

## Renewable Energies: The Role of Regulatory Institutions to Promote the Use of Alternative Sources

Energías renovables: el papel de las instituciones reguladoras para promover el uso de fuentes alternativas

Camilo Andrés Rodríguez Borda<sup>1</sup> y Laura Milena Echeverri Martínez<sup>2</sup>

**Copyright:** © 2019 Revista Internacional de Cooperación y Desarrollo.

La Revista Internacional de Cooperación y Desarrollo proporciona acceso abierto a todos sus contenidos bajo los términos de la [licencia creative commons](#) Atribución–NoComercial–SinDerivar 4.0 Internacional (CC BY-NC-ND 4.0)

**Tipo de artículo:** Resultado de Investigación

**Recibido:** febrero de 2019

**Revisado:** marzo de 2019

**Aceptado:** mayo de 2019

### Autores

<sup>1</sup> Profesional en Ciencias Políticas, Especialización en Gobierno y Políticas Públicas, Magíster en Planificación y Administración del Desarrollo Regional. Profesor del Programa de Relaciones Internacionales y Estudios Políticos de la Universidad Militar Nueva Granada sede Cajicá. Director del Proyecto INV-EES-2588 "Instituciones y regulación de la integración energética europea 2010–2017".

Correo institucional: [camilo.rodriguez@unimilitar.edu.co](mailto:camilo.rodriguez@unimilitar.edu.co)

Código ORCID: 0000-0002-6222-8006.

Enlace perfil Google Scholar: <https://scholar.google.com/citations?user=l3h33LkAAAA&hl=es>

<sup>2</sup> Profesional en Relaciones Internacionales y Estudios Políticos Cum Laude de la Universidad Militar Nueva Granada.

Asistente de Investigación del proyecto de investigación "Instituciones y regulación de la integración energética europea 2010–2017" con código INV-EES-2588 de la Universidad Militar Nueva Granada.

Correo institucional: [u0901591@unimilitar.edu.co](mailto:u0901591@unimilitar.edu.co)

Código ORCID: 0000-0002-1621-9440.

Enlace perfil Google Scholar: [https://scholar.google.es/citations?view\\_op=list\\_works&hl=e&s&user=syv6j7MAAAA](https://scholar.google.es/citations?view_op=list_works&hl=e&s&user=syv6j7MAAAA)

### Cómo citar:

Rodríguez, C. y Echeverri, L. (2019). Renewable Energies: The Role of Regulatory Institutions to Promote the Use of Alternative Sources. *Revista Internacional de Cooperación y Desarrollo*. 6(1). 44-59

DOI 10.21500/23825014.3937

### Abstract

The use of renewable energies is an issue that has been gaining relevance in recent years, of course due to its environmental importance, but also because of the political, economic and social impact that the use of new energy sources entails. Institutions are essential actors to promote the role of these energies in conventional matrices, so it is worth asking what the institutional role of the regulatory body in this case in Colombia is to promote the use of renewable energy. To answer this question, a comparative method is used, considering the institutional behavior of the regulatory body in France, which allows to recognize, from two subjects who are theoretically similar, the scope of these. As a result, the two regulatory actors are identified, and both fulfill the function of building policies and making recommendations in the energy scenario. But while in France, the Energy Regulation Commission is also responsible for the creation of strategies and projects that allow the implementation of the new energies; in Colombia the Energy and Gas Regulation Commission does not fulfill these functions, which are the responsibility of the Mining and Energy Planning Unit; which may represent an advantage or a disadvantage for the energy sector.

**Keywords:** Alternative energies, renewable energies, public institutions, energy regulator.

### Resumen

El uso de energías renovables es una cuestión que ha venido cobrando relevancia en los últimos años por supuesto por su importancia ambiental, pero también por el impacto político, económico y social que conlleva el uso de nuevas fuentes energéticas. Las instituciones son actores esenciales para impulsar el papel de estas energías en las matrices de carácter convencional, por lo que vale la pena preguntarse cuál es el papel institucional del ente regulador, en este caso en Colombia, para impulsar el uso de energías renovables. Para contestar dicha pregunta, se usa un método comparativo, teniendo en cuenta el comportamiento institucional del organismo regulador en Francia, que permita reconocer, desde dos sujetos que en teoría son similares, los alcances de estos. Como resultado más importante, se identifican los dos actores reguladores, y que ambos cumplen con la función de construir políticas y hacer recomendaciones en el escenario energético. Pero mientras en Francia, la Comisión de Regulación Energética también se encarga de la creación de estrategias y proyectos que permitan la implementación de las nuevas energías; en Colombia la Comisión de Regulación de Energía y Gas no cumple estas funciones, que son responsabilidad de la Unidad de Planeación Minero Energética; lo que puede representar una ventaja o una desventaja para el sector energético.

**Palabras clave:** Energías alternativas, energías renovables, instituciones públicas, regulador energético.

\* Este artículo es fruto de la Investigación INV-EES-2588 financiada por la Vicerrectoría de Investigaciones de la Universidad Militar Nueva Granada (Cajicá – Colombia) en el año 2018.



## I. Introduction

At a global level, energy represents the capacity for the functioning of the processes of all the actors. It is an indispensable resource for important issues such as the work of multinational industries, even everyday needs such as turning on electronic devices in homes or using means of transport; all the above are functions that require energy. This reflects the dependence that exists towards the energy sector, and therefore, for its use in almost all the scenarios where man develops and its social, political, economic or cultural developments; energy has become one of the main factors in issues of environmental damage.

The use of different types of energies has accompanied man through his process of evolution and has allowed him to achieve objectives at every step. Currently, this resource generates the highest levels of pollution on the environment, mainly the so-called conventional energies. A brief review of the changes that have arisen in the energy sector allow the understanding of the scope of this, in ecological terms.

At first it is possible to refer to the use of fire to fulfill simple tasks, just when man began to become a social being. Agriculture became a conjunctural factor to look for sources of energy that facilitated the development of such activities; an example of this was the use of animal traction and the subsequent emergence of hydraulic energy. During the fourteenth century, the use of wind as a source also appeared, and in Britain, in the 16th century, coal emerged as a mineral energy base; being so powerful, that led to the Industrial Revolution and still remains as an energy generator (Pacheco & Melo, 2015).

For its part, electricity, gas and oil, are in force a little more than 150 years ago by the public and private sectors. What proves two things: The great advances that have allowed its use, due to the power they ge-

nerate, energetically speaking, and the extent of their damage, because the negative effects are incomparable with any other time, and very little time has passed since its implementation.

But, defining a new type of energy:

Towards the decade of the 1970s, renewable energies were considered an alternative to traditional energies, both for their present and future guaranteed availability, unlike fossil fuels that require thousands of years for their formation, as well as for their lower environmental impact on the case of clean energies, and for this reason they were called alternative energies (Garrido, 2012, p.4).

This type of energy, although it does not solve the problem of environmental damage, does drastically reduce the negative consequences generated by conventional sources, mainly minerals (oil, coal). To promote this new energy path, it is necessary to improve the environment in the short, medium and long term; and those who could lead the initiatives of change, are the institutions.

Institutions represent an inherent factor in the behavior of the actors that interact in any context, and the energy sector does not remain outside. Its changes and progress depend on the behaviors, organizations, decisions and structures that participate in the international system. It is important to clarify that when reference is made to the global environment in terms of energy, it is because the impacts on the environment reach all corners of the planet and do not discriminate in their effects.

The theory that facilitates understanding the role played by institutions in the new energy models and the environmental needs that require actions, is neo-institutionalism. This current understands the institutions "as political actors that, having to act

with coherence and autonomy, make decisions and execute them” (Trigo, 2016, p.226), therefore, not only includes all the participants, demonstrating that the actions of each one has important implications; it also characterizes them as autonomous and adds them as an actor in themselves.

Institutions allow governance, recognizing that they must transform the demands of citizens into policies and orientations, of a formal and informal nature. The interest of an institution is to satisfy the needs of each actor of the system and to achieve its interaction with other systems (Meléndez & Maldonado, 2014). In this case specifically, the focus will be on the energy regulatory bodies, that is, the organizations of each State, in charge of controlling, monitoring and facing multiple situations that surround the energy context in each territory.

Responding to the definition of the neo-institutionalist perspective granted to the institutions, which includes formal and informal rules and the interference they have as actors of the system, the characteristics of the Energy Regulation Commission (CRE) in France are taken into account, with respect to the behavior of the Energy and Gas Regulation Commission (CREG) in Colombia, conducting a comparative exercise to identify the institutional role of the regulatory body in promoting the use of renewable energies in Colombia.

The intention to carry out a study of this type is, on the one hand, to claim the role of institutions in a subject such as renewable energy, which in many cases be something of non-profit organizations or non-governmental organizations. And on the other, to determine the strengths and weaknesses of the regulatory system in Colombia, using as a tool the comparison with France, a State that is in the region with the greatest energy gains.

## II. Method

The deductive method is used (Lafuente y Marín, 2008) and the comparative (Ariza & Gandini, 2012), in which, from neo-institutionalism, similar and different conditions and results are identified and explained, among similar units. This type of research is framed in a qualitative environment, where although variables are identified, they are not of a numerical nature and the description and analysis of the actors is required.

In the sense of the variables, two are identified: The Energy Regulation Commission (CRE) in France and the Commission for the Regulation of Energy and Gas (CREG) in Colombia, against the phenomenon of renewable energies, in the context of the implications and institutional scope. The pretention is that, from this environment, compare aspects, recognize the positive and improve the negative ones.

The research process is developed from a descriptive-explanatory approach where, from the description of the variables, line of interconnection, similarities and differences emerge; and the arguments that allow its understanding are exposed. Knowing the structure of the regulatory bodies, their regulations and influence factors allow the generation of conclusions and recommendations for Colombia, on a greater or lesser institutional insertion in renewable energy issues.

It is a secondary investigation that is born from previous studies, through historical resources, bibliographic review and analysis of the relevance of the sources (Garcés & Duque, 2007). Due to the above, it is of a bibliographic nature, where when making a documentary review of the two regulatory commissions, the situation of renewable energies is known through the search, collection, organization, evaluation and analysis of sources. It is a study in turn oriented to decisions that seek to propose ways to strengthen new sources of energy,

and is longitudinal, to analyze the evolution of the commissions since its inception, and the advances that may exist in the framework of clean energy.

The two subjects mentioned above will be studied, the CRE in France and the CREG in Colombia; within the context of the energy situation in both States, and of course its internal functioning and if there are initiatives of a renewable nature in terms of energy at the institutional level; thus, arriving to establish the long road that remains to be covered in this subject.

### III. Results

#### Energy sector in Colombia

The energy sector in Colombia is divided into three components: the generation, transmission and commercialization of energy. First, energy is produced, connected to the National Interconnected System, transmitted through the transportation of energy through the National Transmission System (STN) and the commercialization consisting of the purchase of energy in the wholesale market and its sale to users final ([Grupo Energía Bogotá, 2018](#)).

In the eighties, the National Planning Department decided to carry out a diagnosis through the National Energy Study and then the National Energy Commission was created. Initiatives such as the National Energy Plan 1994 - 2008 and the Sustainable Energy Self-sufficiency Plan were also developed, addressing issues such as efficient demand management and rational use of energy, full and efficient supply, the arrival of energy in rural areas, the improvement and conservation of environmental quality, the promotion of research and development ([Unidad de Planeación Minero Energética, 2015](#)).

The Integral Energy Strategy Vision 2003 - 2020 also emerged, seeking to extend the market to all types of energy generators,

efficient use and energy sufficiency, and the Context and Strategies 2006 - 2025 to maximize the contribution of the energy sector to the sustainable development of the country. As common themes in the plans are: Security of supply, diversification of suppliers, reliability, quality of service, coverage of demand, affordability to service, social equity, universalization of service, costs of energy, the ability to pay, the impacts of infrastructure works, the mitigation of environmental impacts and the negative effects of climate change, energy efficiency, renewable energies, low CO<sub>2</sub> emissions, the reduction of vulnerability, the generation of value in infrastructure works and the reduction of negative effects on communities ([Unidad de Planeación Minero Energética, 2015](#)).

Regarding the regulatory framework, Laws 142 and 143 of 1994 allowed the participation of the private sector in the entire electricity value chain (generation, transmission, commercialization, distribution), the exclusion of the State from the behavior of public enterprises, make them responsible for their losses and profits, the generation of a wholesale energy market, the creation of the Energy and Gas Regulation Commission (CREG) to stimulate and ensure competitive results in all segments of the value chain, regulated monopolies natural transmission and distribution to discipline costs and improve the quality of service, among others ([Benavides, 2016](#)). In addition, Law 629 of 2000 is defined to approve the Kyoto Protocol and Law 697 of 2001, which promotes the rational and efficient use of energy and the use of alternative alternatives.

With regard to renewable energies, Law 1715 of 2014 arises, which "has as its main purpose to promote and regulate the integration of non-conventional renewable energies to the National Energy System, in order to support and strengthen the supply

to the national energy demand” (Escobar & Quitian, 2015, p.7). This provides economic incentives for those who decide to invest in the subject, such as decreasing the income tax by 50% up to five years, exemption from VAT and import taxes on resources required for the construction and implementation of renewable energy projects (Florez, 2015).

For the regulation of this law, Decree 0570 of 2018 was proposed, which establishes the rules for the long-term contracting

of energy generation projects with non-renewable sources, creating the conditions for the projects to be viable over time and can be connected to the national energy system, “allowing its share of market production to go from less than the current two percent to 10 or 15 percent at around five years (2023)” improving the supply and tariffs for consumers. Next, a brief synthesis of the Colombian normativity is made in energy terms:

Table 1  
*Energy regulations in Colombia*

Energy regulations in Colombia	
Regulation	Function
National Energy Study	Understand the situation of the energy sector in Colombia during the 80s.
Integral Energy Strategy Vision 2003 - 2020	Seeking to extend the market to all types of energy generators, efficient use and energy sufficiency
Context and Strategies 2006 - 2025	Maximize the contribution of the energy sector to the sustainable development of the country
Laws 142 and 143 of 1994	Allowed the participation of the private sector in the entire electricity value chain (generation, transmission, commercialization, distribution), the exclusion of the State from the behavior of public enterprises, make them responsible for their losses and profits, the generation of a wholesale energy market and the creation of the Energy and Gas Regulation Commission (CREG).
Law 629 of 2000	Defined to approve the Kyoto Protocol
Law 697 of 2001	Promotes the rational and efficient use of energy and the use of alternative alternatives.
Law 1715 of 2014	Promote and regulate the integration of non-conventional renewable energies to the National Energy System, in order to support and strengthen the supply to the national energy demand
Decree 0570 of 2018	Establishes the rules for the long-term contracting of energy generation projects with non-renewable sources

Note: Own elaboration with the information consulted in the article

Currently, Colombian energy bases its operation on the hydroelectric sector with 70% of the total energy generated, represented by the dams located in the country, mainly in the Andean region. Among them, ten of the most generated are Central Hydroelectric I of the Bogotá River and the Pagua Hydroelectric Generation Chain, located between the municipalities of San Antonio del Tequendama, Soacha and Mesitas del Colegio, in Cundinamarca. The

Guavio Hydroelectric Plant in Gachalá, Junín, Ubalá, Guasca, Gacheta and Gama, the Chivor Hydroelectric Plant, between Chivor, Garagoa, Guateque, Somondoco and Tenza, in Boyacá (El Tiempo, 2018).

Further north, all in the department of Antioquia, are the San Carlos Hydroelectric Power Plant, in San Carlos, the Guatapé Power Plant between El Peñol, Alejandría, Marinilla, Concepción, Guatapé and San Vicente; the Guatapé Hydroelectric Complex

- Playas, the Ituango Pescadero Hydroelectric Project in Ituango, Toledo, Briceño, Peque, Sabanalarga and Buriticá; the Porce III Hydroelectric Exploitation located in the municipalities of Amalfi, Guadalupe and

Anorí; and the Espíritu Santo Hydroelectric Project that is located between the municipalities of Ituango, Briceño and Valdivia (El Tiempo, 2018).

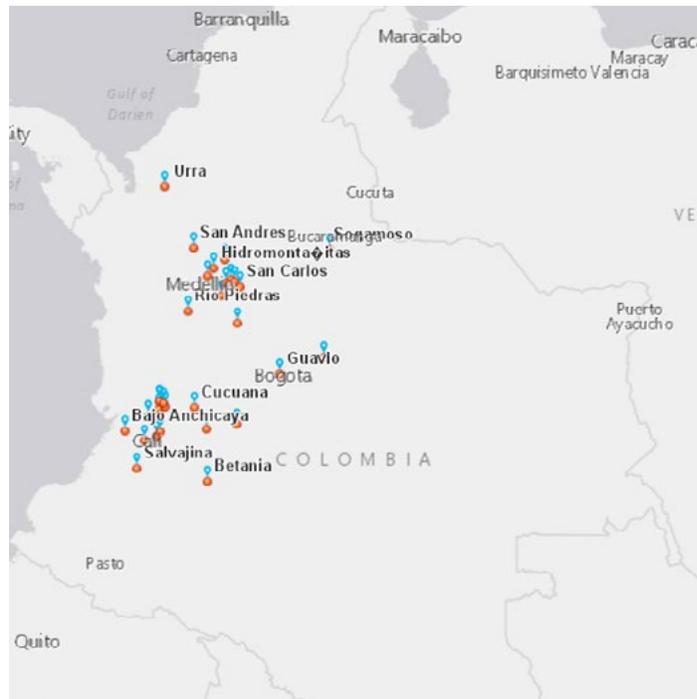


Figure 1: Map of Colombia's main hydroelectric power stations, created with the purpose of visualizing the geographic location of each of the hydroelectric projects that generate energy in Colombia (Arcgis, 2018).

From the geographic location of these structures, it is identified that there is a great centralization of the resource that, although it is understandable from the location of the Magdalena and Cauca River, could be planted with respect to the feasibility of making this type of investment in other tributaries of the country. If Colombia wants to continue investing in hydroelectric energy.

The thermoelectric is the second source of energy generation, being the most polluting, since it uses the heat of combustion of oil, gas or coal and liquid fuels (González, 2015). Since the percentage of hydroelectric energy use is so high, the country is at very high risk due to the climatic phenomena that cause long periods of drought and the

damming of rivers, so the dependence on this source has become a vulnerability.

The Jepírachi Wind Farm, in La Guajira, launched in 2000 by Empresas Públicas de Medellín (EPM), pioneered the use of wind power. But EPM is not the only one, Isagén, plans to develop three projects in La Guajira. On the other hand, solar energy also arouses interest in the country. The Mining and Energy Planning Unit has records to build 160 solar plants and roofs, with Valle del Cauca (34), Atlántico (19), Cundinamarca (15), Cesar (14) and Santander (11) the departments with the most projects. In geothermal energy there is a registry in Caldas, the Ruiz volcanic massif project, developed by Isagén.

It is time to specifically enter the issue of the regulatory body in Colombia. The Energy and Gas Regulation Commission (CREG) is:

A Colombian state agency, dedicated to regulating the activities of provision of home public services related to electricity, natural gas, liquefied petroleum gas (LPG) and liquid fuels, with the aim of ensuring that such services are provided to the greatest possible number of people, at the lowest cost and balancing the compensation for the companies providing quality, coverage and expansion (Creangel, 2016).

As mentioned above, this institution was created in 1994 through laws 142 and 143. Through these, a significant number of functions were assigned to this commission, such as:

- ▶ Regulating monopolies in the provision of public services when the competition is not possible,
- ▶ Promote competition among those who provide public services, create the conditions to ensure the availability of an efficient energy supply,
- ▶ Set quality standards in the provision of the service,
- ▶ Resolve conflicts that arise between companies,
- ▶ Give a concept about the legality of the uniform conditions of public service contracts submitted for their consideration,
- ▶ Establish methodologies and formulas for setting the tariffs for public services of electricity, natural gas and propane,
- ▶ Determine for each public service the units of what is the value of the public service company public funds are defined, in accordance with the parameters defined in the law,
- ▶ Prevent public utility companies from adopting agreements to free competition,

- ▶ Request that investigations be carried out and impose sanctions of their and in accordance with the law, general criteria on the abuse of a dominant position and the protection of the rights of users (Comisión de Regulación de Energía y Gas, 2018).

It is important to clarify that in addition to those mentioned above, there is an even larger number of functions that CREG fulfills.

This organ fulfills its role as regulator through resolutions on the sectors that are established in its functions. There is a significant number of them, but regarding renewable energies it is possible to speak of two. On the one hand, the Single Resolution of Regulation of the Electricity Sector, established on December 12, 2017, in which the provisions on generation, transmission, distribution and commercialization of energy are adopted in Colombia; besides the component of planning, coordination, supervision and control, the guarantees of all the participants, the code of measurement, the remunerations and audits, the non-interconnected zones (Comisión de Regulación de Energía y gas, 2017).

On the other hand, although it is not yet a resolution, in 2016 the six pillars of CREG were established to work on renewable energies, all based on Law 1715 of 2014. The six points are large-scale self-generation, small-scale self-generation scale, the participation of wind and solar energy in the Wholesale Energy Market, smaller plants, non-interconnected areas and biogas. The Commission has issued some more specific resolutions such as 088 of 2012, 004 of 2014 and 024 of 2015 (Comisión de Regulación de Energía y Gas, 2016).

### Energy sector in France

As the intention is to make a comparative exercise to learn the lessons of regulation on renewable energies, it is time to study

the French regulator. The Energy Regulatory Commission of France (CRE) is an independent administrative authority created on 24 March 2000 with the aim of ensuring that the electricity and gas markets in France operate smoothly, for the benefit of final consumers and consumers according to the objectives of the energy policy ([Comission de Regulation de L'Energie, 2018](#)).

Its functions have been evolving. In 2000 they were exclusively dedicated to proposing tariffs for the use of networks, giving their opinion on regulated electricity tariffs, evaluating charges for public service, organizing tenders for renewable energies and resolving disputes related to access to the network. For 2006 it controls the wholesale electricity and gas markets. In 2010, it monitored the wholesale CO<sub>2</sub> markets and implemented ARENH (right of access to nuclear energy) and the capacity mechanism. In 2011, it establishes tariffs for using the networks, certifies transmission system operators and gives approval for the deployment of the Linky and Gazpar meters. In 2015 they allow him to take 13 new roles in accordance with the Law of “Energy Transition” (regulation of gas storage, testing of smart grids, etc.) and can audit the information gathered in the course of his work, with the companies covering the costs. In recent years, it has proposed regulated electricity tariffs (“blue tariffs”) and regulates the storage of gas under the “Hydrocarbons” Law ([Comission de Regulation de L'Energie, 2018](#)).

The entity is participatory in the construction of the European internal energy market, contributing to the smooth functioning of the electricity and natural gas markets, for the benefit of final consumers; regulating the networks for gas and electricity, establishes tariffs and guarantees that they do not give an undue advantage to any user; ensuring that consumers are properly informed and implementing certain me-

chanisms to support renewable energies, by organizing bidding processes ([Comission de Regulation de L'Energie, 2018](#)). One of the most valuable strategies used by the CRE is the Foresight Committee.

The committee intends that all stakeholders in the energy industry come together to adopt an approach that addresses two key challenges, ensuring the success of the energy transition and capitalizing on the digital revolution to benefit all consumers of electricity and gas. Regarding the energy transition to cleaner energies, it is considered essential to understand, deconstruct and assume all the industrial, social and economic challenges involved and their implications, among them the most important ones for Europe in general, and France in particular; decrease carbon dioxide emissions and eliminate nuclear energy. In addition, the production costs of certain forms of renewable energy are decreasing. For its part, the digital revolution seeks the creation of new tools: change the way of production and the use of resources, where the whole chain is improved: from the most affordable renewable generation, thanks to advances in storage technology, to more power for consumers with possibilities to manage energy consumption (and production), with strategies such as self-consumption ([Comission de Regulation de L'Energie, 2018](#)).

The French Commission defines renewable energy sources as environmental, solar, geothermal, thermal, hydrothermal, marine and hydraulic energy ([Comission de Régulation de L'Énergie, 2018](#)). And since the European Union decided, through the 2020 Energy-Climate Package (established in 2007) and the 2030 Climate-Energy Package (adopted in 2017), to create important objectives related to the reduction of greenhouse gas emissions greenhouse and energy efficiency, to achieve at least 20% renewable energy in its energy mix in 2020

and at least 27% in 2030, France has set more ambitious targets.

With a target of 23% of renewable energies in the final energy consumption for 2020 (adopted in the framework of the Grenelle Environment Forum in 2009) and a target of 32% by 2030 (included in the Law on Energy Transition for Green Growth (LTECV) adopted in 2015), France also opted to convert this latter objective into specific objectives: 40% of electricity production, 38% of final heat consumption, 15% of final fuel consumption and 10% of total gas energy consumption (Comission de Régulation de L'Énergie, 2018).

Planned by the Law on the Energy Transition for Green Growth, LTECV, a first Multiannual Energy Program (EPP) is being carried out from 2016 to 2023 with the established objectives, through a specific roadmap for energy sources. A new PEP is being developed to continue until 2028 and the PEP is expected to be reviewed every 5 years. With the intention of achieving the established objectives, Francia identified that the institutional support tools are necessary for the deployment of renewable energies in order to eliminate technological or technical-economic obstacles. Thus, renewable energies benefit from state support either in the field of research and development, or in the industrialization phase. Specifically, the frameworks to support renewable energies and cogeneration, on the one hand, and renewable gas, on the other, for which CRE has an experience.

### III. Discussion

From the identification of the actors, it is important to see what has been applied to the context and has become palpable in the french and colombian reality, that is, how the normativity has taken shape and what the true scope of the institutionality is.

### Energy regulation and renewable energies in France

The multi-annual energy program (PEP) as a tool to direct energy policy, created by the law of energy transition for green growth has among its main components security of supply, improvement of energy efficiency, reduction of energy consumption primary, especially the consumption of fossil fuels; the exploitation of renewable energies, storage, the transformation of energy and the management of energy demand, the promotion of local energy production, the development of smart grids and self-production; the strategy of development of clean mobility; the preservation of consumer purchasing power, the competitiveness of energy prices, and the assessment of the needs of professional skills in the field of energy (Minestère de la Transition écologique et solidaire, 2018).

To meet the objectives of the PEP, France has plans, strategies and programs such as: The hydrogen deployment plan, presented on June 1, 2018 by the Minister of Ecological and Solidarity Transition, where the decarbonization of industrial hydrogen is established: 10% for 2023 and 20 to 40% for 2028; the development of hydrogen mobility with particular deployment in the transport sector, 5,000 light vehicles, 200 heavy vehicles (buses, trucks, TER, ships) and the construction of 100 distribution stations by 2023, from 20,000 to 50,000 vehicles light commercial vehicles, 800 to 2000 heavy vehicles and 400 to 1000 stations by 2028; and the mobilization of 100 million euros in 2019 to allow the deployment of the hydrogen sector (Minestère de la Transition écologique et solidaire, 2018).

On the other hand, the CRE has established programs such as support systems for renewable energies and cogeneration in order to better control budget burdens and to comply with the European regulatory framework. In this case, methods such as fi-

nancial assistance and advice to any sustainable electric power installation are used, in addition to guaranteeing the purchase of energy or an additional remuneration to generators, which guarantees the profitability of renewable energy projects. Regarding gas, biogas plants (including those supported by a wastewater treatment plant) and non-hazardous waste storage facilities can benefit from a 15-year purchase agreement, where they are purchased by a natural gas supplier at a purchase price fixed per order and intended to cover the investment and operating costs of production facilities (Commission de Régulation De L'Energie, 2018).

Regarding the support to the generation of renewable electricity, the total cost of assistance to produce renewable electricity represents 5,315 million euros, 68% of all charges for public energy services for 2019. This amount increases by 5% in comparison with the forecast for the year 2018 (€ 5,047 million) and 16% compared to the charges registered for the year 2017 (€ 4,596 million). This increase is mainly due to the continued development of electricity production lines from renewable energies, in particular, the photovoltaic (2,874 million euros) and wind energy (1,333 million euros). These two sectors will represent respectively 54% and 25% of the support costs to produce renewable electricity in 2019 (Commission de Régulation De L'Energie, 2018).

In France, thanks also to the work of the CRE, there has been the integration of new technologies, through intelligent networks, which allow operators to make the network more adaptable, which increases the resistance of the electrical system, optimizes the reliability and quality of the electricity supply and facilitates the insertion into networks of new means of energy production, particularly from renewable sources (wind, solar) that are intermittent and decentralized; and for consumers, smart networks

make them real actors in the energy system, because they can control their consumption in real time and, if necessary, modify their behavior by playing an active role in the operation of the electrical system (Commission de Régulation De L'Energie, 2018).

Likewise, the regulatory body promotes self-consumption, that is, the possibility that a consumer produces all or part of their electricity consumption. This tool has allowed technological progress to increase the profitability of self-consumption (lower costs of photovoltaic panels and their installation, higher performance, lower storage costs and consumption management tools, among others). The increasing willingness of users to be responsible for their consumption, trying to control and reduce their consumption is a way of protecting themselves against the risk of future increases in the price of electricity; and public authorities encourage this practice: the law of February 24, 2017 that ratifies the ordinance of July 27, 2016 recognizes and supervises self-consumption and its users can benefit from renewable energy support mechanisms (purchase price and tenders). All these conditions allow the development in France of a self-consumption sector, still small, but growing strongly (Commission de Régulation De L'Energie, 2018).

The Commission for Energy Regulation in France promotes six types of renewable energy. Among these, wind energy is the one with the most important development potential today. In this sense, the Multiannual Energy Program foresees the sustained development of the French wind farm: 25,000 MW are planned in France, including 19,000 MW of land, by 2020 (representing 10% of the electricity mix). Regarding photovoltaic, as of June 30, 2011, it was estimated that the power of the entire French photovoltaic park connected to the network reached 1,676 MW, where 35% of the installations were located on the roof

of individual houses, 50 % in large ceilings such as collective housing, factories, commercial buildings, agricultural sheds or public buildings, and the remaining 15% are terrestrial power plants. A goal has been set to develop photovoltaic production capacity by 5,400 MW by 2020, but the pace of development of the photovoltaic park means that this goal will be achieved much earlier (Commission de Régulation de L'Energie, 2018). After the wind and photovoltaic, are the hydroelectric, biomass, thermodynamic solar and geothermal; that although they have not reached the levels of the first two; they are gaining ground in the French energy sector.

### Energy regulation and renewable energies in Colombia

In Colombia the case is very different. While in France the Energy Regulatory Commission proposes the policies and works with the government to make them a reality, in Colombia, while the Energy and Gas Regulation Commission proposes the policies, the one in charge of managing them and making them palpable is the Unit of Mining Energy Planning (UPME, by its initials in Spanish), where all renewable energy projects are subscribed and the program is built to introduce them into the national context.

The most recent advance of the CREC has been the regulation of small-scale self-generation, but it remains in this, in proposing the guidelines through resolutions, where the assembly of the necessary infrastructure and the development of the digital platform is sought. The respective procedures will be carried out. This compared to the French context sounds very similar, but it will be reflected below that the real problem is the implementation of policies, where while in France there are already generation figures collected by the CRE, in Colombia there is a long way to go.

In 2018 there was an announcement that caused joy to those interested in the development of renewable energies in Colombia: With the issuance of Resolutions 40791 and 40795, the green light was given so that “unconventional renewable energies become part of the System Interconnected National (SIN), and by the way are key tab in the generation matrix” (González, 2018), planning the start of auctions in the energy market in January 2019 and allow the award of contracts from 2022.

UPME has currently approved 340 renewable energy projects in July 2018, with 306 solar energy, 17 small hydroelectric plants, 10 biomass, six wind and one geothermal. For them to function and be inserted in the market, they must consider aspects such as the investment and financing mechanisms to obtain the tax benefits provided by law, the behavior and natural resources that will be used, the electric feasibility and the existence of networks. Until now, there seems to be a promising future, since they try to counteract problems such as the high costs of technologies and the lack of knowledge in the use and generation of energy from renewable sources.

But the optimistic vision did not last long. On the one hand, the scenario is not very encouraging for renewable energies, since the government decided to enter to compete with conventional energies, since buyers do not have much security in the purchase of renewable energies, there is no equality of conditions to compete, the proposed contracts are not viable from the financial point of view and for the banks it is not clear the guarantee and the risk of investing in them (Portafolio, 2018). In particular, there are multiple disadvantages for non-conventional generators as very short deadlines to recover investments, these new companies can be classified as high risk, so there will not be much attraction to invest in them, who agrees to buy can

be removed at any time, which can generate losses, conditions are demanded that for the new actors are difficult to fulfill and require time, from which companies with conventional energies that already have all the resources, among other complications, that would prevent the active participation that the country needs.

These critics to the integration of the renewable energies to the system in Colombia, generated that the same one was postponed; therefore, although apparently it seeks to favor companies that are interested in less polluting sources; it also represents a new delay in a topic that requires quick actions. And the problem is that the energy auction is scheduled for January 2, there is no exact date (González J, 2018), so that they can continue taking long affecting the energy issue in Colombia, with negative consequences at environmental and economic levels.

#### IV. Conclusions

From a general approach, first regarding the comparison between Colombia and France, it was important to do this exercise with a subject that institutionally, politically and administratively had a similar organization and hierarchy, to understand the role of institutions; but that in the same way the actor should go forward in renewable energy issues. The above in order to understand that the institutions and the work that is held within them to achieve the objectives of the actors is valuable; and what Colombia can learn institutionally speaking.

If the role of government is analyzed from the neoinstitutionalist concept proposed in this article, understood as the work of political actors who seek to transform the demands and needs of their citizens to be satisfied and achieve the most harmonious interaction of the system; the relevance of the institutions is undeniable.

This is because, responding to one of the biggest concerns on the global agenda today, environmental problems; institutions can become the only actors with the capacity in terms of resources to unite knowledge, monetary funds, initiatives and all social actors around a goal, in this specific case, the use of renewable energy. Therefore, it is in the will of the institutions to respond to the urgent requests to improve the quality of life through the search for friendly solutions with the planet; without losing in economic or political terms, trying to build a stable environment.

It can be stated that the institutions are fulfilling their essential function: Transform demands into policies. But this is not so simple, because although it has begun to consider the use of renewable energies in the construction of policies in France and Colombia, it denotes an abysmal difference between the fulfillment of these in both territories, for what it is worth going deeply into going beyond creating policies.

It is practically impossible to make a fair comparison in terms of results, that is, because from an essentially institutionalist approach, both States have regulatory entities, which seek to build resolutions that guide the energy performance of each country; the application in the national context is diametrically opposed; due to the great progress that France already has in renewable energies and the small steps that are taking place in Colombia, therefore, beyond allowing a comparison, it is better to take into account those lessons that can be applied in Colombia so that there is an advance, if not the speed of French, at least one that is notorious locally.

In France they have concise goals and there is great clarity about the advantages of renewable sources and it is understood that the participation of the public sector is indispensable for the formulation of the guidelines. And although, the regulator

of Colombia has more time since its creation, the most visible achievements are the French, it may be due to the pressure of the European Union, but progress is made. Colombia is going very slowly.

France is focused on the unification of energies, proposing projects and generating initiatives for the use of renewable energies, focusing of course on the new energies; but going further to encompass strategies that allow their integration into the market, such as certain subsidies, self-generation for self-consumption, the use of technologies that allow maximum use, such as smart grids, and maintains a prospective perspective, that is, it is always looking for solutions for possible future problems. The CRE has involved the energy stakeholders in a collective prospective action to face two challenges: to be successful in the energy transition and to put the digital revolution at the service of all electricity and gas consumers.

Although in Colombia one of the areas with the greatest investment potential is the renewable energy sector (La Opinión, 2018). In the country there are two distinct agencies, one that regulates and the other that plans, which may mean an advantage, as a more detailed approach to the objectives of each, but that may be a disadvantage to create dilemmas in the roads that they could become very different, because the same objectives are not sought. This reflects that joint work is needed, that is, while in France all sectors work so that each institution fulfills its functions; here all contradict and criticize the efforts of others.

## V. Recommendations

The European Commission has authorized public measures to support the production of electricity from renewable sources for self-consumption in France until 2020. The measure is designed to encourage the

production of renewable electricity by companies and individuals for self-consumption. The aid program has an initial budget of 200 million euros (Castañeda, 2018). It is clear that large investments are required, of course, but it is a sector that could represent benefits not only at an environmental level, but also as a new source of savings and investment, political at a regional level, technological as a gateway for innovation in energy issues, and social, because it could group many sectors to work for the same goal.

It would also be important to encourage the use of renewable energies with strategies that place them as a competitive actor, generating rules of the game that allow them to compete with the conventional energies so deeply rooted in Colombia, and that can support the energy generated by hydroelectric power plants that depending on the fluvial sources, they can destabilize in some moments and cause energetic havoc in Colombia.

Recognizing that the functions performed by CREG have been maintained since its creation in the nineties, it would be worthwhile to try to rethink some that adapt to today's scenario. What is the lesson that this means? That its foundation was around conventional sources of energy, so, in a context where renewables are becoming increasingly important and require constant work in them, it is necessary to assemble tools to the Colombian Regulatory Commission so that fall short in front of the window of opportunity of the introduction of alternative energies. It is unavoidable to evolve, as the Energy Regulation Commission has done in France, according to the needs that arise every day, of course without neglecting the assigned obligations, but it is a duty to not have anachronistic institutions and policies.

## VI. Bibliographical

- Arcgis. (1° de Junio de 2018). *Centrales Hidroeléctricas en Colombia*. Retrieved from ArcGis: <https://www.arcgis.com/home/webmap/viewer.html?webmap=5c03541b2e9d480686af5da8eabfd5c9>
- Ariza, M., & Gandini, L. (Enero de 2012). *El análisis comparativo cualitativo como estrategia metodológica*. Retrieved from ResearchGate: [https://www.researchgate.net/publication/262971953\\_El\\_analisis\\_comparativo\\_cualitativo\\_como\\_estrategia\\_metodologica?enrichId=rgreq-ece2710b21d890dbf005c2355ba50b73-XXX&enrichSource=Y292ZXJQYWdlOzIzMjk3MTk1MztBUzoxMDY1ODgyMDMzODg5M-jhAMTQwMjQyNDAxNjA1Mw%3D%3D](https://www.researchgate.net/publication/262971953_El_analisis_comparativo_cualitativo_como_estrategia_metodologica?enrichId=rgreq-ece2710b21d890dbf005c2355ba50b73-XXX&enrichSource=Y292ZXJQYWdlOzIzMjk3MTk1MztBUzoxMDY1ODgyMDMzODg5M-jhAMTQwMjQyNDAxNjA1Mw%3D%3D)
- Benavides, J. (20 de Junio de 2016). *Crisis eléctrica: reingeniería, so riesgo de sufrir un 'corto'*. Retrieved from Portafolio: <http://www.portafolio.co/analisis-sector-energetico-colombia-revista-portafolio-497783>
- Castañeda Carvajal, M. (25 de Octubre de 2018). *Europa autoriza una ayuda de 200 M€ para fomentar el autoconsumo en Francia*. Retrieved from Energy News: <https://www.energynews.es/autoconsumo-en-francia/>
- Comisión de Regulación de Energía y Gas. (22 de Junio de 2016). *Regulación de la CREG sobre energías renovables comprende seis grandes temas*. Retrieved from CREG: <http://www.creg.gov.co/index.php/es/noticias/1405-boletin26>
- Comisión de Regulación de Energía y Gas. (12 de Diciembre de 2017). *Resolución Única Energía*. Retrieved from CREG: <http://www.creg.gov.co/index.php/es/regulacion/resolucion-unica-energia>
- Comisión de Regulación de Energía y Gas. (2018). *Funciones del CREG*. Retrieved from CREG: <http://www.creg.gov.co/index.php/es/creg/quienes-somos/funciones?showall=1&limitstart=>
- Comission de Regulation de L'Energie. (2018). *Comission de Regulation de L'Energie*. Retrieved from Comission de Regulation de L'Energie: <https://www.cre.fr/en>
- Comission de Régulation de L'Énergie. (2018). *ÉNERGIE RENOUVELABLE*. Retrieved from CRE: <https://www.cre.fr/Pages-annexes/Glossaire/ENERGIE-RENOUVELABLE>
- Comission de Régulation de L'Énergie. (18 de Julio de 2018). *Objectifs de développement des énergies renouvelables*. Retrieved from CRE: <https://www.cre.fr/Transition-energetique-et-innovation-technologique/Soutien-a-la-production/Dispositifs-de-soutien-aux-EnR>
- Commission de Régulation De L'Energie. (12 de Junio de 2018). *Autoconsommation*. Retrieved from Commission de Régulation De L'Energie: <https://www.cre.fr/Transition-energetique-et-innovation-technologique/Autoconsommation>
- Commission de Régulation De L'Energie. (18 de Julio de 2018). *Dispositifs de soutien aux EnR*. Retrieved from Commission de Régulation De L'Energie: <https://www.cre.fr/Transition-energetique-et-innovation-technologique/Soutien-a-la-production/Dispositifs-de-soutien-aux-EnR>
- Commission de Régulation De L'Energie. (5 de Septiembre de 2018). *Financement du soutien aux EnR*. Retrieved from Commission de Régulation De L'Energie: <https://www.cre.fr/Transition-energetique-et-innovation-technologique/Soutien-a-la-production/Financement-du-soutien-aux-EnR>
- Commission de Régulation de L'Energie. (2018). *Présentation des énergies renouvelables électriques*. Retrieved from Smart Grids CRE: <http://www.smartgrids-cre.fr/index.php?p=integrationenr-presentation>
- Commission de Régulation De L'Energie. (12 de Junio de 2018). *Présentation des réseaux intelligents*. Retrieved from Com-

- mission de Régulation De L'Energie: <https://www.cre.fr/Transition-energetique-et-innovation-technologique/Re-seaux-intelligents/Presentation-des-re-seaux-intelligents>
- Creangel. (Enero de 2016). *¿Qué es la CREG?* Retrieved from Creangel: <http://portal.creangel.com/wp-content/uploads/2016/01/CREG.pdf>
- Economía La Opinión. (13 de Noviembre de 2018). *Colombia pide a Francia aumentar su inversión*. Retrieved from La Opinión: <https://www.laopinion.com.co/economia/colombia-pide-francia-aumentar-su-inversion-165728#OP>
- Economía y negocios. (12 de Enero de 2018). *Gobierno destraba generación de energía solar y eólica en el país*. Retrieved from Portafolio: <http://www.eltiempo.com/economia/sectores/decreto-permitira-generar-mas-energia-solar-y-eolica-en-colombia-170578>
- El Tiempo. (21 de Febrero de 2018). *Mapa: las 10 hidroeléctricas que más generan energía en Colombia*. Retrieved from El Tiempo: <https://www.eltiempo.com/colombia/otras-ciudades/mapa-de-las-hidroelectricas-que-mas-generan-energia-en-el-pais-185382>
- Escobar Caicedo, W. O., & Quitian Reyes, D. (2015). Impactos de la reglamentación de la Ley 1715 de energías renovables no convencionales en Colombia. *EFC Economgrafos*, 2-33.
- Florez Rojas, J. (2015). *Energías alternativas en Colombia bajo la Ley 1715*. Retrieved from Repositorio Universidad Militar Nueva Granada: <https://repository.unimilitar.edu.co/bitstream/10654/7462/1/ENERGÍAS%20ALTERNATIVAS%20EN%20COLOMBIA%20BAJO%20LA%20LEY%201715.pdf>
- Garcés Cano, J. E., & Duque Oliva, E. J. (2007). Metodología para el análisis y la revisión crítica de artículos de investigación. *INNOVAR. Revista de Ciencias Administrativas y Sociales*, 17(29), 184-194. Retrieved from <http://www.redalyc.org/articulo.oa?id=81802912>
- Garrido, S. (2012). *Energías Renovables: Concepto y Evolución Histórica*. *Energiza*, 4-10.
- González Bell, J. (3 de Noviembre de 2018). *Upme y MinMinas anuncian aplazamiento de la subasta de energía eléctrica a largo plazo*. Retrieved from La República: <https://www.larepublica.co/economia/upme-y-minminas-anuncian-aplazamiento-de-la-subasta-de-energia-electrica-a-largo-plazo-2790027>
- González Miranda, C. (23 de Diciembre de 2015). *Breve guía para entender la generación de energía en Colombia*. Retrieved from Twenergy: <https://twenergy.com/co/a/breve-guia-para-entender-la-generacion-de-energia-en-colombia-2057>
- González, X. (25 de Octubre de 2018). *Conozca el ABC de ingreso de energías renovables al Sistema Interconectado Nacional*. Retrieved from La República: <https://www.larepublica.co/especiales/especial-minas-y-energia/conozca-el-abc-de-ingreso-de-energias-renovables-al-sistema-interconectado-nacional-2785889>
- Grupo Energía Bogotá. (2018). *Sector Energético en Colombia*. Retrieved from Grupo Energía Bogotá: <https://www.grupoenergiabogota.com/eeb/index.php/transmision-de-electricidad/sector-energetico-en-colombia>
- Lafuente Ibáñez, C., & Marín Egoscozabal, A. (2008). Metodologías de la investigación en las ciencias sociales: Fases, fuentes y selección de técnicas. *Revista Escuela de Administración de Negocios*(64), 5-18. Retrieved from <http://www.redalyc.org/articulo.oa?id=20612981002>
- Meléndez Muñoz, I., & Maldonado Veloza, F. (2014). El institucionalismo como factor determinante en el proceso de gobernabilidad. *Economía*, 39(38), 59-86.

- Ministère de la Transition écologique et solidaire. (1 de Junio de 2018). *Programmations pluriannuelles de l'énergie (PPE)*. Retrieved from Ministère de la Transition écologique et solidaire: <https://www.ecologique-solidaire.gouv.fr/programmations-pluriannuelles-lenergie-ppe>
- Pacheco - Floreza, M., & Melo - Poveda, Y. E. (2015). Recursos naturales y energía. Antecedentes históricos y su papel en la evolución de la sociedad y la teoría económica. *Energética*(45), 107-115.
- Portafolio. (18 de Octubre de 2018). 'Las fuentes renovables perderían relevancia en la subasta de energía'. Retrieved from Portafolio.com: <https://www.portafolio.com/negocios/las-fuentes-renovables-perderian-relevancia-en-la-subasta-de-energia-522440>
- Trigo Soto, L. G. (2016). Una revisión de los aportes del institucionalismo histórico a la ciencia política. *Revista Colombiana de Ciencias Políticas*, 7(1), 224-241.
- Unidad de Planeación Minero Energética. (Enero de 2015). *Plan Energética Nacional Colombia: Ideario Energético 2050*. Retrieved from UPME: [http://www.upme.gov.co/docs/pen/pen\\_idearioenergetico2050.pdf](http://www.upme.gov.co/docs/pen/pen_idearioenergetico2050.pdf)