

Copper or aluminium cable conductors, broadly compared in a life-cycle perspective

Wim **BOONE** (1), Arnav **KACKER** (2), Remco **BAL** (3)

1 DNV GL, Arnhem, The Netherlands, Wim.Boone@dnvgl.com

2 PE-International, Stuttgart, Germany, A.Kacker@pe-international.com

3 DNV GL, Arnhem, The Netherlands, Remco.bal@dnvgl.com

A cable conductor usually consists of copper or aluminum. Next to cost differences, each material has pros and cons that affect their use in various applications. Originally copper was the only conductor material used, later aluminium was introduced as a conductor material as well. Some utilities are in favour of copper, some utilities are using aluminium. A questionnaire was prepared that was sent to about 100 distribution utilities in 25 countries, to obtain information about the motivation behind the decision to use copper or to use aluminium conductor. After giving summarized information on the typical properties of copper and aluminium conductors and information on failure mechanisms related to conductor material, the results of the questionnaire will be presented.

After this introduction to the technical aspects of copper versus aluminium and the related perception of utilities, attention will be paid to the environmental performance of both conductor materials in a Life Cycle Analysis (LCA). An investigation into the end-of-life of cables has been performed following an LCA approach for copper and aluminium power cables in Europe. This also included a thorough market survey of the cable recycling industry to reflect a real-world quantification of the end-of-life stage.

The LCA aggregates the environmental impacts associated with the manufacturing, recycling effort, and credits through replacement of primary metal by recycled metal on the market.

Our analysis finds that copper cables have lower net environmental impacts than aluminium counterparts for several impact categories. The relative difference in net impacts between the copper and aluminium variants becomes more pronounced for higher voltage cables. The difference amongst

This paper about copper and aluminium will be completed by a proper Life Cycle Cost Analysis (LCCA), in order to compare costs over the entire lifetime. With this method, it is possible to calculate the real economic choice between cables of copper and aluminum.

To find the life cycle cost, all costs over the lifetime of a cable are considered, including initial capital costs, O&M costs, cost of electric losses and residual value after demolition. These costs are discounted and totaled to a present day value.

This has shown that the difference between copper and aluminium cables over their entire lifetime is not as significant as generally thought. The cost for raw copper material is about 3.5-4 times higher than aluminium but looking at lifetime costs, and within the uncertainties of LCCA over the long cable lifetime, both solutions can be considered equivalent.