SUMMARY

This is the final report of the study entitled *Electric Energy Production Costing for the Saudi Electricity Sector,* which started on September 1, 2003 for duration of 12 working months. It was carried out for the Electricity and Co-generation Regulatory Authority (ECRA), Riyadh, Saudi Arabia. The study was conducted by a project team from the Center for Engineering Research of the Research Institute and the Electrical Engineering Department of King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia.

The main objective of this study was to determine and evaluate the electric energy production cost for each generating unit in the electric system of Saudi Arabia. These include the generating units in the power stations of Saudi Electricity Company (SEC), Saline Water Conversion Corporation (SWCC), Saudi Aramco, and the Power and Water Utility Company known as MARAFIQ. The results of the study will show the realistic economic merit of each generating unit and plant in the national electric grid system of Saudi Arabia. Moreover, it will also provide a summary of the cost of producing electric energy for all generating units in the Kingdom's power system.

Generation studies are conducted over a number of years reflecting plant life time. The cost components include the capital, fixed operation and maintenance (O & M), variable O & M, and the fuel intake. The generating units in the Kingdom use several types of fuel: natural gas, crude oil, heavy fuel oil (HFO), and diesel oil. The base fuel prices, considered in the study, were based on the data provided by SEC. Transportation costs were then added for the liquid fuel to reflect regional diversities. Calculations were carried out to determine the levelized cost of producing per kWh of electric energy at a number of assumed capacity factors. All calculations were levelized to the year 2004.

Performance indicators were calculated for each generating unit. The indicators adopted in this study represent typical indicators used by some international utilities. These indicators are: Utilization index (UI), Equivalent forced outage rate (EFOR), Fuel cost per unit (Hal/kWh) (FC), Total production cost (TPC), and Ageing Factor (AF). A weighted score is then determined. Generating units of low performance indicators and highest weighted sum are ranked the highest. The units were ranked in descending merit order.

A major task of the study was to provide an overview of some international experiences in restructuring and/or privatizing the electric sector. The review process has ascertained that the restructuring format is country and system specific, and the generation unbundling appears to be the most common feature. Moreover, each of the countries surveyed has different set of indicators to measure and gauge the performance of the power plants. They range from forced outage rate, total cost/unit, fuel cost/unit, reduction of planned outage duration, employee satisfaction index, and variance in capital utilization.

The major recommendations of this project may be listed as :

- The generating units in the SEC system may be grouped into at least three groups of similar performance based on the ranking system adopted in this study. The type of technology, fuel, and geographical location shall be taken into consideration.

- The SWCC system shall be treated separately. Its major objective, performance and location shall be considered and its impact on other generation entities shall be taken into account.

- The power plants owned by other utilities such as Saudi Aramco, MARAFIQ etc. may remain under the jurisdiction of the present owners for the foreseeable future.

- The fuel cost is a major portion of the electric energy total production cost. Its cost shall be considered as a pass-through in any future pricing of electricity and the tariff structure.

- There is a definite need for preparing a new master plan for electricity and desalinated water covering the needs of the Kingdom of Saudi Arabia over the coming 25 years. The plan shall also take into account the restructuring process that has been taking place in the Kingdom since 1998 in both sectors: water desalination and electricity generation and transmission. It shall also take into account the recent major developments in the Natural Gas production and its impact on fuel supply.