

# ENERGY INTEGRATION BASED ON RENEWABLE SOURCES AS A MEANS OF DEVELOPMENT

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## Introduction

This work relates to the field of Energy and Development studies and suggests the creation of a South American energy policy based on the extensive use of renewable resources and the pursuit of a broad energy integration as a way to break the energy insecurity that frequently characterizes the South American energy sector and to relieve, to some extent, the pressure on the environment, characterized, for example, by the construction of giant dams, deforestation for biofuels and polluted gas emissions coming from coal mining, gas and oil along with local economies destruction. Although South America does not suffer from a lack of resources, it is undeniable that in the region there is an energy security problem<sup>1</sup>. Blackouts, electrical constraints, faults in the transmission network, bottlenecks in distribution, pressure on the environment are part of the history of the unsteady South American development. Through the establishment of a normative speech sustained by a human security concept which proposes South American energy integration based on renewable energy, one seeks to overcome this type of problem.

The argument is based on the notion that the reaching of a safe level of power supply is not only essential to the national economy of the States, but also for the human development and security. The advantages of an integrated regional energy system and the broad use of renewable energy bring energy security to South America so that human security is not only respected, but improved.

When the use of natural resources is analyzed throughout history, especially since the Industrial Revolution, it becomes clear how society has become dependent on exosomatic energy and how the capitalist way of production accelerated and distorted

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<sup>1</sup> Besides the Brazilian blackout in 2001, Colombia faced the same problem in 1992, Peru at the same year – due to a short rain season –, Ecuador in 1995 – due to a low hydraulicity and a “*sucateamento de equipamentos termelétricos*” –, and Argentina, in many periods of its history, as well as recently, has faced energy shortages. On April 23th, 2013, a state of emergency was decreed by the Venezuelan government. Before that, On February, 2010, the same was done.

the relationship between man and nature and the pace which humans fulfill the desperate need for energy<sup>2</sup>.

There is an overwhelming incompatibility between the current growth and development model and nature's ability to replenish its resources<sup>3</sup>. Although this model, since the Industrial Revolution, has been producing some progress for some people, and that it could still produce wealth (regardless of *who* is the addressee of this wealth) for another fifty years as it is speculated; it is known that in the long term it will become impossible to bear the economic and social costs of this development model, which is based on huge levels of energy consumption, threatening the human existence on Earth.

Therefore, development must be understood not only as the expansion of material conditions, but it should also take into account other aspects, such as environmental protection, social cohesion, preserving cultural diversity, gender equality and expansion of human capabilities<sup>4</sup>.

If development must be understood this way, then, energy plays a key role, both for national and human development. For development to occur, access to energy must be guaranteed. This relationship brings with it the energy security problem in itself. Energy security, in this sense, is an indispensable and fixed prerequisite for the development. There is no development without energy.

In order to work on these issues, the paper is structured as follows: in a first topic, brief remarks about the notion of human security and its relationship with the idea of energy security are presented. The second topic discusses the reasons why it is believed that an integration policy based on renewable energy in South America should be taken into effect. The third topic examines concrete actions in the context not only of MERCOSUR, but also along with two international organizations and an international forum which think of solutions for energy integration in South America: CIER, OLADE and IIRSA, as well as it brings a survey of what already exists in terms of energy exchange. Finally, the work draws its conclusions.

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<sup>2</sup> COTTRELL, Fred. *Energy and society – the relation between energy, social change and economic development*. Nova Iorque: McGraw-Hill, 1955; DEBEIR, Jean-Claude; DELEAGE, Jean-Paul; HEMERY, Daniel. *In the Servitude of Power: Energy and Civilization Through the Ages*. Zed Books, 1992; GEORGESCU-ROEGEN, Nicholas. *The entropy law and the economic process*. Cambridge: Harvard University Press, 1971.

<sup>3</sup> ALTVATER, Elmar. *O fim do capitalismo como o conhecemos: uma crítica radical do capitalismo*. Rio de Janeiro: Civilização Brasileira, 2010; MEADOWS, Donella et. al. *The limits to growth*. Signet, 1972; SHIVA, Vandana. *Making peace with the Earth. Beyond resource, land & food wars*. South Africa: Jacana, 2013.

<sup>4</sup> SEN, Amartya. *Desenvolvimento como liberdade*. São Paulo: Companhia das Letras, 2000.

It is worth to note that the article does not intend to exhaust the topic or present a final solution to the South American energy problem, as it is truly complex and dynamic. By studying the energy issue, one is faced with a theme, which besides being politicized, it touches many fields of knowledge, so the purpose of the work is no other than to merely bring the arguments to the academic arena in order for them to be analyzed, criticized and revised.

### **1. Energy Security: a critical approach**

Before starting the discussion, the significance of electricity to any human undertaking should be emphasized. Electricity is an essential commodity, to either promote the well-being of people, or for industrial production of various tools and equipment. Almost everything around us is power-operated. This way, power is fundamental to the human development, in the broadest sense one may wish to give to the expression. Power translates into means to reach various ends, including economic development and the realization of social rights, which includes GDP growth, increased industrial capacity, universalization of electricity, increase the household and durable goods purchase and consumption, higher quality of life<sup>5</sup>, fulfillment of basic social needs.

Thus, having electricity is vital for the country's development path. Therefore, it is imperative that countries have a continuous concern with the energy resources' mode of operation and the planning of such activity. It is understood that planning energy policies, which include the energy integration, should have as a guide the premises of a sustainable and balanced exploitation of the environment. It is about thinking the integration not only in terms of conciliating supply and energy demand, but also the realization of social and environmental rights as well as development fostering.

Within the framework of the essentiality of electric energy, the State's presence stands out in the regulation of the energy sector, whether as a planning body, a regulating entity or a service supplier in the economic activity. What is evident is the fact that a self-regulated market arrangement for the energy sector leads to social inequalities and ecological unbalance. Under an economic prism, many studies have concluded that it is impossible to establish a pure market arrangement for the energy

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<sup>5</sup> GUIMARÃES, Lucas Noura de Moraes Rêgo. *A efetividade do Programa Nacional de Universalização do Acesso e Uso da Energia Elétrica – Luz para Todos*. In: *Revista Brasileira de Políticas Públicas*, Brasília, v. 1, p. 2-16, 2011.

sector<sup>6</sup>. Through the lenses of ecology and physics, our resources and their extraction processes abide by their own logic, laid out in the First and Second Laws of Thermodynamics. Until the 1970s, this logic that regulates our energy resources was ignored. It was believed that the productive process could be expressed solely in terms of capital and labour, leaving out the fact that the labour of men and machines can only be carried out because energy was placed in the process. Another aspect about the relation among energy, State and society is related to the sheer impossibility of substituting in limitedness fashion natural resources for capital<sup>7-8</sup>.

Besides catering to basic human needs, such as the preparation of food, treating water and sewage, providing light, transportation, entertainment and thermal comfort, electric energy promotes changes in the production standards of a society, as well as in lifestyle and culture. Based on this, the United Nations Development Program (UNDP) considers “commercial energy use” as one of the elements when measuring a country’s human development level. Thus, development is intrinsically connected with income, technological evolution and access to energy. Therefore, to deprive a community or even an entire country of electric energy goes against the very principle of human dignity, as stated in numerous constitutional texts.

Thinking up solutions for universal access to clean and renewable energy sources is therefore of utmost importance so as to reach a satisfactory level of development, whether it is in its most basic levels – fulfilling basic human needs – or in its most complex ones – implementing factories and heating up trade. To achieve such goals, I see energy integration among countries as a powerful instrument. As described ahead, it presents many advantages that should be placed above all political, legal,

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<sup>6</sup> COSTELLO, K. *The shocking truth about restructuring of the US electricity industry*. In: The Electricity Journal, jun., 2003; GLACHANT, J. M. *European electricity markets: variety and integration*. In: FINON, Dominique; MIDTTUN, Adle. *Reshaping European gas and electricity industries – regulation, markets and business strategies*. Elsevier, 2004; GREEN, R. *Failing electricity markets: should we shoot the pool?* In: Utilities Policy, v. 11, n° 3, pp. 155-167, set., 2003; JOSKOW, P. L.; SCHMALENSEE, R. *Markets for power: an analysis of electric utility deregulation*. Londres: The MIT Press, Cambridge, 1983.

<sup>7</sup> According to neoclassical economics, capital, land and labour were monetized, transformed into a common unit. This procedure led to the impression that they could be interexchanged or exchanged for natural resources. In the light of the elasticity of substitution, if the price of a natural resource goes up, its participation share in the productive process would drop due to the introduction of capital. However, there are no goods on Earth that are not, in their origin, the fruit of natural resources. Capital, translated into machines, required energy to be built. Moreover, according to the Second Law of Thermodynamics, the final product cannot be the same if a smaller amount of a given natural resource (bestowed with low entropy) was used.

<sup>8</sup> GEORGESCU-ROEGEN, Nicholas. *Energy and economic myths*. In: Southern Economic Journal, vol. 41, n° 3, 1975, p. 3.

technical and regulatory obstacles that appear when crossing national borders so as to achieve a common goal.

It is this notion about the essentiality of electricity to modern industrial society that gives conditions to blossom the concept of energy security<sup>9</sup>. But knowing where the energy insecurity lies, depends on where one searches. For example, in Europe, energy insecurity is found at the high dependence on Russian gas; in the United States, it relies on the Middle East oil. In South America, the uncertainty is related to exploitation problems, often accompanied by pressures on the environment. There is a tension between energy security and environmental damage, which can be solved by configuring a power system based on renewable energy combined with energy integration.

It is important to highlight the role that the State plays in this change. The State should be seen as the ultimate underwriter of energy security and promoter of human development. The State should be the incubator of a new model, although this task is cruel to some extent, since, when dealing with renewable energy, the State's role is to empower citizens to develop, so that the State itself becomes up to a certain point no longer needed.

An approach that does not exclude the State action and responsibility is especially useful regarding energy security, since energy security is often the subject of geopolitical disputes.

Despite the geopolitical aspect, nationalistic and sometimes military-oriented concept that energy security may take, I seek an approach focused on the interdependence among countries, as well as to human security. As mentioned, this approach benefits from two structures: the development of clean and renewable energy, and the search for energy integration among countries. It is believed that only these two features can build a consistent energy security, permanent and environmentally sustainable.

Currently, energy security is stated as the reliable power supply at fair prices, in a continuously and uninterrupted way<sup>10</sup>. However, mainly considering the various

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<sup>9</sup> KLARE, Michael T. Energy security. In: WILLIAMS, Paul T. *Security studies – an introduction*. London: Routledge, 2008, p. 484.

<sup>10</sup> DEUTCH, John; SCHLESINGER, James R. *National security consequences of US oil dependency*. Independent Task Force Report n. 58. New York: Council on Foreign Relations, 2006.

studies about the peak of oil<sup>11</sup> (as well as other sources of energy and mineral resources<sup>12</sup>) and the pressure on the environment<sup>13</sup>, it is also imperative to consider *which* features ensure energy security, and *to whom* that security is guaranteed.

Since the age of oil is coming to an end, and climate change threatens the very existence of mankind on Earth, to think the notion of energy security implies not only in formulating means for the maintenance and improvement of the current *status quo* of energy systems - based on a broad use of a finite resource - but rather to create new and redesign existing energy systems, so that human security is ensured. This way, energy security is a vector - and should be understood as a facet – to human security.

Thus, a new paradigm in security becomes necessary, focusing on the person, and not on the States, as in the seventeenth century, when the State monopolized the rights and means to protect its citizens. Although today the State is still the largest security provider, there are flaws in its performance and the ideal of national security is not enough to ensure the safety of people. Likewise, in a world where interdependence and transnationalism are increasing, revisiting the idea of unilateralism and seek limited interpretations about state security simply does not respond to the current energy-environmental problem.

Human security therefore complements State security, strengthening human development; thus, they are mutually dependent. The notion of human security has in its core the objective of empowering individuals to act on their own<sup>14</sup>.

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<sup>11</sup> CAMPBELL, Colin. J; LAHERRÈRE. *The end of cheap oil*. Scientific American, March, 1998; DEFFEYES, Kenneth S. *Hubbert's Peak: the impending world oil shortage*. USA: Princeton University Press, 2001; HEINBERG, Richard. *The party's over: oil, war, and the fate of industrial societies*. Kanada: New Society Publishers, 2003, p. 88; HIRSCH, Robert L.; BEZDEK, Roger; WENDLING, Robert. *Peaking of world oil production: impacts, mitigation and risk management*. USA: Hirsch Report, 2005, p. 19; IVANHOE, L. F. *King Hubbert-Updated*. Hubbert Center Newsletter n. 97/1, 1997; LEGGETT, Jeremy. *Peak oil. Die globale Energiekrise, die Klimakatastrophe und das Ende des Ölzeitalters*. Köln: Verlag Kiepenhauer & Witsch, 2006; YOUNGQUIST, Walter. *Geodesinies: the inevitable control of Earth resources over nations and individuals*. USA: National, 1997.

<sup>12</sup> KLARE, Michael T. *The race for what's left: the global scramble for the world's last resources*. USA: Picador, 2012.

<sup>13</sup> ALTVATER, Elmar. *O fim do capitalismo como o conhecemos: uma crítica radical do capitalismo*. Rio de Janeiro: Civilização Brasileira, 2010, p. 123; GIDDENS, Anthony. *A política da mudança climática*. Rio de Janeiro: Zahar, 2010. PASTOWSKI, Andreas. Möglichkeiten und Grenzen entropietheoretisch begründeter Folgerungen für die Wirtschafts-, Umwelt- und Energiepolitik. In: BECKENBACH, Frank; DIEFENBACHER, Hans (Hrsg.). *Zwischen Entropie und Selbstorganisation: Perspektiven einer ökologischen Ökonomie*. Marburg: Metropolis-Verlag, 1994, pp. 222 – 225; REBHAN, Eckhard. Prinzipielles zur Energie, zu ihren Formen, ihrer Umformung und Nutzung. In: REBHAN, Eckhard (Hrsg.). *Energiehandbuch: Gewinnung, Wandlung und Nutzung von Energie*. Berlin, Heidelberg: Springer-Verlag, 2002, p. 54.

<sup>14</sup> COMMISSION ON HUMAN SECURITY. *Human Security Now*. New York: 2003, p. 2.

A new idea of energy security, on one hand, defends the thought that States should join efforts to integrate their energy systems and, on the other hand, empowers citizens to generate their own electricity through renewable sources; it operates in favor of this complementarity between the old - but still needed - notion of State security and the new concept of human security.

The paper of the UN Commission on Human Security clearly states that access to resources and the promotion of a healthy environment are characteristics that contribute to the rise of human security<sup>15</sup>, in such a way that when environmental resources are threatened or when its access is limited, human security itself is in danger. The relationship between human security and use of environmental resources is exploited when fostering sustainable development.

Furthermore, the notion of human security is greatly benefitted by the development of initiatives that focus on regional and continental cooperation. Advocating for energy integration from renewable sources plays an important role as a catalyst in this cooperative and interdependent process among States.

According to the Commission, the concept of human security, by advocating the idea of increased freedoms and human achievements, aims to protect the vital core of all human lives. It means protecting the human being from threats and severe deprivations; it also means the freedom of future generations to live in a healthy environment. It is to weave peace, security and development in a long-term vision.

Human freedoms encompass all that is essential to life. Due to the fact that essentialities and needs are different and vary from individual to individual and from society to society, the concept of human security must be dynamic. Moreover, although the concept conducts a subjective idea, it is highly unlikely that in any given context access to energy is not part of this concept<sup>16</sup>.

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<sup>15</sup> “Security becomes an all-encompassing condition in which individual citizens live in freedom, peace and safety and participate fully in the process of governance. They enjoy the protection of fundamental rights, have access to resources and the basic necessities of life, such as health and education, and inhabit an environment that is not injurious to their health and well-being”. COMMISSION ON HUMAN SECURITY. *Human Security Now*. New York: 2003, p. 3.

<sup>16</sup> It is worth to mention that the concept of human security is multifaceted. There is today in the literature three different approaches to what characterizes human security: the first one assumes the liberal idea of basic individual rights, such as the right to life, freedom and the search for happiness; the second approach is humanitarian, turned to the international norms related to genocide and war crimes, abolition of special weapons, as well as turned to enforcement of interventions in what regards the improvements of the refugees' conditions; the third one is wider, because it considers economical, social and environmental aspects that, somehow and in some extent, jeopardize and hurt the very basic individual conditions. HAMPSON, Fen Osloer. Human security. In: WILLIAMS, Paul T. *Security studies – an introduction*. London: Routledge, 2008, pp. 230-231.

Finally, it is emphasized that to protect the citizen - primary objective of human security - there should be joint efforts to develop national and international norms, processes and institutions that have as their scope the realization of human security, in a systematic and not improvised way, comprehensive and not compartmentalized, preventive rather than reactive. It is no longer viable or acceptable that a given State, in the name of national sovereignty and self-interest, damages and affects other States and people through their actions<sup>17-18</sup>.

Therefore, it makes no sense to speak of energy security when, for example, a State, in the name of energy security, attacks another country in order to obtain more oil, as it is a finite resource and, at the end, brings war and destruction. This short term view, which aims to obtain a finite resource, cannot be regarded as energy security, as it does not consider the environment or future generations. Energy security should be discussed in a realistic way, that is, by looking at the natural capacity of the Earth, so that the entropic behavior of the planet is taken into consideration and a development model - dependent on established energy systems – which holds on to this behavior can be achieved.

The notion of human security, therefore, as opposed to traditional theories and concepts about security, marked by unilateralism, independence, geopolitics and militarism, is an important contribution to a new concept of energy security, characterized by high energy integration among countries and extensive use of renewable energy sources, within a context of multilateralism, interdependence, cooperation and reciprocity.

Currently, much of the speech around energy security is based on the traditional view, composed of the tripod (i) end of oil, (ii) oil geopolitics - change in the gravitational center from the Northern to the Southern countries - and (iii) terrorism. It is a vision still quite concerned only with the States and their interrelationships. This view lacks the human dimension of energy security.

To think about energy security "in human terms" implies thinking solutions that empower citizens to generate their own electricity, keeping them away from the

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<sup>17</sup> COMMISSION ON HUMAN SECURITY. *Human Security Now*. New York: 2003, p. 11-12.

<sup>18</sup> In the energy field, it was known as the Carter Doctrine the rhetoric through which interventions in the Gulf region, especially in what concerns the free flow of oil to the USA, were to be interpreted as a direct attack to the vital interests of the USA, which would be protected, including the use of military force.

monopoly and corporate power<sup>19</sup>; it implies thinking about strategies to break society's dependence on oil, as it is a limited and expensive resource; it also implies thinking ways of conserving energy and means to increase the energy efficiency of electric powered equipment; it implies bringing countries together and making them co-dependent, so that tensions and rivalries are eliminated and people are not threatened. A concept of energy security which considers those aspects and that in its core advocates for energy integration from renewable sources.

## **2. For an energy integration policy based on renewable sources.**

Renewable energy has its own characteristics, such as intermittency and decentralized generation. This first feature brings an apparent contradiction with the principle of a regular power supply, which, if unresolved, can undermine the relationship between renewable energy and energy security. The challenge is to think how an irregular source of power can offer a regular power supply without damaging the environment.

In order to solve this contradiction, some measures should be taken, some regulatory and others technical: first, absolute precedence should be given to the injection of renewable energy in the electricity system, compared to non-renewable energy sources. This means that while solar plants and wind farms are generating, their electricity should take precedence in the injection in transmission networks.

Another measure deals with new possibilities for energy storage. Larger batteries are being developed – they are not ready yet - in order to keep the sun's energy stored, so it can be used when the sun is no longer shining in the evening. Efforts should be concentrated in a way for such batteries to be developed as soon as possible.

Also, improvements in efficiency and energy conservation, with the establishment of a suitable reward for citizens who generate *negawatts* should be

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<sup>19</sup> Another aspect of the citizen's empowerment relates to the promotion of democratic processes when implementing and executing energy projects. There should be a greater participation of the citizen in the debates related to the South American energy policy, so that, for example, “**populações ribeirinhas e tradicionais**” are heard and their rights respected. Considering the character of universality of the environmental problems that need to be fought, it is necessary a strategic articulation that involves not only companies and governments, but also the civil society, so that the energy matrix be radically transformed. AEDO, María Paz. *Política energética en América Latina: críticas y propuestas de los pueblos*. Chile: Programa Chile Sustentable, 2008, p. 6.

sought. These measures - and others, such as smart grids - contribute to reducing the risks posed by the intermittent power generation from renewable sources<sup>20</sup>.

The second characteristic of renewable energy is the decentralization of its generation, which brings the problem of low energy density, on one side, and on the other has the ability to empower citizens to, whenever possible, become self-sufficient, depending on the power distribution company only when necessary.

The technical argument is formed by studies which demonstrate the abundance of renewable energy<sup>21</sup>, paving the way for a radical change in the world energy matrix. While many advocate the impossibility of an energy revolution, and others advocate a diversification of the sources (with the use of energy-bridge sources), the efforts should be fully directed to the development of renewable sources<sup>22</sup>.

This makes South America a special place, where there are plenty of wind, sunlight and water.

German villages and cities are current examples of successful decentralized electrical systems where citizens decided to organize themselves into cooperatives in order to develop their own electric systems based on renewable energy, without renouncing the State as a last guarantor of this public essential<sup>23</sup> service<sup>24</sup>.

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<sup>20</sup> It is worth highlighting that only the solar and wind energy are intermittent. Biomass, tidal, waves, algae and others are constant sources of energy. And all of them are, in great measure, predictable.

<sup>21</sup> Examples are found in the following studies: GREENPEACE; EUROPEAN RENEWABLE ENERGY COUNCIL; GLOBAL WIND ENERGY COUNCIL. *Energy (R)evolution: a sustainable world energy outlook*. 4. Ed, 2012; INSTITUTE FOR SELF-RELIANCE. *Energy self-reliant States*. 2. Ed. Minneapolis: The New Rules Project, 2010; NATIONAL RESEARCH COUNCIL. *Electricity from Renewable Resources: Status, Prospects, and Impediments*. Washington: The National Academies Press, 2010; PRICEWATERHOUSECOOPERS. 100% Renewable electricity. A roadmap to 2050 for Europe and North Africa. 2007.

<sup>22</sup> Note that the shift should be radical, but not sudden. Considering the technological upgrades and the dimension of the revolution that needs to be implemented, a diversified portfolio of energy sources is still necessary.

<sup>23</sup> In Germany, more than 130 villages and cities chose for a decentralized and renewable energy system, formed by hydro, wind, solar, geothermal and biomass. Although it is a extremely costly transition, it should be mentioned that the renewables industry in Germany generated alone 6,8 billion euros in 2009, 10,5 in 2010 and 9 billion in 2011. Besides that, Germany is the only country of the Western Europe where the employment rate still grows, due to the renewables industry. Another aspect worth to note relates to the role that technology plays in that shift. For example, in the Simonsberg Windpark, in the German State of *Schleswig-Holstein*, technological upgrades made possible to generate more energy from the wind, with less intervention and damage to the environment, through the installation of higher towers. The result is a smaller number of towers, which nevertheless reach more constant winds, producing more energy and in a less intermittent fashion. Available at: <http://www.kommunal-erneuerbar.de/>. Last viewed on February 20th, 2013.

<sup>24</sup> For a discussion about the public nature of the generation, transmission and distribution of energy, see GUIMARÃES, Lucas Noura de Moraes Rêgo. Serviço público vs. atividade econômica no contexto da geração de energia elétrica. In: XIX Congresso Nacional CONPEDI, 2010, Florianópolis. XIX Congresso Nacional CONPEDI, 2010.

Also parts of the energy turning point are the mega solar and wind power plants that are being built, respectively, in Northern Africa – the Desertec Initiative – and in Northern Europe – the Nordsee Initiative – in order to meet the European energy demand, while reducing energy dependence on Russian gas. It is worth noting, however, that such projects are compatible with the already consolidated energy structures of our time, marked by centralization and concentration of power.

Despite its existence, there is no doubt that the growth of the exploitation of renewable energy sources brings greater autonomy to the citizens, related to the possibility of breaking the dependence on energy companies, empowering them to achieve their freedoms and desires. This is an extremely important contribution to human security and to the idea of development it brings.

As to the energy integration, the literature<sup>25</sup> on the subject enrolls several advantages and disadvantages. Beforehand, however, it stands out to be of fundamental importance to underscore that in processes of energy integration, the negotiations for implementing projects should be grounded on principles of cooperation and not just competition and economics, where the State or the private agent seek the highest profit. They do not consider that, besides economic interests, other equally important variables gravitate around the integration process and must be dealt with.

Some of the advantages created from the energy integration among countries are: the generation of economies of scale; reduction on the demand for fossil fuels and, therefore, CO<sub>2</sub> emissions; delay in new investments for electricity generation; revenue generation through export of surplus energy; establishment of greater confidence in electrical systems and optimization of resources use.

Greater energy exchange among countries enables the development of other types of trade and it can bring historically rivals neighboring countries closer to one another, reducing the risk of threats and wars.

There are advantages to human security itself as a broad access to electricity could mean the end of hunger, disease and other degrading situations, caused by the lack of electricity and by problems with irrigation, food refrigeration, recycling and waste treatment, and sewage.

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<sup>25</sup> See, for example, CASTRO, Nivalde J. de; LEITE, André Luis da Silva; ROSENAL, Rubens. *Integração energética: uma análise comparativa entre União Europeia e América do Sul*. Estudo apresentado no Seminário Internacional Integração Elétrica na América do Sul. Rio de Janeiro: SINERGIA, 2012; PAZ, André da; NUNES, Rodrigo. Buscando as complementaridades – diagnósticos das interconexões energéticas sul-americanas. In: COSTA, Darc (org.). *América do Sul. Integração e infraestrutura*. 2. Ed. Rio de Janeiro: Capax Dei, 2011.

We should also underscore that electric energy has its own intrinsic traits which require greater attention from governments and, in our opinion, justify the need for South-American energy integration. One of these traits is that, in rough terms, electric energy cannot be stored, making it necessary that there be great synchrony between the amount generated and the demand for this energy. This way, the more energy options the system operator has, the safer the system will be. This system can also be optimized so that there are no shortages where energy is needed and that there is no waste where it is not demanded. To think regionally, not nationally or locally, however, is important to mitigate these problematic characteristics of electric energy.

Alongside this is the fact that the more a system is interconnected, the greater the need for energy generators to coordinate their actions optimally, i.e. using energy rationally, deploying it where it is in fact needed to avoid excessive production. That is where the importance of national grid operators comes into play. They are responsible for organizing the order in which power plants will dispatch their electricity production to the transmission lines. The need for system coordination is even greater in hydraulic systems, such as the Brazilian case. In Brazil, and in other places such as Canada and Norway, the level of reservoirs is measured to calculate assured energy, i.e. the amount of energy that can be guaranteed to be available in a worse case scenario<sup>26</sup>. Energy integration, linked to the coordination of the integrated system, allows an increase of the level of assured energy per power plant since many reservoir areas are taken into account to calculate firm energy.

Another favorable aspect of energy integration is the fact that there is a disproportion between the installed capacity and the real demand among countries<sup>27</sup>. The consequence of this, in South America, is that we end up with countries that demand less than their energy potential as well as countries that demand more. In the case of natural gas, the northern part of the continent – Bolivia, Peru and Venezuela – holds the biggest natural gas reserves; the southern part – Argentina, Chile, Uruguay and Brazil, have the greatest demand.

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<sup>26</sup> “Energia firme” é a capacidade de produção constante de energia. Jerson Kelman *et. al.* apontam que “o conceito de suprimento firme surgiu no final do século XIX, quando se estudava o dimensionamento de reservatórios para o abastecimento de água a cidades. O objetivo era determinar a capacidade de armazenamento que asseguraria uma determinada vazão ‘firme’ mesmo na ocorrência da sequência mais seca registrada no histórico”. KELMAN, Jerson; KELMAN, Rafael; PEREIRA, Mario Veiga Ferraz. *Energia firme de sistemas hidrelétricos e usos múltiplos dos recursos hídricos*. Revista Brasileira de Recursos Hídricos, Porto Alegre, v. 9, nº 1, 2004, p. 1.

<sup>27</sup> PAULA, Ericson de. *Um modelo de integração energética para a América Latina*. São Paulo, 1997.

Some of the advantages related to energy integration among countries are: additional hydraulicity due to differences in rainfall; differences between the consumption peaks and critical periods in South-American countries; reliability offered by integrated systems through energy exchange (reduction of shortage risks)<sup>28</sup>; reduction in investment costs for energy supply; strengthening trade relations among the integrated countries and its consequent socioeconomic outcomes. In relation to South America, due to its extensive river network and vast natural gas reserves, there is the additional advantage of drastically reducing the use of fossil fuels when a hydroelectric or thermoelectric power plant is built.

In South America specific advantages can be noted, such as hydrological complementarity due to different rain periods (between Brazil and Venezuela, or Brazil and Argentina, for example); and, differences in consumption peaks during critical periods, since South America has 5 different time zones.

Many of the benefits derived from the energy integration contribute to a reduction of the risk to which an energy matrix based on intermittent energy sources is subject.

However, some of the obstacles toward energy integration lie in the many diverse ideological stances in Latin America in relation to the role of state-owned companies; the ideal of “national security”, so dear to authoritarian regimes of the 60s and 70s; the use of the infrastructure sector to balance macro-economy, especially in relation to rate policies (the use of tariffs to control inflation); different energy cycles between Brazil (60Hz) and other countries (50Hz); and the great distances between production areas – mostly located in border zones – and distribution centers, taking into account that six of the twelve countries have border areas on the Andes or in the Amazon Forest<sup>29</sup>.

The first of two obstacles could be solved at the core of multilateral cooperative processes, while the latter could be mitigated with the decentralization of energy generation, prioritizing a local approach whenever possible.

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<sup>28</sup> Electric energy rationing in Brazil in 2001 could have been mitigated had there been a bigger transmission system between Brazil and Argentina. This would have made it possible for Argentina to export energy to the Brazilian market. In the same way, the Argentine natural gas crisis could have had a lesser impact on citizens' life had there been a better and far-reaching grid between the two countries. WORLD ENERGY COUNCIL. *Regional energy integration in Latin America and the Caribbean*. 2008, p. 98.

<sup>29</sup> SALOMÃO, Luiz; MALHÃES, José. *Processo de integração energética: rumos e percalços*. Papeis Legislativos do Núcleo de Estudos sobre o Congresso. Rio de Janeiro: IUPERJ/CAM, nº 3, julho de 2007, p. 19.

Generically termed “political problems” haunted Latin American governments until the 1990s when it came to energy integration. The creation of MERCOSUR and, more recently, greater economic stability give way to a possible favorable environment for negotiations. However, we cannot turn our back to historic disagreements between Bolivia and Chile<sup>30</sup>, nationalization of Bolivian natural gas reserves<sup>31</sup>, the unilateral decision of the Argentinean government to suspend the gas supply to Brazil and Chile, and the renegotiation of the Itaipu Treaty, which all generated, in different degrees, greater support for Brazilian energy self-sufficiency.

Furthermore, one of the greatest difficulties faced by energy integration is related to the institutional model established to coordinate power integration and interconnection operations. This includes establishing laws, rights, accountability, selecting a proper court for the resolution of conflicts, drafting its legal regulatory framework; in sum, the very integration process. Alongside energy integration comes the concern to properly harmonize regulatory processes and rules to build a safer and more enticing environment for State companies and private agents alike, with clear and consistent rules. It is notorious that there is considerable variation of institutional arrangements in South America. For example, in Paraguay, electric energy is a State monopoly, controlled by ANDE. In Uruguay, both electric energy and oil are state monopolies. In Brazil and Argentina, part of the electric sector is regulated (distribution and transmission) and part of it, up to a certain point, is deregulated (production), with State-owned companies working on both parts. In these two latter countries, there have been greater incentives to stimulate competition. Surely, establishing rules in such an environment is a difficult task and governments must create appropriate institutional arrangements that are compatible with the ideological positions and domestic policies.

Such measures also include the creation of a regional grid operator. This is what normally happens at a national level in each country and its objective would be to

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<sup>30</sup> This historic disagreement dates back to 1879, when the Pacific War took place. After that War, Chile took from Bolivia its exit to the sea. Although old, the end of that war already impeded the implementation of the Bolivian gas exportation project to the North American market. ALEXANDRE, Cristina; PINHEIRO, Flávio Leão. *Integração energética sul-americana*. Observatório Político Sul-Americano. Rio de Janeiro: IUPERJ/CAM, 2005, p. 4.

<sup>31</sup> Regarding Bolivia, its strategical position in South America should be highlighted, because it is situated in the middle of the continent and is surrounded by Brazil, Peru, Chile, Argentina and Paraguay, allowing for a great integrationist potential, even stronger when its gas reserves and hydro electrical and wind potential are taken into account. UDAETA, Miguel Edgar Morales; BURANI, Geraldo Francisco; FAGÁ, Murilo Tadeu Weneck; OLIVA, Cidar Ramón Rocha. *Ponderação analítica para a integração energética na América do Sul*. Revista Brasileira de Energia. São Paulo: Sociedade Brasileira de Planejamento Energético, vol. 12, nº 2, 2005, p. 10.

coordinate energy dispatches and to optimize South American energy production. Beside this, operative agreements, international contracts or treaties mitigate the risks of political and economic circumstances, which can only be verified over time, hindering the integration pact. Still, these agreements are positive beacons to other countries in relation to credibility and regional political stability<sup>32</sup>. In MERCOSUR, for example, there are conflict solution mechanisms that can be used by nations for the resolution of any breaches to operative agreements. Lastly, a regional energy policy must be established so that investments are properly allocated to rationalize the exploration of energy resources<sup>33</sup>.

We understand that there are problems to overcome before we integrate energy. There problems are mainly institutional and regulatory, for energy resources abound in the area (except in Chile and Uruguay). This abundance of energy stands as a hindrance to energy integration because, based on this, governments lack willingness to promote such integration. Perhaps, presently, there is no reason to increase their energy dependency and become more vulnerable. There is still an abundance of energy resources to be explored domestically.

However, this posture completely ignores the rational use of energy resources and the optimization of the system as a result of an increase in the possibility of interconnections. It thoroughly despises the premise of sustainable development, looks down on the savings in investments that integration brings about, and misprizes international agreements, pacts, contracts or treaties that advocate the principles of regionalism as a means of development and empowerment against all other geo-economic blocs.

### **3. The state-of-the-art of the South American energy integration**

#### **3.1 Brief institutional history**

Although the energy integration process suffered a boost as of the 1990s, we shall go back a few decades in time to better contextualize this process. On June 10, 1964<sup>34</sup> the Regional Energy Integration Commission (CIER), a non-profit international

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<sup>32</sup> OXILIA, Victorio; FAGÁ, Murilo Werneck. *As motivações para a integração energética na América do Sul com base no gás natural*. Revista Petro & Química. São Paulo: Valete Editora, nº 289, 2006, p. 4.

<sup>33</sup> MARCOVITCH, Jacques. *Integração energética na América Latina*. Revista Brasileira de Energia. São Paulo: Sociedade Brasileira de Planejamento Energético, vol. 1, nº 3, 1990, p. 3.

<sup>34</sup> Na mesma década de 60 foi criada a Assistência Recíproca de Empresas de Petróleo e Gás Natural da América Latina – ARPEL.

organization, was created with the objective of promoting and fostering the integration of regional energy sectors<sup>35</sup>.

The creation of CIER aimed at overcoming isolation among companies, most of which were state-owned, in charge of developing the electrical energy sector in their countries<sup>36</sup>. It is clear that they sought not only physical integration but also an exchange of experiences and information. These were the very practices that unquestionably contributed to the development, years later, of binational projects, such as Itaipu (Brazil – Paraguay), Salto Grande (Argentina – Uruguay) and Yaciretá (Argentina – Uruguay).

Nearly a decade later, on November 2, 1973, based on the Lima Agreement, the Latin American Energy Organization (OLADE) was created. It was a direct response to the 1970s energy crisis. OLADE is a political and technical support organization which aims at promoting energy integration based on premises of sustainable development and energy security in the region by coordinating with its member-countries.

Such organizations are paramount in institutionalizing an environment where international players, notably Chiefs of State and their respective Ministers of Energy, can gather to discuss energy integration in the subcontinent, which is critical for the socioeconomic development of the region.

Most of the energy integration initiatives that were fully achieved during the 70s and the 80s were binational projects, i.e. bilateral relations between countries, that aimed at making the best use of the hydroelectric potential in border areas, such as Itaipu (Brazil – Paraguay), Salto Grande (Argentina – Uruguay) and Yaciretá (Argentina – Uruguay). Such projects, carried out by binational companies and regulated by international treaties, mark the “first phase” of energy integration<sup>37</sup>. Little was said about multilateral energy relations, an example of which is the “energy ring” presently being built to integrate the southern cone with natural gas. The project aims at

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<sup>35</sup> Among such measures, some should be highlighted: technical help and cooperation among companies and organizations; knowledge transfer; development of regionally focused projects that consider the viability of international electrical interconnections; rational use of electrical energy with the aim of, among others, optimizing equipment and the operation of plants; and the promotion of regional use of electrical energy with a special emphasis on environmental issues. Available at: <http://www.cier.org.uy/a05-cier/01funciones/index.htm>. Last viewed on May 4<sup>th</sup>, 2013.

<sup>36</sup> VAINER, Carlos; NUTI, Mírian. *A integração energética sul-americana: subsídios para uma agenda socioambiental*. Brasília: Instituto de Estudos Socioeconômicos – INESC, 2008, p. 12.

<sup>37</sup> The “first phase” encompasses the 70s and the 80s, while the “second phase”, marked by the creation of MERCOSUR and by the privatization of the infrastructure sectors, starts in the 90s.

interconnecting the natural gas reservoirs in Camisea, south of Peru, as well as Bolivia, and the markets in Chile, Argentina, Brazil<sup>38</sup>, Uruguay and Paraguay<sup>39</sup>. Let us underscore that the solutions for energy supply of a country were always thought to be a national affair to be dealt with internally. The birth of bilateral projects and the passage to multilateral projects, however, represent an opening towards and the regionalization of energy solutions.

As significant as these cases were, there has never been a clear government program that targeted energy integration. What governments have always done, at the most, is take advantage of their binational hydroelectric potential<sup>40</sup>. However, starting in the 90s, and following the birth of the Southern Common Market (MERCOSUR), the movement towards Latin American integration gained momentum (“second phase” of the energy integration process) – several agreements, no longer treaties, were celebrated and a number of projects were implemented by private agents. Some might argue that such development is not the fruit of the creation of MERCOSUR, but the result of a neoliberal overhaul on the energy sector of various countries of the subcontinent<sup>41</sup>. Anyway, it is recognized that both the creation of the regional bloc and the private agents’ desire to the profit achievement in the infrastructure sectors may have jointly contributed to an increase in energy integration projects, particularly in the natural gas sector.

A landmark event in this process was the creation, in the year 2000, of the Initiative for the Integration of Regional Infrastructure in South America (IIRSA) during the Meeting of the Presidents of South America, held in Brasilia, Brazil. It is an initiative for “the promotion of the development of transport, energy and communications infrastructure under a regional perspective, aimed at physically integrating all twelve member countries of South America so as to achieve a high

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<sup>38</sup> In Brazil, Peruvian natural gas would reach the northern states of Acre and Rondonia, which were only recently interconnected with the National Interconnected System (SIN).

<sup>39</sup> SALOMÃO, Luiz; MALHÃES, José. *Processo de integração energética: rumos e percalços*. Papeis Legislativos do Núcleo de Estudos sobre o Congresso. Rio de Janeiro: IUPERJ/CAM, nº 3, julho de 2007, p. 15.

<sup>40</sup> This pragmatism when it comes to the development of the physical electrical equipments is what differentiates the South American energy integration from the European one, which feeds itself from the Directives on Energy, where the main concern lies in the establishment of harmonized institutions and norms. Regarding this matter, see ROLIM, Maria João. *Integração energética: oportunidades e desafios. Avaliando o setor elétrico europeu e sul-americano*. In: LANDAU, Elena (org.). *Regulação jurídica do setor elétrico – Tomo II*. Rio de Janeiro: Lumen Juris, 2011.

<sup>41</sup> OXILIA, Victorio; FAGÁ, Murilo Werneck. *As motivações para a integração energética na América do Sul com base no gás natural*. Revista Petro & Química. São Paulo: Valete Editora, nº 289, 2006, p. 2.

standard of equitable and sustainable territorial development”<sup>42</sup>. According to IIRSA, this development is to be attained through efforts towards the convergence of regulations and institutions <sup>43</sup>. It is actually an action plan to develop areas of infrastructure through integration. As it becomes evident, it addresses not only electric energy, but other sectors too. IIRSA is composed of several government representatives, the Inter-American Development Bank (IDB), the Andean Development Corporation (CAF), and the Prata Basin Development Fund (FONPLATA).

Amidst an environment where the participation of public and state entities in energy development was no longer the rule due to privatization, deregulation and destatization, there came the need to overhaul the ideals of energy integration. In 2003, OLADE is restructured and passes its new bylaws. Whereas OLADE has greater participation of government agents, IIRSA, which was highly influenced by the privatization process of the infrastructure sector, operates on the margins, more informally and independently<sup>44</sup>.

Today, one can clearly observe not only the ubiquitous presence of private capital firms in the sector, but also an uprising of national companies, with a special emphasis on oil and state-owned energy companies. Such companies ought to represent an important axis for energy integration and should even carry out projects that, under a strictly economic scope, are not particularly attractive to private capital. To achieve such goals, they can even strike up partnerships or consortiums with private and public companies.

Based on the issues addressed in this topic, we can conclude that, historically, in Brazil, energy integration has never been prioritized or given due concern. There have been isolated movements sympathetic to binational projects and other small energy interconnections. The overwhelming view was that energy supply had to be obtained with the country's own domestic resources and that energy integration was synonymous to energy dependency.

There is also some institutional confusion, with overlapping rules and institutions. Besides the mentioned CIER, OLADE and IIRSA, in the electricity sector

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<sup>42</sup> Available at: <http://www.iirsa.org/Page/Detail?menuItem=28>. Last viewed on May 4<sup>th</sup>, 2013.

<sup>43</sup> WORLD ENERGY COUNCIL. *Regional energy integration in Latin America and the Caribbean*. 2008, p. 71.

<sup>44</sup> VAINER, Carlos; NUTI, Mírian. *A integração energética sul-americana: subsídios para uma agenda socioambiental*. Brasília: Instituto de Estudos Socioeconômicos – INESC, 2008, p. 21.

in South America the Latin American Integration Association – ALADI, MERCOSUR and UNASUR are also in operation.

### **3.2 Treaties, Agreements and Declarations**

Therefore, during the 90's it became clear that the adoption of neoliberal policies such as privatization of state enterprises and the creation of an economic environment favorable to private companies aimed at the feasibility of the energy integration - among others - as is the case the aforementioned IRSSA. As a result of this choice, contracts and operating agreements between private agents were celebrated, much more than the signing of treaties and specific bilateral agreements between States, leaving only general clauses of action. Faced with the decline of state agents and the increase of private agents operating in the sector, it incurred in the unnecessary formalization of treaties between sovereign entities, with only general and broad bilateral agreements formalized between the rulers, leaving it to the private entities themselves the formalization of energy purchase and sale contracts and infrastructure investments.

As already stated, the absence of treaties and more rigid and formal pacts generates legal uncertainty in the utilities sector of the country. Political, economic and regulatory differences of each of the countries become more evident and have a negative effect on energy integration when there is a lack of such agreements.

Among the agreements concluded in recent years, there is the Declaration of Cusco, of December 8, 2004, that stands out as the agreement that formed the South American Community of Nations – an attempt to create an integrated South American space. It also symbolized the struggle to boost, among other processes, physical, energy and communication integration in the continent.

There is also the Framework Agreement on Regional Energy Complementation among member States of Mercosur and associated countries celebrated on December 9, 2005<sup>45</sup>. Its main objective is to contribute to the advancement of regional energy integration in terms of energy production, transportation, distribution and trade among

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<sup>45</sup> MERCOSUL. Acordo-Quadro Sobre Complementação Energética Regional entre os Estados-Partes do Mercosul e Estados Associados. Montevideú, Dezembro 9th, 2005.

member States so as to assure energy input and generate conditions that minimize the costs of trade operations among countries, among other things<sup>46</sup>.

The Declaration of the 1<sup>st</sup> Meeting of Ministers of Energy of the South American Community of Nations, which took place on September 26, 2005, in Caracas, Venezuela; the Presidential Declaration on South American Energy Integration, signed on December 9, 2006, in Cochabamba, Bolivia; as well as the Margarita Declaration, signed on April 17, 2007, on Margarita Island, triggered the creation and ratification of a number of guiding principles for the South American energy integration process.

Finally, more recently, on May 4, 2010, in Buenos Aires, the Instrumentation Plan and Schedule for the Development of Contents for the(?) South American Energy Treaty (TES)<sup>47</sup> was approved under the Union of South American Nations - UNASUR<sup>48</sup>, where, when drafting the future treaty energy, stated the need to consider principles and national legal instruments; conducting comparative studies on similar international laws; take into account the energy integration projects underway and under consideration by the UNASUR countries and similar legislative project in other regions of the world<sup>49</sup>. Finally, on May 18, 2012, at the Third Meeting of the South American Energy Council of UNASUR, held in Caracas, Venezuela, an Ad Hoc Expert Group on Legal-Political matters was created with the responsibility to develop the normative content of the TES.

### **3.3 Existing projects and on-going studies**

In relation to binational projects, one of the remarkable acts of the Brazilian Government was resuming negotiations with the Argentinean Government to rebuild the Garabi plant. Since the 1970s, Brazil and Argentina have been settling agreements

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<sup>46</sup> Inside MERCOSUR, little has been done regarding energy integration. The Member-States, sometimes through their organs, sometimes through private companies that play in their territories, choose to celebrate operative agreements, protocol of intentions, treaties, as well as form working groups and commissions, when it comes to energy integration.

<sup>47</sup> Just to make a comparison, since 1998 Europe has a similar treaty. The Central America countries celebrated already in 1996 a treaty related to energy integration. Currently, they are about to finish a 1.800km transmission line, which will integrate Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama.

<sup>48</sup> On may, 2007, in the I UNASUR South American Energy Summit, it was created the South American Energy Council, “with the goal of promoting the integration of the national energy policies and build regional pipelines networks, electric interconnection systems, programs for the production of biofuels, besides industrial activities connected to the sector”. Available at: <http://www.isags-unasul.org/interna.asp?lang=1&idArea=38> Last viewed on April 28<sup>th</sup>, 2013.

<sup>49</sup> Available at: [http://www.unasursg.org/index.php?option=com\\_content&view=article&catid=81:consejo-energetico-suramericano&id=320:plan-tratado-energetico-suramericano](http://www.unasursg.org/index.php?option=com_content&view=article&catid=81:consejo-energetico-suramericano&id=320:plan-tratado-energetico-suramericano) Last viewed on March 23<sup>th</sup>, 2013.

to put this plant into operation. They have, however, always stumbled upon technicalities or environmental restrictions<sup>50</sup>, either due to pressure by environmental activists and the population of the affected areas.

In 2005, the Government of the State of Rio Grande do Sul signed an agreement with the Provinces of Corrientes and Misiones, creating an Interstate Work Group to speed up the process to make the Garabi binational complex feasible. Along the same year new projects were proposed<sup>51</sup>, among which one, proposing three dams and a smaller flooded area. The project schedule was forwarded to the Ministry of Mines and Energy. From 2006 to 2010 there was a lot of discussion over studies related to the exploitation of hydroelectric potential, environmental issues and technical feasibility. These were great enterprises of enormous physical complexity which required the coordinated work of Brazil and Argentina, which inevitably led to slow project implementation. On January 13, 2011, a bid invitation was published, by the state companies of Argentina and Brazil - respectively Ebisa and Eletrobrás, to contract environmental and engineering studies for the Garabi and Panambi<sup>52</sup> hydropower plants. On March 15, 2012, Eletrobrás announced the consortium that won the competition to prepare the above mentioned studies, which should be officially presented in 24 months.

It is worth to note that the performance of the state companies occurred outside the institutional framework of MERCOSUR, having signed a cooperation agreement for the implementation of hydropower studies in 2008. Similarly, the start of negotiations transcends the existence of MERCOSUR, being the result of the 1980 treaty, which has as its purpose the study of the Uruguay and Pepiri-Guaçu rivers.

In relation to the existing interconnections for energy sales and purchases, Argentina has converter stations Garabi I and II, which are operated by the Energy

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<sup>50</sup> The original Project for the binational Garabi hydroelectric complex had two dams: Roncador, 2.800 MW, and Garabi, 1800 MW. The Roncador dam would flood the Uruguia River valley in the region of Yucumã Falls, in Brazil, and Moconã Falls, in Argentina, besides part of the Turvo National Park. Available at [http://www.natbrasil.org.br/Docs/publicacoes/impactos\\_iirsa\\_mata.pdf](http://www.natbrasil.org.br/Docs/publicacoes/impactos_iirsa_mata.pdf). Last viewed on: April 28<sup>th</sup>, 2013.

<sup>51</sup> Due to the devastating environmental impacts of the first Project, others were presented. The project with the best technical arrangement and smallest environmental impact was presented in 2005, by the Argentinean company IMPSA. It proposed the construction of three plants – Garabi, San Javier and Santa Rosa – each with an output of 900MW. This project proposed a smaller flooded area and greater plant and wildlife preservation. Available at: [http://www.natbrasil.org.br/Docs/cartilha\\_rio\\_uruguai/hidro2.pdf](http://www.natbrasil.org.br/Docs/cartilha_rio_uruguai/hidro2.pdf). Last viewed on April 28<sup>th</sup>, 2013.

<sup>52</sup> Both plants present 2,2 GW.

Interconnection Company (CIEN)<sup>53</sup>. The conversion capacity is 2.2GW from Argentina to Brazil and 1.33GW from Brazil to Argentina.

In Venezuela, the Guri hydroelectric power plant supplies Brazil with approximately 200MW through an electric interconnection in Boa Vista, in the state of Roraima. There are plans to increase exchange, which would allow energy swaps in the order of two to three gigawatts through interconnections between Guri hydroelectric power plant, in Venezuela, and the Tucuruí hydroelectric power plant, in Brazil. This project would also greatly benefit from the different and complementing rainfall patterns of both countries<sup>54</sup>. Furthermore, it is worth to emphasize, that the initial project foresaw a supply of 200 MW; however, due to the supply crisis seen in Venezuela starting in 2009, up to June 11, 2010 not only the 200 MW were not provided, but the 100 MW effectively available were reduced to 40 MW<sup>55</sup>.

Uruguay has the Rivera-Livramento interconnection, which allows energy swaps of approximately 70MW. This exchange is carried out frequently, as can be witnessed in ANEEL's Authorizing Resolutions that have been published since 2000<sup>56</sup>.

Brazil and Uruguay also share the objective of interconnecting the two countries by 2013. The kickoff was on July 5, 2006, when the Ministers of Energy of both countries signed a memo of understanding on energy interconnection, establishing the intention of interconnecting the city of San Carlos, in Uruguay, to Candiota, in Brazil. On March 10, 2009, an Addendum to the Memorandum was signed, and its art. 4 foresees an agreement among Eletrosul, Eletrobrás and *Adminstración Nacional de Usinas y Trasmisiones Eléctricas* – U.T.E. to manage the interconnection construction inside the Brazilian territory. In 2010, Eletrobras and the Uruguayan state company

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<sup>53</sup> A converting station adjusts the frequency of the transmitted energy. Argentina distributed electric energy at 50 hertz, while Brazil at 60 hertz.

<sup>54</sup> Available at: <http://www.aneel.gov.br>. Last viewed on April 26<sup>th</sup>, 2013.

<sup>55</sup> INSTITUTO ACENDE BRASIL. *Energia e geopolítica: compromisso versus oportunismo*. White Paper nº 1, agosto de 2010, p. 14.

<sup>56</sup> Resolution nº 15, January 14, 2000; Resolution nº 153, May 23, 2000; Resolution nº 43, February 1, 2001; Authorizing Resolution nº 260, June 3, 2004; Authorizing Resolution nº 8, January 10, 2005; Authorizing Resolution nº 379, December 19, 2005; Authorizing Resolution nº 785, January 9, 2007; Authorizing Resolution nº 1.133, December 11, 2007; Authorizing Resolution nº 1.495, August 12, 2008; Authorizing Resolution nº 1.712, December 9, 2008; Authorizing Resolution nº 2.091, September 15, 2009; Authorizing Resolution nº 2.231, December 15, 2009 and Authorizing Resolution nº 2.280, February 23, 2010. Vale destacar que esta última é resultado do Memorando de Entendimento sobre Interconexão Energética e respectivo Adendo, que tratam do projeto de integração elétrica entre Brasil e Uruguai.

U.T.E. sealed a cooperation agreement<sup>57</sup>, whereby the Brazilian state company would be responsible for the studies and the construction of the necessary facilities for the integration. The project is estimated to cost roughly R\$128m and will allow energy swaps of up to 500MW. Eletrobras recently signed an agreement with Eletrosul to promote the implementation of the substation and the transmission lines in a 36-month deadline that starts once all studies have been concluded and a contract is signed between Eletrobras and UTE<sup>58</sup>. Article 2 of the Authorizing Resolution n° 2.280 of February 23, 2010, states that Eletrobras is authorized to start building the structures.

The energy relation between Brazil and Paraguay is based on the sharing of the energy produced by Itaipu Hydroelectric Power Plant, the second biggest in the world, with an output of 14GW. A transmission line between Itaipu and Assumption, the capital of Paraguay, is under study and negotiations for its constructions are also under way. The estimated cost is around US\$400m and a fourth of this amount would be financed by Eletrobrás.

Besides the aforementioned binational interconnections and projects, there are other treaties being negotiated with other countries. For example, Bolivia's minister of energy, in a statement made in August 2009<sup>59</sup>, manifested the country's intention to export electricity to Brazil once the construction of hydroelectric power plants financed with foreign capital is concluded. Brazil is presently negotiating with Peru over the construction of six hydroelectric power plants in its territory, namely, Paquitzapango (2,000MW), Sumabeni (1,074MW), Urubamba 320 (940MW), Cuquipampa (800MW), Vizcatan (750MW), and Inambari (2,000MW). These plants will supply the Peruvian market and the generated surplus will be exported to the Brazilian market. The feasibility study was carried out by a pool formed by Eletrobras and private companies. Among the various projects, Inambari power plant has taken the lead in feasibility studies and is expected to be operational in 2015<sup>60</sup>. This enterprise will certainly play a decisive role in Brazilian energy supply, allowing for economies of scale and energy transmission to the northern region of Brazil. This will eventually reduce fossil fuel consumption in thermal energy generation.

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<sup>57</sup> According to the cooperation agreement, there should be built the Candiota Station, 500/230kV, two transmission lines, one in 230kV and another in 500kV, each with 9 and 60 km extension, respectively, until the Uruguayan border, and a connexion in 230kV in the Presidente Médici Station.

<sup>58</sup> Available at: [http://www.eletrosul.gov.br/home/conteudo.php?cd=65&tipo=55&galeria=8 &id\\_codigo=1029](http://www.eletrosul.gov.br/home/conteudo.php?cd=65&tipo=55&galeria=8 &id_codigo=1029). Last viewed on June 13<sup>th</sup>, 2013.

<sup>59</sup> CASTRO, Nivalde J.; DELGADO, Danilo. *Relatório de conjuntura: Internacional*. 2009.

<sup>60</sup> Available at: <http://www.eletrobras.com.br>. Last viewed on April 14<sup>th</sup>, 2013.

Thus, it is seen that the South American energy policy is marked by bilateral partnerships<sup>61</sup>, often involving projects that take decades to be implemented. Another notable fact is the celebration of technical cooperation protocols and bilateral agreements. Another strategy present in the South American electric sector regards the financing instruments for large and expensive projects offered by the Brazilian National Bank for Economic and Social Development - BNDES.

## **Conclusões**

Energy integration, as it has been shown, is of dire importance for the social and economic development of the peoples of the world. This is even more self-evident in the South American continent that ails with a still lagging development index, undervalued currencies, soaring criminality rates, social disparities and a democratic crisis. Such circumstances contrast drastically with the amount of energy resources available, many of which are clean and renewable, but still unexplored.

The South American challenge lies in the creation of a political and regulatory environment that brings together the interests of all nations and peoples involved in the energy integration process from renewable sources. The approach supported by the idea of human security could be adopted for this purpose because it benefits from the bad examples implemented in the past related to the adoption of an unilateral attitude (or merely bilateral). Moreover, it implicitly brings the principle of a safe and healthy environment, aligned with the defense of a sustainable and renewable energy matrix.

Even though there are institutions, forums and responsible organisms to promote energy integration in South America, it still lacks a common voice about the theme, which could be formalized in a treaty, following the example of what has been done in Europe and among Central American countries. But for this, as mentioned above, a minimal consensus as to what should be prioritized is required. Thus, the concept of energy security plays an important role.

The difficulty lies in strategic sectors such as infrastructure, as the complexity of such sectors require deep technical analysis and feasibility studies. This way, there must be adequate resources - both concerning installations as well as human capital - to achieve the proposed goals for energy integration.

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<sup>61</sup> A chart with the main South American interconnections is to be found at the end of this paper.

There is the need to establish very clear rules regarding energy exchanges between neighboring countries. This proved extremely necessary during the Argentinean natural gas crisis. Adopting clear rules that establish contract liabilities is above the fact that it is a public or private companies that supplies the service. In other words, it's not about whether Eletrobras or a private company carries out the energy exchanges. A clear-cut operative agreement that foresees resolution of conflicts, sanctions and liabilities in case of non-compliance – especially within MERCOSUR – is always necessary for the sake of relations between contracting countries. Nonetheless, we are thoroughly aware that climate factors, political differences and different levels of development can always shift the balance of relations among countries. In relation to energy issues, there must always be a great effort by governments to establish clear and comprehensive rules, due to the essential and indispensable nature of electricity for the promotion of social welfare and the attainment of the productive industrial process.

There should be a greater concern to harmonize regulatory processes and rules in order to establish a more secure and encouraging environment for state-owned and private companies, while civil society is heard and the issues relating to energy serve as a mechanism to increase citizens' participation in democratic processes. Once again, an energy matrix based on renewable sources should be stressed, in which the sources are characterized by the decentralization of its generation and it contributes to increase people's participation in decision-making related to energy policy. It is also to empower the citizen by developing renewable energy.

It is clear that there are many tension points when thinking of energy security. Among them, it is worth to highlight the pressure between energy integration, and the principle of national sovereignty over resources. One should try to balance the current situation marked by natural resources, artificial borders and different energy demands.

The human security approach, focused on the citizen, in order to establish an arrangement where energy security is achieved through the integration of energy from renewable sources, helps shift the problem of energy sovereignty, making it not only a national problem, but a "problem of the citizen." Although the State can claim sovereignty over the waters of the rivers, coal from the mines, or oil from pre-salt, it cannot do the same with regards to sunlight and the air currents. Thus, the old dichotomy public versus private vanishes.

To deal with renewable energy is not just about a decision regarding privatization or nationalization. It is, much more, about seeking technical and legal

solutions to energetically free the citizen, both from the State and the power companies, performing, at the end, the sovereignty of the citizen, understood as energy autonomy.

Another example of these points of tension relates to the relationship between national interests and energy integration, which has in its center the ideals of cooperation and solidarity. The advantages of an integrative and cooperative solution advocate in favor of an overturn of national borders. This movement - national to regional - demands a different kind of relationship among countries, which is based not on competition and individualism, but on cooperation and reciprocity. In this new relationship with citizens – and not with the States - and their freedoms as a top priority to be performed, the various national interests need to be equalized on a common agenda.

It becomes imperative that South America adopts a regional and developmentalist thinking that hover over different national policies and integrationist projects, which are in fact implemented, to generate gains for the participating nations.

It is still open how such cooperation should take place - if a new world order will be necessary, or multilateral governance practices, or a totally decentralized arrangement. What is already known with great certainty is that a mere geopolitical approach, focused on national interests, will not bring development and peace in a world that needs to find a common solution to a common problem, namely, the maintenance (and establishment in the most precarious areas) of human security in an environmentally threatened world.

The world is now in the initial phase of a major change, which, although greatly and extremely expensive – there is no doubt about it - needs to be implemented, and as quickly as possible. To observe examples of decentralized power generation, learn from mistakes and missed opportunities regarding energy exchange in South America, invest heavily in new technologies and research, establish a regulatory framework with a regulatory agency and an interregional electric system operator, are some steps that should be taken towards a single South American development model.

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## Anexo I<sup>62</sup>

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<sup>62</sup> CASTRO, Nivalde J. de; LEITE, André Luis da Silva; ROSENTAL, Rubens. *Integração energética: uma análise comparativa entre União Europeia e América do Sul*. Estudo apresentado no Seminário Internacional Integração Elétrica na América do Sul. Rio de Janeiro: SINERGIA, 2012.

## Principais Interconexões Elétricas na América do Sul

<b>Países</b>	<b>Interconexões</b>	<b>Status</b>
Argentina-Brasil	Rincón S.M. (Ar)-Garabí (Br)	Operativa
Argentina-Brasil	P. de los Libres (Ar)-Uruguaiana (Br)	Operativa
Argentina-Uruguai	Salto Grande (Ar)-Salto Grande (Ur)	Operativa
Argentina-Uruguai	Concepción (Ar)-Paysandú (Ur)	Emergencial
Argentina-Uruguai	Colonia Elia (Ar)-San Javier (Ur)	Operativa
Argentina-Chile	C.T. Termo Andes (Ar)-Sub. Andes (Ch)	Operativa
Argentina-Paraguai	El Dorado (Ar)-Mcal. A. López (Pa)	Operativa
Argentina-Paraguai	Clorinda (Ar)-Guarambaré (Pa)	Operativa
Argentina-Paraguai	Salidas de Central Yacypetá	Operativa
Bolívia-Peru	La Paz (Bo)-Puno (Pe)	Em Projeto
Brasil-Venezuela	Boa Vista (Br)-El Gurí (Ve)	Operativa
Brasil-Paraguai	Saídas da Central Itaipu	Operativa
Brasil-Paraguai	Foz do Iguaçu (Br)-Acary (Pa)	Operativa
Brasil-Uruguai	Livramento (Br)-Rivera (Ur)	Operativa
Brasil-Uruguai	Pte. Médici (Br)-San Carlos (Ur)	Em Construção
Colômbia-Venezuela	Cuestecita (Co)-Cuatricentenario (Ve)	Operativa
Colômbia-Venezuela	Tibú (Co)-La Fría (Ve)	Operativa
Colômbia-Venezuela	San Mateo (Co)-El Corozo (Ve)	Operativa
Colômbia-Panamá	Cerromatoso (CO)-Panamá (PA)	Em Estudo
Colômbia-Ecuador	Pasto (Co)-Quito (Eq)	Operativa
Colômbia-Ecuador	Jamondino (Co)-Santa Rosa (Eq)	Operativa
Colômbia-Ecuador	Ipiales (Co)-Tulcán/Ibarra (Eq)	Operativa
Ecuador-Peru	Machala (Eq)-Zorritos (Pe)	Operativa