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DYNAMIC ANALYSIS OF THE EFFECTS OF LIBERALIZATION IN THE INVESTMENT OF ELECTRICITY GENERATION

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Overview

In the last decade, a liberalization process has been developed in the electricity systems with the objective of increasing competition and efficiency in the industry. However, the international experience has shown the presence of problems with respect the achievement of such an objective such as California. The reasons which can disrupt the decision of an optimum investment in such countries are the existence of imperfect information (Hobbs et al., 2001), the presence of regulatory uncertainty (Newberry, 2001) and the possible creation of cycles in the investment due to the time period which takes place between the moment investment is decided and the new plants are available (Bagnall y Smith, 2005).

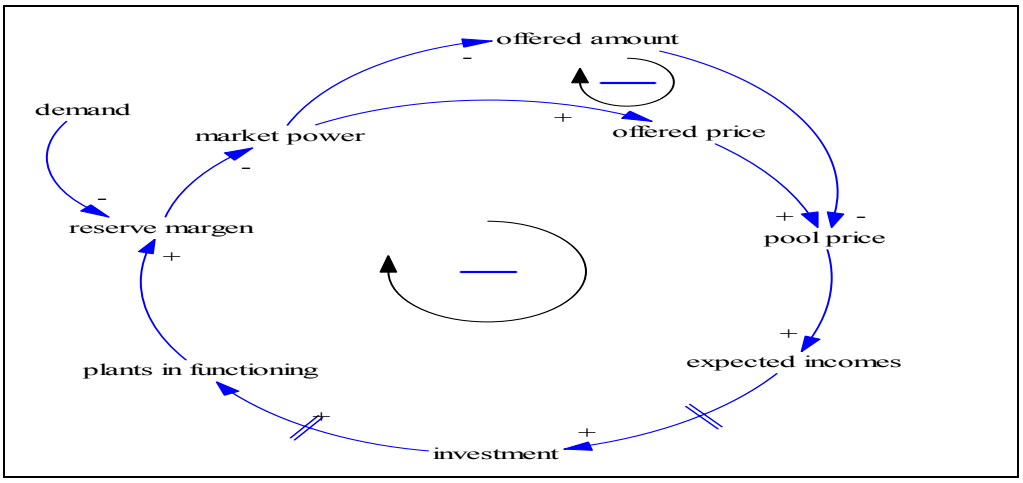
Methods

With the aim of analyzing the comprehension of investment in new generation capacity, in the Spanish electricity system, we develop a simulation model with System Dynamics. The selection of such a methodology is due to the electricity industry, in the new liberalized context, is characterized by the presence of loops[1], the non existence of linearity and the presence of delays in the relations between the variables. These three characteristics are the fundamental pillars which System Dynamics is based. Moreover, this methodology has been widely used to analyze the cycles in the electricity markets (Bunn and Larsen ,1992; Ford, 2001)

In our study, we identified the figure 1 as the basic loop of the model, which shows the interrelations between the formation of the pool price and the investment decision. In this sense, an increasing of demand reduces the reserve margin of the system (because the demand increases to the same generator park). This situation allows to increase the market power of the electricity companies because their generation capacity can be indispensable to supply the demand with the consequent increasing of the offered price or reduction in the offered amount. This action entails the expectative of a higher expected pool price which incentives the request of construction permits in new plants. After a delay of twelve months, the beginning of the construction of new plants will be increased, and after other twelve months, the number of new plants in functioning will be raised. The increasing of the capacity will allow to rise the reserve margin which will entail a downward adjust in the price.

Figure 1. Basic loop of Spanish electricity market

[1] All simulation model, in System Dynamics, is shaped by one or various loops which show the relationship between the variables, the interaction between them and as such explain the behaviour of the latter, which sometimes is difficult through lineal relationships.



Results

The results of our model shows that pool prices are very volatile and they show a cyclical behaviour pattern that affects to the request of new gas combined cycles and so to the new capacity that enters in the system. In this sense, the spike price of 2002 entails the request of applications by all electricity companies because a high profit margin is obtained and there is scarce capacity in the system. Such applications are materialized in new generation plants at the end of 2004, as a consequence of the delay of 12 months between the date application is approved and the date construction is started and a second delay of 12 months between the beginning and finishing of construction. It origins lower pool prices with the consequent stop of construction until a new spike price is developed (our model obtained it in 2008).

Conclusions

As a concluding remark, we can establish that the actual investment incentive in new generation capacity is not suitable possibly due to its amount has been reduced and besides there is not guarantee about its maintenance in the long-term. So, the results of our model establishes the presence of investment cycles which increasing the instability of the system. Therefore, it could be necessary to consider the introduction of alternative policies which allowed to reduce the regulatory uncertainty and so eliminating the volatility of pool prices and the formation of cycles in the investment such as the creation of capacity markets.

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