

## LIMITATIONS FOR RENEWABLE ENERGY DEVELOPMENT IN ARGENTINA

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Date received: January 13, 2015. Date accepted: May 19, 2015

### Abstract

In recent decades, renewable energies have become increasingly important at the global level, with a significant impact on the sustainable development of various nations. Although multiple papers have examined the efficiency of policies and instruments to promote renewable energy sources, the majority have disregarded the fact that the context in which policies are implemented determines how well they perform. This paper analyzes renewable energy development in the electricity market in Argentina, paying special mind to the contextual conditions in which the policies were designed and finding that in recent history, it is precisely these conditions that constitute the main reason why renewable energies have such a low degree of penetration in the electrical power system in Argentina.

**Keywords:** Argentina, renewable energy, electricity sector, sustainable development, public policy.

### INTRODUCTION

Promoting new renewable energy sources (RES) has become one of the top items on the sustainable development agenda, although the motivations behind this effort have differed, up until now, between developed and developing countries. While the principal driving force for the former group has been to reduce carbon dioxide (CO<sub>2</sub>) emissions, many developing countries are more focused on the need to increase the energy supply and provide access to electricity in isolated zones (Fouquet, 2013: 17-18). However, this situation may be changing, because according to multiple policy scenarios, by 2040 to 2050, developing countries are likely to account for more global energy consumption and bear a greater share of the responsibility for greenhouse gas emissions derived from the burning of fuels, in light of their projected demographic situations, welfare improvements, and economic growth rates (DOE/IEA, 2013: 159-163). For these reasons, it is likely that mitigation objectives will become an increasingly important reason for developing countries to resort to more renewable energy sources.

The literature about energy and power has mainly discussed the degree to which energy policy instruments used to promote renewable energy sources are more or less effective. However, their effectiveness is directly

dependent on the institutional, political, economic, and social context in which they are implemented, in other words, the conditions of the policy environment.

Although Argentina is a country with high potential for RES, its primary energy matrix displays very low levels of RES usage, especially in the electricity generation matrix. According to the National Ministry of Energy, in 2012, 87% of the domestic supply of primary energy came from hydrocarbons, with less than a 9% share derived from renewable energy sources, mainly coming from major hydroelectric power plants. In addition, according to data from the Wholesale Electricity Market Managing Company (CAMMESA), in 2013, 63.8% of electricity was generated with thermal technologies, principally drawing on natural gas and oil byproducts, and 31% came from hydropower generation (major plants and smaller projects), 4.41% from nuclear energy and 1.3% from RES. Despite the fact that Argentina has policies and programs to promote the diversification of the energy matrix, RES still accounts for a low share of the overall mix.

Argentina began to promote replacing imported sources with more abundant local sources of power in its energy matrix in the mid-1940s. The need for an energy self-sufficiency policy emerged at the end of the Second World War, with the risk of becoming dependent on foreign sources to ensure the success of the industrialization program (Dubrovsky, 2004: 7-8). From that point on, and until the end of the 1980s, the national energy policy was directed by a set of general objectives: energy self-sufficiency, better adaptation of the consumption structure to the reserve matrix, and the diversification of the energy matrix, actions which primarily relied on public investment.

The push for RES dates back to the mid- or end of the 1970s and the early 1980s, in keeping with a worldwide trend derived from rising oil prices in the first half of the 1970s. Since then, various initiatives have been introduced, none of which has managed to significantly develop these sources.

The objective of this study is to analyze the degree of development of new RES in the Argentine electricity market and study some of the drivers that explain their low level of penetration. To that effect, this paper begins with a conceptual approach to the nature of energy policies and the groundwork for developing renewable energy policies. Second, we analyze the development of RES promotion policies during various presidential administrations, looking at the socioeconomic context in which they were implemented. The study is divided into presidential terms in order to elucidate the degree to which institutional changes determined the boundary conditions for policies and their final impact. Third, we examine the current installed capacity of RES. Finally, we offer some reflections.

## ENERGY POLICY: ENVIRONMENTAL CONDITIONS AND PROMOTION INSTRUMENTS

An energy system is a *series of activities, which, beginning with a certain endowment of natural resources, permit the provision of energy services, and which are articulated within a socioeconomic system* (Hasson and Pistonesi, 1988; Bouille, 2004: 227-253). These energy chains are shaped by various historical factors, and are interdependent on each other. The decisions made by an agent in one link of the chain have repercussions for the decisions made by the rest of the agents in other links and the overall outcome. These features, added to the lack of competition, energy market concentration, or the existence of externalities, render market mechanisms incapable of ensuring the sustainable evolution of the energy market on their own, making it necessary for public policy intervention.

When energy policies are designed and implemented, multiple factors come together to produce the final result: the conditions of the national and international context (environmental conditions), the barriers facing the policy, key actors, and instruments (direct or indirect) that will be used (OLADE/Cepal/GTZ, 2003: 145).

The environmental conditions (the enabling context) describe the conditions of the institutional, regulatory, and policy framework, in a broad sense, that influence, determine, or facilitate the feasibility of sectoral or sub-sectoral policies. We must also take into account the technology and market conditions, institutions, and specific resources of each country that may be subject to change in response to government actions (Boldt *et al.*, 2012: 9-13). In general, this term refers to the national and international context in which policies are implemented, and which cannot be easily modified by whoever is designing the sectoral policy. On the other hand, entry barriers refer to the obstacles that technologies face to enter the market, which can indeed be removed by way of sectoral policies and specific instruments. While the former are outside the realm of political action, the latter can be eliminated with carefully designed policies. The existence of propitious or enabling conditions eases the removal of barriers to penetration that technologies face, by furnishing a favorable context in which to develop strategies (Boldt *et al.*, 2012: 9-12).

In large measure, these environmental conditions (in particular, the conditions of the national context), are quasi-dependent on the institutional development of the country. In that sense, institutional development is clearly tied to a favorable context for the development of renewable energy sources. This link has been studied (although not necessarily mentioned explicitly) by various authors, who have established the existence of a relationship between institutions and economic development, made concrete thanks to the effect of institutions on economic and political performance (Acemoglu and Robinson, 2010: 1-33, among others). At the same time, diverse studies have analyzed the importance of institutional development and other contextual conditions for the development of renewable energy sources in various regions around the world. Many of these studies emphasize that the principal environmental conditions necessary for the development of renewable energy sources are: institutional quality and enforcement of regulatory standards, the capacity and adaptation of new technologies, access to financing, and technology and human capital knowledge, among other characteristics

(Cherni, 2011: 113-128; Van Dril and Van Tilburg, 2011: 226-233; Bloomberg New Energy Finance, 2014: 28-33, 50-58; Sala-i-Martin, 2014; Recalde, 2015: 1-15).

Table 1 shows a breakdown of the conditions that enable RES to develop. It is important to note that each condition will have a different influence on technology development, by virtue of the specific features of the market conditions that exist (Boldt *et al.*, 2012: 9-13). Favorable environmental conditions will also facilitate the removal of entry barriers facing RES, through well-designed development policies. Although each barrier will require a country to adopt different policies or instruments, countries tend to implement a portfolio of measures, which carefully complement each other, to define a path for the growth and development of these sources in the medium or long term (Foxon *et al.*, 2007 in IIASA, 2012: 876).

Table 1. Conditions to Enable the Development of an RES Policy

<i>Enabling Condition/ Category</i>	<i>Subcategory</i>	<i>Importance</i>	
GOVERNANCE	Organizational and institutional capacity	High level of commitment and leadership Strong and suitable institutional organization	Political will that prioritizes RES development in the energy agenda. Fundamental to stimulate investment through policies.
	Political, legal, and regulatory framework	Synergy with other sectoral policies	Laws and standards that encourage the rational use of energy resources in the long term and investments in RES. These standards are fundamental to ensure the long-term sustainability of economic activities and investment in the private sector.
		Stable and clear regulatory framework. Effective enforcement of standards and laws	The existence of clear regulations is a prerequisite that can be complemented by other instruments and actions.
	Capacity development (R&D)	Importance of standards related to technology transfer	Access to technology is fundamental and is a condition for the potential development of an RES industry. Reduce technology dependence.
		Individual and institutional capacities	Developing RES promotion policies will require a team with diverse skills: knowledge of the sector (strengths and weaknesses, barriers), technical aspects, economic aspects, social impact, environmental impact, and monitoring and reporting of policies implemented.
		Synergy between individual and institutional capacities	Both individual and teamwork capacities will be required, as well as institutional maintenance.
ECONOMIC AND FINANCIAL ASPECTS	Macroeconomic conditions	Elimination of obstacles facing RES. These include stable conditions for the major macroeconomic variables, such as inflation and exchange rate volatility. Uncertain macroeconomic environments affect investment. In addition, macroeconomic conditions impact the socioeconomic conditions of a country with an indirect effect on the capacity to take on the costs of RES.	
	Access to domestic/foreign financing. Availability of funds at government level	The development of RES promotion policies will require public and private funding. Public funding will also be necessary to implement the promotion policies. There is a close relationship between funding and the right macroeconomic conditions to allow funds to flow and the existence of a capital market.	
INFORMATION	Information for the design of policies and decision-making	Availability of enough good-quality information Systematization of information	Special consideration in the data collection process
	Information for monitoring	Transparent and good-quality information regarding the energy sector and the overall economy	Will allow monitoring and assessment of policies, allowing for their adjustment if the desired results are not obtained. Positive impact on investment.
PUBLIC AWARENESS	Recognition of the relevance of RES in environmental terms	Greater public awareness will increase the demand to incorporate more sustainable RES and will support the development of policies that promote these sources.	

Source: Created base on Bouille (1999).

## HISTORICAL EVOLUTION OF RENEWABLE ENERGY REGULATIONS IN ARGENTINA

This section analyzes the use of instruments to promote RES in Argentina during various historical time periods, describing the contextual conditions of each term. As described in the introduction, we have divided the history into time periods to easily identify how institutional changes derived from the presidential administration in place (Argentina has experienced frequent changes throughout its economic and political history) impact the context in which policies are implemented and affect their outcome.

### 1960-1982

The second administration of General Juan Domingo Perón (1952-1955) marked the beginning of the energy policy era, with a clear trend towards diversifying the energy matrix, which at that point in time consisted mainly of imported resources. Similarly, one of the energy objectives of the third Peronist administration (1973-1976) was to promote renewable energy sources (Barrera, 2011: 19). However, this trend came to an abrupt end with the coup d'état in March 1976, leading to the complete abandonment of this policy concept, and doing away with the majority of public investment and increasing the role of private investment in the economy. There are two clear examples of this rupture. One is the delay in finishing the works at Yacretá, which were initially planned for 1980 and completed in 1994, and the second is the transfer of exploration and exploitation zones from *Yacimientos Petrolíferos Fiscales* (YPF) to national and foreign private producers (Barrera, 2011: 19).

In spite of this situation, by the end of the 1970s, there were plans in place to develop information sources for geothermal and solar energy. In 1979, the National Office for Energy Conservation was established and some progress was made in the field of geothermal and solar energy. The government drafted guidelines for the development of geothermal energy and created the Solar Measurement Network, which reached its peak in 1985 and was dissolved in 1991 as a result of budget cuts made to the National Commission for Space Activities (CNAE), on which the network depended at that point in time, and the default of payments to the Organization of American States (OAS) (García, 2006a: 1-2).

### 1983-1989

The Raúl Alfonsín administration represented a return to democracy in the midst of a series of social policy conflicts, which, in combination with the national and regional problems ailing the country, led him to step down. His mandate took place in a context of high debt (in 1989, total foreign debt reached 82.6% of the gross domestic product (GDP)) and high inflation (in 1998, inflation hit 342%), which had a major impact on the subsequent performance of the Argentine economy and the reforms implemented. With regard to the energy sector, this time period is characterized by both advances and setbacks in terms of the control of natural energy

resources, which were manifest in the constant conflict surrounding the participation of private companies in the exploration and exploitation of areas belonging to the state enterprise YPF S.A. (Basualdo and Azpiazu, 2002: 6-9).

The most ambitious program related to renewable energy consumption and energy efficiency during this administration was the National Rational Use Program (Dto. 2.247/85), inspired by many of the policies implemented in developed countries since 1975 (Calleja, 2005: 121). The program was composed of three smaller programs: the energy conservation program; the fuel substitution program; and the evaluation, development, and application of new energy sources program, demonstrating the breadth of the program's scope, although instruments that would have resulted in increased installed capacity were neither implemented nor enforced.

In 1985, the Regional Wind Power Center (CREE) was set up, and the same year, this institute issued the first estimates of national wind power potential. In 1987, the Ministry of Energy published the "National Inventory of Small Hydropower Projects," which listed projects generating up to 5 MW of power.

### **1989-1999**

The context of the crisis ushered in President Carlos Saúl Menem in July 1989. This administration implemented a series of measures that upended the macroeconomic context of the country. The State Reform Act (Law 23.696) and the Economic Emergency Act (Law 23.697) constituted the key instruments to develop many of the energy sector policies, and laid the foundation for the privatization of the major State enterprises.

The deregulation of the market and privatization of companies, the introduction of private rationality, the vertical disintegration of productive chains, the lack of control, and the increase in the extraction and exploitation of resources, exhausted the system and made it unsustainable, prompting the energy problems Argentina faced in the 2000s (Azpiazu, 2008: 87-110; Basualdo and Azpiazu, 2002: 13-20; Kozulj, 2002: 31-47; Pistonesi, 2001: 17-41; Recalde, 2011: 86-138 ). These aspects shaped the environmental conditions that brought about a negative framework for developing RES policies and Rational Energy Use (REU), making these efforts rather unsuccessful.

At the same time, in March 1991, the government enacted the Austral Convertibility Act, which set a fixed exchange rate between the United States dollar and the Argentine peso (austral). This new monetary policy brought with it major economic repercussions and consequences for the energy sector (Basualdo and Azpiazu, 2002: 9-17; Pistonesi, 2001: 9-17).

Even so, during this time period, the first specific laws to promote geothermal, wind, and solar power were approved. First, in 1993, Law 24.224 was enacted, declaring that geological surveying was an activity of

national interest. Second, in 1998, Law 25.019 was enacted, establishing the National Wind and Solar Energy Regime, which set up a system of premiums or surcharges equivalent to one cent of *the Argentine peso* per kWh effectively generated by the Wholesale Electricity Market (WEM) and/or destined to the provision of public utilities, for a period of 16 years. With the Convertibility Act in effect, this incentive was equivalent to one dollar cent per kWh. Second, fiscal policy instruments were employed, such as the possibility to defer for a period of 15 years the amounts corresponding to the Value Added Tax (VAT) on capital investments.

However, this law did not produce the expected results. The vast majority of the wind power facilities developed during the 1990s and in subsequent years were implemented on the basis of cooperation agreements with governments from the European Community. In the time period 1994-2003, investments resulted in an installed capacity of 28.88 MW of wind power, although the majority of facilities did not formally join the Interconnected System (national power grid), but were rather destined towards the electricity generated and distributed through local networks. The incentives available did not improve the competitiveness of the power stations enough to be able to sell to the WEM. This aspect is closely tied to the fact that the currency policy was amended between the time that the law and regulations were enacted (end of 1999) and when the projects were eventually implemented.

With regard to policies to increase information and knowledge, in 1999, the Ministry of Energy put together the first wind power map in Argentina's history, based on measurements taken much earlier, in 1985 (García, 2006: 2-3).

### **1999-2001**

In the midst of a recession, Fernando de la Rúa came into office in 1999, although his mandate would end prematurely as a result of the economic crisis. Between 1998 and 2001, the economic activity level fell more than 8%, plummeting in 2001. The crisis was further exacerbated in 2002 when the GDP fell 10%. Some authors have described the establishment of the new monetary policy at the end of 2001, in the aftermath of the collapse of the banking system as a result of capital flight, as a turning point in the macroeconomic crisis<sup>2</sup> Political, economic, and social unrest led to the outbreak of protests, which peaked in December 2001 and ended with the resignation of the president. In the energy sector, this administration largely stayed the course of the previous government.

The biggest advance in the realm of RES during this time period was related to an energy access program for isolated markets, known as the "Renewable Energy in Rural Markets Project" (PERMER). This program, implemented at the end of 1999, sought to expand the private market for alternative energy systems in rural areas spread out around the country through State planning and the supply of energy to rural markets in a sustainable fashion. The program was still in place as of 2014, and receives 70% of its funding from the Ministry of Energy, through loans from the World Bank (WB) and donations from the Global Environmental Fund (GEF),



as well as 4% from the Ministry of Education, Science, and Technology (to provide electricity to rural schools), 9% from the National Energy Fund, and the remaining 17% from the private sector.

The economic barrier, derived from electricity rates in the energy sector and investment financing (boundary conditions for the policy), has been one of the principal obstacles facing PERMER, highly correlated with the low rates set by the local governments in the provinces (Best, 2011: 15-17). Moreover, the context in which the program was designed in 2002 is now different, which has complicated its implementation. The principal problems are related to the viability of private investment (for two reasons, because the cost of investment is higher due to the need for imported components and because the payment capacity of the agents is lower). This aspect, in combination with the explosive growth in demand for solar panels in Europe, brought the development of the project to a halt. Additionally, Argentina's default at the end of 2002 put the project on hold, due to the complete lack of money flowing in from the World Bank (WB), although these funds began to come in again at the end of January 2003 (Dubrovsky, 2004: 6). However, the changes made to the program in 2006, the agreements between the federal government and the local governments in the provinces, and the capacity to grant concessions to private, public, or cooperative enterprises, all had a positive impact on its subsequent performance (Garrido *et al.*, 2012).

### **2002-2003**

In January 2002, during the Eduardo Duhalde administration,<sup>3</sup> and in the context of economic activity levels plunging 10 percentage points, the "Public Emergency and Currency Regime Reform Act," Law 25.561, was enacted, declaring a public emergency in social, economic management, financial, and currency-related matters. One of the principal aspects of the act was to amend the articles of Law 23.928 that had stipulated the convertibility regime, leading to the shift to a fixed exchange rate.

This change in the macroeconomic environment would impact the energy sector structure by modifying the context in which parties entered into contracts. On the one hand, the law prohibits the indexation of all types of debts, taxes, prices, or fees and rates for goods and services. On the other, the prices and fees resulting from these clauses were to be set *in pesos*, with an exchange ratio of one to one with the dollar, in what was known locally as the *pesification*, or conversion into pesos, of public utilities rates. Finally, it empowered the Executive branch to renegotiate contracts, paying special mind to the potential impact of rate adjustments on economic competitiveness and income distribution. As will be seen below, this national monetary policy shift and the declaration of a public emergency would drastically alter the environmental conditions, with a direct impact on the performance of the energy sector that would persist for more than a decade.

## **2003-2007**

In May 2003, President Néstor Kirchner was inaugurated as President. After four years of economic recession, the Argentine economy began to recover. According to data from the National Institute for Statistics and the Census (INDEC), between 2003 and 2007, the GDP grew more than 8% annually. One of the principal pillars of the government strategy to sustain this economic recovery and help the social situation rebound was the containment of domestic prices, particularly energy prices (Barrera, 2014: 132). This at the same time would cushion the impact of devaluation on inequality<sup>4</sup> and poverty, which, according to WB data (2005), rose from 37% to 57% between October 2001 and 2002. In that sense, there are two particularly interesting aspects. First, the nature of energy as a consumable good essential to life, its contribution to overcoming poverty, and the impact of an increase in household energy bills on the incomes of the lowest-earning sectors. Second, in light of the importance of energy as a productive input, and its relevance to the cost of transporting products, any adjustment to energy prices could increase the already major impact of currency devaluation on inflation.

Starting in 2004, Argentina began to show symptoms of the energy crisis, in particular with respect to the availability of natural gas, a fundamental resource for the national energy system,<sup>5</sup> as a result of the growing demand for energy and reduced production levels and the depletion of hydrocarbon reserves (Recalde, 2011b: 3860-3863).<sup>6</sup> In that context, the government began to implement various measures, but they proved insufficient to mollify the supply problems that were only exacerbated throughout this decade and the next.

At the same time, the lack of investment in electricity generation, restrictions on the electricity transportation sector, and problems with supplying natural gas for electricity generation, made the State reconsider its role in the sector and start to look to the potential of RES to resolve these problems (Dubrovksy, 2004: 8). Specifically, RES were seen as an alternative for power generation in isolated areas, and a way to increase the energy supply with resources besides natural gas and liquid fuels (which are more polluting and tend to be imported), although they would not necessarily solve the issues related to the transportation and distribution of electricity.

In August 2006, Law 26.123, the Regime for the Development of Technology, Production, Usage, and Application of Hydrogen as a Fuel and Energy Vector, was enacted, declaring that the development of technology, the production, the usage, and applications of hydrogen as a fuel and energy vector were of national interest.

That same year, in the framework of the National Strategic Wind Power Plan, a National Wind Power Geographical Information System was released, developed by CREE in conjunction with UTN and the support of the Ministry for Planning (REEEP/SE/FB, 2009: 12). This tool is fundamental for estimating national wind power potential and for developing pre-feasibility analyses for wind farms in various zones around the country,

In 2007, a law amending the Wind and Solar Power Promotion Act was passed. Law 26.190, the Regime for the National Development of the Usage of Renewable Energy Sources for Electricity Production, has been from that time forward the overall legal reference framework for developing RES in Argentina.

The main aspect of this law is that it introduced for the first time a target for the access policy, setting a goal of having RES account for 8% of national electricity consumption by 2016. This quantified target was Argentina's first voluntary commitment to RES, made at the International Conference for Renewable Energies in 2004 (Villalonga, 2013: 37). The law encompasses other technologies besides wind and solar, such as tidal, hydraulic up to 30 MW (small hydropower projects (SHP)), landfill gases, purification plant gases, and biogas.

The instruments used for the promotion of this law have not differed significantly from the last law. The remuneration was set at 0.015 pesos/kWh effectively generated with any of the technologies mentioned, with the exception of photovoltaic generators, for which the remuneration was set at 0.9 pesos/kWh. This incentive will be granted over the price of kWh in the WEM, and will be based on a set of criteria fixed in Article 14 of regulatory decree 562/2009. These incentives were to be financed with funds from the Renewable Energy Trust Fund.<sup>7</sup> The law also provides for fiscal policies to reduce the tax burden of the projects, such as the potential to defer VAT payments on capital investments and an exemption from the Minimum Presumed Earnings Tax, whose benefits will last for 15 years from the time the law was enacted. The implementation of the law was postponed to 2009, the year in which the regulatory decree was approved.

However, the law did not produce the outcome expected and there were scarce signs of major investments until the GENREN program was implemented in 2010. The strategy was unsuccessful in large part because these technologies faced sectoral economic and financial barriers that could not be overcome with the promotion instruments chosen, which were insufficient to increase profits and encourage investors. On the one hand, the economic incentives fixed in Argentine pesos became outdated in light of the rising costs of power generation, and in light of the cost of investing in this type of technology, which tends to require imported components.<sup>8</sup> On the other hand, beginning with the conversion of rates into pesos, prices recognized for generators in the WEM became quasi-frozen, leading to a discrepancy between generation prices and costs, making the incentives even less relevant.<sup>9</sup> The situation was accompanied by a simultaneous increase in the share of transfers to the energy sector in public expenditures,<sup>10</sup> and the increased impact of the energy deficit on the trade balance.

In this way, in a context of an increasingly exacerbated supply problem along with low investment in generation, and electricity demand that has grown consistently since 2002, Argentina began to implement other programs to encourage investments in electrical power, which in some cases represented an opportunity for RES. Such is the case of Resolution SEE N° 1.281/2006, which defined the supply as a priority in light of deficits facing public utilities; or Resolution SEE N° 220/2007, which permitted parties to enter into Supply Contracts with the WEM and permitted the associated offers of generation and energy availability, by way of the concept of Generator Agents, Co-Generators, and Self-Generators, which had previously not been agents of the WEM.

In July 2006, the *Vientos de la Patagonia I* partnership was launched between the National Argentine Energy Company S.A. (ENARSA) (80%) and the government of the Province of Chubut, to promote the development of wind power for the national industry, with the objective of building a wind farm with a capacity of 60 MW.

## 2007-2015

In December 2007, Cristina Fernández de Kirchner began her first presidential term, and four years later, in December 2011, she began her second. The majority of the economic policy pillars of this government stayed the course of the previous administration, keeping public utility prices down, especially those related to energy utilities.

In the energy sector, the situation that began in 2004 escalated in light of the growth in energy demand, especially for electricity, which experienced growth rates of nearly 5%, accompanied by an average annual economic growth rate of 5.5% pursuant to INDEC figures, except in 2009, when consumption fell 0.9% (when the GDP growth rate was also below 1%).

With all of that said, these aspects did not manage to reverse the trend and demand continued to rise. Starting in 2009, energy imports took off, which will have a major impact on the trade balance in the medium term. According to data from the Ministry of the Economy, in 2011, the energy balance went from a surplus of 1.760 billion dollars to a deficit of 2.784 billion; between 2012 and 2013, said balance rose 263%, hitting 6.2 billion dollars.

In April 2012, in the context of the aforementioned energy crisis, the national government decided to take back control of YPF S.A., and through Law 26.741, "declares of national public interest the self-sufficient supply of hydrocarbons [...] and subjects to expropriation 51% of the shares of the company belonging to Repsol YPF S.A.," giving rise to an intense national debate about the short-/medium-term impact of this recovery method on the country's access to foreign credit. In early 2014, seeking to increase access to the credit granted by international bodies and encourage foreign investment, the Argentine government entered into an agreement with Repsol to compensate the company for the percentage expropriated.<sup>11</sup>

Although there have been no new laws to promote RES during this term, it is during this time period that Argentina has seen the greatest increase in installed capacity, related to the implementation of the Renewable Energy Generation Program (GENREN), various private price tenders, and the emergence of certain resolutions that have entailed major opportunities for new generators, many of them motivated by increasing the supply.

In June 2009, the Ministry of Federal Planning, Public Investment, and Services launched the first edition of *GENREN I*. This program consisted of a system of tenders to cover 1000 MW of generation with RES (500 MW for wind power, 150 MW for biofuels, 120 MW for solid waste, 200 MW for biomass, 60 MW for SHPs, 30 MW for photovoltaic solar, and 20 MW for biogas), implemented by ENARSA. The winning companies would sign purchase agreements for a period of 15 years in United States dollars, at a fixed price calculated on a project by project basis. In other words, beginning with the GENREN program, new facilities would benefit from this fixed-price scheme. Some of the other fundamental criteria taken into account when selecting projects

included not only the price offered, but also the timeline for investment and, most importantly, the percentage of national components in the entire investment.

Besides private investors, there are three major players in the public or public/private sector: the Foreign Investment and Trade Bank S.A. (BICE), which is the administrator of the project guarantees; ENARSA, which currently acts as an intermediary, and CAMMESA. In addition, BICE contributes, through its renewable energy financing line, to funding the projects. As of 2011, seven projects had been approved for funding by the bank: Loma Blanca IV, Koluel Kaike II and Malaspina I for wind power; La Rápida, Los Algarrobos and Las Pirquitas for SHP; and Cañada I and II for solar photovoltaic power.

In 2010, the national government published the list of awarded projects, adding up to a total of 895 MW. Because these projects did not cover the entire supply, in September 2010, the government launched GENREN II for an amount of 1208 MW.

Table 2. Capacity Contracted Through GENREN I

<i>Source</i>	<i>Projects (#)</i>	<i>Capacity (MW)</i>	<i>(%MW)</i>
Wind	17	754.0	84.25
SHP	5	10.6	1.19
Photovoltaic	6	20.0	2.23
Biofuel	4	110.4	12.33
Total	32	895.0	100.00

Source: Created by the authors based on data from ENARSE and the Ministry of Energy.

In the case of this program, the awarded projects were given prices that would guarantee attractive returns (James, 2011: 29). For example, the prices for the wind power generation projects ranged from 121-134 dollars/MWh; biofuel: 258-297 dollars/MWh; SHP: 150-180 dollars/MWh; and photovoltaic: 547-598 dollars/MWh.<sup>12</sup> These prices exceeded those granted in other countries in the region, especially in the case of wind energy, where Brazil and Uruguay only offered prices of around 60/80 dollars/MWh. Despite this situation, few of the projects have adhered to the timelines and goals initially set. Regarding wind power, only three of the approved projects (Rawson I and II and Loma Blanca IV) are currently operating.

Limited or interrupted access to funding has been one of the principal impediments to adhering to the timelines, majorly due to the conditions of the energy policy environment. Banks and investment funds stopped granting

long-term credit in response to the macroeconomic uncertainty resulting from some policies, such as the foreign exchange market controls, restrictions on the remittance of profits abroad by international companies, the lack of agreement with the Paris Club,<sup>13</sup> or the controversies with foreign debtholders.<sup>14</sup> Likewise, part of the higher price required by developers in Argentina, as compared to Uruguay, was due to the relatively greater role that taxes play in Argentina, while in comparison with the Brazilian case, the fundamental difference can be found in the financing of the investment, which was more complicated in Argentina with the existence and participation of the BICE.<sup>15</sup>

In addition, one of the reasons that may have led to the lack of financing is the fact that the awarded companies were asking for a lot of money to open the projects to new interested investors. Various media sources noted that the amount required to open the projects up to new investors for projects with Approved Rates for renewable sources (such as GENREN) was four times higher in Argentina than in Brazil.

Once again, it would seem that the contextual or environmental conditions, rather than entry barriers and the design of the instruments, that were responsible for many of the GENREN projects failing to meet their deadlines.

In this context, and with the dual objective of raising electricity generation and meeting the quota stipulated in Law 26.190, the government made available other mechanisms to encourage investment in RES. For example, they released tenders or private bids on prices for biogas, urban solid waste, thermal solar power, and biomass.

In addition, Resolution SEE 280/2008 enabled municipal and provincial providers of electricity distribution services to offer generation capacity based on SHPs (less than 2 MW), under the conditions of Law 26.130, while Resolution S.E. 108/2011 replicated the GENREN program scheme (15-year contracts and prices set on a project by project basis), and permitted generation contracts for RES between the WEM and Generator Agents, Co-Generators, and Self-Generators, which prior to the program did not have a standard for this capacity. Under this scheme, Argentina will analyze investing in 100 MW in the Chubut Province.

However, problems for obtaining financing persist, principally because the operators of the electricity market have showed signs of uncertainty (Villalonga, 2013: 37-40).

Finally, at the end of 2012, an initiative from the Ministry of Agriculture, Livestock and Fishing, and from the Ministry for Federal Planning, Public Investment, and Services, with the technical assistance of the United Nations Food and Agriculture Organization (FAO), launched a project to promote energy derived from biomass (PROBIOMASA), to exploit waste, mainly forestry waste, and incorporate 200 MW of electrical and 200 MW of thermal. However, once again, financing the investment is one of the principal barriers facing the project. For these reasons, since 2013, Argentina has been preparing a proposal for Nationally Appropriate Mitigation Actions (NAMA) based on PROBIOMASA to access international financing. This is a novel initiative, because it is one of the first national efforts to coordinate energy and environmental policy to develop RES power generation.

**CURRENT SITUATION**

Table 3 shows the RES installed capacity as of 2014. Many of the wind, photovoltaic, and biomass power projects were implemented in the framework of GENREN. There are also some other joint initiatives between the provinces and national agencies, such as the Arauco Wind Farm, which are projects carried out by the national and provincial governments, with schemes quite similar to those seen in the GENREN projects, with 15-year contracts and a rate of 126.46 dollars/MWh (Villalonga, 2013: 38). In some cases, the role of foreign financing, although still minimal, has been fundamental, such as for the Diadema Wind Farm. Despite this situation, five years after the launch of the GENREN program, only 130 MW of the 754 wind power MW (17%); 7.2 MW of the 20 photovoltaic MW (36%); 1 MW of biogas and 1 MW of SHP are actually up and running.

Although small, low-power wind facilities are not included in the table, Argentina does have an important history with the installation of multi-bladed mills, particularly in the agricultural zone of the humid pampas. Nor does it include the installed capacity of the framework of PERMER, whose direct beneficiaries, according to the Ministry of Energy, amount to 27,422 households (23,456 solar, 1,615 wind, and 2,351 through mini networks), 1,894 schools, and 361 public utilities with electricity; 307 solar thermal systems, and 188 water pump solar systems.

Table 3. Total Current Installed Capacity

<i>Source</i>	<i>Projects (#)</i>	<i>Capacity (MW)</i>
Wind	8	166.8
SHP*	32	284.4
Photovoltaic	5	28.8
Biofuel	2	18.6
Total	47	498.6

\*Includes all SHPs with less than 30 MW pursuant to the definition in Law 26.190.

Source: Created by the authors based on information from REEEP/SE/FB (2009), the Ministry of Energy, CAMMESA, and various journalistic sources.

## FINAL REFLECTIONS

Despite the fact that Argentina enjoys high potential for generating power with RES and despite having implemented various policies and programs over the past decade, Argentina still has a very low degree of RES development. Only 498 MW correspond to RES, as compared to total installed capacity of 31,001 MW. Only 1.3% of the total demand on the WEM in 2013 was covered by RES. As has been discussed through this paper, this situation is largely due to the environmental or contextual conditions surrounding the energy policy. Factors related to *governance*, in particular, the lack of political will and weak regulatory frameworks, as well as *economic and financial aspects*, continue to constitute the main limitations for the sector.

Initially, the push for renewable energies in Argentina ran up against the barrier of profitability, which the policies introduced in laws 25.019 and 26.190 failed to remove, mainly due to the economic and political context in which these regulations were implemented. This situation was maintained throughout the 1990s in the convertibility era, due to low prices in dollars for thermal generation, and was solidified in the post-convertibility period with the freezing of energy prices and the high subsidies given to the energy sector. For example, in a study conducted to assess the profitability of wind power projects in Argentina under existing incentive schemes, the principal problem resided in the low prices of thermal generation and high levels of surcharges established (Recalde, 2010: 5911-5973). As a result, the indicators used in this study to assess the profitability of investment would only produce satisfactory results if the base price of thermal generation were three times its value. However, the barrier related to the profitability of projects seems to have been overcome with GENREN, as each of the projects gains access to a fixed-price contract in dollars, set on a project by project basis.

However, financing the investments continues to be the principal challenge. The country has been subject to a dearth of foreign financing, which constitutes the majority of the funding supply for this type of project. This has been evidenced both in the reduced funding made available by the WB for PERMER in 2003, as well as the lack of financing facing many of the awardees of the GENREN contracts in recent times. The participation of the BICE in the total funding of the investments required has been low and insufficient to leverage financing from the commercial banks. Additionally, low energy prices and the intervention in the energy sector have had a negative impact on the incentives of private agents, their guarantees, and the funding supply for the sector. A combination of environmental conditions (national and international) have made it so that even with the development of instruments to reduce the impact of the economic and financing barrier, the country has not been able to substantially develop RES.

As such, one of the principal conclusions of this paper is that beyond the policy developed and the instruments selected, it is fundamental that the framework be conducive to the policy. This framework encompasses aspects tied to the overall macroeconomic situation, such as inflation, and political/institutional factors such as legal security, among others. Even within the energy sector, the workings of the wholesale market, subsidized prices, the absence of a long-term policy and planning, are all environmental elements that affect the decisions made by actors in the renewable energy source arena. Likewise, perhaps influenced by these environmental



conditions, the rationality of actors and the mechanisms implemented that do not require those who bid on a tender to present a guarantee of the availability of the resources in order to carry out their projects are all additional aspects that factor in to explaining the fact that many of the expectations placed in these programs have not been met.

It will be essential to recognize how important these contextual conditions are for energy policy in Argentina. It will thus be necessary to keep these conditions in mind when designing strategies to promote renewable energy sources, making it easier to select the right instruments to improve their performance, and taking into account the possibility of implementing government policies to modify those conditions that restrict the potential of the energy policies, as well as other national development policies.

## ACKNOWLEDGEMENTS

The authors would like to thank the anonymous reviewers for their comments and contributions, which were very important in improving the quality of this paper.

The opinions expressed in this paper are wholly and exclusively the responsibility of the authors, and do not necessarily reflect the opinion of the institutions to which they belong, and therefore do not implicate these institutions.

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<sup>2</sup> Capital flight between 1998 and 2001 amounted to 6.4 billion dollars a year, massively destabilizing the sustainability of the national economy (Barrera, 2014: 147-152).

<sup>3</sup> When De la Rúa stepped down, the President of the Senate, Federico Ramón Puerta, took his place. Three days later, the Constituent Assembly convened to elect Adolfo Rodríguez Saa as temporary president, but he resigned on December 30, 2011. The president of the Chamber of Deputies, Eduardo Oscar Camaño, then stepped in, who was later replaced by Duhalde.

<sup>4</sup> Inequality as measured by the Gini index rose at the end of the 1990s and the beginning of the 2000s. The Gini index in 1997 was 0.530, increasing to 0.560 (2001) and 0.578 (2002), to later fall significantly at the end of the decade and the start of the next: 0.509 (2010) and 0.475 (2012).

<sup>5</sup> Between 2004 and 2007, it represented approximately 51% of the domestic primary energy supply.

<sup>6</sup> Initially, this situation was due to high levels of extraction in the decade prior, but the problem quickly escalated as energy prices fell.

<sup>7</sup> The Renewable Energy Trust Fund (managed by the Federal Electrical Energy Council) is funded by a specific tax stipulated in the framework of the Electricity Regulation Framework Act (Law N°24.065). Pursuant to this regulation, the tax specified rose by up to 0.3 Argentine pesos per MW/hour set by the Ministry of Energy.

<sup>8</sup> The average exchange rate at the time the law was approved was 3.10 pesos to the dollar, but it rose to 8.47 by September 2014.

<sup>9</sup> In July 2014, the market price in the WEM was 120 Argentine pesos, while the average marginal cost per day was 1,729 pesos per MWh.

<sup>10</sup> According to the Ministry of Economy and Public Finances, in 2003-2007, current transfers rose 21%, while in 2008-2013, they rose 221.5%. According to estimates from the Professional Council for the Economic Sciences, in 2013, 61% of current transfers to companies were related to Energy Sector transfers, while subsidies for the sector rose from 41% to 61% in 2006-2013.

<sup>11</sup> Some of the debate regarding this recovery and the need for access to foreign investment should be understood in the framework of the new context following the discovery of non-conventional hydrocarbon reserves. For a full explanation, see Di Sbroiavacca (2013).

<sup>12</sup> It would be useful to draw a brief comparison between the the cost of generating power with RES and the cost of generating power with older technologies in the national electricity system. However, this comparison is difficult to do, given the fact that prices and costs are currently distorted in the Argentine electricity system, and the cost of generating power with thermal technologies is extremely wide-ranging in Argentina. In that sense, the cost of generation with conventional technologies ranges from 20 dollars/MWh to 200 dollars/MWh, depending on whether the fuel used is national natural gas or a different fuel (imported fuel prompts the highest cost). This generation cost could be compared with the prices obtained for the aforementioned renewable energy projects, but we must avoid making the mistake of considering these prices to be the cost of generation, because these prices include an expected profit on the investment and other tax components. For a more in-depth discussion regarding the costs of generation, see: Schmidt (2013) or the information published by the Argentine Renewable Energy Chamber (CADER) and by the

Ministry of Energy.

<sup>13</sup> In May 2014, the government made an agreement with the Paris Club, so it is likely that this situation will improve in the near future.

<sup>14</sup> Rosi (2013): "*Energía verde: fracasó el plan de ENARSA y habrá nuevas licitaciones*," *Diario Clarín* 08/12/2013.

<sup>15</sup> "*Cada vez es más barato generar energía eólica en la región*," in *Revista Nuevas Energías*, num. 7.