

## MODERN 3-CORE MV XLPE CABLES AND THEIR IMPACT ON TCO

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### ABSTRACT

As the cost of power is increasing the total cost of ownership of medium voltage cables is getting more and more important. Both the cost of different installation techniques and losses are relevant to consider when looking at the total cost of ownership for medium voltage cables.

### KEYWORDS

Total cost of ownership, ploughing, trenching, losses, installation techniques

### INTRODUCTION

The Total Cost of Ownership for a medium voltage cable is not only the investment cost of the cable itself as you may believe. In this paper the different impacts on the TCO for a modern 3-core medium voltage cable will be discussed, such as how the cable is installed and the benefits with a common screen during the whole lifetime for the cable.

### Background

In the time of paper insulated medium voltage cables a common lead sheath was needed to keep the oil in place which led to the large use of 3-core medium voltage cables. With the development of XLPE cables in the 1960:ies the advantage of a common sheath was not as obvious and single core cables became more dominate.

To avoid the treeing phenomena, which were discovered in the 1970:ies, the cables needed to be totally water tight. The modern 3-core cable should also be flexible and easy to handle and at the same time tough enough for the modern installation techniques. This is solved with an aluminium-foil around the 3-cores, as seen in figure 1 below, and the outer sheath is reinforced with a hard layer outside the cable body [1].



Figure 1 Cross section of a modern 3-core cable with enforced outer sheath

### Installation techniques

There are two different ways to install the cable in the ground, ploughing and trenching. Which method that is most suitable depends on the landscape for the installation.

#### Ploughing

To make sure that the soil is suitable for ploughing the ground is examined with a geo radar. Then the installation path should be ploughed once, without any cable just to make sure that there are no sharp objects in the path that might damage the cable during the installation.

There are two ways to plough down single core cables, one way is to have three separate drums for each single core cable. This has the advantage of being able to use longer lengths in each drum which might decrease the number of joints needed. The disadvantages are that a rather large machine is needed for handling these three drums and the preparation time with installation of the drums on the ploughing machine will take longer time. The other solution is to bundle the single core cables into a tripack on one drum for only having to have one drum on the machine ploughing the cable. This will on the other hand limit the amount of cable on each drum leading. For ploughing a 3-core cable only one drum is needed on the machine and it is possible to have rather good length of the cable on a drum. After the cable has been ploughed down in to the ground the soil only has to be pressed back either by a tractor bucket or a vibrating foot which results in a quite low impact on the environment.

According to the EBR, the Swedish system for rational planning, construction and maintenance of distribution plants and facilities in the range of 0,4 – 145kV, the total cost for ploughing 1km will be approximate 50 000 SEK [2].