Coal purchase optimization: a review from Spain

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Abstract: In this study is addressed the need to manage the risk of the purchase price of coal in a power company by changing the management model of the purchasing department. It eliminates the risk of price reduces the cost of buying coal and optimizing the performance of all electricity generation plants belonging to the company. You get more flexibility and optionallity to gain additional benefits both economic and efficiency in the supply to our generation fleet. The tools to achieve the above purpose will be financial derivatives that will be used as elements of management and not as mere speculation in the markets.

1. Introduction

The study addresses the need to manage the risk of the purchase price of coal in a power company by changing the management model of the purchasing department. For this, the state of the electricity market and coal in Spain is reviewed briefly.

1.1 The Spanish electricity market

On the supply side, the electricity generation sector in Spain is liberalized and highly concentrated in five companies: Endesa, Iberdrola, Hidrocantábrico, Eon and Union Fenosa-Gas Natural. The rational use of energy has become a prime target in the continuing search for system efficiency. This objective also should also help domestic consumers.

On the side of the application, the domestic sector in Spain represents 25% of the demand even in number of users reaches 75% of the market. Certain generation technologies have poor social image: 1) nuclear power plants, after cases like Chernobyl and Fukushima, do not have good image about the potential risks to the population. 2) the construction of hydroelectric plants pose a high environmental cost involved in the disappearance of towns, destruction of valuable natural landscapes and reducing biodiversity. 3) The combined cycle power plants improve their competitive position as the best alternative power generation for large companies. They are locating near large populations to reduce transport costs but they increase emissions of CO_2 [1, 2] into the atmosphere.

When a company generating electricity provides the option to bid on the market takes into account the following variables:

- Installed capacity
- Generation mix

- Production costs
- Price of coal
- Price of oil
- Price of natural gas
- Price of CO_2
- Water availability
- Wind production
- Availability of nuclear power

The costs of each fuel vary throughout the year and the purchase price of energy is a function of equilibrium price in the market.

With the advent of liberalization of the electricity sector risks arise not exist in the stable legal framework, the main and most obvious is the price risk. During the Stable Legal Framework recognized the regulator fuel costs for generating units so that there was no price risk and its management was not necessary, no matter whether a producer was able to buy at a price less than any competitor such as ensuring the availability of the plant at the time it was supposed to produce.

Figure 1 shows the relative position of coal. Its perception as a clean energy source has worsened recently with the advance of renewable energy. But Spain cannot ignore a technology that has a weight of 22% in the Spanish electricity generation. This situation has generated after the emergence of new alternatives such as combined cycle plants are as visually clean and of a size smaller than coal-fired power plants.

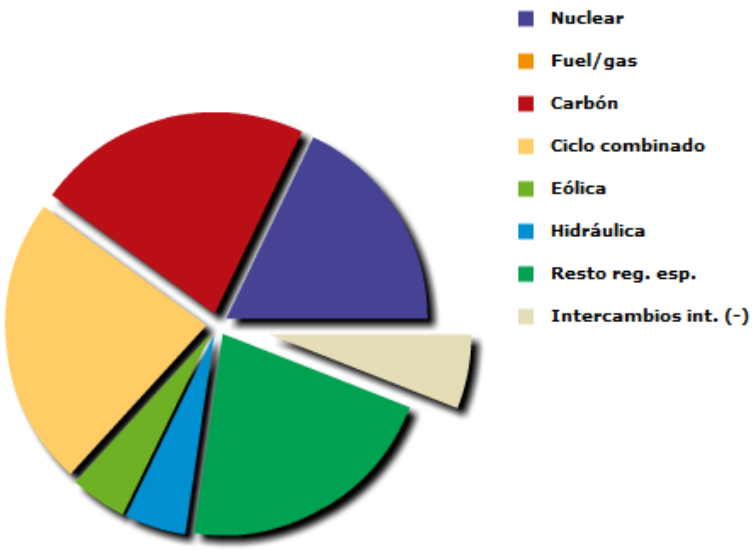

Fig. 1 Fuente: Red Eléctrica de España. Distribution of electricity generation.

The combined cycle is a natural evolution to be followed by conventional thermal plants. However, from the strategic point of view, Spain can not rely too heavily on a single fuel in which also has no control supply nor prices. Due to fuel costs and lower CO_2 emissions combined cycle plants make it difficult for conventional thermal power plants entering the market at certain times.

Spain has 22 GW of installed capacity and only used about 50% of this power (9062 MW). This is because not only the competitiveness of the sector but also in situations of plant maintenance. In these cases it is better not to start the plant as it is not efficient to bid on the intraday market. The Spanish electricity market has six stages daily crossing supply and demand, called intra-day markets. Additionally, there may be special situations demands that cross out of the market.

The business objective is to align the cost of generation in conventional power plants with other electricity supply available. These alternatives are more competitive in performance and CO_2 emissions so the fuel price proves crucial to prioritize which plants produce and which are left standing [3].

1.2 The coal market

Coal is the most abundant fossil fuel and has greater geographic dispersion. The purchase and sale are framed in an active market with many producing countries and a variety of agents demanding this energy source [4]. These factors make the coal approaches the perfect competition market [5, 6]. Variability in price is less than that reflected from other fossil fuels and their behavior is quite stable [7].

Coal consumption in Spain has increased from 12 Mt in 1970 to 30 Mt in 2005. As its origin in the 70 over three quarters of the coal consumed in Spain was of domestic origin while in the second half of the 80's domestic coal production decreased and imports increased dramatically. In the mid-'90s saw the crossing between the curves of domestic production and imports. Today this trend continues: the Spanish coal accounts for less than one-third of total consumption.

2. Methodology

The purchase method of optimization is based on two aspects: 1) technological improvement (which is not subject of this paper) and 2) improving the methodology of purchase and value for money offered by the market economy.

In the new competitive environment, a change in fuel price between an exchange and another can mean the difference between the control unit produces or is left standing [8]. And the business of an electricity company is to produce electricity and that its plants are working as many hours as possible.

2.1 Applied variables

To make a simplification in the number of variables involved in calculating both the cost of production as the scope of production, it has been considered: 1) the cost of fuel and 2) the cost of operation, maintenance and logistics costs [9, 10]. We will not count the depreciation costs. We can break down the cost in the following areas:

1) Cost of coal: use the API 2 odds of future estimated arrival of the month published by any intermediary (in this case we use TFS). The API2 is an index published by Argus and McCloskey that reflects the price CIF ARA entered a port in a given month [11,12,13,14].
2) Logistics costs and operation and maintenance. In our case will be $ 7.5 per tonne.
3) Exchange rate euro / dollar: use the futures trading published by Reuters.

Traditional method of operation: Company A has signed the contract and as of this moment has very little room to maneuver and little or no adaptation to change: you can choose the month of arrival while the rest is left to the supplier and little else can be done.

Optimized method acting: Company B, to ensure the same price of company A, what it has done is:

-Buy 4 x 150.000 mt FOB + -10% buyer's option (to be responsible for transporting this is the one that has room for maneuver due to the different sizes of vessels) with a producer / supplier of quality from for example, Colombia is that at that moment offers a better chance at a fixed price determined, which is equivalent to API 2 (month charge) - freight port of loading to ARA (route called C7).

-To close the charter price could simply hire a guard at a fixed price equal to C7 or can buy the C7 futures traded on a market. What we used to cover their price risk but did not require a physical contract we would take away flexibility. So buy futures C7, 150kt of the mean of each quarter (a total of 600kt) in order to cover the risk of the delivery month, we do not forget is the option of the purchaser. Finally sell futures-API 2 of each quarter equal to 150kt per quarter.

2.2 Alternatives for coal purchased

Two alternatives have been considered [15,16]:

1) Sale of boat DAP or CIF port in Europe: while Company A will have to negotiate with the owner with whom the contract of carriage entered into a new destination, and this will result

in over insurance costs, since the owner is take advantage of its dominant position. While the company B to be simply covered their price risk through futures C7 route, you can negotiate directly with an owner at the last minute and give this a fair price for the agreed destination.

2) Another option is to sell the cargo FOB and freight out the position. Suppose the U.S. market, totally disconnected from Europe, regarding prices of electricity, gas, coal and emissions are in strong demand when it can not be entirely covered by local production, and coal in Colombia is the most economical geographical proximity and because of this the result of buying API 2 + sale + sales FOB freight (C7) is greater than the result of the operation in February (2 + API sale purchase of freight (C7) + purchase FOB) is economically profitable.

2.3 Additional business opportunities

Some additional business opportunities are presented below:

1) Optionality on purchases FOB: Exercising the optionalities the tolerances of each purchase contract FOB (when we find a ship that was larger than the contracted load and the price is higher).
2) Arbitration quality: potential customers require specific qualities, we can replace one another and sell quality specified quality to a third party who is willing to pay an extra cost.
3) Geographical Arbitration: As multisource contracts shall be at the option of the seller to deliver a product from different origins adapting ourselves to the most affordable at all times.
4) Optimization of freight per trip: offers simplicity and low risk but little room for optimization.
5) Optimization of freight time: there are greater optionality, we can choose the rental of vessels with higher performance and greater optimization of containers. Similarly we have option to act on fuel and port of destination.

It is like investing money, if you opt for the simplest solutions with fewer factors that optimize fulfill but may not be able to enter the generation market. If you take risks, the greater the risk a greater chance of making a profit, we must estimate the right balance between risks and benefits.

3. Discussion and Conclusions

With more flexibility in purchasing coal we can concentrate on reducing the cost of the purchase of imported coal to achieve lower production costs than the competitors. Thus the generating unit will operate for a greater number of hours per year, which will result in a higher profit.

With a fleet of generation as the currently present in Europe, where the marginal technology (which covers the last MWh of demand) is reduced to a competition between imported coal and gas (pipeline or LNG), supplies need flexibility to minimize costs for cases in which the gas becomes more competitive than imported coal. We need to be able to extract all the value that risk management tools available allow us, to thereby be able to improve fuel costs compared to our competitors and maximize the number of hours of production of our generation fleet.

In summary, optimizing the conditions of purchase of coal will facilitate a gain that will allow us to improve the competitive position of our country. More research is needed to develop the mathematical model [17,18,19,20] to get evidence from the numbers.

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