



# **A DYNAMIC PROGRAMMING MODEL WITH PARAMETRIC STUDY FOR SCHEDULING THE CONSTRUCTION OF ELECTRIC TRANSMISSION/DISTRIBUTION SUBSTATIONS IN JEDDAH CITY**

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## **Abstract**

Jeddah is one of the big cities in the Kingdom of Saudi Arabia. It has a very important location near to the two holy mosques, with lot of architectural, commercial and industrial development. As per long-term strategy plan for Jeddah, the population forecast is expected to be increased from 2.9 million persons to 5 million persons within the next 25 years. The Saudi Electricity Company (SEC) in Jeddah is facing a big challenge to balance the constraints of needed demand and budget availability.

This study is devoted to predicting and economically scheduling the needed number of electric transmission/distribution substations for long-term time horizon (2009 – 2018). The forecasting of needed number of substations is based on predicting the electricity total consumption in each year and then defining the number of substations needed for that year. The schedule is aimed at minimizing the total cost based on a dynamic programming model.

The obtained optimum solution is to build the following number of substations (3,1,3,3,3,3,0,3,3,3) respectively building in the coming 10 years with total cost of SR. 2,088,220,000. There are many parameters affecting the optimal solution of the problem. These parameters are:

- Initial value of the substation building cost.
- The percentage of yearly increase in the substation building cost.
- The percentage of discount for buying more than one substation.
- Initial value of the operation cost.
- The percentage of yearly increase in the operation cost.

The proposed dynamic programming model with parametric study will provide SEC with a systematic procedure to arrive at best decision based on the optimal combination of the substations number to be built in each year during the planning time horizon, and gives an overview for the range of parameters changes for the same optimal solution. It gives also other optimal solution ranges with more parameter changes.