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Wind Generation in the Argentine Power System

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Abstract: Energy policy is an essential part of the economy and the society. In some countries, there is a lack of a regulatory framework, which must be clear and practicable to allow new technologies to compete with the conventional way of generation. This is the problem in Argentine, the lack of a regulatory framework that can regulate the insertion of wind energy into the Argentine power system (SADI). In this paper, a review of typical incentives for the installation of wind farms in the world, and a review of some laws and policies in Argentine are presented. Also financial and economic issues that are related to the installation of wind farms are analyzed, and some recommendations related to the topics are presented in this paper.

Key words: Wind generation, Argentinean laws related to wind generation, Argentinean regulation and programs.

1. Introduction

Today, the problem of sustaining the global energy matrix has no solution, if such a matrix of the proportion of renewable energy is not increased. Generations are using renewable energy, including clean energy, reducing the use of non-renewable sources such as fossil fuels and producing no emissions that are harmful to the environment. Because wind energy is environmental and consumer friendly, it requires shorter construction time, cost competitive, and its permits in some countries are usually obtained quickly. It becomes one of the most competitive actual sources of renewable energy [1, 2].

Interest in wind generation has been growing rapidly in the past few years in many countries around the world. And it is expected that this trend will continue in the immediate future. Most, if not all, older wind turbines are designed to disconnect from the system immediately following any system fault. This is possible to carry out because the wind farms are small and connected, generally, at distribution levels. With wind generation increasing in size, and being connected to the transmission systems levels, this is no longer an acceptable behavior. Despite the relative maturity of wind energy technology, the exploitation of wind as an energy supply has some limitations and problems, being the three most serious limitations from the engineering point of view. The energy efficiency of electric generators, the impact that wind farms cause to power system [3, 4], and the variable output power due to wind fluctuations make it difficult to balance power and manage reserves in the grid.

This issue has been partially addressed with the development of short and medium term wind power prediction models but the increasing penetration of wind energy makes this a pressing problem [5].

Worldwide capacity reached 159 GW, of which 38 GW were added in 2009, showing a growth rate of about 32%, the highest rate since 2001. In the end of 2009, Germany got a total installed capacity of about 25 GW, and USA reached a value of about 35 GW. In Argentine, the installed capacity reached only 29.8 MW.

Considering the impact that wind farms cause to power system, it is important to mention that until

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recent time the only mature planning and interconnection standards were those applied in Denmark and Germany. Other countries around the world are adopting similar standards, such as Spain, Ireland, North America, etc..

Today, operational experience and relevant knowledge of grid connectivity is limited. However, various analytic studies and investigations within this topic have been initiated in recent time. Argentina is being inserted in the market of wind energy, but the problem is the lack of standards that can regulate the insertion of wind energy into the SADI. This situation makes it difficult for the investors to carry out planning and construction of wind farms.

In this paper, a review of typical incentives for the installation of wind farms in the world is presented. Then a review of some laws and policies in Argentine is presented. Next, financial and economic issues related to the installation of wind farms are analyzed. Finally, some recommendations related to the topics are presented in this paper.

2. A Review of Typical Incentives for the Installation of Wind Farms

Incentives, here presented, which are used to persuade the investors for the installation of wind farms, have achieved significant impetus for the development of reliable technologies and also an important reduction of generation costs.

2.1 Reliable Market Conditions

One of the most critical requirements for wind projects is the existence of a market to which to sell the generation. This is very easy to do in case of a monopoly system, which would certainly have an assured market in case it wants to use wind generation. However, many of the existing enterprises are due to independent investors, obviously in these cases the generating companies need the assurance that they will sell the wind power generated. It is essential to have adequate legislation to create a stable and reliable market. That is, the mechanism in this case is the creation of conditions in order to make reliable contracts for the sale of wind energy. It is important to take into account that wind farms that act as merchants in electricity markets which are subject to adverse market conditions that result from the stochastic nature of the power they generate [6]. The inability of these merchant wind plants to follow a deterministic power generation schedule exposes them to the volatility of real-time energy prices and, in some markets, to charges based upon their deviations from a predetermined schedule.

2.2 Grant for Wind Energy Production

Clearly, if the wind power is more expensive than conventional power, wind alternative becomes economically unattractive. An indirect way to reduce the cost of wind power generation in this case is via the grant paid per kWh of electricity generated from wind. The grant is considered as an important mechanism to support renewable energy development like wind energy [7]. The grants could convert a wind project into an economically viable one. These grants usually come from general revenues of the government in countries interested in getting generations of low environmental impact, or forced upon them by regional commitments. Also, the grants come from a fund composed of an extra charge on consumer bills for the utilization of electricity produced for conventional sources. In general, these subsidies are for predetermined periods to get time until technological improvements can make wind power generation more competitive.

2.3 Tax Reductions

Another mechanism is designed to make it more attractive for investors to finance through tax reductions. These reductions are based on the total amount of investment required, and the kWh generated. The first alternative is preferred by investors in the case of high risk projects, but the second is more suitable to ensure that the project really provides a benefit to the community and not merely a benefit for the investor.

2.4 Minimum Percentage of Wind Power

A lesser used mechanism is to require that from the total amount of electric generation that handles a particular distributor utility, certain "minimum" amount should come from a renewable source, such as wind generation. This ensures a reduced but sure market for independent producers of wind power.

2.5 Penalization of Conventional Generation Projects

This mechanism is used to economically penalize new projects of conventional power generation in the planning stage. The money generated is to finance non-conventional projects such as wind generation.

2.6 Additional by Carbon Content

This additional consists of a penalty, which is a function of the carbon content affecting the atmosphere for fuel used in a conventional generation that is considered guilty for climatic changes. Contrary to the previous mechanism, this is only applied during the planning stage. This mechanism is applied to the generator producer on all their energy generation by conventional methods.

2.7 Financing at Preferential Rates

Also, another mechanism is used for the installation of wind farm, which is the financing at preferential rates for generating plants projects, such as loans to grants at lower rates than the market rate, guarantees of return for credits to make them more attractive to financiers.

2.8 Promotion and Education of the Consumer

To promote the installation of wind farms, it is necessary to examine very carefully the current separation in many countries of the market into generation, transmission and distribution. Perhaps this may force to establish new guidelines to encourage generators with low environmental impact, for the purposes of not distorting the generation market too much, subject to the rules of free competition. In this regard, voices have been heard of criticizing subsidies of any kind given to certain forms of clean generation like anti-ethical. One of the concepts that have emerged in some countries is the promotion and education of the consumer, which is known as "green pricing". It provides to the consumers the opportunity to choose their supplier based on their desire to use a clean energy. Whereas in Argentina it is difficult to conceive it now, there are already cases of consumers in countries that agree with this policy.

3. A Review of Legislation of Wind Generation in Argentine

The progress of the use of wind power is notable in those countries in which wind generation costs a minimum of U$D 0.09 per kWh. This is achieved as a result of an adequate legislation, known as feed-in tariff [8, 9], which is a mixture of several mechanisms mentioned in the previous section. This legislation catches the attention of investors, due to that guarantee a certain amount per kWh delivered to the network in certain periods of time, independent of changes in tariff for political reasons, generally. Consequently, the investors can predict, with some reasonable time, the refund of their investments. In many countries, however, these mechanisms are often criticized, because they are considered as imcompatible with the free market rules. In Argentine, undoubtedly, it will be very difficult to enforce the application of these mechanisms, because they are opposed with the philosophy of privatization of the electricity sector, and also there is an interest of governments to regulate the electricity sector by the mean of subsidies.

In 2010, there were 159 GW projects of wind power in the word [10]. In this regard, it should be noted that a current problem of Germany in this issue is related to two key considerations. The first one is that the big magnitude of installed capacity is difficult for the power system operation [3, 4]. The second one is that the law prohibits the installation of wind turbines at distances less than 400 m of houses. The consequence

is the lack of sites for the installation of new wind farms, which in turn has led to replace existing turbines with other turbines of higher capacity and offshore installations.

In different countries there are different ways to reach these values of MW installed of wind power, ranging from the total indifference of governments to a serious concern to find solutions which represent an appropriate balance between economy, ecology, ethics, and avoiding as far as possible to favor certain sectors over the acquired rights and interests of other sectors within the electricity market.

Dismissing the policy of countries that prefer the indifference, the solutions adopted, although not definitive in any case, in general follow two different lines, the first one is to determine and guarantee an adequate sale-price to wind generator and the second one, is the obligation, for all generators that participate in the electricity market, of producing a predetermined percentage of electricity from renewable primary sources.

Both guidelines are accompanied by educational campaigns of the population, which help to promote the concept of “green pricing”. In this regard, it is interesting to note that the countries that have the most quantity of installed wind power like USA, Germany, Spain, China, India, are just the countries that guarantee the minimum price of around U$D 0.09 per kWh generated.

Other countries like UK, Ireland, Netherlands, France, etc., which only require a small proportion of generation from renewable resources have a smaller amount of installed capacity of wind energy. It is important to note that the higher growth of wind energy is for these countries that use the law as a guideline.

Denmark left the application of the so-called legislation “feed-in tariff”. This mechanism led Denmark to lead the world ranking of MW installed of wind generation. In contrast, there was a substantial increase due to the return to this form of legislation in USA.

Next, a review of some laws and regulations in Argentine is presented.

3.1 Corchuelo Blasco (Law 25,019)

This law considers an extra payment of U$D 0.01 per kWh to wind generator investors, and also considers a deferred payment for ten years of taxes such as VAT (value added tax). The province of Buenos Aires added another U$D 0.01 per kWh. The real costs of generation were greater than this value. The law was useful only to raise awareness of the existence of wind generation.

3.2 Salvatori Law 26,190

In 2001, the monetary value of the Argentine peso relative to the U.S. dollar changed from 1-1 to 3-1. For this reason the law 25,019 was changed, tripling the incentive to U$D 0.03 per kWh. In fact it was only a modification of law 25,019, but adapted to the new parity. But the philosophy was not changed: to pay a market price for wind power, which is a political price, and does not guarantee to the investors the recovering of their investment.

3.3 Project of Law Arnold

This proposed the use of the mechanism called “feed-in tariff”, which has been applied in many countries, but the law was not enacted. This explains the very low installed capacity in Argentina, only 29.8 MW.

3.4 Regulation No. 1281/06

In short, it states that the energy demand of a large user should be provided by a new generator at the price fixed by the new generator.

3.5 Regulation No. 220/07

The realization of EPSC (Electric Power Supply Contracts) with a validity of 10 years between the electricity market and companies that provide a new supply of generation to the system is enabled. The

electricity market is implemented by the Argentine Power System Operator CAMMESA [11]. Projects that fit this regulation must be additional to existing ones, and must involve in some sense the Argentine Government, or the company ENARSA [12] or whoever that determine the Ministry of Federal Planning MINPLAN [13]. The remuneration of contracts EPSC would be calculated monthly and it must take the costs into account, and also must consider an adequate return for the investors. This is possibly the unique regulation applicable to investment in wind power in Argentina.

3.6 Regulation No. 269/08

It is introduced that the DG (distributed generator) which consists of a consumer of electricity can also generate electricity, but with the difference that the points of consumption and generation are linked to the SADI in different nodes. It may be useful for those users that choose to invest in generation within or outside the industrial plant. It is understood that the thrust of the resolution is that the user achieves the independence, if possible, of the SADI, or at least contribute to auto generate part of its demand.

3.7 Regulation No. 280/08

This regulation enables electric power distributors of the provinces and municipalities to provide to CAMMESA the operation of its hydroelectric generating units with installed capacity below 2 MW which are not currently enabled for commercial operation, according to conditions for its habilitations, scheduling, dispatch and financial transactions. It is intended to stimulate the supply of electricity, mainly in isolated areas.

3.8 Total Energy Program PET 2008

In order to ensure supplies of energy resources which are demanded by consumers, the PET was implemented in 2008 in Argentina, which allowed an electric power energy saving of 40 GW. Given the short time elapsed since the beginning of PET, the lack of regulation prevented many companies from being able to join to PET.

5. Financial and Economic Issues

The technology necessary for the exploitation of renewable energy is available. In some countries, there is a lack of a regulatory framework, which must be clear and practicable to allow new technologies to compete with the conventional way of generation. Possibly the financial incentives in the short term would generate the recovery of payments and begin to produce a major development in the sector. This incentive could be considered as insurance for the economic risks and environmental damage. Wind power had, in the early 90s, a considerable development with the progress of automation and information technology. The average nominal power in the world was multiplied by 15. Also, the performance of wind generators has increased considerably with the evolution in each component separately.

Currently, there are wind generators of around 2 MW per turbine. Due to the demand of such wind turbines, producers have increased their production, reducing not only construction time but also costs. While renewable energy sources will always be only a percentage of total energy sources used, the wind reached a level of competitiveness that can be considered as an alternative to other conventional sources.

Today, a wind farm is entirely constructed by companies around the world, with wind turbines of proven technology, high performance, which are attached to financing plans becoming an attractive alternative for both governments and private investors. However, the schemes IPP (individual power producer) with international funding can only be made if the project is above a minimum volume. The installation of 5 GW in 10 years in Germany created 20,000 new jobs, principally in decentralized areas, which resulted in a massive savings in subsidies for unemployed. Hence,

the simply comparison of the cost of 1 kWh of wind generation against another source makes no sense.

Considering the specific issue of creating jobs in undeveloped countries like Argentine, and based on works carried out by AWEA (Argentina Wind Energy Association), it can be said as the following: for each new MW installed, it will create 20 jobs directly and 160 jobs indirectly, considering professional, technical and skilled and unskilled jobs. Considering for example, the installation of 2 GW, a reasonable value for Argentina given its total conventional power generation installed, would involve the creation of 42,000 jobs directly and 336,000 jobs indirectly. Also, the incorporation of wind generation will provide a double benefit, the first is the economic and the other is the environmental.

6. Conclusions

Energy policy is an essential part of the economy and therefore of the society. In some countries, there is a lack of a regulatory framework, which must be clear and practicable to allow new technologies to compete with the conventional way of generation. This is the problem in Argentine, the lack of a regulatory framework that can regulate the insertion of wind energy into the Argentine power system (SADI). This makes it difficult for the investors to carry out planning and construction of wind farms. Possibly the financial incentives in the short term would generate the recovery of payments and would begin to produce a major development in the sector. It is important to mention that the incorporation of wind generation in countries will provide a double benefit, the first is the economic and the other is the environmental. There is a clear need for a clear regulatory framework that promotes the installation of wind farms, so they can compete with conventional generation.

The utilization of renewable energy sources, like wind power, is necessary for the sustainable development of any country due to reduced fossil fuel level, climbing fossil fuel prices across the world and more recently due to the pressure for reduction of emission level.

From the point of view of the penetration of wind power in the world there are two kinds of countries: those with a high level of penetration and those who have almost no wind generation. There is one important relationship between those countries with a good level of development and a high level of penetration of wind power and it is the legislation that these countries have.

On the other hand, the lack of legislation in those countries with a low level of penetration is one of the main reasons for failure to achieve integration of this type of generation in the power system. This is the problem in Argentine, the lack of a regulatory framework that can regulate the insertion of wind energy into the SADI which makes it difficult for the investors to carry out planning and construction of wind farms, so it is clear the need of a regulatory framework that promotes the installation of wind farm, and that it can compete with conventional generation.

References

[1] E. Denny, M. O'Malley, Quantifying the total net benefits of grid integrated wind, IEEE Transactions on Power Systems 22 (2) (2007) 605-615.

[2] J.H. Teng, C.L. Yu, Assessments for the impacts and benefits of wind farm placement, in: TENCON 2005, Melbourne, Nov. 2005, pp. 1-6.

[3] T.M. Papazoglou, A. Gigandidou, Impact and benefits of distributed wind generation on quality and security in the case of the cretan EPS, in: CIGRE/IEEE PES International Symposium on Quality and Security of Electric Power Delivery Systems, Montreal, Canada, Oct. 8-10, 2003, pp.193-197.

[4] N. Jenkins, Impact of dispersed generation on power systems, Electra 199 (2001) 6-13.

[5] Y.S. Drenan, European Network for Integration of Renewable and Distributed Generation, ENIRDGnet, pp. 13-17.

[6] H. Louie, K. Anderson, Economic analysis of power generation forecast utilization by merchant wind plants, in: 40th North American Power Symposium, Calgary, Canada, Sept. 28-30, 2008, pp. 1-7.

[7] I. Falconett, K. Nagasaka, A stochastic model to analyze the economic competitiveness of wind power projects within a restructured electricity industry, in: International

Power Engineering Conference, Singapore, Dec. 3-6, 2007, pp. 30-35.

[8] C. Kongnam, S. Nuchprayoon, Feed-in tariff scheme for promoting wind energy generation, in: 2009 IEEE Bucharest PowerTech, Bucharest, 2009, pp.1-6.

[9] S.M. Pietruszko, Feed-in tariff: The most successful support programe, in: Conference Record of the 2006 IEEE 4th World Conference on Photovoltaic Energy Conversion, Waikoloa, HI, 2006, Vol. 2, pp. 2524-2527.

[10] World Wind Energy Association Home Page, http://www.wwindea.org/home/index.php.

[11] Argentine Power System Operator [Online], http://www.cammesa.com/.

[12] ENARSA Home Page, http://www.enarsa.com.ar/.

[13] Public Investment and Services, Ministry of Federal Planning [Online], http://www.minplan.gov.ar/.