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AGA (Asset Governance Assessment) for analyzing affect of subsidy on MC (Marginal Cost) in electricity distribution sector

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ABSTRACT

Nowadays subsidy payments on electrical energy have to be managed and controlled to prevent any side effect particularly in developing countries. Effects of some *external factors* on Energy consumption and electricity distribution indices are analyzed in this paper. External factors are classified into three categories of social behavior, governance and urban planning. MC (Marginal Cost) of electricity in distribution is considered as the main index to be analyzed. Also, ANN (Artificial Neural Network) is applied to simulate effect of the mentioned factors on MC of distribution sector. Numerical investigation on the indices for a sample DISCO (Distribution Company) in Iran is made, results indicate that the more subsidies are allocated to consumers the more MC is increased. AGA (Asset Governance Assessment), which is proposed as a kind of governance decision, could improve the performance efficiency and avoid lose of activities done by DISCOs through subsidy management.

1. Introduction

From the electricity market view, every DISCOs' (Distribution Company) income depends on the amount of energy purchased and sold. Obviously the distribution companies can afford required electricity using the DG (distributed generation). Hence, the average income of the DISCOs depends on the DGs prices and energy received from them. Since the DISCOs are economical enterprises, they will somehow optimally manage their required energy to be purchased a profitable.

In some research, main effort is to increase the incentive of the distribution companies to increase the efficiency of distribution processes by economic relations [1]. An analytic approach to determine appropriate regulatory strategies for the energy sector is proposed by Banovac E, Glavić M and Tešnjak S [2]. Performance base regulation [3], price cap regulation [4]; under revenue cap regulation and yard stick regulation are some regulation of this category [5]. Lam P.L [6] explains China's electricity pricing policy and the variations in electricity prices across different regions of China. Corazon M.S [7] calls attention to the role pricing policy plays in influencing patterns of energy consumption and production. Economical penalties for improper performance are considered in all of mentioned methods. Therefore, by establishing framework of desired performance and its relation with penalties, the abovementioned studies have tried to describe efficiency of process economically [8]. These methods need complex calculations to find long term MC (Marginal Cost) [9]. However, in this paper, risk of DISCOs' benefit is investigated which leads to lose motivation of DISCOs.

Due to the social reasons such as economical policies of the families as well as unfamiliarity of the users with the electricity market, the rate of energy sold to the customers by DISCOs is based on the tariff policy and is being kept constant during one year average purchasing rate, however, can have different amount as they are obtained from different methods.

Electricity market should be evaluated to have minimum income equal to MC of energy trading in DISCOs. If DISCOs' incomes are decreased from their MC, they will reduce the quality of their services. Reference [10] proposes an efficient portfolio framework for load-serving entities to evaluate the role of demand response programs in achieving a desirable tradeoff between profit and risk. Reference [11] measures outage costs by using conjoint analysis. Reference [12] identifies the major factors that have turned the California dream into a nightmare. Such as poor market design, market power, sustained demand growth not matched by new capacity, rising MC, and financial insolvency. This paper illustrates effect of consumption behavior on DISCOs' benefit and MC. The aim of [13] is to re-examine the energy 2000 by redefining energy in

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terms of exergy (the amount of energy available for useful work) and the amount of useful work provided from energy inputs. Reference [14] seeks to explicate a link between energy and long term economic growth and development. Reference [15] discusses the influence on energy consumption and economic growth of Global Financial Crisis and the stimulus plan against it by input–output analysis. Reference [16] applies portfolio theory to evaluate China's 2020-medium-term plans for generating technologies and its generating portfolio. But this paper investigates role of asset governance that lead by consumers' consumption behavior in DISCOs' MC.

In this paper, a method is proposed in which the criteria of determining distribution portion in electricity price are considered based on load and network costs indices by forecasting load and energy consumption.

Energy management is very important for governments as a long term target to supply electricity. DISCOs must improve efficiency of their activities. Reference [17] presents a project designed to increase the monetary value of photovoltaic solar production for residential applications. A holistic perspective of various energy stakeholders regarding the Strengths, Weaknesses, Opportunities and Threats of the energy sector in Macedonia is utilized as baseline to diagnose the current state and to sketch future action lines towards sustainable energy development in [18]. Reference [19] presents the energy policy of the Republic of Cyprus government controlled areas. Reference [20] reports on the evaluation of the effectiveness of an energy efficiency program in eastern North Carolina. This paper proposes a new model to evaluate energy efficiency improvement considering some other governance decisions like subsidy and urban planning that is not investigated so far.

Proposed model can evaluate electricity market and assets of distribution systems. AGA (Asset Governance Assessment) is considered by DISCOs to improve budgeting and planning. Mean while AGA is taken into account by government to improve tariff strategy. DISCOs' MCs is determined via both their operation and development processes and also external factors. Reference [21] shows that large marginal distribution capacity costs variations are due to the dispersion in distribution capital expenditures by time and space. Reference [22] considers both the internal and external costs of the utility in deriving the avoided capacity cost and the avoided operating cost caused by the implementation of load management program. Electric load forecasting is crucial for managing electric power systems more reliable and economical. Reference [23] presents a new combined model for electric load forecasting based on the seasonal ARIMA forecasting model, the seasonal exponential smoothing model and the weighted support vector machines. Reference [24] applies three time series models, namely, Grey-Markov model, Grey-Model with rolling mechanism, and singular spectrum analysis to forecast the consumption of conventional energy in India. However, the effective factors on the load are not considered directly in mentioned researches. In this paper, distribution MC is obtained based on the external factors such as governance, social behavior and urban planning. These factors effect on consumers' services like quality and reliability.

Customers and DISCOs are the main components of distribution system asset governance. Distribution targets and indices are determined based on customers' profits and DISCOs' benefit. Customers want service improvement and payment reduction but DISCOs' benefit is high price tariffs, distribution system economy stability and higher consumption that lead to payment increment. This paper introduces distribution indices that represent stakeholders' benefit.

Here direct impacts of urban planning and social factors on load are investigated. Subsidy as the other effective factors on load is depended on governance economical policies and highly affects on amount of investment. Hence, distribution system asset management is essential. Improper asset management may result to MC increment and also

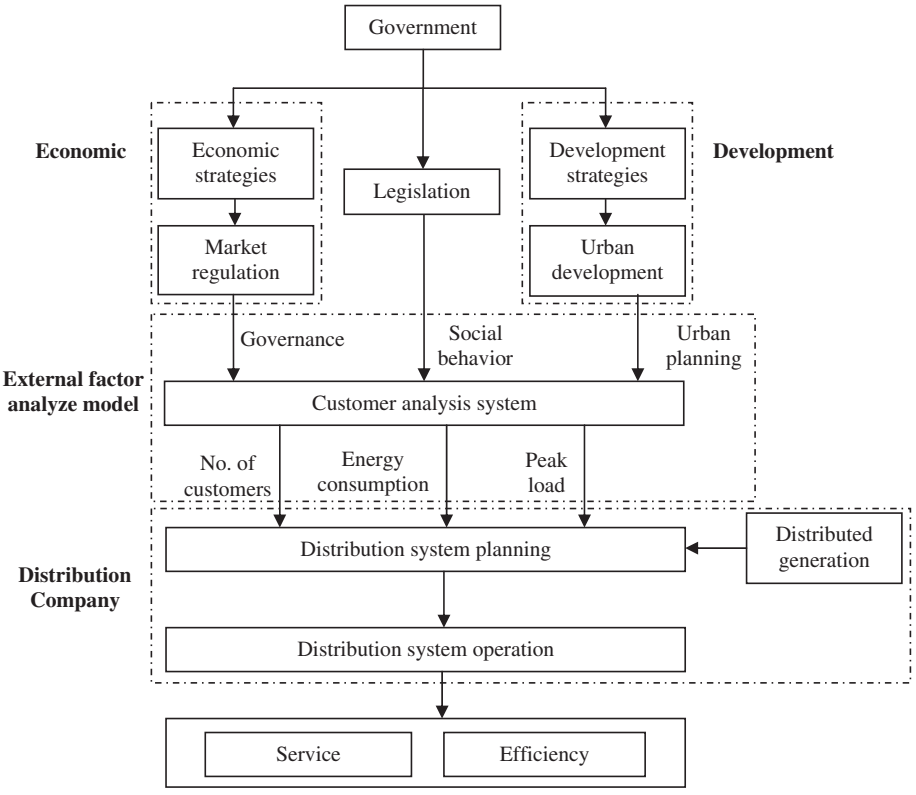

Fig. 1. Distribution system governance schematic.