Enhanced medium voltage cable ratings by improving cable trench design and thermal conditions

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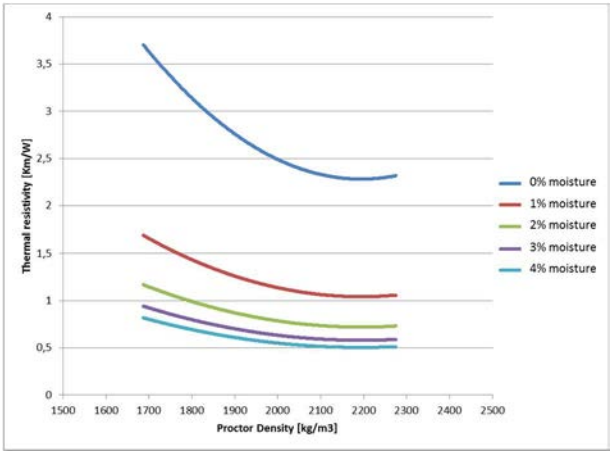
Due to increasing power demand, Dubai Electricity and Water Authority (DEWA) is experiencing higher loading of their medium voltage (MV) cable network. Expansion of the cable network is restricted mainly due to space limitations in the city of Dubai. Therefore, other means to increase the current rating of the MV cable network are required.

The cable current rating depends on different aspects, such as the cable arrangement in the cable trench and the soil surrounding the cables. In particular, the value of the thermal resistivity of the backfilling material is of utmost importance. DEWA and DNV GL have investigated possibilities to reduce the value of the soil thermal resistivity to 1.0 km/W or less by using special backfilling materials. Moreover, the backfilling material should be made from local available materials. This will result in a significant improvement in medium voltage cable ratings.

This contribution describes the performed soil investigations, the optimized cable trench arrangement and lay-out. It also describes the necessary quality control and assurance measures to ensure proper fabrication, transportation and installation of the backfilling material. As expected, it is shown that the presence of moisture and the magnitude of the dry density have an important impact on the magnitude of the thermal resistivity. It was concluded that locally available crushed rock combined with red dune sand, with a minimum dry density of 2100 kg/m^3 and 1% moisture content will lead to a thermal resistivity of around 1.0 km/W.



Finally, an existing cable trench has been selected as pilot project to partly replace the existing backfilling material by the proposed backfilling material. Temperature measurements have been conducted for over one year in a part of the trench with the original sand and in a part with the backfill material. The thermal influence of the proposed backfilling material has been investigated, but also the stability and settling of the proposed backfilling material. After one year, samples have been taken in both parts of the cable trench. It was concluded that the moisture content was in the order of 2% and no significant changes in the material itself occurred. The temperature measurements showed lower values in the backfill material compared to the original material which confirms the improved thermal conductivity of the backfill material.