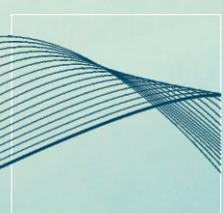
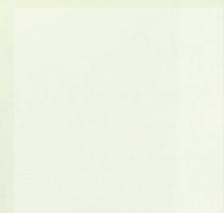


REGIONAL ENERGY INTEGRATION

Geopolitical And Climate Challenges



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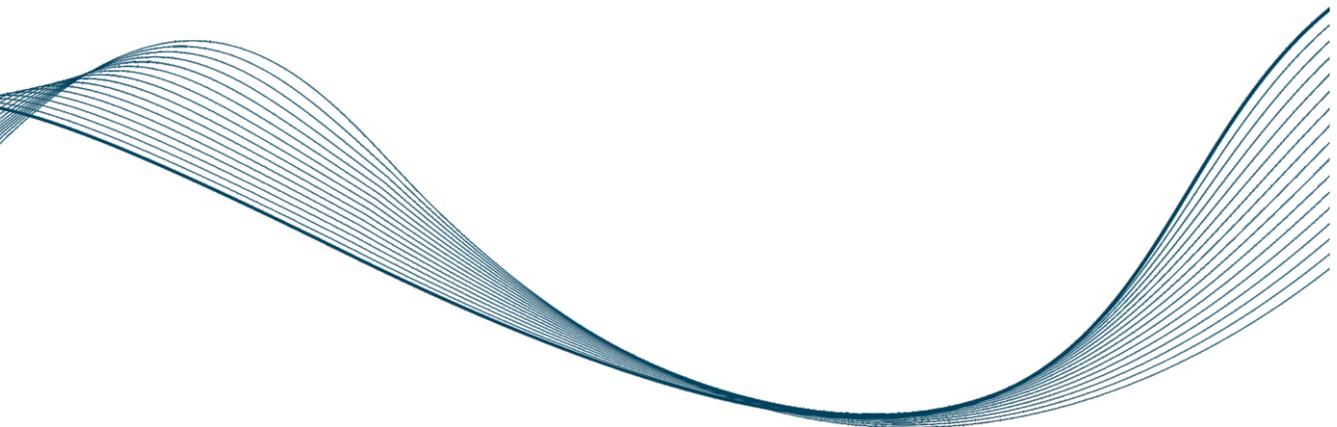


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**REGIONAL
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Geopolitical
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Challenges



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The views and opinions expressed in the present collection of papers and essays are those of the contributing authors alone and do not necessarily reflect the views and positions of the organising parties.

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Energy is a leading concern worldwide. As such the international agenda on sustainability is becoming increasingly linked to the security of energy supplies.

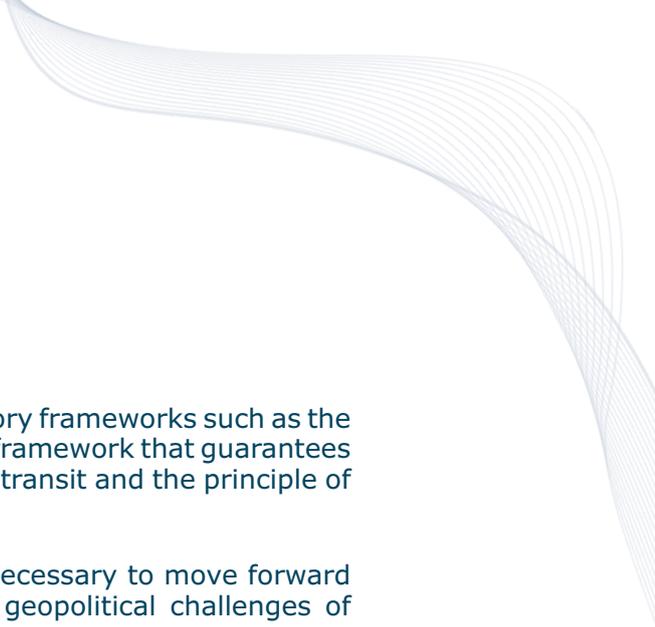
As a fundamental input to production, energy plays a key role in the development planning of countries. On the one hand, middle income countries have experienced years of growth and betterment of their people's living standards, leading to higher energy consumption. On the other hand, climate change is now a tangible reality and one example of its impacts is the relation between global warming and reduced water availability. Recent scenarios of water scarcity have put a new challenge to countries that have decided to construct their energy plants based on hydropower.

In sum, energy production is lowering at the same moment its consumption is rising. Tackling these challenges necessarily requires cooperation between nations through, inter alia, regional integration.

Bearing these challenges in mind, on the 1st and 2nd of June, 2015, a conference on "Regional Energy Integration: geopolitical and climate challenges" was held in Brasilia, Brazil as a collaborative project between the Regional Programme Energy Security and Climate Change in Latin America of the Konrad Adenauer Foundation (EKLA-KAS) and the Brazilian Centre for International Relations (CEBRI), with the support of the Asociación Civil de Estudios Populares (ACEP).

The conference focussed on Latin America, a region with the potential to become self-sufficient in energy due to its wide variety of energy sources. However, it is essential to invest in infrastructure. Until now bilateral agreements have been predominant in the context of Latin American energy integration. The Itaipu hydroelectric plant – the result of a Brazilian-Paraguayan partnership – is the most successful example of such arrangements.

Multiple bilateral projects constitute the puzzle of regional energy integration. However, it is also possible to identify many international institutions in Latin America that address the issue of energy. With the incorporation of Venezuela, and more recently Bolivia, the Southern Common Market (Mercosur) has become a leading energy world power, with the fourth largest production of crude oil, after Saudi Arabia, Russia and the United States. The Union of South American Nations (UNASUR) has two councils dealing directly with energy challenges: the South American Energy Council (CES) and the South American Council of Infrastructure and Planning (COSIPLAN). Additionally, the Community of Latin American and Caribbean States (CELAC) promotes gatherings of Energy Ministers to exchange experiences and views on energy security, sustainable development, and proper and balanced use of energy. Finally, the Latin American Energy Organisation (OLADE), the oldest Latin American organisation on energy which was formed in response to the energy crisis of the 1970s so as to provide technical and political support for countries wilful of achieving integration and development in the regional energy market.



It is also essential to emphasise the development of regulatory frameworks such as the South American Energy Treaty, which aims to create a legal framework that guarantees energy exchange between countries, based on free energy transit and the principle of non-discrimination.

Notwithstanding the existence of such mechanisms, it is necessary to move forward with concrete projects to deal with current climatic and geopolitical challenges of integration.

To contribute to this development and as a follow-up to the debates held in Brasilia, we have organised this publication, intended to present an overview of the main topics discussed. Based on the opinions of experts that participated in this project, we invite you all to consider the many challenges to be overcome in order to optimise the rational use of energy resources in an integrated manner and to ensure access to energy for all citizens.

Since freedom, justice and solidarity are the basic principles underlying the work of the Konrad Adenauer Foundation, a political foundation linked to the Christian Democratic Union of Germany (CDU), current global challenges of climate change and energy security are viewed as central issues, which KAS has already been addressing over the past years. Alongside the more than eighty country offices of the Konrad Adenauer Foundation around the world already analysing these concerns, the urgency and importance of the issues at hand led to the establishment of the Regional Programme Energy Security and Climate Change in Latin America of the Konrad Adenauer Foundation (EKLA-KAS). The regional programme has been designed as a dialogue platform, in order to provide impetus for political decision-making. Its central goal is to raise awareness of the topics of climate change, environment and energy security in Latin America. To achieve this goal EKLA-KAS cooperates with governmental institutions, political parties, civil society organisations and handpicked elites, building strong partnerships along the way, such as the fruitful and traditional partnership with CEBRI, in Brazil, and ACEP, in Argentina.

We thank our partners for the success of this first conference on Energy Integration and we hope this joint endeavour strengthens the cooperation between our institutions ever further and facilitates the finding of solutions for the ongoing global challenges of our time.

PRESENTATION CEBRI

JULIA DIAS LEITE

Executive Director at the Brazilian Center
for International Relations (CEBRI)

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Although the energy issue has been considered over time as a matter of fundamental importance in international relations, its latest association to environmental and climate issues has been giving it greater prominence in global discussions. Today, the growing concern around the subject is the result of a unique combination of factors, which point to the need for structural changes that allow countries to meet the energy demand in an efficient and sustainable manner.

Firstly, among these factors, it is imperative to understand the pressure caused by seven billion individuals whose daily activities require considerable energy expenditure ranging from a small coffee after lunch, the fuel used in transportation to the battery in electronic devices. This factor must be multiplied by the fact that we are living in a world that is experiencing a rise in consumption standards with emerging social classes marking a strong presence in the market and maximizing demand.

Secondly, the risk of depletion of the planet requires us to rethink the means of energy production, indicating the inevitability of a revolution in the energy matrix in order to make it cleaner, i.e., founded on renewable energy sources and sustainable management. However, one must subtract from this march towards sustainability the recent discoveries of numerous non-renewable energy basins, especially oil and gas in several parts of the world. A noteworthy example is the large oil reserves of the Brazilian pre-salt layer. Because of price advantages and convenience, these sources represent a challenge to the adoption of renewable energy sources leading to a debate that may be summarized in one question: produce more or produce better?

By concentrating much of the planet's natural resources, South America presents an optimistic outlook for regional energy integration. With an energy matrix based mainly on water sources and hydrocarbons, South American countries have complementary profiles and the ability to reduce weaknesses regarding energy security through cooperation.

We know that diversification is the key to reducing weaknesses and dependencies. Thus, integration through the exchange and sharing of techniques, resources and energy would ensure a scenario of balance and development for the region.

Whereas the main task of CEBRI is to study Brazil's inclusion in international relations from the point of view of its potential for political, economic and social development, we believe in the need to discuss issues of integration and cooperation, especially those involving our South American neighbors by asking what Brazil can do for the continent and what the continent can do for Brazil.

In this case, we know that the prospect of an integrated South American energy matrix can lead us to produce more and better.

In this sense, it was with great satisfaction that we joined the project Regional Energy Integration: geopolitical and climatic challenges, which CEBRI is honored to carry out alongside the Konrad Adenauer Foundation (KAS), the Regional Programme on



Energy Security and Climate Change in Latin America (EKLA) and the Civil Association of Popular Studies (ACEP).

The initiative aims to discuss opportunities for energy integration in South America, analyzing the progress made through South American cooperation projects such as Mercosur, IIRSA and UNASUR, among others, and evaluating the next steps in building an integrated and efficient energy matrix.

Our First Conference held in June 2015 in Brasilia was attended by renowned experts who engaged in high-level discussions covering topics such as barriers to integration, investments, regulatory convergence and environmental impacts.

In this book, we present some of the views that stood out during the Conference. We believe they have a strong understanding of the current situation of integration and could bring solid proposals for the near future. We are certain that this is an essential debate for the region and for Brazil and hope to contribute to the construction of an energy initiative for efficient production, sustainable consumption and integrated development.

PRESENTATION ACEP

ENG. CARLOS RIZZUTI

1st Vice President of Asociación Civil Estudios Populares (ACEP)

ENG. MAURICIO LISA

Director of the Socio-Environmental Institute of Asociación Civil Estudios Populares (ACEP)

With great pleasure our organization participated in and supported the conference "Regional Energy Integration: geopolitical and climatic challenges" held on the 1st and the 2nd of June, 2015, in Brasilia, which was organized by the Regional Programme Energy Security and Climate Change Security in Latin America of the Konrad Adenauer Foundation (EKLA-KAS) and the Brazilian Center for International Relations (CEBRI), whom we thank for the invitation.

These challenges bring us closer at the regional level through common actions of the various nations comprising Latin America, many of which are already in progress on power supply, as in the case of the Binational Entity Yacyretá between Argentina and Paraguay, and the Itaipu hydroelectric dam between Paraguay and Brazil.

Our countries have a great responsibility to address human development for the social inclusion of many citizens who still report high levels of poverty. In turn, this requires the necessary economic growth to be established aiming at environmental sustainability and without repeating mistakes of other "developed" nations, on bases that have little or nothing to do with environmental protection.

From ACEP, we understand that power generation should progress toward renewable and low-carbon matrices, as a response to the need to adapt to climate change and its consequences suffered by the developing countries and, in particular, cruelly hit people living in poverty.

The search for solutions to the energy challenges of our region is a moral obligation of our governments and should be a central element of regional policy because, as expressed by Pope Francis in his encyclical *Laudato Si*: *"Interdependence forces us to think of one world, a common project. But the same intelligence used for a huge technological development, cannot find effective forms of international governance in order to overcome the serious environmental and social problems. To address the underlying problems, which cannot be solved by actions of individual countries, it is essential that a global consensus will lead, for example, to planning sustainable and diversified agriculture, to developing renewable, non-polluting forms of energy, to encouraging greater energy efficiency, to promoting better management of forest resources and marine, to ensuring that everyone has access to clean water"*.

The "intelligence" of our nations must not only solve technical and energy demand issues "at any price", much less when the cost is the deterioration of the environment. This intelligence must consider, since the beginning of the analysis of energy issues, the social and environmental dimensions for the integral human development. This is the real challenge.

We from ACEP are committed to continue this discussion, integration and proposals as part of our corporate responsibility along with KAS, EKLA and CEBRI, understanding that it is our task to live under the humanist and Christian values that underpin our political action.

PREFACE

AMBASSADOR MARIANGELA REBUÁ

Former Director General of the Department of Energy of the Brazilian Ministry of External Relations

The need for greater energy integration is a topic that seems to build consensus in the region. This objective should result from a process of acknowledgement and appreciation of regional energy potential leading to the transformation of this potential into real opportunities to use these resources.

Due to its large hydrocarbon reserves, high hydropower capacity (30% of global water resources), bioenergy, wind and solar potentialities, the region arises as a relevant actor in the new world energy scene that points to a trend to further diversify sources and exporters. According to the "BP Statistical Review 2014" proved reserves in South and Central America account for 329.6 billion barrels, 19.5% of the world total. Only the Middle East (about 808.5 billion barrels, 47.9% of world reserves) has larger reserves.

South and Central America present, however, a lower exportable surplus (0.518 Mbd) than the Middle East (19.832 Mbd) and Africa (5.194 Mbd). Asia-Oceania, North America and Europe/Eurasia present deficits of 22.238 Mbd, 6.466 Mbd and 1.419 Mbd, respectively. In percentage terms, Central and South America accounted for only 2.03% of the world's oil exports in 2013. However, production prospects in the pre-salt layer suggest a potential increase of 1.48 Mbd in 2023 for the Brazilian exportable surplus (in relation to the import of 0,400 Mbd in 2013). South and Central America could increase their exports by 363% to about 2.4 Mbd.¹ The growth of the region's economies, however, will require greater energy consumption, which could increase regional exchanges and encourage energy integration, especially in South America.

Generally speaking, there are two conceptions of regional integration: one is based mainly on the physical energy interconnection that seeks to optimize energy resources and promote access to energy sources at affordable prices, as well as to ensure the safe and continuous supply of energy within a trading system. The other conception, which is deeper, requires not only energy interconnection, but also the coordination of regional policies based on common rules and standards for using resources efficiently and considers social and environmental aspects as well.

These conceptions include different types of energy integration. The integration of opportunity seeks to harness the seasonality of each region and generates power purchase agreements between countries continuously, for short periods of time, according each country's needs. The integration of firm energy, in turn, extends the trade for longer periods, even establishing it permanently, while boosting investments and greater regulatory coordination. The integration based on specific projects, such as the Itaipu hydropower plant between Brazil and Paraguay and on investment markets is also included. There is also the possibility of fuller integration that requires greater coupling of markets with common regulations, integration of investment markets and energy orders. In the latter, energy security and country sovereignty challenges are observed.²

Due to its attributes of natural resources and energy resources, South America can become self-sufficient in energy. The expansion of electric interconnection, especially based on hydroelectricity, can benefit from the complementary nature of the rainfall regimes in a latitudinal manner (north-south), which could ensure greater security of supply. Besides hydroelectricity, the region may count on the diversification of power generation and supply sources in order to broaden the base of the energy matrix and creating synergies between countries. For this to be possible, it is necessary to expand the electricity transmission lines and the natural gas pipelines. However, to date, specific energy exchange is predominantly governed by bilateral agreements.

Therefore, there are great challenges for the region to expand and deepen its energy integration. Among them, the main initiative is the development of a regional regulatory framework with higher density and that is able to capture the specifics of energy exploration in order to create the legal framework that will provide greater safety in trade and that can offer space for energy policies in the region.

Although the region is home to one of the oldest international organizations in the area of energy, the Latin American Energy Organization (OLADE), established in 1973, the idea of energy integration in the continent began to consistently gain force especially with the Initiative for the Integration of the Regional Infrastructure in South America (IIRSA). As of the year 2000, the ideas outlined in the IIRSA have been developed and deepened by the South American Council of Infrastructure and Planning (Cosiplan), an entity within the UNASUR, created in 2008 by the Treaty of Brasilia.

Still in the early 2000s, a discussion about energy was established within the South American Community of Nations (CASA). This exercise was absorbed in 2008 by the newly created Energy Council, composed of the Ministers of Energy of the South American countries, within the framework of UNASUR. A South American Energy Integration Treaty began to be negotiated and its structure was approved in a 2009 draft. The goal is to build a regional legal framework in order to promote energy integration and increase the flow of trade in the energy sector, as well as to provide legal security to the agreements held in the energy sector. Brazil actively participates in the negotiations, which have so far focused on the articles on free movement, non-discrimination and on contractual stability/legal security.

Brazil supports the assurance of free transit through the territories of the treaty's Member States, with the aim of facilitating and increasing energy flows in the region, ensuring respect for national regulatory frameworks and sovereignty of each State over its own infrastructure. In addition, Brazil defends the principle of non-discrimination between Member States of the future treaty, in order to encourage and promote the development of the regional energy market. The future Energy Treaty can coordinate the various South American initiatives already underway and expand the regulatory space and energy policies in the region. The completion of the South American Energy Treaty will allow the region to have its own rules and to hold a position in the international energy scene with parameters suitable to its vocation as an important energy producer and exporter, which will help increase the competitiveness of the region's countries.

In addition to the future Energy Treaty, countries in the region may be required to reflect on the type of energy integration that best meets the possibilities of building future regional production chains and greater integration to promote the social and economic development of all, which will mean greater autonomy.



CHRISTIAN HÜBNER

Since October 1st, 2014 Dr. Christian Hübner is head of the Regional Programme Energy Security and Climate Change in Latin America of the Konrad-Adenauer Foundation (EKLA-KAS) based in Lima, Peru. His thematic priorities are the national and international analysis of the German Energiewende, the geopolitics of energy security and the economic evaluation of climate policy instruments. Prior to this position he has worked as Coordinator for environmental, climate and energy policy within the KAS' department of European and International Cooperation in Berlin for four years. The three years before joining the foundation Christian Hübner has been research associate at a research institute of the Leibniz Association. There, as a trained economist, his focus has been on environmental economic analysis of ecosystems.

AN OVERVIEW OF THE ENERGY POLITICS IN LATIN AMERICA

Christian Hübner

In international comparative terms, Latin America is one of the richest regions in relation to the world's natural resources. It has fossil energy sources as well as similar quantities of renewable energy sources. At present, more than half of the Latin American energy supply is assured by fossil fuels of the region. Within Latin America, however, the distribution of natural resources is highly unbalanced. Mexico, Venezuela and Brazil dominate the regional oil and gas sources, accounting for almost two thirds. Venezuela has the largest oil and gas reserves. Argentina, Ecuador, Colombia, Peru and Bolivia share the remaining production. At present Venezuela, Colombia, Mexico, Trinidad and Tobago, Ecuador, Bolivia and Peru export oil and / or gas. Argentina and Brazil are net importers. In the area of hydraulic energy, the largest hydroelectric power plants are located in Paraguay, therefore contributing substantially to the electrical supply of Brazil and Argentina.

Despite the abundance of energy resources, there is a fundamental shift in energy policy in many Latin American countries. There is an almost complete restructuring of energy supply in Chile, and in the long term, renewable energy in the region plays an important role if we are to consider climate change and the reduction of dependence on imported energy. In addition, Costa Rica and Paraguay invest steadily and substantially in renewable energies such as wind, photovoltaic and geothermal energy, and have great repercussion in the mass media. Mexico has recently implemented a wide liberalization scheme for the energy sector, which includes, in addition to the privatization of government institutions, the existence of a sector in charge of renewable energy. Beyond these measures, Mexico, Brazil and Argentina invest heavily in the exploration of energy sources that are still inaccessible and unconventional, such as schist gas or oil in deep waters.

The integration of energy policy in Latin America is closely related to the integration of the economic policy. Different regulatory policies in the Latin American countries influence both processes. Especially in the sector of natural resources, we can see substantial differences in the regional ownership structures. Thus, in countries such as Peru and Bolivia, exploitation of fossil energy sources such as gas is conducted almost entirely by the private sector. In Brazil and Argentina, the State involves the private sector. In Bolivia, Ecuador and Venezuela gas and oil are explored and these activities are almost entirely in the hands of the State.

Joint strategies for the whole region that seek to promote the integration of energy policies are typically found in the context of economic alliances and social policy. The largest alliance of this kind in Latin America is the South American Nations Union - (UNASUR), with several sub-agreements and institutions aimed at promoting jointly energy infrastructure, energy markets and energy security, as well as the exchange of energy between the countries in the region. UNASUR also serves as a regional platform for discussing political disputes in the energy sector, and has a role in relation to the foreign policy of its member countries in the power area.

There is also the Community of Latin American and Caribbean States - CELAC, which includes Mexico and several Caribbean states. This alliance, however, is primarily a platform for political dialogue among its member countries and other international organizations like the European Union. However, it enjoys a relevant position in terms of international dialogue in the area of energy and climate policy. In the latest EU - CELAC summit, the main subject were also climate and energy policies.

There are several other partnerships in the UNASUR, their main purpose being not necessarily the integration of power policies in Latin America. However, they make their contribution towards its development in terms of contents. That is how the Strategic Andean Agenda (EAE)

was developed within the Andean Community of Nations – CAN.¹ It is involved, among other topics, in the building of transnational electric networks and the expansion of renewable energy and explicitly in the area of power security and climate changes. In the area of the Southern Common Market (MERCOSUR),² investments seek to develop common regulations for power markets. The main target, however, is the exchange of information on power policies. In addition, a Meeting of Ministers of Mining and (RMME) was established within the MERCOSUR, with the aim of promoting joint initiatives on power policy by prominent politicians. In this context, the main driving forces in terms of power policy are Brazil and Argentina. In the area of the Bolivarian Alliance for the Peoples of Our America (ALBA), some left-wing states such as Venezuela, Bolivia, Ecuador or Cuba, established closer links for a deeper regional integration. Political integration is one of the main areas in which the Alliance operates, and integration is mainly promoted through the energy resources that are abundant in Venezuela. An example of this is Venezuela's Petrocaribe Alliance, an oil alliance through which Caribbean countries can purchase oil from Venezuela under favorable conditions. A more recent alliance for the promotion of free trade in the region is the Pacific Alliance (Mexico, Colombia, Peru and Chile). The first discussions around the area of power economy are already visible as a further area of operation of this alliance. The Latin-American Energy Organization (OLADE) and the Inter-American Development Bank (IDB) also encourage regional power integration, but not specifically in political terms. Both of them support capacity-building projects, prepare compilations and make statistical data on the region available.

Despite numerous initiatives in the region, the integration of energy policies in Latin America is scarce. The shifting profile of energy integration in Latin America discloses in general a highly complex structure that demands new and credible initiatives. The energy policy in Latin America is facing brand new requirements in view of the various global changes such as low oil prices, investments in oil shale in the US or the international climate policy.



LILIANA DIAZ

Ms. Diaz is a Ph.D. candidate at the Johns Hopkins School of Advanced International Studies (SAIS) in Washington D.C. She is writing a dissertation on the 1970s Brazilian energy sector policies that transformed the country's energy profile. She is also an experienced consultant having practiced with premier energy consultancies in the United States advising both public and private sector clients on upstream and downstream projects in the United States, in Latin America, Europe and the Middle East. Her experience encompasses market, commercial and regulatory analysis of fossil fuels and renewable energy sources in emerging markets, energy efficiency standards and power regulatory standards in the United States, and liquefied natural gas markets and disputes.

Earlier in her career she worked on corruption and accountability as a consultant of the United Nations Development Program for the Colombian government accountability office (Contraloría General de la República). She then transitioned to the Organization of American States in Washington D.C. where she worked on terrorism and hemispheric security.

Ms. Diaz also holds a Master of Arts (M.A) degree with an emerging markets specialization from SAIS with a regional concentration in Latin America and Canada and a functional concentration in the energy sector. Her M.A. degree was awarded with Distinction. She also holds a Bachelor of Arts in international relations and finance from Universidad Externado in Colombia. She is fluent in English, Spanish and Portuguese. She lives in the Washington D.C. area with her husband and two children.

LATIN AMERICA: RISING ENERGY DEMAND, INTEGRATION AND IDEAS

Liliana Diaz³

How will Latin America respond and adapt to challenges of increased energy demand and heightened energy security brought about by climate change related impacts such as rising temperatures and reduced water availability? This was the main question addressed at a regional energy conference co-sponsored by the Konrad-Adenauer-Stiftung Foundation (KAS) and the Centro Brasileiro de Relações Internacionais (CEBRI) in Brasilia this past June 2015. The objective of this conference was to explore the region's options to address these challenges while promoting economic growth and cooperation among countries. With that in mind, I was asked to comment on the evolution and outlook of the regional energy matrix and to elaborate on the opportunities and obstacles in developing a regional integrated energy matrix.

While Latin America's energy matrix is diversified, it is still heavily dependent on hydrocarbons. Despite the region's sizable renewable energy potential, renewable energy resources contribute only a small fraction to meet energy demand. Latin America's energy demand is expected to double by 2040 requiring substantial amounts of investment to develop adequate energy supplies. In a business as usual scenario, such energy demand increase will contribute to rising levels of greenhouse gas emissions further aggravating the regions' energy security challenge. In this context, energy integration presents a viable solution to address the challenges of rising energy demand and heightened energy security. Integration can help optimize the use of current and future energy infrastructure and resources. By optimizing, the region can avoid installed capacity additions and reduce investment demands; promote greater coordination of the operation and expansion of infrastructure; and finally, further expand and develop the region's renewable energy potential.

Progress made with regards to regional energy integration provides useful information on what is needed to advance. Successful integration largely depends on the political will of countries and their leaders. Without it, developing a functioning and effective regional institutional framework is not possible. Furthermore, political will is required to develop the right conditions to stimulate investment in needed infrastructure for integration projects. Ideas can help promote integration. A common ideational framework can help in developing a regional consensus on the need to integrate Latin America's energy markets. Regional integration fora, multilateral institutions and Think Tanks are asked to rise to the challenge and help disseminate knowledge and information that promote ideas such as:

- Energy coordination and expansion of resources and infrastructure at a regional level will bring considerable benefits and possibly outweigh the cost;
- It is time for the region to develop its sizable renewable energy potential;
- Climate change is real and imposes a threat to the region because it threatens its ability to meet rising energy demand; and
- Reliable and affordable energy leads to greater economic growth.

This short essay memorializes oral remarks delivered at the conference and summarizes my views as well as feedback received during the panel discussion. The essay is organized in three sections. The first section provides a brief narrative on the regional energy matrix evolution and outlook. The second section examines regional energy integration as a solution to the challenges the region faces and identifies some lessons learned from integration efforts. The third section closes with a discussion on the role of ideas and how they can help promote regional integration of energy markets.

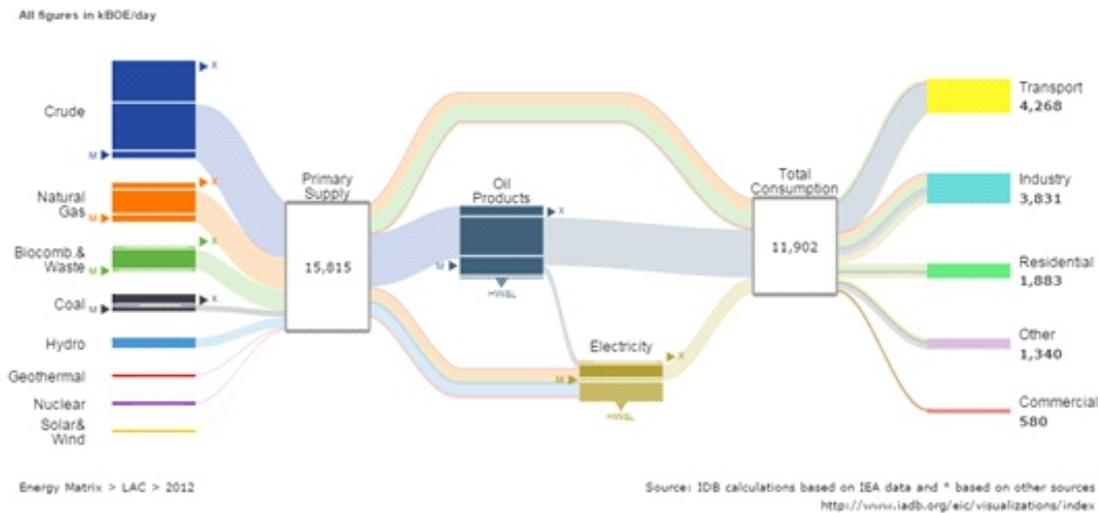
³ Doctoral Candidate at Johns Hopkins University School of Advanced International Studies (SAIS) and research fellow at the Centro Brasileiro de Relações Internacionais.

EVOLUTION AND OUTLOOK OF THE REGION'S ENERGY MATRIX

THE CURRENT ENERGY MATRIX

As depicted in , Latin America's current energy matrix is diversified and relatively clean. This representation of the region's energy matrix published by the Inter-American Development Bank (IADB) is based on data from the International Energy Agency (IEA) for 2012, the latest aggregate data available. In that year, crude oil accounted for 43 percent of total energy supply while natural gas and biomass each contributed approximately 20 percent and other fuel sources including coal, hydropower, nuclear and renewables accounted for the remaining 17 percent of the total energy supply.

FIGURE REGIONAL ENERGY MATRIX- 2012



Source: Inter-American Development Bank with data from the International Energy Agency.

According to the IEA, in the last forty years the region has made great strides to diversify away from oil.⁴ Since 1972, sources such as hydropower and natural gas have substantially gained ground increasing their participation in the total energy supply from 3 and 9 percent in that year to 10 and 22 percent respectively in 2012. Today, hydropower accounts for 60 percent of electricity generation in the region, which is a far greater share than in any region of the world. Notably, non-traditional renewable energy sources have made an appearance, but their contribution remains marginal at best.

Regional energy consumption is led by the industrial sector. In 2012 this sector accounted for 41 percent of total final consumption, followed by the transportation and residential sectors with 34 percent and 16 percent, respectively. As indicates, almost half of total final consumption corresponds to oil consumption, which is driven, like in any region, by road transportation. However, what makes Latin America different is the great participation of liquid biofuels in meeting transport fuel demand. Biofuels account for 9 percent of total fuels in the transport sector, which is a substantial share given the world's average.

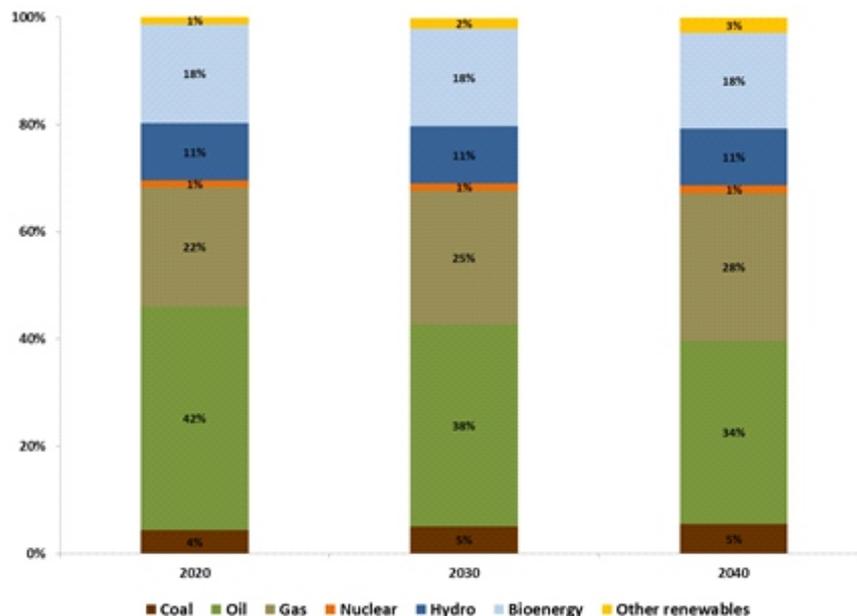
REGIONAL ENERGY OUTLOOK

Due to population increases and advancements in quality of life standards, Latin America's gross domestic product (GDP) is expected to grow at a three percent annual rate for the foreseeable future. To fuel that economic growth, the region will demand more energy resources. Energy projections reveal a concerning outlook. By 2040, Latin America is expected to require approximately 1.046 million tons of oil equivalent (Mtoe) by 2040 or 42 percent more energy than it currently consumes. These estimates come from the IEA Business As Usual Scenario -- the more likely scenario--. This scenario assumes current regional energy consumption trends are maintained, no policy changes are implemented to halt carbon dioxide emissions (CO2) growth, and sustained economic growth at a three percent clip.

A closer look to the IEA forecast, presented in Figure 2 below, indicates that among all energy sources natural gas is poised to experience the greatest growth by capturing most of the incremental demand and displacing oil consumption. Notably projections assume the current trend of meeting energy demands with fossil fuels and hydropower will continue into the future as demand rises.

7

Figure Total Primary Energy Demand Outlook to 2040



Source: International Energy Agency. World Energy Outlook 2014. Paris, 2014.

Despite the vast regional non-traditional renewables (NTR) potential, NTR are expected to have a rather marginal contribution by 2040. Latin America's NTR energy potential, encompassing energy from wind, solar, marine, geothermal and biomass sources, has been estimated at around 78 petawatt per hour (PWh).⁶ Given that current regional energy consumption amounts to only 1,3 PWh, experts point out that by exploiting 1,6 PWh of the NTR energy technical potential, the region could be meeting all its current electricity needs. What is then preventing the region from taking full advantage of its NTR resources? Great strides have been made to lower the installation costs of these technologies as market entry obstacles are dismantled and markets mature. The region's NTR potential can also help reduce installation costs given the prospects for substantial economies of scale. As the IADB points out however, the greatest obstacle to successfully developing the region's potential is the regulatory change that it demands.⁷ Introducing NTRs into the energy mix in such proportions would require a substantial change to recognize the particular features and benefits of these resources such as their intermittency.

⁶ Vergara, Walter, Claudio Alatorre, and Leandro Alves. Rethinking Our Energy Future: A White Paper on Renewable Energy for the 3GFLAC Regional Forum. Inter-American Development Bank, 2013, pp.9-11

⁷ Ibid, p. 17.

The outlook for the power sector is still more concerning. Electricity demand is expected to increase at a strong 2.7 percent annual rate and reach 2,424 terawatt- hours (TWh) by 2040. This is double the amount of electricity demanded in 2012. To meet this demand, the region is expected to require additions to the electric plant capacity in the order of 55 percent and substantial investments of approximately \$430 billion dollars.⁸ In this energy scenario, CO2 emissions are expected to grow significantly and consistently for the next 25 years. In 2012, emissions totaled 1,148 tons of CO2. According to the IEA, regional emissions are expected to reach 1,806 tons of CO2 by 2040, a 36 percent increase from 2012 levels. In essence, the region will face a heightened energy security challenge as global warming and water reduction impacts are expected to intensify.

Given this bleak and concerning outlook, what are the options available for the region to face its future energy demand challenge? According to various regional experts and energy analysts,⁹ Latin America has the following options:

- Invest in demand management and energy conservation to arrest demand increases
- Develop its vast renewable energy potential
- Integrate its energy markets

Of these options, integrating Latin America's energy markets has been touted as a solution with great potential, not only for solving the region's energy demand and security challenges, but also for contributing to regional economic integration efforts and thus, propelling economic growth.

10

REGIONAL ENERGY INTEGRATION

Why integrate? Economic theory tells us larger markets provide a fertile ground for the expansion of production activities. The development of economies of scale or the reduction of unit production cost leads to productivity gains and thus, the efficient allocation of resources. Therefore, integrating Latin America's electricity markets should lead to an efficient use of energy resources and to greater economic efficiencies that result in enhanced energy production and lower prices.

As noted in the Outlook section, future energy demand projections estimate the region would require substantial additions in installed capacity to meet rising power demand. This would require allocation of sizable investment amounts, which may constrain the region's capacity to dedicate resources to other key areas such as transport infrastructure, education and social safety nets. Electricity markets worldwide are currently facing transformational challenges. Latin American power markets are not the exception and they are dealing with challenges such as climate change mitigation and adaptation issues; fossil fuel price volatility; the advent and adaptation to new information and communication technologies for the grid (smart grids); and the emergence of the new business models for integration of NTR in small and large scale.

The case for integration of power markets as a solution to regional energy demand and security challenges is predicated on the following considerations. By optimizing the use of the installed generating plant capacity, integration of power markets has the potential to reduce the amount of capacity additions required to meet future demand and investment levels. Additionally, integrating power markets is expected to allow and promote greater coordination in the operation and expansion of electricity generation. Thus, integration can become a key policy tool to meet the transformational challenges regional power markets face today. Finally, integration can serve as a catalyzer for the development of the vast regional NTR energy potential.

Scholars, market analysts, politicians and policy makers all agree that the benefits from regional power market integrations are many, sizeable and relevant. Among those are:

- Optimization of resources through the use of geographic and seasonal complementarities
- Increase of energy diversification
- Attainment of economies of scale
- Lower power system reliability cost (interruption cost)
- Lower environmental cost

- Lower total electricity supply cost
- Integration of NTR energy sources
- Expansion of investment markets

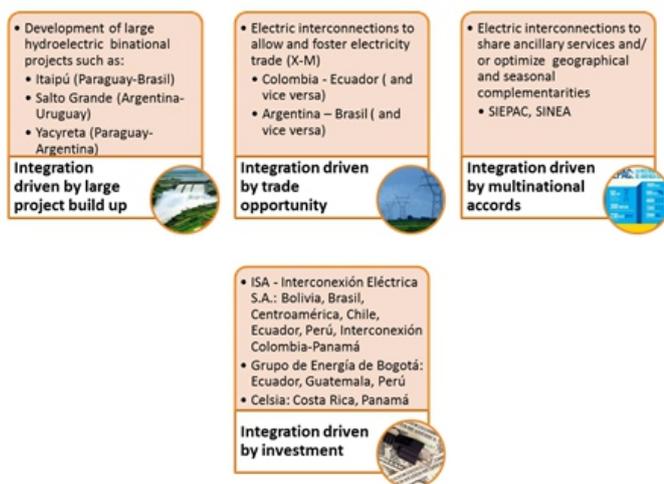
According to the IADB and the Latin America Energy Organization (OLADE in its Spanish acronym), benefits from integration are greater as integration is deepened.⁹

REGIONAL POWER INTEGRATION EXPERIENCE

Various types of energy integration have developed in the region. Figure 3 below provides a graphical depiction of the types of integration as well as some examples. Drivers of power market integration include buildup of large hydropower projects; binational or multinational electricity trade that seeks to take advantage of marginal cost differentials; multinational accords that seek to take advantage of geographical and seasonal complementarities to optimize the use of resources; and intra-regional investment flows. Investment flows present an interesting case study since they are purely driven by market forces and economic incentives.

The largest investments by Colombian enterprises in the region have taken place in the power sector by three state owned or controlled companies: Interconexión Eléctrica S.A. (ISA), Empresas Públicas de Medellín (EPPM) and Empresa de Energía de Bogotá (EEB). These three companies have invested in neighboring countries seeking to expand their activities once growth prospects at home were capped by regulatory constraints. These Colombian companies enjoyed the necessary support to expand abroad, which has been said is buttressed on the belief that such expansion would, in the longer term, help them successfully provide an enhanced public service to Colombians. Unlike their Colombia counterparts, other large power companies in the region such as Comisión Federal de Electricidad (CFE) in Mexico and Centrais Elétricas Brasileiras S.A., (Eletrobras) in Brazil have only been able to garner support for specific projects that seek to make a direct contribution to the energy security of their countries.

FIGURE INTEGRATION TYPES



The region has made strides in the development of concrete mechanism and tools for the advancement of regional power integration. These mechanisms and tools include the following:

⁹ Op Cit, Vergara, Walter. Castillo R, Isaac A. Apuntes sobre la Integración Eléctrica Regional y Propuestas para Avanzar. OLADE, April, 2013.

- Central American Regional Electricity Market (MER in its Spanish acronym): MER is a market organized around its own rules and independent of the six domestic markets that integrate it. However electricity trade in MER relies on the use of regional and national grid infrastructure to which MER enjoys open access. According to the treaty that governs MER, MER operates as a permanent vehicle for short term electricity exchanges; economic dispatch electricity exchanges; and firm exchanges of electricity for medium and long term contracts. MER is supported by infrastructure and programs developed for the Central American Electrical Interconnection System (Sistema de Interconexión Eléctrica para América Central or SIEPAC).
- Andean Region Framework Agreement: is an agreement developed to facilitate electricity trade in the sub region. It was established with Decision 536 of 2002, subsequently amended to allow for the execution of bilateral agreements such as the Colombia- Ecuador agreement. This agreement developed a novel tool known as International Energy Transactions or "Transacciones Internacionales de Energía (TIE)". Ecuador and Colombia established a transmission interconnection that since 2003 allows the two national systems to trade energy based on economic dispatch criteria (daily day ahead). Exchanges are the reflection of the differences in marginal generation costs that surpass an eight percent threshold.
- Brazil and Argentina Accords: are a series of operative accords geared towards the optimization of resources due to differences in demand profiles. Exchanges are driven by weather conditions and hydropower resources. Brazil exports hydroelectricity to Argentina during the winter and its reservoir levels are at its highest.
- Other binational accords: are accords specifically designed for the development of large infrastructure projects such as the Yacreta and Salto Grande hydroelectric plants.

These integration mechanisms have led to the development of concrete projects and physical infrastructure that through the buildup of transmission lines seek to connect power markets. An example of this is the SIEPAC project. SIEPAC, a 300 MW capacity transmission line that extends through 1,970 kilometers (Km) through Central America, seeks to connect 37 million consumers in Panama, Costa Rica, Honduras, Nicaragua, El Salvador and Guatemala. This transmission line was commissioned on September 2014. Cost- benefits studies developed to analyze SIEPAC demonstrate that net benefits from integration increase as the integration process deepens. The long term average incremental generation cost is reduced ostensibly- in the range of 14 percent to 23 percent reductions. Importantly, these studies also show that greater coordination of generation expansion activities leads to greater reduction¹⁰of investment and operating cost resulting in enough savings to justify the investment cost.¹¹

In both the Andean region and the Southern Cone regional electricity transmission infrastructure projects have taken place. Today, 15 electricity interconnections exist among the MERCOSUR members. The Andean Community members are currently working towards the establishment of the Andean Electricity Interconnection System (Sistema de Interconexión Eléctrica Andina or SINEA). SINEA seeks to develop an electricity corridor among Bolivia, Chile, Ecuador, Peru and Colombia between 2014 and 2024. The project entails the construction of infrastructure to generate a regional interconnected grid and the design and establishment of a supra-national regulatory framework to facilitate electricity transactions and trade. To date, the SINEA has some institutional arrangements in place with the Ministerial Council and the working groups developing the planning and regulatory aspects of the project. In April 2014, the Ministerial Council established the Hoja de Ruta which lays out specific interconnection goals, starting with the first interconnection project between Peru and Ecuador between 2014 and 2015.

Analysis of regional integration experiences has served not only to identify the benefits of integration but also the obstacles that countries face to advance and foster electricity integration. According to various studies performed by multilateral organizations, the main obstacles or barriers to integration originate from the lack of political will, institutionality and infrastructure. According to their nature, barriers have been classified as political; normative; commercial; technical; of standardization; institutional; geographic; and budgetary-financial. However, generally speaking, they are the product of two main features:

- Heterogeneity of regulatory frameworks that result in different market structures. Today, in the region, vertically integrated public or private monopolies coexist with wholesale market systems.
- Poor institutional capabilities of national regulatory entities. This condition greatly affects the probability of success of integration processes since much depends on the ability to harmonize dissimilar regulatory frameworks.

Regulatory harmonization, understood as the establishment of common rules and procedures with regards to technical, commercial and legal aspects, is essential for successful energy integration. Important issues such as treatment of congestion rents; handling and prioritization of domestic electricity demand; contracting rules and access conditions should be resolved through regulatory harmonization. These issues are of a nature that if successfully resolved, they propel integration efforts into a new phase.

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THE ROLE OF IDEAS IN PROMOTING REGIONAL ENERGY INTEGRATION

Integration largely depends on the political will of states and their leaders. Without political will it is difficult to develop strong and functioning institutional frameworks. Political will is also necessary, or better put, a key ingredient to generate the appropriate conditions to incentivize and promote investment in energy infrastructure needed to advance integration projects. The crucial consideration is that integration processes require the acceptance of commitments where regional interest prevail over domestic ones. This existing tension between integration and sovereignty is further enhanced by the following factors:

- The strategic nature of energy resources: Exploitation and use of domestic energy resources helps provide needed resources to fuel industrial activity and generate economic growth. They also provide the ability to collect greater fiscal rents and increase the ability of states to provide social services to their citizens. The control and management of domestic energy resources should help increase energy security.
- Supra-national institutions that wield power and may generate frictions among its constituents: For example, integration treaties or commercialization accords may require commitments that request country members to define in advance the level of energy security that they are willing to accept and to maintain such commitments even when market disruptions make compliance costly. Supra-national institutions should help to enforce such compliance.

How to overcome this dilemma and foster integration at the same time? Or in other words, how to generate the much needed political will essential for integration? The answer to this question may lie in the realm of ideas and how they can help promote integration. Scholarly works that examine the role of ideas in political economy offer the theoretical underpinning needed to understand their role in regional integration efforts. According to John L. Campbell, ideas provide specific solutions to policy problems. These ideas can take the form of assumptions that provide background to policy debates but can also be explicitly discussed by policy-making elites. Ideas constrain the cognitive and normative ranges for policymakers. At a cognitive level, ideas describe and explain cause and effect relationships while at a normative level ideas include values and attitudes. In addition, in his view, ideas encompass symbols and concepts that allow policymakers to propose policies and build frameworks in which to develop and legitimize them.

Mark Blyth advanced the notion that economic ideas play a crucial role in how institutional responses are shaped during times of economic crisis. Blyth theorized that in periods of economic crisis, ideas both give substance to interests and determine the shape of new institutions. Thus, in times of crisis leading to institutional change, ideas act to reduce uncertainty, assist in the building of coalitions, empower agents to challenge existing institutions; are resources in the construction of new institutions and finally, help coordinate agents' expectations, thereby reproducing institutional stability.

A common ideational framework among regional leaders and policy makers responsible for energy integration efforts is a key element to generate political will. Ideas can assist in the building of consensus and help legitimate political agendas among constituents. Ideas are resources in the building of new institutions. Ideas could be the supporting rock on which the edifice of energy integration is built. Regional integration fora, multilateral institutions and Think Tanks should rise to the challenge and help disseminate knowledge and information that promote ideas such as:

- Energy coordination and expansion of resources and infrastructure at a regional level will bring considerable benefits and possibly outweigh the costs.
- It is time for the region to develop its sizable renewable energy potential
- Climate change is real and imposes a threat to the region because it threatens its ability to meet rising energy demand.
- Reliable and affordable energy leads to greater economic growth.

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CONCLUDING THOUGHTS

The region faces two important challenges: rising energy demand and heightened energy security. Integration can help the region face these challenges head-on.

The experience and outcome of integration efforts to date indicate that its benefits may outweigh its costs. Successful integration however largely depends on the political will of countries and their leaders. A common ideational framework can help in developing a regional consensus on the need to integrate Latin America's energy markets. So let's build it.



SYBILLE RÖHRKASTEN

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REGIONAL ENERGY INTEGRATION: THE GLOBAL ENERGY GOVERNANCE AND THE LATIN AMERICAN SCENARIO

Sybille Röhrkasten

Energy policy has traditionally been regarded as a national task. As energy supply is central for economic development and military strength, energy is often considered as a strategic good which is crucial for the survival of a state and its political power in international relations. As a consequence, governments for a long time have been hesitant to engage in transboundary cooperation on energy, and sovereignty concerns have been prevailing in energy policy-making. In International Relations research, a geopolitical approach towards energy issues has been dominating. Here, energy has been framed in the context of competition and power politics in zero-sum-games rather than in the context of transboundary cooperation and mutual gains (Röhrkasten 2015: 98-100).

However, important changes are underway. More and more policymakers and researchers recognize that energy is a central precondition for and a key component of a globally sustainable development and that energy policy-making involves a range of transboundary interdependencies. These interdependencies are the starting point for a global governance perspective on energy. It is a central argument of global governance research that transboundary cooperation can lead to better policy outcomes than unilateral action and that there are many policy problems that cannot be tackled by single governments alone (Röhrkasten 2015: 21). This also has important implications for Latin America and its regional integration.

MAJOR CHALLENGES FOR GLOBAL ENERGY GOVERNANCE

Enhancing energy security and combatting energy poverty is the first set of global challenges that transboundary cooperation on energy needs to address. With a growing world population and more and more countries climbing up the ladder of socio-economic development, it is necessary to satisfy a globally rising energy demand. The International Energy Agency (IEA) estimates that between 2012 and 2040, world primary energy demand will increase by 37% (IEA 2014: 23). Different to the past, the non-OECD world becomes the new powerhouse in global energy markets. While energy demand in the US, Japan and the EU will be stable or even declining up to 2040, energy demand will significantly increase in non-OECD countries, particularly in China and India (IEA 2014: 57). In Latin America, primary energy demand will increase by more than 60% between 2012 and 2040 (own calculation, based on IEA 2014: 678). Meanwhile, energy poverty is still prevailing in many parts of the world. One fifth of world population lacks access to electricity and 40% relies on traditional biomass for cooking.¹ Electricity deprivation is particularly widespread in sub-Saharan Africa and Southern Asia. In Latin America, the overall rate of electrification is high (95%). However, there are vast differences across countries in the region: in Haiti, for example, less than 30% of the population has access to electricity, while in a country like Brazil, there is near-universal coverage. In total, 23 Million Latin Americans still lack access to electricity. 86 Million – 15 percent of Latin Americans – use traditional biomass, mainly firewood, for cooking. In Central America, the share even amounts to more than 50%. In the rural areas of the Amazonian basin (in Bolivia, Brazil, Colombia, Ecuador, and Peru), reliance on firewood is also widespread (REN21 2015: 103f., 159-164).

¹ Sustainable Energy for All, Universal Energy Access, <http://www.se4all.org/our-vision/our-objectives/universal-energy/> (accessed July 19, 2015).

Climate change is the second major challenge for global energy governance. Global energy supply is a major driver for climate change and thus a central field of action for climate mitigation. The global energy sector accounts for two thirds of global greenhouse gas emissions. Current energy trends are consistent with a global temperature increase of at least 3.6 degrees – which is by far beyond the internationally agreed goal of 2 degrees (IEA 2015). Thus, there is an urgent need to transform global energy supply, by replacing carbon-intensive energy sources and improving energy efficiency. Coal is the worst energy source in terms of CO₂ emissions. In 2012, it contributed to 44% of global energy-related CO₂-emissions, while it only made up a share of 29% in world primary energy demand. In the same year, oil was responsible for 36% of global energy-related CO₂ emissions and gas for the remaining 20%. Nuclear power and renewables, on the other hand, are climate-friendly energy sources. They have no significant contribution to global energy-related CO₂ emissions, although renewables provide 13% and nuclear power 5% of world primary energy demand (IEA 2014: 606, 608). In its World Energy Outlook 2012, the IEA – an organization that is often accused of having wrested interests with fossil fuels producers (Roehrkasten/Westphal 2013: 12) – even made the historic statement that up to 2050, no more than one-third of worldwide proven fossil fuels reserves can be consumed if the two degrees target is to be achieved (IEA 2012: 3). In Latin America, energy-related CO₂ emissions are projected to increase by more than 40% between 2012 and 2040 (own calculation, based on IEA 2014: 680). Against this background, replacing fossil energy by renewable energy sources is of utmost importance – in Latin America and beyond. Nuclear energy, by contrast, is by no way an environmentally sound alternative for fossil energy. Next to the risks of nuclear disasters, as for example experienced in Fukushima 2011, there is the unsolved problem of how to deal with nuclear waste. No country around the world has found permanent disposal facilities to isolate the long-lived and highly radioactive waste produced by nuclear reactors (IEA 2014: 28).

The third set of global challenges is the increasing oil price volatility and further uncertainties that decision-makers in the energy sector around the world are confronted with (Westphal/Roehrkasten 2013: 35f.). In the last decade, the world has not only experienced the highest average oil prices, but also the highest oil price volatility. This price volatility makes sound investment decisions difficult. It is important to note that investment decisions in the energy sector cover long time periods. As a consequence, the return on investment depends on developments that in part lie far ahead in the future. Future uncertainties do not only relate to future price developments – of oil and other energy sources – but also concern climate change regulations and risk perceptions. With regard to changing risk perceptions, the case of nuclear energy after Fukushima is quite interesting, as it sealed the fate of nuclear energy in Germany. In Germany, there are few topics which receive as widespread public support as the phasing out of nuclear energy. Just a few months before Fukushima, the German government had decided a “phase out of the phase out”, which had already been decided in 2000. As such, it had made a decision in favor of nuclear energy against the widespread public opposition. After Fukushima, it became obvious to the government that if they would not reverse this decision, they would run into serious political trouble. But Fukushima did not only impact on nuclear energy in Germany. For governments and utilities that want to build nuclear power plants, ensuring their plants has become an increasingly difficult undertaking – as a consequence, the costs of building new nuclear power plants went up significantly. This also impacts on Latin America, as Argentina, Brazil and Mexico have nuclear power plants running, and further countries – such as Bolivia, Chile and Peru – consider the introduction of nuclear power.²

STATE OF ART OF MULTILATERAL COOPERATION ON ENERGY

In comparison to areas such as climate protection, security or trade, global governance on energy is still weakly developed. Besides, multilateral cooperation on energy is highly fragmented (Roehrkasten/Westphal 2013). It is interesting to note that the United Nations – which is the primary forum for multilateral cooperation on a whole range of issues – has not been a strong actor with regard to energy policy. So far, there is no intergovernmental energy organization covering the whole range of energy sources and being open to universal membership.

During the last century, international cooperation at first focused on nuclear energy and oil. Nuclear energy was the first area of transboundary energy cooperation. In 1957, the International Atomic Energy Agency (IAEA) was created – inspired by both concerns over the spread of nuclear weapons and enthusiasm for the opportunities offered by this new energy source. Fossil fuels, especially oil, became the second area of transboundary energy cooperation. Here, transboundary cooperation reflected the conflicts between oil-importing and oil-exporting countries. In 1960, the oil-exporting countries Iran, Iraq, Kuwait, Saudi Arabia and Venezuela founded the Organization of Petroleum Exporting Countries (OPEC). They worried about their dependence on foreign oil companies and wanted to improve control of domestic oil reserves. In the 1970s, OPEC members started to nationalize domestic oil industries and thus increased OPEC's control over worldwide oil production and pricing policies. The OPEC embargo against the US and Netherlands due to their involvement in the Israeli-Arab-War led to the first oil price shock in 1973. As a reaction to this oil price shock, the oil-importing OECD countries founded the International Energy Agency (IEA) in 1974. The IEA established an emergency mechanism for oil shortages and later on became a central actor for analysis and advice on international energy markets. The multilateral development banks such as the World Bank or the Inter-American Development Bank also established themselves as central actors in global cooperation on energy, as they have been central for financing energy infrastructure projects in the developing world (Roehrkasten 2015: 74-79).

In the 1990s, multilateral cooperation on energy experienced a major change, as the UN agreed on joint action to combat climate change (Roehrkasten 2015: 103). In 1992, they adopted the United Nations Framework Convention on Climate Change (UNFCCC), which has been signed by 164 countries. As the energy sector is a central field for action, this step had major implications for energy policies around the globe. Global efforts to mitigate climate change are still a key driver for global energy cooperation, and they mobilize a lot of international finance, offering vast investment opportunities for the energy sector. According to information by the UNFCCC Standing Committee on Finance (2014: 65), the energy sector has been the major target for global climate finance between 2010 and 2012. This is even more the case for Latin America. As the impacts of climate change are becoming more and more tangible, in future public pressure on governments to act will increase. As a consequence, it is very likely that in future, climate change concerns will exercise stronger influence on global energy markets. Forward-looking policymaking and economic decision-making needs to anticipate these developments. As such, smart investments in the energy sector are needed, which on the one side exploit the potential that climate finance offers and on the other hand avoid stranded investments in CO₂-intensive energy sources.

In the course of the last years, new actors appeared on the stage of global energy governance. In 2010, the International Renewable Energy Agency (IRENA) was founded to promote renewables around the world. Different to the IEA, the IRENA is open to all UN member states. It nowadays counts with more than 140 member states.³ Interestingly, the UN became active on energy issues as well. In 2011, the UN Secretary-General set up the Sustainable Energy For All (SE4All) Initiative which comprise three goals up to 2030: first, to double the share of renewables in global energy supply; second, to double the improvement rate for energy efficiency; and third, to ensure access to modern forms of energy to all.³ The Sustainable Development Goals (SDGs) which will be adopted by the UN General Assembly in September 2015 will also comprise a goal on energy: to ensure access to affordable, reliable, sustainable and modern energy for all (Open Working Group Proposal for Sustainable Development Goals 2014).

In global energy governance, the old "north-south" paradigm still plays an important role, although it does not fit to new realities. The old paradigm builds on "north-south" flows of finance and technical cooperation, which also implies "north-south" flows of ideas and knowledge. Thus, within the old paradigm, the "north" sets the agenda and takes the lead, deciding on the direction of international cooperation (Roehrkasten 2015: 237-240). However, we nowadays have new realities. Decisions in emerging and developing countries will become the key drivers for developments on global energy markets (IEA 2014: 53ff.). There are significant investment flows and technological developments coming from emerging countries. In 2014, China was the country around the world that invested most in renewable power and fuels. In total, developing countries accounted for a share of 49% in global renewable energy investments (REN 21 2015: 20, Frankfurt School-UNEP Centre/BNEF 2015: 20). There are also important initiatives for global cooperation coming from the "south". The SDGs, for example have been proposed by Colombia and Guatemala. Besides, the "north" and the "south" are too simple categories for heterogeneous country groups. The "south" for example comprises countries like China, Afghanistan and Tuvalu – which do not have much in common.

³ IRENA, IRENA membership, <http://www.irena.org/Menu/Index.aspx?mnu=Cat&PriMenuID=46&CatID=67> (accessed July 19, 2015).
⁴ SE4All, about us, <http://www.se4all.org/about-us/> (accessed July 19, 2015).

IMPLICATIONS FOR LATIN AMERICA AND ITS ENERGY INTEGRATION

The state of art of global energy governance and the global challenges it addresses have several implications for Latin America and its regional integration.

First of all, Latin American energy decision-makers – be it national and subnational governments, private sector representatives or staff of regional organizations – should set the course for a sustainable energy future as soon as possible. Whereas in the short run, trade-offs between economic development and environmental protection might exist, these disappear in the long run, as environmental pollution brings along significant economic costs that might not be visible today, but will become visible in the future. Decision-makers in Latin America should exploit the potential of green investments, which is already significant but will become even more important in future. They should invest in energy technologies that offer economic advantages in the long run and avoid stranded investments in CO₂-intensive energy sources, as climate regulations will become more restrictive and public opposition against CO₂-intensive energy will increase. Phasing out fossil fuel subsidies is another step that is crucial for a sustainable energy future in Latin America and beyond. In 2013, Venezuela, Argentina, Mexico and Ecuador were among the 25 countries with the worldwide highest fossil fuel subsidies (IEA 2014: 321).

Secondly, policy-makers in the different Latin American countries and in the regional organizations should leverage the expertise of Latin American frontrunners both at the regional and the global scale and transmit their knowledge to other countries. Interesting leverage points are for example the ethanol technologies and flex fuel cars in Brazil, the Brazilian auctions for renewable energy, and the goal of a 100 percent renewable electricity supply by 2021 set by the government of Costa Rica.

Thirdly, policy-makers in Latin America should take an active stance in global cooperation on energy, and on sustainable development in general. There have been very important initiatives coming from Latin America in the past. As mentioned above, the SDGs go back to an initiative of Colombia and Guatemala. In the realm of climate policy, many Latin American initiatives have been decisive. It was for example a Brazilian proposal that led to the establishment of the Clean Development Mechanisms (CDM), which is a major instrument for technology transfer to developing countries under the UNFCCC. In addition, as a host of the Rio Earth Summit 1992 and of the Rio+20 Summit in 2012, Brazil has been a key actor in global cooperation on sustainable development. In order to take an active stance in global cooperation on renewable energy, those Latin American countries which have so far not joined IRENA – particularly Brazil as a renewable energy power – should rethink their position. IRENA is already a very important actor in global energy governance and its importance will increase in future. Those countries that refrain from joining, squander the opportunity to influence what course towards the global energy future is taken.

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BRAZIL AND THE ENERGY INTEGRATION PROCESS IN SOUTH AMERICA

Nivalde de Castro⁵

Paola Dorado⁶

INTRODUCTION

Energy integration is an issue that is winning attention and concern worldwide due to, on one hand, the increasing need of electricity consequence of the growing economic and social demand and, on the other hand, as a direct result of the advantages for the countries involved. Among other advantages, it could be highlighted: the most efficient use of energy resources; the reduction of wholesale prices; the promotion of efficiency through the increase of competition; and the reduction of greenhouse gases emissions.

An example of this process is observed in the European Union where countries have been integrating their energy policies aiming to create a regional electric market in order to achieve tangible and intangible gains for the countries involved. However, in South America the creation of a regional electric market in the same basis as Europe is still a distant possibility because of the economic and social disparities between countries, but especially because of the different energy trading rules, a factor that largely hinders the process of regional energy integration.

Brazil, the largest electric market in South America, developed energy integration projects with Argentina, Uruguay and Venezuela besides the bi-national hydroelectric of Itaipu constructed with Paraguay. In addition to these projects that are already in operation, there are studies for the construction of two bi-national hydroelectric power plants, Garabi and Panambi on the Uruguay River at the border between Brazil and Argentina, and the construction of a bi-national hydroelectric plant with Bolivia on the Madera River.

In this context, this article seeks to point out some of the reasons why Brazil is a key player in the energy integration process of the region, although it is not yet possible to think of a common electric market, at least in the medium term.

Therefore, this paper is divided into three sections following this introduction. The first part presents the reasons why it is not possible to structure a common electric market in South America, at least in the medium-term, highlighting the limitations imposed by the Brazilian model. The second part presents the integration experiences of Brazil with its neighbors and the important role it plays in this process in South America. Finally, the conclusion points out that although the Brazilian model is an obstacle for the conformation of a common electric market, Brazil plays a strategic and key role in the progress of the regional energy integration process.

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ENERGY INTEGRATION IN SOUTH AMERICA

There are technical and economic reasons to recommend the international integration of power grids. For example, integrating generation matrixes with diverse profiles allows optimizing the use of available resources. Even simple activities, such as sharing resources, could allow the increase of economies of scale and enable projects that otherwise could not be made.

Worldwide, the energy integration paradigm seeks to create regional electric markets. According to Castro, Brandão and Dantas (2011), an integrated power operation between several countries tends to lead to a more efficient allocation of resources than would be possible if national markets remained isolated. However, technical benefits from energy integration are maximized only when it is possible to establish equal and solid commercial rules. In this sense, to achieve integrated electric markets European countries have been unifying their energy policies since the early 1990s⁷, making the domestic energy markets, including the electric market, to have the same regulatory framework.

Energy integration in South America faces resistance associated to economic, institutional and regulatory issues as well as some political restrictions such as the fear of losing national autonomy and some historical differences between the countries (Castro, Leite and Rosental, 2012). Due to these differences and limitations it cannot be expected a substantial convergence of commercial rules in South America at least in the medium term. Because of this, it is difficult to think in an integrated regional electric market.

In addition to those factors, must be also consider the great distances between regions where are placed the generation plants or have hydropower potential and the consumer centers. Thus, the challenge to connect the countries' power grids demands not only the convergence of commercial rules but also large investments in infrastructure; a very different situation than what is verified in Europe.

Specifically with regard to Brazil's position in the regional energy integration process, Castro et al (2012) points out that the Brazilian commercial model is a great obstacle to the establishment of integrated markets. The Brazilian model, contrary to other countries in the region, does not trade physical energy because generation depends on the optimized dispatch defined by the National Grid Operator (Operador Nacional do Sistema - ONS). All industry players are required to contract energy through a strictly financial mechanism called "physical guarantee", which differs from the plants' generating power potential.

The physical guarantee is a certificate issued by the Ministry of Mines and Energy (MME), which represents a fraction of the energy that a generating plant can produce. The computation of the physical guarantee results from a model based on the optimal functioning of the integrated system. Therefore, each project may result in energy contracts up to the limit of their physical guarantee (Tolmasquim, 2011). In this sense, it is a system designed in closed format, planned and operated in an optimized and centralized way differing from the European market model, which prevails in almost all South American countries.

Although there are some difficulties and limitations to implement a truly integrated energy market in South America, it does not mean that the prospects for regional power trade are impossible. In fact, the Brazilian commercial model includes both imports and exports of electricity. Currently, Brazil has interconnections with Argentina, Uruguay and Venezuela, as well as a bi-national hydropower plant with Paraguay - Itaipu Binacional. These projects are based in hydropower generation. Aside from Itaipu binacional, trade interactions with other countries are made on specific basis, without long-term contracts, largely due to differences in commercial arrangements.

Projects based on bi-national hydropower projects offer the best terms for commercial arrangements and security of supply. Itaipu Binacional is the best example of a successful integration project involving the construction of a bi-national power plant. Because of this successful experience, recent advances in energy integration between Brazil and other countries are based on this type of projects. In this regard, in 2012, were hired the engineering and environmental studies and also the communications plan for Garabi and Panambi power plants, projects carried out between Argentina and Brazil (Eletrobras, 2010). In addition, in July 2015

2015 was signed an amendment to the 2007 Memorandum of Understanding between Bolivia and Brazil in the field of electricity. This document aims to build a bi-national hydropower plant on the Madera River.

INTEGRATION EXPERIENCES AND BRAZIL'S ROLE

The energy integration experiences between Brazil and its neighbors were designed operationally and commercially to properly function according to the Brazilian operation system.

Itaipu Binacional, with 14,000 MW of capacity installed, sells around 90% of its annual production to Brazil. In 2014, for instance, Itaipu Binacional provided 88,467 GWh to the Brazilian market, which represents 19.1% of the country's total energy consumption, while the Paraguayan market consumed 8,751 GWh, which represents 75% of its national demand for energy (Itaipu Binacional, 2013). Although Itaipu Binacional was conceived long before⁸ the new Brazilian electric market model was adopted in 2004, the energy commercialized by this plant had to be adapted to the new model's logic while observing what had been established in the Itaipu International Treaty.

As for Brazil's energy exports and imports, these transactions have been done on specific basis, taking advantage of the imbalance between supply and demand and not representing major international energy exchange operations. In fact, as pointed out by Castro et al (2012), energy trade with Argentina and Uruguay has only taken place occasionally and most of the time the existing interconnections remain idle.

Although there have been limited electricity integration experiences in Latin America, Brazil has a strategic role in the development of the region's integration process due to some factors that will be discussed below.

The first factor refers to the Brazilian power system itself, which constitutes a clear and objective example of electric integration demonstrating technical knowledge of this process. Brazil has a continental dimension with an integrated power system with over 4,200 power plants (ANEEL, 2015), 139,800 MW of capacity installed and over 100,000 kilometers of high voltage transmission lines (MME, 2015) operating in a centralized way.

Second, the Brazilian energy matrix has one of the highest shares of renewable sources in the world, especially hydropower. In 2014 this source represented 73.1% of the total installed capacity in the National Integrated System (SIN) (MME, 2015). This fact gives the country a high technical expertise for the construction, installation and operation of large hydropower plants. Also must be consider the knowledge acquired concerning bi-national power plants consequence of the construction of Itaipu Binacional. This experience is imperative for the integration process progress, especially when considering that some of the remaining potential lies in the region's border rivers.

In addition, Brazil's total power consumption is the largest in the region. In 2013 Brazil consumed 463,335 GWh, representing approximately 50% of South America's total consumption (EPE, 2014). Therefore, the Brazilian market enables not only binational generation projects, but also allows the construction of power plants which aimed to supply the Brazilian market, once the regulatory and commercial problems are outweighed by a common regulatory framework.

On the other hand, the new electric sector model, implemented in 2004, guarantees and encourages competitive conditions in power generation. The dynamic of new energy auctions ensures the undertaking of long-term contracts with highly predictable revenues that are indexed to the inflation rate. These contracts, which emerge from a competitive process, constitute the financial guarantee for the project finance credit with which the project will be constructed. (Tolmasquim, 2011). This commercial design has attracted the interest of entrepreneurs, enabling the expansion of the generation and transmission installed capacity.

⁸ The construction of the Itaipu power plant was agreed between Paraguay and Brazil in 1973, and the International Treaty establishes the special rules for energy trading between the power plant and their partner countries.

Finally, Brazil has borders with almost every country in South America excepting Ecuador and Chile. In addition, it has energy integration projects with Argentina, Bolivia, Paraguay, Uruguay and Venezuela. Thus, Brazil holds a strategic position for encouraging the integration process, in particular due to the annual need of more than 5,000 MW of new generating plants.

CONCLUSION

The analysis made in this article demonstrates that due to economic, political and regulatory disparities between Latin American countries, the power integration process in the same basis as Europe will be slower, particularly with regard to the creation of a common electric market.

A hindrance to this process is the Brazilian commercial model implemented since 2004. It relies on the trade of electricity certificates (physical guarantee), defining a closed model, designed and operated in an optimal and centralized way.

However, despite these limitations, an immediate and positive outlook for the regional electric integration is found in the bi-national hydropower projects, they represent a direct integration model as can be confirmed with the results obtained by Itaipu Binacional between Brazil and Paraguay.

It was also pointed out the strategic role of Brazil in the integration process due to five factors: (i) the Brazilian system size which is an example of integration itself; (ii) the renewable energy matrix that allows Brazil to have a broad technical knowledge in the use of these resources, particularly hydropower; (iii) Brazil is the largest energy consumer in the region accounting for approximately 50% of total demand, (iv) the commercial model that operates throughout auctions ensures long-term contracts with predictable revenues; and (v) stable and non-belligerent trade and diplomatic relations between Brazil and other countries in the region, particularly in the energy field.

These factors place Brazil as the central actor to boost the electric integration in Latin America, but within a different paradigm than observed in European countries, especially throughout bi-national power plants that allow exploring shared water resources. This last point is evident with the existing advances in this respect with Argentina and Bolivia.

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ADVANCING THE REGIONAL ENERGY MATRIX: THE PERUVIAN CASE

Fiorella Molinelli Aristondo

GLOBAL AND REGIONAL CONTEXT: POTENCIAL DE FONTES DE ENERGIA

According to information by the World Energy Council, the Middle East and Northern Africa are the regions with the most recoverable oil and natural gas reserves in the World in 2015. These regions account for 52.4% of oil reserves, or 44.4 billion TOE (Tonnes of Oil Equivalent) and 42.1% of natural gas reserves, or 6.57 million TOE.

The Council also highlights Latin America as the second region with the largest oil reserves by having 19.9% of total recoverable reserves, while Europe is the region with the second largest reserves of natural gas with 25.3% of total recoverable reserves.

Regarding to the world's coal reserves, which can be classified as bituminous 49.7%, sub bituminous, 50.1% and lignite, 0.2%, these are mainly concentrated in Europe with 30.8%, followed by North America with 27.5% and East Asia with 13.2%. Latin America and the Caribbean account for only 1.6% of total reserves, contributing to the regional energy matrix being cleaner.

With regards to the installed hydroelectric power capacity worldwide, it amounts to 139 GW of power and is located mainly in East Asia with 29.9% and Europe with 24.3%. North America and Latin America and the Caribbean account for 17.5% and 14.8% of total installed capacity, respectively.

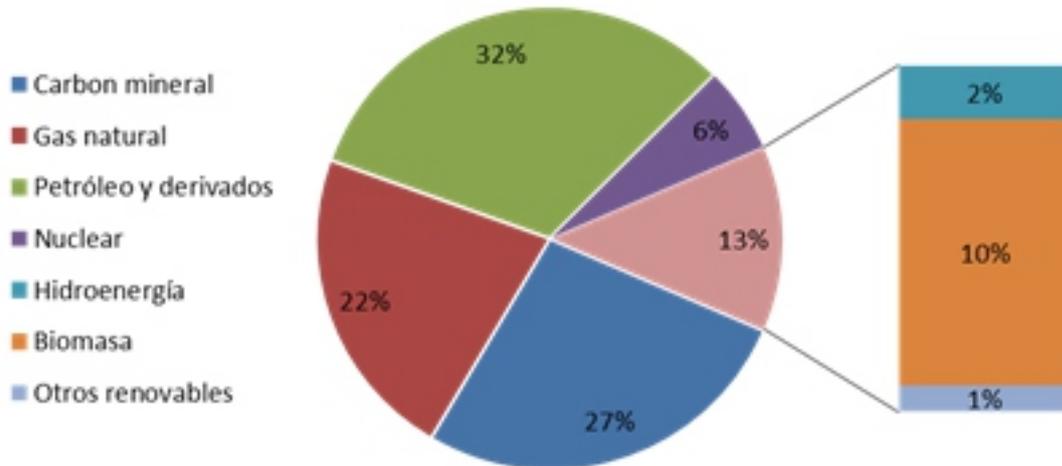
Finally, with respect to nuclear energy worldwide, the current capacity is 0.08 TEP, being located mainly in Europe with 43.3% and North America with 30.1%. Regarding Latin America and the Caribbean, they account for only 0.8%.

If we carry out a similar analysis for Latin America and the Caribbean, Venezuela is the country with the largest oil reserves (40.5 billions tonnes), followed by Brazil (2.05 billions tonnes) and Ecuador (900 millions tonnes). Regarding natural gas reserves, Venezuela is also the country with the largest reserves (4.75 thousand Mtoe), followed by Brazil (395 Mtoe), Trinidad and Tobago (328 Mtoe) and Peru (303 Mtoe). On the other hand, based on installed capacity for hydroelectric power, Brazil is the country with the largest installed capacity (82.5 GW), followed by Venezuela (14.6 GW), Argentina (10 GW), Colombia (9.19 GW) and Paraguay (8.13 GW). Finally, Brazil and Argentina are the only countries in the region with nuclear power installed capacity of 0.06 Ktoe and 0.03 ktoe.

GLOBAL SUPPLY

A feature of the global energy matrix, whose supply of energy equivalent for 2013 was 91,564 million barrels of oil equivalent (Mboe), is its concentration on three sources of generation: i) oil and oil products (32%), ii) coal (27%) and iii) natural gas (22%), while the share of renewable energy is minimal (13%, divided by 2% hydropower, 10% biomass and 1% other renewables) as reported by OLADE.

Graph #1: Global Energy Mix in 2013*



* * Total supply 91,564 Mbp

Source: OLADE. Elab: prepared by author

(Graph Legend: Coal, Natural Gas, Oil and Oil Products, Nuclear energy, hydropower, biomass, other renewables)

Unlike the global energy matrix, the matrix of Latin America and the Caribbean, whose supply of equivalent energy totaled 5,909 Mboe in 2013, has increased the participation of renewable energy (25%, divided into 9% hydropower, 14% biomass and 2% other renewables) while oil and oil products accounted for (41%) and natural gas (28%).

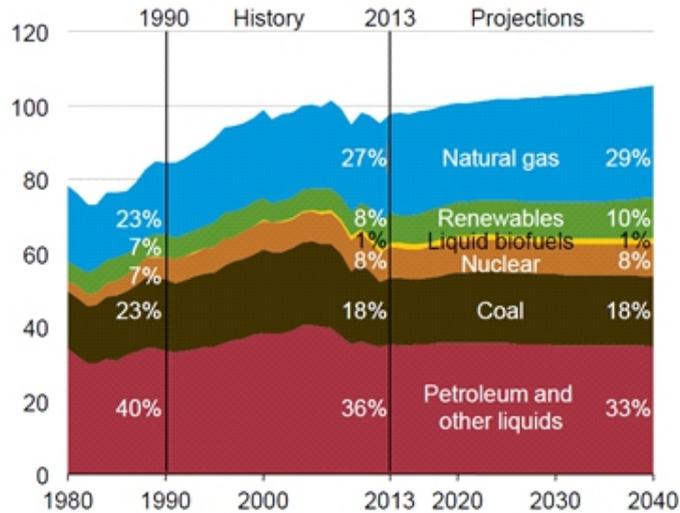
On the other hand, with respect to the leading producers of energy by energy sources, in Latin America and the Caribbean, Venezuela is the main oil producer with 155 Mtoe per year, followed by Brazil and Colombia with 105 and 45.6 Mtoe per year respectively. Regarding the production of energy from natural gas, Argentina is the main producer with 39.1 Mtoe per year, followed by Trinidad and Tobago and Venezuela with 36.5 and 26.8 Mtoe per year. Colombia stands out as the main producer of energy from coal with 60.1 Mtoe per year. Finally, Brazil stands out as producer of hydroelectric, nuclear and wind power with 36.9 Mtoe per year, 444 ktoe per year and 233 ktoe per year, respectively, according to data from the World Energy Council.

GLOBAL DEMAND

World energy consumption grew by 54% in recent years, from 8,258 MMTOE in 1993 to 12,731 in 2014. During this period the standard or structure of consumption was mainly characterized by a reduction in oil consumption (from 38% to 33% of total consumption) and an increase in the use of renewable energies (from 0.4% to 2%) according to the BP Statistical Review of World Energy.

Also according to the International Energy Agency (IEA), the worldwide consumption of primary energy would rise from 97.1 quadrillion BTU in 2013 to 105.7 quadrillion BTU in 2040, an accumulated growth of 9% during that period. The Agency also notes that there will be a consumption-oriented transition of power towards natural gas (from 27% to 29% of total consumption) at the expense of a lower demand for oil and oil products (36% to 33% of the total consumption).

Graph # 2: Primary Energy Consumption by Type of Fuel (quadrillion BTU)



Graph from the Annual Energy Outlook 2015 with projections to 2040

PROSPECTS FOR THE REGIONAL ENERGY MATRIX: LATIN AMERICA AND THE CARIBBEAN

According to OLADE, the supply of energy in Latin America and the Caribbean in 2030 will be 11,026 Mboe while energy demand will be 7,618 Mboe, with an oversupply of 30%.

On energy demand, the main sources of energy will be oil (43%), electricity (25%) and natural gas (16%). On the other hand, the industrial sector will be the largest consumer with 40% of total demand, while other important sectors such as transportation or residential will require 24% and 12% of the total, respectively.

Finally, OLADE estimates that the electricity generation matrix will be 3,306 TWh by 2030 and will be concentrated mainly in hydropower (50%) and natural gas (29%). Oil and oil products have a smaller share (6%) as well as coal and coke (6%).

PERU: CURRENT SITUATION AND PROSPECTS

In the last fifteen years the proven hydrocarbon reserves increased significantly due to exploration activities. With this, the proved natural gas reserves increased by 71%, from 9 TCF in 1998 to 15 TCF in 2013. These reserves are located mainly in Cuzco.

On the other hand, proved liquid hydrocarbon reserves increased by 71%, going from 937 million barrels in 1998 to 1,617 million barrels in 2013. Of these, 875 correspond to natural gas liquids and the difference corresponds to oil.

It is noteworthy that during this period, energy consumption evolved into cleaner and more economical sources such as natural gas (36.1%) i.e. 307.9 million barrels of oil equivalent a day consumed in 2014, mainly due to the start-up of commercial operations of the Camisea Project.

ENERGY MATRIX

Since 2004, the energy matrix of Peru has entered a new stage of transition from a matrix concentrated basically on hydroelectric generation sources to a matrix concentrated on natural gas and hydropower. This is related to i) the commencement of the exploitation of the Camisea natural gas Block 88 by Pluspetrol in the region of Cuzco and ii) the promotion of private investment in natural gas thermal power plants, which has allowed greater diversification of energy sources.

In short, while in 2001, 91% of electricity production was done with water resources, by 2014, only 54% of electricity production was with water and 43% was with natural gas.

RISCOS ASOCIADOS A CADA TECNOLOGIA HIDRELÉTRICAS:

Today, Peru is a country with a high hydropower potential (69.445 MW) and water resources are relevant to the energy matrix. However, there are certain risks associated with this type of power generation, such as i) natural risks, based on the seasonal fluctuation of river flow that affects the constant generation of energy or ii) the bureaucratic risk, regarding to cumbersome procedures and government procedures, such as, for example, the number of permits needed for the development of a new hydroelectric project, which is of 129. There are also low incentives for the construction of hydropower plants, such as the benefit of accelerated depreciation, which is temporary.

NATURAL GAS THERMAL POWER PLANTS:

In the last ten years the use of natural gas as a source of electricity generation has been growing significantly. However, there are certain factors that may pose future risks such as i) the lack of a "single" price of natural gas established in the contracts, which can have a negative impact on long-term investments by not encouraging exploration of new fields of production if they do not have enough fluids, ii) the existence of "inadequate" prices could boost demand for natural gas from other countries through the export of natural gas and its products, which could hinder the development of new power generation infrastructure or iii) the reliability problem of infrastructure to transport natural gas from the Camisea natural gas production plant to major power plants. For instance, the pipeline that transports the natural gas from Camisea depends on a production capacity of 3,616 MW, of which only 905 MW could be replaced with D2, therefore, a failure of the pipeline, would mean that 2,711 MW would be unavailable.

DIESEL OR RESIDUAL THERMAL POWER:

The main risk faced by the development of power generation projects based on diesel or residual is the fluctuation of international oil prices given Peru's characteristic of being a net importer of crude oil. For example, during 2014 Peru consumed approximately 155,000 barrels per day and produced less than 70,000, the difference corresponding to imports.

RENEWABLE ENERGY RESOURCES (RER):

The current discussion in various international panels on the negative effects in the medium and long term of climate change has brought significance to the issue of promoting the use new sources of electricity generation that are environmentally friendly or based on sources such as the RER wind power, solar, biomass or other. However, one of the main risks faced by the electricity generation from renewable sources is not considering the issue of positive externalities, which justifies the higher cost of these technologies over the use of conventional technologies. It is important to note that these prices that reflect a "social" price, incorporate the positive externalities such as being a clean alternative that does not pollute the environment. Other sources such as fossil lack these externalities.

A special feature of the use of these technologies is their reasonable average cost for isolated areas compared to other sources because of the lower cost of transport or "transmission". Therefore, the non-participation of the state through "subsidies" schemes or "incentives" is also a risk in the implementation and development of RER projects in the long run.

CROSS RISKS

Promoting new projects of hydro, thermal or RER generation face risks that are particular to each type of generation technology. However, we can identify three types of risk that are common or cross these types of technologies such as i) the business environment, which refers to the fiscal conditions, general taxation, trade barriers, quality of infrastructure, availability of skilled human capital, among others, ii) the regulatory environment, which is related to the cost of regulatory compliance, predictability in enforcement, environmental regulation, protected areas, regulations and labor contracts, regulatory duplication or inconsistency, the legal system and territorial disputes and iii) the geopolitical risk which includes topics such as political stability, physical security aspects of operations or lack of proper strategic planning and clear State policies on diversification and energy efficiency.

THE NUMES PLAN BY 2040

In April 2012, the Ministry of Energy and Mines (MINEM) of Peru, with the support from the Inter-American Development Bank (IDB), published the New Sustainable Energy Matrix Plan (NUMES Plan) with the objective of achieving other favorable changes to the country in 2040 such as i) a new sustainable, diversified and competitive energy mix, with emphasis on the use of RER, ii) universal access to energy supply, iii) efficiency in energy supply and demand, iv) self-sufficiency in energy production, v) achieve minimal environmental impact, vi) the development of the gas industry and vii) the integration with energy markets in the region.

However, to achieve the above mentioned objectives, the Plan should be part of a state policy, which must be complemented by the role of private sector investment. Policy should seek that energy prices will encourage development and promote competitiveness with the highest standards of energy efficiency; facilitate access to energy for low-income social sectors achieving decentralization and regional development and limit the social and environmental conflicts and/or minimize environmental impacts.

CHALLENGES AND OBJECTIVES FOR ENSURING ENERGY SECURITY

The objectives outlined in the NUMES Plan pose challenges to overcome by 2040, such as the integration of markets and international interconnections, for which Peru should be a net exporter of electricity by then, given its enormous hydraulic and thermal potential based on natural gas.

Also, as the economies of the region develop, finding new environmentally friendly sources of power generation is key to ensuring sustained development of the economies in the long run. To overcome this challenge, greater integration between the countries will require taking into account the particular diversification in each country's energy matrix, so it is very important to carry out a plan for regional integration.

CONCLUSIONS

Security in the generation and supply of energy is a fundamental aspect for economic and social development of countries, so it should be considered as a strategic factor in a country's economy. Therefore, it is important that countries have specific policies and legal frameworks to promote electricity generation projects that include incentives and mechanisms to promote sustainable energy development without affecting social inclusion policies and without transferring additional costs to the population. In addition, these policies should promote technology transfer and use of human resources and local inputs in each country.

On the other hand, the energy integration of the countries will create favorable conditions for the development of major renewable energy infrastructure projects, allowing for the diversification of the energy matrix of each country, improving energy security and lowering prices in a scale economy. However, a regulatory framework for the integration of the countries must acknowledge that this is a slow process and the full integration of markets should not be forced, given that there are significant gaps between the regulatory frameworks and prices between countries.

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