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ANALYSIS OF AUCTIONS AS A NORMATIVE INSTRUMENT TO PROMOTE RENEWABLE ENERGIES IN THE ENERGY MARKET

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Abstract- Last century was usual that the same company in each country managed generation, transportation and distribution of energy, particularly electricity. Moreover, this company was public or semi-public; that is, government was in charge of the system and the existence of an energy market was a utopia. Nowadays, the scenario has totally changed and renewable energies have had a growth that only some experts predicted. In this change of scenario, policies of governments regarding energy generation have focused the interest of scientists, engineers, and in general of all citizens. Among the policies that have been used for the management of the energy market, in this paper auctions are analyzed. This system is the tool that Spanish government has chosen, and the one that European Union is promoting.

Keywords: Renewable Energy, Management, Auctions, Energy Policy.

I. INTRODUCTION

In several countries, renewable energy generation should be encouraged if some legislative measures are put forward. But the introduction of competition involves the restructuring of the electricity sector, which must pass from the monopoly model to another model of structure of free market [1]. Different promotional tools, particularly used by governments, can improve the development of renewable energies. During the last years, there has been an increased emphasis also on the quality of the energy injected to the network due to the widespread use of sensitive and nonlinear loads in electrical power systems, and the rapid growth of renewable energy sources [2]. Moreover, if we take into account the last ten years, it has been a spectacular increment of the renewables. Focusing on Europe, the development experienced in recent years allows the European Union (EU) to meet its annual objectives in the path of renewable targets in year 2020.

At the beginning, these policies were thought to promote renewable energy to reduce effects of greenhouse gases emissions, so they intended to replace electricity generation from sources of fossil origin. On 14 March 2017, Eurostat, the statistical office of the European Union, issued a press release on the share of renewable energy in EU Member States.

According to the press release [3], in 2015 the share of energy from renewable sources in gross final consumption of energy reached 16.7% in the European Union (EU), almost double that of 2004 (8.5%), the first year for which data are available.

The share of renewable energy in gross final consumption of energy is one of the key indicators of the Europe 2020 strategy. The EU 2020 target is a 20% share of energy from renewable sources in gross final energy consumption.

However, renewable energy will continue to play a key role in helping the EU to meet its energy needs beyond 2020. For this reason, the countries of the EU have already agreed a new EU target for renewable energy of at least 27% by 2030.

II. DIFFERENT SYSTEMS FOR PROMOTING RENEWABLE ENERGIES

Renewable energies are taking higher percentage in the generation market and it does not matter which country we are speaking about. Energy transition from fossil fuels to renewable energies is nowadays a typical topic in the international meetings. What is under discussion across the globe is the best system to successfully confront this important transition, finding the balance that guarantees long-term sustainability.

The perfect support system for renewable energies does not exist and there are several of them that are used in different countries, and even the case of different systems in the same country, like USA. The four more relevant systems, because its use in the world, are the following:

- Feed-in-tariff
- Green certificates
- Fiscal incentives
- Auctions

Energy is basic for any country and the different technologies have different prices for generation. Countries that want to achieve a massive implementation of renewable energies, such as India or China, are committed to expansive systems like the feed in tariff or the feed in premium [4]. In these systems, the renewable energy producer company has the right to sell all the

generated energy to the electric grid, so it receives a fixed price or the hourly market price plus an incentive. The generated energy has guaranteed priority access to the grid and the period of validity of the incentives is 12 to 20 years.

Green certificates are less widespread, but countries like Sweden, Norway, Belgium, Poland and Romania have opted for them [5]. The regulator imposes on the distributors or generators the obligation that a percentage of their energy comes from renewable energies. In order to comply with this obligation, each marketer must deliver a green certificate for each MWh of energy supplied, which is sold by the renewable energy generator based on its actual production, through a market organized for this purpose, or directly to the distribution/ generators companies. Producers' incomes have two components: market price plus value of green certificate.

A green certificate is basically a tradable asset. This certificate proves that electricity has been generated by a renewable (green) energy source (wind, solar, biomass, etc.). The number of green certificates can be depended on the energy source, and it is possible that greener or more innovative technologies can achieve more certificates than other technologies per MWh of power produced.

Other method is that of the fiscal incentives, and it is the method chosen by the United States, another of the great renewable energy producers of the world. This method promotes the realization of projects by means of fiscal benefits of investment in wind projects or indirectly in recurring activities of other investors than wind farms.

III. FEED-IN-TARIFF

One of the most popular systems, from the viewpoint of the legislators, to manage the energy market has been the called Feed-in-Tariff. Feed-In Tariff (FIT) is a normative instrument that promotes the development of renewable energies, through the establishment of a special tariff, premium (bonus) or over-price, per unit of electrical energy injected into the network per unit of renewable energy generation. That is, the price that is received by the renewable energy generator is intervened, knowing the minimum price that will be paid for electricity [6]. This system emerged in the USA by means of the Public Utility Regulatory Policies Act (PURPA) in 1978, being adopted by several countries [7], such as Germany and Spain.

Three are the essential elements in order to understand the existence of the FIT:

- First, and perhaps the most characteristic of this instrument, is that the authority establishes a minimum tariff, over-price or premium for injected electricity from renewable energies, tariff that tends to differentiate according to the type of power, size and location of the power station.
- Secondly, an obligation of access to the electricity network to the renewable energy power plants is established, in order to ensure that generators will be able to deliver their product.
- Third, there must be an obligation to purchase all the electricity injected into the system.

In recent years, the FIT systems of Germany and Spain have become the most recognized FIT models worldwide [8].

The FIT German System establishes different tariffs for the electric energy injected by the power plants, due to the size of these plants, location and type of energy used, which are insured for a long term (fixed periods, for example rates up to the year 2030). This differentiation of tariffs is based on the logic of avoiding over-sized economical support for plants that, due to the factors they use to generate electricity, are in a more competitive situation and close to conventional energies. Supporting plants that do not need these incentives or support measures in practice, only translates into the inefficient use of resources. For example, tariffs will be higher for solar and geothermal energy, but for hydroelectric plants between 50 and 100 MW, which will be supported by the minimal. The costs of establishing this special tariff are borne by consumers, with an increase in their electricity bills.

Another characteristic element of the German FIT is the progressive reduction of the tariffs set by the authority. This means that every year, the rates are reduced by a certain percentage with respect to the one originally set, for the plants that come into operation that year. For example, if a plant goes into operation in the first year, it will be able to access 100% of the tariff for the duration of this benefit (usually 15 years); but that which enters the second year may qualify for "only" 95% of the tariff for the remaining term; and so on. This decrease is not the same for all energy technologies, but varies according to the type of energy. In this way, it seeks to promote the technological development of less mature technologies with a stronger progressive decrease, so that in this way companies engaged in the manufacture of these technologies have the pressure from the generating companies to continue innovating.

Spanish FIT differed mainly from German in that special tariffs for renewable energies were based on the average marginal costs of the previous year, so renewable energy tariffs were changing year by year, based on a closer situation. As in the German system, in this system there were differentiated rates according to type of energy and size, which were calculated based on the value of the marginal costs of the previous year. One difference was that in Spain the tariff was flat for a certain period of time (no matter in what year the power station went into operation), at the end of which it was reduced equally for all power plants of that type of energy. For example, for an initial period of 10 years the tariff for wind generation was 150% of the marginal costs, after which it went down to 125% for a period of 5 years.

The FIT as a normative instrument to encourage renewable energies has several advantages. On the one hand, by establishing differentiated tariffs according to the type of renewable energy used, it allows for the comprehensive development of all technologies and not only those that are more competitive than conventional energies. In this way, by boosting all the energies, it is expected that the less mature technologies will achieve advances, tending their costs in the future to fall.

Another advantage is that it does not impose any barrier to the market players, who are free to generate electricity (without any sanction in case of not doing so) through renewable energies if they deem it convenient, taking advantage of the fixed tariffs, without being forced to invest in them. A third advantage is that it benefits all generating companies, regardless of their size (asymmetries are reduced based on the size of the companies, which affects access to financial credit, among other elements), which encourages new actors enter the market.

But the FIT also has disadvantages. One of them is related to the fact that the authority intervenes in the generation market, by setting specific tariffs for renewable energies, which would come into collision with market freedom, such as in Europe. A second disadvantage pointed to the application of the FIT is that it would increase electricity tariffs. The argument that this system is the most expensive has been refuted by some authors [9], as well as by the International Energy Agency [10], who have indicated it as the best option to obtain the most efficient and fastest development of renewable energies within system of electric generation.

IV. AUCTIONS

All these systems are based on the principle of free access to the market: the investor develops a project and then seeks the authorizations that will allow him to build and begin to perceive both market revenues and the incentives envisaged by the region or the state. Auctions are a different gateway when it comes to granting incentives: since they are a mechanism with the aim of reducing the volumes of support needed to deploy renewable energies, companies bid for incentives, so that only projects that, in principle, are more competitive will obtain these incentives. Following poor start-ups in Europe in the 1990s, auctions began to spread in developing countries such as Brazil, South Africa and Peru. And today they are imposing themselves in more mature markets, like the European market. Since there are many types of auctions, the challenge is to hit a system that balances the dual objective of attracting investment in renewable energies without compromising the resources of the country.

For governments, the main advantage is that holding down auctions allows them to limit the incentives. But they often find that projects are not carried out, so that the objectives initially pursued are not achieved. This risk is increased in the case of wind power generation due to the complexity of the development of the projects because granting of permits by different types of authorities takes a high time and also because the need for wide acceptance at the local level.

But Europe walks inexorably towards the auctions. The road map on state aid in Energy and Environment of the European Commission requires that, by 2017, the granting of support for renewable energies will be carried out through auction systems, in order to increase the efficiency of prices and limit distortions in competition.

The only exceptions will be small-scale projects, cases where there is a risk of low bids or where the chances of setting up projects are low. The decision is made, but some doubts arise. For example, what will happen if the prices set by the authorities of a country contradict the rules of a liberalized European single market. Or whether the auctions will increase the effectiveness of funding compared to existing systems or if, on the contrary, they will restrain projects and prevent achievement of the European objectives by 2020 and 2030.

The European Commission calls for more cooperation among member states of the EU in this area, so as to move towards greater harmonization in the support systems of different countries. In Europe, the systems of feed in tariff and feed in premium dominate, as it was the case in Spain before its Energy Reform. Today, in addition to our country, only in the Netherlands rates are fixed based on auctions for on-shore wind. It is expected that other countries such as Germany and Poland will also be incorporated soon.

From the viewpoint of the transition between one system and the other, a series of steps are recommended: at the beginning, it should be recommendable to conduct thorough market analyzes when designing auction processes; it should also be good to organize pilot auctions to gain experience, since poorly done processes end up making projects more expensive or preventing them from being installed; and finally to guarantee the participation of a sufficient number of companies to ensure healthy competition.

In Spain, the first auction of renewable energies of 500 MW wind and 200 MW of biomass was held at the beginning of the year 2016. The Spanish Energy Reform established the end of incentives for new renewable facilities, but the government reserves the right to call auctions when it needs to achieve an increase in renewable power in a given period of time. At the moment, it needs these calls if it wants to meet the European targets for 2020, which are binding.

V. SPANISH CASE

The result of this first auction was surprising and at the same time unexpected. It was a clear example of the importance of the procedures and how to not act in the future. In Spain, neither the sector was consulted on the design nor pilot auctions have been made or an adaptation period enabled. However, competition has been high, especially because the sector had been paralyzed for years as a result of the 2012 green moratorium.

In Germany, we are seeing the opposite case: German government and industry have been discussing the best way to make the transition to auctions for two years. This government intends to slow down the rate of installation of on-shore wind generation from 4.000 MW per year to 2.900 MW. But, before making decisions, it is proposed to carry out a pilot auction of 600 MW of photovoltaic energy. According to the Commission's recommendations, "in the transition phase of 2015 and 2016 aid for at least 5% of the new projected renewable power must be granted through auctions based on clear, transparent and non-discriminatory criteria" [11].

European market is quite difficult because the amount of countries and different systems, but it can be said that renewable energy market, as a whole, have experienced a good 2015 in Europe. Wind power increased by 12.8 GW, making it the fastest-growing and cheapest-to-build (in the case of on-shore wind) technology in the region in terms of installed megawatts. However, it must be borne in mind that 47% of new European wind power plants were concentrated in a single country: Germany. Meanwhile, in Spain it was not installed a single wind megawatt as a result of its Energy Reform, that retroactive regulation that has plunged Spain into an important legal insecurity.

Why this overwhelming difference? In Germany, there is a serious and structured plan to deal with the energy transition we were talking about. In Spain, no. In fact, according to a report published on 5 February 2016, by the European Commission with research from Ecofys, Fraunhofer and Eclareon [12], the design of systems to support renewable energies is seen as the most important barrier to their development in the European member states, as well as one of the factors that represents more risk and; therefore, makes the implementation of projects more expensive.

That is precisely one of the most widespread recommendations of good practice. Although there is no ideal system because each country has its own characteristics and circumstances, there are a number of aspects that are important to take into account. In the *Design options for wind energy tenders* document [13], the European Wind Energy Association (EWEA) outlines the guidelines on which the authorities should focus on whether to opt for one system or another.

EWEA assumes that auctions are an effective system as long as they are well designed as they can minimize the risk of abrupt or retroactive changes in national systems. They assert that experience shows that the effectiveness of auctions is largely in details, and lists a number of shortcomings based on past experience: investors' uncertainty about price; too low offers to secure victory but without economic logic, so the projects have not been carried out; overly complex procedures and financial risks that have discouraged small businesses from participating; selected projects without taking into account the environmental impacts, which has provoked public opposition and, ultimately, non-installation of the farm; projects chosen without taking into account the territorial distribution, leading some geographical areas to be over-solicited and others to be ignored; low competition and, therefore, no incentive to propose lower prices.

If we want the system to be effective, there must be a balance between the reduction to the incentives to be granted and the materialization of the projects.

VI. BETTER PRACTICES

Before deciding on an auction system or another, a country's regulators must have a stable regulatory framework that includes long-term renewable planning, which has a public budget. They must have clear the situation about the state of the industry, whether there is a sufficient domestic supply chain or whether imports will be required. And make sure that auctions are the best method to meet the set goals.

It is very important that the introduction of an auction system does not bring retroactive changes in regulation, which is achieved with a transition period in which companies adapt.

It is also important the fact that the auctions are not isolated, but that they are summoned sufficiently in advance, in a regular way, with calendars that allow to plan. In addition, the process should be transparent and open to give chance to as many participants as possible.

With these ideas in mind and after having consulted with companies that, in short, are those that have studied the systems more thoroughly and in many cases they have international experience, it is time for the regulator to choose the characteristics of the auction. And there are many options.

- Organization and territorial selection: the auctions can be centralized (places for installation of farms are chosen by the authorities) or decentralized (promoters present the projects that they consider opportune).
- Prequalification criteria and fines: preliminary licenses, territorial permits, connection points, secured financing, etc. All of them serve to dissuade companies that are not 100% committed to the projects, so that only those that have real interest are presented. It is a way of ensuring that the farms will be installed.
- The incentive itself: generation can be remunerated (euros/MWh), which encourages the farms to generate more, or the installed power (euros/MW). In the latter case, the authorities always know what they have to pay, regardless of the generation of each plant.
- Differentiation by technologies: there is the possibility of doing auctions by technology or that all the renewable ones compete with each other. In the latter case, the risk is that allotments go exclusively to the cheapest, such as on-shore wind, leaving out technologies with potential for future cost cuts, such as solar technologies.
- Mechanisms for fixing prices: closed envelope mechanisms assume that all offers are submitted within a period of time and they are not disclosed. In those processes of the up or down watch, the auctioneer sets a price that goes up or down during the process until a bidder accepts a certain price level. The hybrid system combines the two above methods.
- Method of payment: either each contractor receives the price of his own offer, or all companies take the highest price of all awarded (marginal system).

VII. CONCLUSIONS

Both energy consumption and renewable energy generation have increased during the last years, and sometime in a notable way. For example, Spain has 23.000 MW of wind energy installed, generating 20% of the electricity needed by the country. And wind power is the second technology that has generated the most electricity in the last four years.

But policy of governments has a very high and direct effect in the markets, energy market included. In the case of Spain, since 2013, it has seen its revenues reduced by 1.500 million euros as a result of the cuts introduced by the Spanish Energy Reform, and the industry has not had a single order for the national market since 2011 and the sector has lost 50% of its employment since 2008.

Wind power is leading the transition from fossil fuels around the world. In 2015, it was the most installed technology in both Europe and the United States.

Meanwhile, Spain languishes. The last legislature has been the least wind since 2000, since only 1,932 MW were installed as the first result of the green moratorium and then, the Energy Reform. Moreover, since the new pay system came into force in 2013, only 27 MW have been installed, that is, 1.4% of the total accumulated in the legislature.

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