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Methodology for electricity price forecasting in the long run

Gyanendra Singh Sisodia*

Amrita School of Business, Amrita Vishwavidyapeetham, Coimbatore, India
Department of Marketing, Faculty of Economics, Ghent University, Belgium

Abstract

The long-term forecasting of electricity price has received less attention in literature. A probable reason for less attention is uncertainty about various factors in the long run, for instance- oil price, regulatory policies, political intervention, technological changes, energy mix, grid operations, etc. As a general operation, energy generated through different sources is supplied to grid which is finally composed of "energy mix". A large decision on the finalisation of retail electricity price could also depend on the load factors and capacity utilization of energy generating plants.

A majority of the studies dealing with electricity price forecast electricity prices in the short run. Whereas, the aim of this study is to present a long-term perspective by introducing a methodology framework that consists of various parameters associated with the forecasting of electricity price in the long run. To the best of our understanding, this framework has not been proposed in existing energy literature, and therefore, under an assumption that future electricity market will be dominated by clean energy generation, this study brings novelty to the literature.

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Keywords: electricity price forecasting; long run electricity prices; energy mix; carbon price

* Corresponding author. Tel.: +32-4655-8968
E-mail address: singh_gis@yahoo.co.in

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1. Introduction

In general, the energy market has been considered to be highly sensitive and exerts a high volatility. Additionally, with the revisions of national objectives and changing of political priorities, energy policies are difficult to forecast. Under uncertain frameworks and dynamicity in markets, predicting an electricity price in the long run is considered to be a tedious task. However, with the evolution of volumes of energy research conducted at the EU level, a simulation study under various sets of hypothetical scenarios can offer a potential clue on the movement of future retail electricity prices.

The forecasting of various aspects of energy can be significant to politicians, businesses, industries and academic researchers. An advancement of the energy subject, particularly in prediction, forecasting and modelling, can be observed across the industry. For instance, Sisodia and Soares [1] proposed macro level investments determinants model through panel data analysis. Similar models were proposed in the area of environment [2, 3] and power consumption [4–6].

The regulations in energy markets have been observed to have a casual effect on the investments. Sisodia et al. [7] studied the effects of regulations on investments. They have studied the model with price as a variable to calculate returns on investment. If forecasting of energy is considered as a separate domain then many instances of modelling and forecasting in the short run are observed. A critical review of literature on short run modelling is presented by Sisodia et al. [8] and Suganthi & Samuel [9]. In most of the studies reviewed by Suganthi & Samuel a mix of different forecasting methodologies, for example, artificial neural networks, time series, hybrid methodologies, etc. were considered to be the latest trend in short runs electricity forecasting research. However, Sisodia et al. [8] mention that despite long run price forecasting research being very attractive to investors, a due contribution is not found in literature. Therefore, under an assumption that wind and solar will be the dominant technologies for power generation in the future, this study proposes a hypothetical framework to predict electricity prices in the long run.

2. Sub-model

2.1. Project evaluation and capacity utilization

In general, maximum profits that an energy generator can attain are through utilizing the maximum capacity of an energy generating plant. In many cases, as dictated by energy demand, generation varies during the different periods of days and seasons. Therefore, maximum utilization of energy plant for generation of energy and supplying 100 % of energy to grid is many times in question. Additionally, with the grid priority policies and EU's renewable targets, 100 % energy generation from full capacity may not be possible for certain energy generating plants. For instance, renewable energy sources (RES) have grid priority over thermal plants.

Further, higher public and private investments in energy sector has greater role to play in attaining the long run sustainability in energy generation. Through the economic framework of demand and supply, it can be mentioned that higher supply of energy leads to reduction of electricity prices. Denmark has proposed to supply 100 % of renewable energy in its electricity mix by 2050 [10]. Thus, the "long run" represents predictions for the year 2050. Also, the price will have sub classification as "household prices" and "industrial prices". Additionally, forecasted data is also available through EnergyPlan (Energyplan.eu). Therefore, we chose Denmark as it is a unique market. Further, as the Denmark favours RES over fuel based energy generation, the supply of energy through sources such as thermal, gas, nuclear, etc. may reduce in near future. Denmark has almost no hydro power [11], so we have not considered hydro power generation in this methodology.

In the Fig. 1, we propose to consider a financial evaluation of major energy generating plants on the basis of per MW energy generation cost versus cash inflows. The total cost of per MW generation is a function of installation cost (over the project life cycle), fixed cost and variable cost.

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