Simulation of Power Plant Construction in Competitive Korean Electricity Market

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Abstract

This paper describes the forecast of power plant construction in competitive Korean electricity market. In Korea, KEPCO (Korea Electric Power Corporation, fully controlled by government) was responsible for from the production of the electricity to the sale of electricity to customer. However, the generation part is separated from KEPCO and six generation companies were established for whole sale competition from April 1st, 2001. The generation companies consist of five fossil power companies and one nuclear power company. Fossil power companies are schedule to be sold to private companies including foreign investors. Nuclear power company is owned by government. The competition in generation market will start from 2003. ISO (Independence System Operator) will purchase the electricity from the power exchange market. The market price is determined by the SMP (System Marginal Price) which is decided by the balance between demand and supply of electricity in power exchange market. Under this uncertain circumstance, the energy policy planners are interested to the construction of the power plant in the future. These interests are accelerated due to the recent shortage of electricity supply in California. In the competitive market, investors are no longer interested in the investment for the capital intensive, long lead time generating technologies. Large nuclear and coal plants were no longer the top choices. Instead, investors in the competitive market are interested in smaller, more efficient, cheaper, cleaner technologies such as CCGT (Combined Cycle Gas Turbine). Electricity is treated as commodity in the competitive market. The investor's behavior in the commodity market shows that the new investment decision is made when the market price exceeds the sum of capital cost and variable cost of the new facility and the existing facility utilization depends on the marginal cost of the facility. This investor's behavior can be applied to the new investments for the power plant. Under these postulations, there is the potential for power plant construction to appear in waves causing alternating periods of over and under supply of electricity like commodity production or real estate construction. A computer model was developed to study the possibility that construction will appear in waves of boom and bust in Korean electricity market. This model was constructed using System Dynamics method pioneered by Forrester (MIT, 1961) and explained in recent text by Sternman (Business Dynamics, MIT, 2000) and the recent