# OUTSOURCING PREVENTIVE MAINTENANCE ON UNDERGROUND POWER TRANSMISSION CABLES

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## *ABSTRACT*

*This paper will present Kuwait's ministry of Energy's experience with outsourcing preventive maintenance on power cables. The structure of the current contract and the tests carried out are discussed. While testing, inspecting, and reporting is left for the contractor, the decision of where these tests shall be performed in the network is left for ministry staff to decide. The criteria by which cables are selected for testing are outlined. The importance and quality of outsourced preventive work could be highlighted by result analysis. Such analysis is discussed and presented briefly. Finally, enhancements planned for future contracts are presented.*

## *KEYWORDS*

Power Transmission Network, Outsourcing, Underground Oil-filled Cables, Preventive Maintenance

## INTRODUCTION

Transmission network cables are manufactured and installed through a firm system of standards that account for safety and reliability [1]. However, with networks around the world getting older, the necessity to maintain and pay closer attention to cables is becoming more and more important as the cost and effect of a cable failure may impact a large area of consumers [2]. Because of this, a policy of doing no more than maintaining an efficient team of fault repairers is not enough to keep up with the demand of such a network. This policy must be augmented with a scheme of preventative maintenance that relies on techniques of condition diagnosis, failure prevention, failure prediction, and fault analysis. Therefore, a good maintenance team must try seriously to know why faults occur and try to prevent them from happening again. It must carry out diagnosis tests to know the condition of the network at hand and where it might be in need of intervention. It must also know where to look for weak components and replace them and how to find such information. Further, it must do this wisely and reasonably with an acceptable degree of precision using all the data and resources available while weighing the cost of failure against the cost of preventative measures [3][4][5].

With all of this in mind, Kuwait's ministry of Energy's Electrical Transmission Networks Sector has undertaken preventive maintenance practices since long and the extent of such practices would vary in time according to staff and resource availability. Since year 2000 however, outsourcing preventive maintenance were considered as an option for preventive work on underground transmission feeders. The ministry has already successfully outsourced preventive works on transmission overhead lines, transformers, and substations. In 2000 a pilot contract was introduced for power cable. This pilot contract later evolved into a three year contract of preventive maintenance on power cables.

This paper discusses in three sections the ministries experience with outsourcing preventive work. The first section focuses on the evolution of the current contract from the pilot stage, as well as an introduction of the structure, specifications and tests performed by the current contract. The second section outlines the advantages and disadvantages of outsourcing preventive maintenance, in addition to issues regarding the selection of cable feeders for preventive work. The final section briefly deals with data analysis to verify the effectiveness and significance of the works carried out by the contract to justify going further with such preventive measures.

## A CONTRACT FOR PREVERNTIVE MAINTEANCE ON POWER CABLES

Kuwait electrical transmission network holds around 5000 km (route length) of underground links. Underground cables currently constitute 54% of the total circuit of transmission feeders; the rest (46%) is overhead lines. Nearly 96% of these feeders are oil-filled cables. The highest transmission voltage level is 300KV, but it only constitutes 4.5% of the network. The other two voltage levels 132KV and 33KV make the bulk of the network with 69% and 26.5% respectively.

As the network is now ageing the need for a better policy in preventive maintenance is more important than it has ever been. While the maintenance team is quite experienced and structured when it comes to corrective maintenance, preventive maintenance has always had its ups and downs. Issues like staff and resource availability, difficulty in hiring new skilled staff, weather conditions, links availability for shutdown, have always interfered with the quality and quantity of preventive maintenance performed. Therefore, the focus of the maintenance team was always shifting from preventive maintenance and more towards other responsibilities, like stock management, availability of spare parts, strengthening the corrective or repair maintenance capabilities, and the 24-hours emergency repair teams. While stock management and 24-hour emergency corrective maintenance is important, a good policy of preventive maintenance would help ease the tension of these tasks. Preventive maintenance could predict faults before they occur and it could point at the weak parts of the network. Due to these reasons, it was thought that by outsourcing preventive maintenance on a regular basis using clearly defined and structured contracts would definitely regulate the progress of and strengthen preventive work in the network. With outsourcing, preventive maintenance could be