Forecasting Prices in Electricity Markets

Electricity is one of the most important goods for our society. Forecasting electricity prices at different time frames is very important for all industry stakeholders for cash flow analysis, capital budgeting and financial procurement as well as regulatory rule-making and integrated resource planning, among others.

All factors determining the price can be clasified as endogenous or exogenous to the market, bring about uncertainty and volatility to the electricity prices.

The most important outcome of an electricity market is the formation of a price at which all power is traded, at least on a daily basis, by way of the so-called 'Spot' market.
The daily (spot) electricity market serves as a marketplace of last resort for generators and demands to trade their remaining available not-contracted power.

Almost all spot electricity markets currently under operation have implemented a mandatory day-ahead bidding framework, which may or may not be complemented with intra-day and real-time (balancing) markets. In terms of the amount of energy being traded, the day-ahead market is the most significant one among all spot (intra-day or real-time) markets.
As a matter of fact, the economics of the whole electricity industry depends on a great deal on the electricity prices cleared at the market. In the short- run (from three to 24 hours) electricity price forecasting is especially important in electricity markets in which participants must optimize their positions (bidding price and quantity for the various markets, namely day-ahead and intraday) based on their perception of what the future hourly prices and incremental costs will be over the bidding period. Moreover, some agents, especially large consumers with self power production, are able to decide which portion of their consumption is to be supplied by the market or by their own production and the corresponding timing. Nonetheless, the driving force behind the decision-making of all market participants is the maximization of profit.
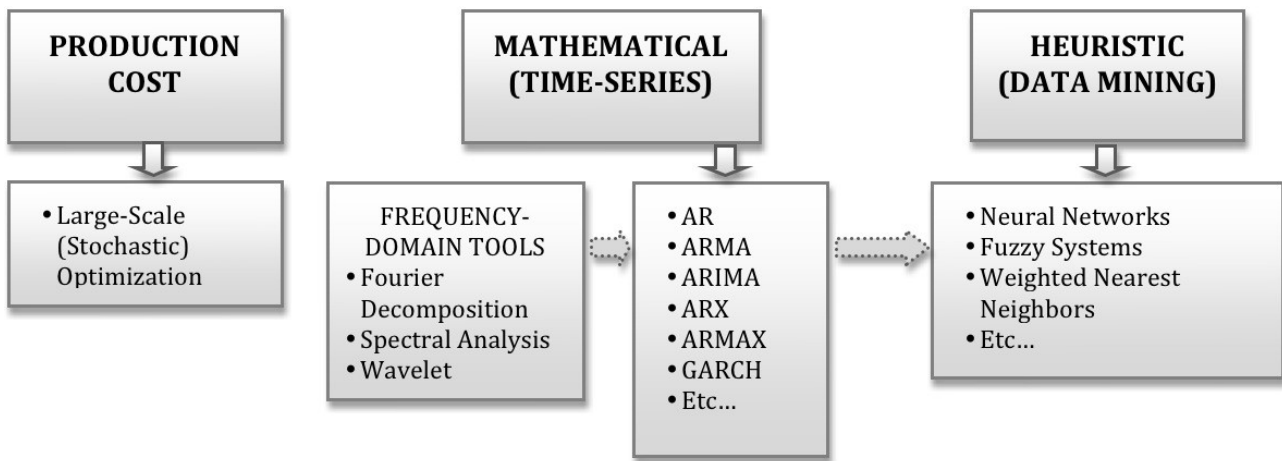
Forecasting electricity prices is a challenging task not only because the prices are uncertain but, most importantly, because of the particularities of how these prices are brought into being. The process of price formation in electricity markets follows in essence the basic rule of microeconomic theory (Law of Supply and Demand) by which the price of the underlying commodity in a competitive market should reflect the relative scarcity of the supply for a given demand level. If the demand for a commodity is low, those suppliers with higher incremental costs must step out of competition (or make negative profits) and give way to suppliers with the lowest incremental costs. This process results in relatively low equilibrium prices. On the other hand, as the demand increases, those suppliers with the lowest incremental costs are the first ones to enter the market and use up their production capacity so more and more expensive suppliers have to come in to supply the increasingly scarce commodity, rising the equilibrium price.
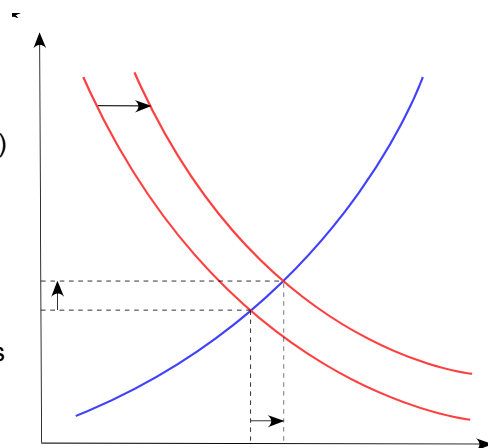
This process is observed in electricity markets on a regular basis. The market clearing prices tend to follow closely the daily and seasonal swings in consumption. If consumption and price were determined by a one-to-one deterministic relationship, anticipating the electricity prices would boil down to forecasting accurately the demand, which is one of the most investigated problems in power systems operation and planning. The influence of the demand on the electricity prices is, however, far from being deterministic. There are a series of factors that bring about uncertainty to the price formation process even if the demand is known with certainty.

One of the known factors that play a special role in electricity prices are the renewable energies. For example, in Spain ,the wind power is the most important factor to know electricity prices.

Electricity price forecasting techniques may be classified according to three major basic approaches, namely Production-Cost, Statistical and Heuristic or Data Mining models

PRODUCTION COST	MATHEMATICAL (TIME-SERIES)	HEURISTIC (DATA MINING)
• Large-Scale (Stochastic) Optimization	FREQUENCY-DOMAIN TOOLS • Fourier Decomposition • Spectral Analysis • Wavelet → • AR • ARMA • ARIMA • ARX • ARMAX • GARCH • Etc…	• Neural Networks • Fuzzy Systems • Weighted Nearest Neighbors • Etc…

The aim of this work is the development of a prediction model of the hourly generation program and price of the Spanish power market . Also, is desirable to conclude the strenths and weakness of this model and a little comparison with the most used in the market.

Our first preference to develop a new method is use WNN (Weighted Nearest Neighbor methods) after the processing of historical data prices adding the correlations found due to endogenous and exogenous conditions to the electricity prices.

Work To Be Done

1) Find the correlations between data set factors and electricity prices
2) Transform the data according to this correlations
3) Compare results with other methods

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