% of the electricity. Besides, Brazil is connected with Venezuela through a line of 230 kV that serves Roraima state. The binational Itaipú dam (14,000 MW) – shared with Paraguay – strengthens the system in the south. Two power transmission lines were also laid from Argentina to allow imports and exports of energy. Electric connections also exist between Brazil and Uruguay, which also buys electricity transported through Argentina; an operation by means of a third party, exceptional in South America.

Brazil – as Argentina – developed nuclear energy, but at the beginning of the 21st century, hydroelectricity was responsible for 80% of total generation. However, the low hydraulicity of 2001 resulted in a crisis that – apart from energy rationing for several months – led to diversifications with gas power stations. To expand natural gas, Brazil connected its main energy consumption centres to Bolivia and Argentina gas fields. A gas pipeline and a central station in Uruguaina – border town – were built to receive expected gas imports from Argentina. Nevertheless, these were cancelled by the government due to decrease in gas production.

- Argentina has bet on gas since the 1950s. Its natural gas consumption is diversified, intense and extended. At the beginning, gas was distributed through pipeline networks, for heating, cooking and industry. Currently it is also used as a car fuel (with one of the main CNG vehicle fleets in the world) and by generating plants. It provides more than half of the energy used in the country. Oil follows it in importance, providing a third of the needs. The rest is completed by hydroelectricity, nuclear energy and other renewable sources. The electrical system covers 99% of inhabitants, interconnecting all the regions in the country and Brazil, Chile, Uruguay and Paraguay systems. With these two countries, it shares respectively the dams of Salto Grande and Yacyretá. Isolated population, not connected to the national system, has individual solar panels or micro supply systems. The hydraulic potential is very high but the part provided by hydroelectricity (29%) is the lowest in the region. Although Argentina has become the main world exporter of biodiesel from soy, the energy balance depends increasingly on imports.
- Venezuela is an OPEC founding member, the eighth oil exporter in the world (1.9 million barrels per day, OPEC 2015) and it possesses the largest

reserves in the world. PDVSA – the State Company created in 1976 – in association with great foreign companies, such as PETROBRAS (Brazil), CNPC (China), ONGC (India) and PETROPARS (Iran), seeks to develop extra-heavy oil resources from the Orinoco belt. PDVSA also owns important refining capacity, in the country and outside it, particularly in the United States. Oil provides 40% of the energy that the country needs, and gas contributes with 35%, but this is used mainly to extract oil, being re-injected in fields to enhance recovery ratios. Hydroelectricity covers the remaining demand, basically from a great dam in Guri river, also connected with Brazil.

- Colombia acquired the fourth place among coal exporters in 2015 (155 Mt, IEA 2017), a resource increasingly demanded. Since 2008, it has sold natural gas to Venezuela through a gas pipeline, originally built to sell Venezuelan gas to Central America. The Colombian power grid is also connected to Venezuela and Ecuador. Although flows between the countries are marginal, those connections contribute to construct a regional system considering existing links between Venezuela and Brazil as well as Ecuador and Peru. Oil exports are growing, especially since guerrillas' attacks to oil facilities decreased. Oil provides 39% of the energy to the country, and hydroelectricity 26% (BP, 2017).
- Chile needs to satisfy increasing demands from mining and industry, two strategic sectors for its economy. Currently, it imports two thirds of its energy, mainly oil, coal and liquid natural gas (LNG). Its oil and gas fields are already mature, and their production decreases while coal fields are almost unexploited, due to the high contents of sulphur in Chilean coal. Consequently, national electricity production relies mainly on hydroelectricity. Nevertheless, recent projects have met strong opposition. People also contest coal and geothermal power for environmental issues. Imports from Bolivia are almost impossible. The interconnection of the three Chilean regional power systems is difficult to tackle due to distance, natural obstacles and the opposition of dominant actors³. All these factors

³ The central interconnected system (9,100MW of capacity, mainly hydroelectric) supplies 93% of the population. It finishes near the interconnected system in Norte Grande (3,650MW of installed capacity, mainly thermal), which supplies the mining region with 5% of population, but 19% of the national demand. There are also two isolated small systems – Aysén and Magallanes with 100MW of capacity – in the south end, which assist 2% of the population and 1% of consumption.

- increase the uncertainty about energy scenarios in Chile.
- Ecuador constitutes the smallest producer of OPEC, but it stands on the third place in South America for proven oil reserves, after Venezuela and Brazil (OPEC 2015). It is extremely dependent on oil, which provides 72% of primary energy (BP 2017), and its export represents a higher income source. Sixty per cent of those external sales are to North America (OPEC 2015), but it aims at incorporating China among its main customers. Despite that, Ecuador has not a sufficient refining capacity and it has to import an important part of processed fuel.
 - Peru has high and varied energy potential. Since 2009, it has increased electrification levels and, by 2012, 91% of households (6,155) had electricity (CIER 2013). Its main energy sources are oil, gas and hydroelectricity, which provide respectively 45%, 28% and 21% of primary energy consumption. The exploitation of the mega-field Camisea, in Amazonia, connected to Lima city, through a gas pipeline operating since 2004, has pushed up gas consumption. Peru exports liquefied natural gas since 2010, mainly to the United States and Mexico. It also exports heavy oil, because its refineries cannot process it; but it has imported light oil since 1995, especially from Ecuador.
 - Bolivia, a country with conspicuous gas reserves, has exported gas to Argentina since the 1970s, and to Brazil, since 2002. However, the national supply is limited, and projects to export liquefied natural gas through the Pacific have not been settled due to geopolitical problems with Chile and Peru. Bolivian society was opposed to taking it out through Chile, and the companies were not willing to pay for the higher costs implied by taking it out through Peru. Gas has become the main fuel for electric generation. In 2013, 60% of the electricity was obtained from gas (4,770 GWh), and 31% was hydroelectricity (2,515 GWh). The national and isolated electric systems are limited. Electrification has been expanded, but 12% of the population still have no service. Bolivia has the lowest regional level of electrical consumption – 775kWh/capita – far below the second one, 1,300 kWh/capita in Colombia (CIER 2013).
 - Paraguay is one of the main world exporters of hydroelectricity, since it sells 100% of the production of the huge dam of Yacyretá to Argentina, and 84%

of the Itaipú dam, the second largest in the world, to Brazil. The national power station Acaray completes the hydroelectric offer that provides 54% of the energy used in the country; the rest is practically provided by oil, totally imported, mainly from the Argentinean bordering province, Formosa. Paraguay produces biodiesel from soy. Despite its privileged situation in hydroelectric generation, the system presents deficits in transmission due to lack of investment in order to reach the whole country and to respond to the increase in demand.

- In Uruguay 50% of the installed power capacity is hydraulic (1,538MW), but hydroelectricity represents a bigger part in generation (8,234 GWh in 2013, equivalent to 76%) (CIER 2013). Uruguay does not produce hydrocarbons, which are imported by ANCAP – State Company. Uruguay widened and renewed its generating park to work with gas, but imports from Argentina could not be sustained in time. The State company UTE [National Administration of Power Generation and Transmission Facilities], created in 1912, had the monopoly of electric generation until the opening of the binational dam Salto Grande in 1979; it still has monopoly in transmission (1,000 km of power lines, with generating plants relatively close to consumption centres) and manages an important part of distribution. Interconnections with Argentina—in San Javier and Salto Grande – and with Brazil – in Rivera – are very important for Uruguay, to reinforce system safety.

National energy deficits and imports dependence are growing in South American countries since consumption increases and production has not risen at the same pace. Diversification is an answer to this challenge. Except Venezuela, all countries implement policies to facilitate the inclusion of non-conventional renewable energies. In that way States limit external dependence and avoid economic risks linked to oil price volatility. Considering the diversity of energy profiles, regulations, energy potentials and system conditions, diversification challenges faced by each country are very different.

DIVERSIFICATION: WHICH PROSPECTS FOR THE ENERGY TRANSITION?

South American countries show energy and environmental concerns; they have launched plans, elaborated programmes and devised economic measures (Mastropietro et al. 2016) in order to promote non-conventional renewable energies and efficient energy use (Table 1). Clean development mechanisms triggered some initiatives. OLADE executes the Energy Efficiency Programme for Latin America and the Caribbean (PALCEE), which seeks to strengthen legal and institutional frameworks.

With regard to the incorporation of biofuel, South American countries have set legal ratios of bioethanol and biofuel in commercial fuels. They cover a wide spectrum from the Chilean objective of incorporating 2.5% of biodiesel and bioethanol, to the implementation of a cut to 10% of biodiesel in Argentina (Bolivia set as a goal a mixture with 15% of biodiesel for 2015) and a cut of 25% of bioethanol in Brazil, where cars sold can use either gasoline or bioethanol.

There is an even higher diversity of initiatives encouraging other non-conventional renewable energies, particularly regarding electricity generation. Bolivia's Constitution (2009) explicitly states that the State will promote alternative energy, and in the Patriotic Agenda to the year 2025 it establishes objectives linked to renewable energy development (IRENA, 2015). The most frequent incentive mechanisms launched by the South American States are contracts with a special fee (guaranteed feed-in-tariff), additional bonuses (fixed percentage added to base energy price), obligation for participation or quota (mandatory percentage of renewable energy to be generated, set by the State, known as standard portfolio, renewable targets or renewable obligations), investment subsidy, tax exemption and tax incentives (Molina, Rudnick, 2011; Sauma, 2011).

By means of different mechanisms, Brazil has acquired a higher diversification level, with a significant participation of non-conventional renewable energies in the national primary and electric matrix. The capacity of governments to successfully carry out diversification depends on the existence of a long term prospect that guarantees continuity in public policies, adaptations to new challenges and financial support. In comparison, Argentina exhibits discontinuous energy policies, responding to particular circumstances and interests, and not to long term plans. The same could be said about Chile, that let the markets make decisions about

Table 1.

National Programs and legal aims for renewable energies development

Country	Program/Law	% bioethanol Aim	% biodiesel Aim	ERNC Aim	Incentive mechanism
Argentina	1999-2012 PERMER – Programa energías renovables para mercados rurales				special fund to grant subsidies to private concessionaires
	Law 26,093/2006	2010: 10%	2010: 10%		quotas & Special fee
	Laws 26,190/2006; 27,191/2016			2017: 8% generation; 2025: 20% +1015 MW / 1,000MW	Special fee
	GENREN 2009; RenovAR 2016				Requests for bids. Special fee.
Bolivia	Law 3,207/2005	2007: 10%	2007: 2,5, 2015: 20%		
	Law 300/2012 de la Madre Tierra y Desarrollo Integral para Vivir Bien				Gradual change to renewable energy
	Universalization Plan. Bolivia with Energy 2010			2015: universal urban access 2025: universal rural access	
Brazil	Proálcool 1975, resolução do Conselho Interministerial do Açúcar e do Alcool 2015	27% with normal gasoline; 25% with premium			
	Law 13,263 /2016		15%		
	Proinfra Law 10,438/2002			10% in 20 years +3,300MW	Requests for bids; BNDES financing
Colombia	Biocombustibles Fondo Capital Riesgo	8-10%	10%		
	PROURE Indicative action plan 2010-2015; Law 1,715/2014			2015: 3,5% SIN & 20% not connected zones; 2020: 6,5 et 30%	tax exemption; Special funds for biofuels, renewable energy; rural areas

Table I.

Cont.

Country	Program/Law	% bioethanol Aim	% biodiesel Aim	ERNC Aim	Incentive mechanism
Chile	Law 19940/2004; Law 20257/2008; Law 20.698/2013; Decree 29/ 2014	2008: 2,5	2008: 2,5	2024: 20%	Quotas to big generators; Tax exemption, Requests for bids
Ecuador	Plan Nacional Buen Vivir 2013-17	5%	5%	2017: 60% including hydroelectricity	feed-in tariff
Peru	Decree 1,002/2008	7,8%	5%	5%; 2010 +500 MW y 1,314 GWh/year 2011: + 1981 GWh/year	Requests for bids.
Paraguay	Law 2,748/2005; Decree 2,998/2015; Law 5,444/2015; Resol. 507/2017	24% min. 25% max. flex fuel: 85% de alcohol y 15 gasoline	2007: 1%, 2008: 3%, 2009: 5%		Fiscal incentives
Uruguay	Law 18,195/2007 2008 Energy Policy 2005-2030	5 min	5% min	2015: 15% ER (surpassed)	

energy mixes since the beginning of the 1980s, leading to serious shortages when Argentine failed to supply the expected quantities of gas. In Brazil, thanks to the constant support of the *Proálcool* Plan, the bioethanol industry grew, became competitive and does not need direct public help any longer. Co-generation from sugarcane waste represents an estimate potential of 14,000 MW. Incentives later focused on Proinfa – *O Programa de Incentivo às Fontes Alternativas de Energia Elétrica* (Decree 5,025/2004), which seeks to add 3,300 MW of capacity from non conventional sources. Within this program 800 MW of wind power, 1,200 MW from small hydraulic power stations and 1,400 MW from biomass were contracted (144 projects in 19 States) (PROINFA 2013). Renewable energy is paid by ELETROBRÁS (a public-private company hold by the federal government at 70%) with a special fee, for 20 years; and national industry receives strong support: long-term financing by BNDES is conditioned by equipment purchase with certain nationalization indexes. In 2016, Brazil accumulated 10,000 MW installed wind power capacity and it is in 9th place in global ranking.

In proportion to the national market size, the most ambitious goal in South America was outlined by Uruguay (2008), which expected renewable energies to contribute with 50% of primary energy, and non-conventional energies to provide 30% of electricity by 2015 (MIEM). In consequence, UTE – *Administración Nacional de Usinas y Trasmisiones Eléctricas* – contracted 300 MW of wind power and 200 MW of biomass power capacity, guaranteeing to pay special fees for 10 years (2010 - 2011). Public and private investments in renewable energy increased. First wind farms started operating in 2008. Between 2014 and 2016, 1,200MW of wind turbine capacity were added. The country became one of the 29 world countries to have more than 1,000MW (17 in Europe; 4 in Asia – China, India, Japan and South Korea; 3 in North America – Canada, Mexico and the United States; 3 in South America – Brazil, Chile and Uruguay; South Africa and Australia) (GWEC, 2015). Uruguay passed from 1% of wind energy over the total generated in 2013, to 22% in 2016 <http://portal.ute.com.uy/rpp-novedades/la-nueva-energ%C3%AD>.

Argentina targets a share of 20% of electricity from non-conventional renewable sources by 2025. To achieve this, special fees are implemented in non-conventional renewable energy, and two Programs – GENREN and RenovAR – were launched. In each case, National State bid approximately 1,000 MW of installed capacity, guaranteeing the benefitted producers a contract with tax exemption and a special fee for 15 years.

As in Brazil, Argentina and Uruguay, Peru has also made requests for bids of power and energy. This country intends to provide 5% of electricity to the national system coming from renewable sources, thus attracting mainly wind and hydraulic proposals.

Colombia intended to have 3.5% of non-conventional renewable electricity in the interconnected system by 2015 and 20% in non-interconnected areas, since these cover 66% of the national territory. These percentages are expected to increase to 6.5 and 30% by 2020 correspondingly. In order to encourage new sources development, the State sets incentives and tax exemptions, according to an Indicative Action Plan, to develop the Programme of Rational and Efficient Use of Energy and Other Non-Conventional Energy Forms, PROURE (2010).

Unlike other mentioned countries, which bid and hire power or renewable energy, or offer tax incentives, Chile obliges generators with capacities above 200MW, connected to Central and North systems, to contribute with an increasing percentage of non-conventional renewable energy, which must be 5% between 2010 and 2014, and reach 10% by 2024, an increase of 0.5% yearly (Act 20.257/2008). This has been in force since 2010 and it has been accomplished. Chile has reached wind installations of almost 1.5 GW (GWEC, 2016)

Ecuador, instead, enables a part of 6% – maximum percentage– of the total installed power (284.5 MW) in the national interconnected system for non-conventional renewable energy (excluding sugar factories projects or hydroelectricity) setting for 15 years, a fee mechanism that differentiates technology type, size and location – continental or Galapagos Islands.

Public programmes favour renewable energy growth. Parallel to them, several initiatives and undertakings aroused. Many of them also happen in the context of public-private partnerships that have made possible the development of small pilot projects using different technologies.

Projects multiply, especially in Brazil, where BNDES provides financing to renewable energy, and in Uruguay and Chile, where higher energy cost makes renewable sources more attractive than in other countries. In Argentina especially, high subsidies are granted to energy, which noticeably lower cost for users and increase public spending significantly. Social criteria and political calculus prevail over rational use efficiency parameters (Coviello 2012).

In general, non-conventional renewable energies development is incipient, since programmes were defined at the beginning of 2000, but experiences have been positive. All these measures show that South American countries are willing to increase the share of renewable energy in the national mix, but they continue to work independently focussing on national issues and available sources, with little regard to cooperation with their neighbours. Except for the Brazilian programme of ethanol from sugar cane, South American countries prefer to use proven technologies, namely hydro power where building of new dams is possible, providing power networks with stable and cheap base load. Wind energy, which is currently the more mature technology, comes second. Solar energy is expanding. Small systems are used by isolated populations, far from networks. Large solar plants have been built or planned, especially in Chile, Uruguay, Argentina and Brazil, to cover increasing electric demand in national or regional systems. Other non-conventional sources, of which South America is richly endowed, are hardly considered. For example, little has been done to improve the use of bioenergy from forestry and agriculture, even in regions where the use of wood and charcoal is already high.

THE MAZE OF INTEGRATION

Integration of South America alternates advances and withdrawals phases. It has never succeeded to build up a unified geo-economic space, but it is always present on the regional agenda. UNASUR is the current expression of this process. Technical initiatives from the energy sector intend to boost the activity or guarantee supply safety. For example, improving power grids and interconnecting national and regional systems with physical infrastructures facilitate commercial exchanges between countries. They make easier the access to new sources, hydrocarbons reserves or places suitable for large scale hydroelectric dams. But this is feasible under clear and stable long term conditions of access to the resources. Better physical networks make the exchanges easier and can also help to cope with disruption of supply on a short term basis.

During the 20th century, periods of active integration – the 1960s, the 1990s – alternate with moments of conflicts between countries – the 1970s and part of the 1980s. During the first periods, political and technical organisms were created

and operated actively to improve cooperation between countries, set common standards and build infrastructures for exchanges. Conversely, during the harsher times of conflicts, existing alliances broke out, and countries made choices aiming at national independence with no regard to possible cooperation with their neighbours.

The heritage of the 20th century consists in a set of political and technical energy integration institutions listed in table 3, none of which has been suppressed, although some share common objectives. Some of these bodies are political, some are devoted to technical topics, like tariffs or infrastructures that affect energy markets. All of them are concerned with energy but only two are dealing exclusively with energy: OLADE (Latin American energy organization) and CIER (Commission of Regional Electrical Integration).

Table II.

Political and energy integration institutions

Years	Acronym	Name	Objective
1960-1980	LAFTA	Latin American Free Trade Association	Create a free trade zone.
1969	CAN	Andean Community	Social and economic integration and cooperation. http://www.comunidadandina.org
1973	CARICOM	Caribbean Community and Common Market	Foreign policy coordination and functional cooperation.
1964	CIER	Commission of Regional Electrical Integration	Interconnection (privileging the use of equipments and materials produced in the region)
1973	OLADE	Latin American Energy Organization	“Promote agreements between its Member Countries and carry out actions to satisfy their energy needs by means of the sustainable development obtained from the different sources of energy.” http://www.olade.org
1980	ALADI	Latin American Integration Association	“To progressively merge in the creation of a common economic place.” http://www.aladi.org
1991	MERCOSUR	Southern Cone Common Market	Progressive development of Latin America’s integration. It implies: goods, services and factors free transit; establishing a common external tariff and acquiring a common commercial policy; coordinating macroeconomic and sectoral policies; law coordination in the corresponding areas.

Table II.
Cont.

Years	Acronym	Name	Objective
1994	FTAA	Free Trade Area of the Americas	Eliminate barriers to trade and investment.
2000	IIRSA	Initiative for South American Regional Infrastructure Integration	“Advance in regional infrastructure modernization and take specific actions to promote its integration and economic and social development.” http://www.iirsa.org
2004	ALBA	Bolivarian Alliance for the Peoples of Our America	“Solidarity, genuine cooperation and complementarity among our countries, in the rational application and based on our peoples and their natural resources’ wellbeing—including their energy potential—on the integral and intensive formation of human capital required by our development, and attending to our men and women’s needs and aspirations.” http://www.alianzabolivariana.org
2008	UNASUR	Union of South American Nations	“Aimed at regional integration regarding energy, education, health, environment, infrastructure, safety and democracy. Its efforts are directed to strengthen South American nations union, under the acknowledgement of its regional objectives, social strengths and energy resources.” http://www.unasursg.org
2011		Pacific Alliance	Regional integration initiative formed by Chile, Colombia, Mexico and Peru to advance progressively toward free circulation of goods, services, capital and people; to promote higher growth, development and competitiveness for their economies and to become a platform for political, economic and commercial integration with global projection, especially over Asia-Pacific. http://alianzapacifico.net/

The creation of new institutions sometimes could be seen as a way to sort out obsolete mechanisms. In this succession of bodies, UNASUR represents a framework that encompasses all South America but not Latin America – Mexico, the Caribbean and central America excluded. It gathers CAN, MERCOSUR,

Chile, Suriname and Guyana. Its official objectives are to act as a regional group in international relations, build up a Free Trade Area and achieve physical integration, particularly energy integration. Nevertheless UNASUR gave higher priorities to political issues rather than energy union.

Despite recurring initiatives regarding the creation of institutions, energy integration remains incomplete because during the greater part of the 20th century, energy resources were considered strategic and a matter of national sovereignty. However, in the 1990s, energy was no longer considered as a strategic issue, it became a “*commodity*” that could be managed in a more efficient way by private companies operating on free markets. Energy integration processes were again encouraged. They responded to an increase in demand, associated with a rise in primary activities, a growth in households consumption and low energy efficiency of both sectors. Transnational companies that expanded throughout the continent were responsible for increasing energy supply. Natural gas became the keystone of integration: gas pipelines were built from Argentina and Bolivia to Brazil, Uruguay and Chile. Power grids were also improved. For example, Endesa laid two lines from Argentina to Brazil and another from a gas power station installed in the north of Argentina to the Norte Grande System in Chile. Its objective was to penetrate Brazilian and Chilean markets offering lower prices. For the same reason and to achieve even lower prices, its competitors built two gas pipelines parallel to the electric lines, in order to transport gas from Argentina and generate electricity in Chile.

Without a systematic long-term vision, extraction and export volumes regulation, oil and gas production levels were not sustainable in time. Facing shortages of gas and electricity, Argentina decided to limit its exports to neighbour countries. This decision led to conflicts between the State and the firms and fuelled tensions with Brazil and Chile that had become dependent of GNL imports. Reduction of gas exports from Argentina led to under utilization of gas lines, whereas Argentina always delivered small quantities of gas for household consumption. Similarly the nationalization of gas by the Bolivian government in 2007 caused a severe crisis with Brazil where facilities had been built relying on long term supply from Bolivia.

Electricity exports from Argentina through lines Garabí I and II supplied Brazil in critical years such as 2000 and 2001, but then they fell significantly. These lines have functioned in the opposite direction since 2004, to supply Argentina

temporarily, in critical times or peak demand. Chile was not able to continue importing electricity from Salta (Argentina) and tried to develop new hydraulic or coal power stations in its territory, but these plants faced strong social protest. Paraguay claims to sell electricity produced in the binational dams Itaipú and Yacyretá, to third parties, such as Chile, and asks for higher prices for electricity sold to its partners.

States have taken unilateral measures regarding national interests. The non compliance of international treaties led to mistrust between partners. The inadequate treatment of asymmetries between countries, particularly the differences of weight and power between small and large countries, has diminished the political credibility of integration (Ruchansky 2013). Integration processes are getting slower, and new types of obstacles appear⁴. Nationalist policies put the State back in its roles of business maker, investor and planner. Energy companies have been renationalized, economic subsidies set up, and internal price control is enforced. South American States provide economic incentives or obligations to expand energy production and transport infrastructure. Energy supply is again a strategic topic, associated with ideas of self-sufficiency and sovereignty.

However, governments keep saying that integration must transcend commercial matters, and countries must ally with each other to reach a higher autonomy from the rest of the world. In this way, the contradiction between sovereignty and integration is solved by the idea that it is possible to overcome energy crisis and shortages achieving higher levels of integration. Consequently, governments and multilateral organisms launched an Action Plan for the Integration of Regional Infrastructure in South America (2000) – IIRSA – which includes the objective of developing “efficient regional energy interconnections, in a regulatory context promoting competence and free trade.”

However, optimal solutions are not prioritized for networks design, neither on a national scale, nor on a regional one. Investments do not address social issues, local development or reliability improvement. Instead South American networks expansion are designed mainly to increase energy supply to mines, industry and metropolitan areas.

⁴ For example, in Brazil, since 2009, international interconnections will be subject to public concessions and have to be preceded by an international treaty.

UNASUR has taken in charge the overarching programme of IIRSA to build large infrastructure that are seen as indispensable to achieve a higher level of connectivity and exchanges. Energy interconnections are key elements of the integration process⁵.

Although interconnection results in global benefits, distribution is often unequal in the interior of the region. Thinking about an equitable distribution requires a higher planning effort, which becomes more necessary since each country looks for more renewable energies, what demands technical coordination.

FINAL REFLECTIONS

South American countries exhibit a wide gamut of energy mixes and organization of energy markets, but they share the same need to improve security of energy supply and efficiency of energy use. Most have centralized systems that depend on fossil fuel and hydropower. The former ties local economies to international oil prices volatility, the latter makes them vulnerable to climate change and its consequences on rainfall and rivers. Economic growth entails the rise of energy consumption and the need to increase systems capacities. This context creates an opportunity to incorporate non-conventional renewable energies and distributed generation systems, which could facilitate supply to millions of people who still have no access to modern energy services. This could reduce high levels of technical losses and greenhouse gas emissions as well as favour local resources development.

Consequently, governments launched national programmes promoting non-conventional renewable sources and the creation of public-private partnerships. This also changes the ways of planning, operating and managing networks, which require a higher level of coordination and interaction among actors, in order to optimize the use of resources.

The low level of coordination among actors limits the scope of integration. In this sense, integration is achieved with minimum institutionalization, basic regulatory harmonization and arbitration schemes, according to national plans

⁵ In 2005, a first meeting of Energy Ministers from the South American Nations Community was held; in 2007, the first UNASUR's Energy Counsel Summit took place; in 2009, the Guidelines Energy Integration Strategy were approved, along with an Agreement and an Action Plan.

with a regional view, but without firm commitments. These are agreements among governments privileging flexible and adaptable solutions for changing circumstances. Asymmetries among countries, their political views and national problems limit the scope of integration, which does not achieve a geopolitical unit.

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