INSTALLING A LONG-DISTANCE HTS CABLE

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ABSTRACT

Nuon, nkt cables and Praxair will install a long HTS cable in Amsterdam. An existing HV circuit will be retrofitted by replacing a 150 kV gas pressure Cable with a 50 kV HTS Triax cable. The Triax design will be used to fit in the steel pipe.

The cable will be located within an existing steel cable conduit, which will reduce digging activities and minimize cable costs. The cable construction consists of 16 cryostat sections and 3 cable sections. As a result the pulling forces can be kept within the acceptable tolerances. Closed loop cooling systems will be installed at each end of the cable.

KEYWORDS

HTS, Triax, cable, cryostat, civil, cooling, retrofit.

INTRODUCTION

One of the first applications for HTS cables is within urban cores. This requires long cables with limited cooling systems. The utility Nuon, nkt cables and Praxair, Inc. are working together to install a 6 km long HTS cable in the city of Amsterdam. An existing high voltage circuit will be retrofitted by removing a 150 kV gas pressure cable from the steel pipe and replacing it with a 50 kV HTS cable.

Several financial and technical challenges must be overcome. New cable designs and better cooling systems are needed. A special designed three-phase cable, called Triax cable, will be used. To fit in the steel pipe, this cable will be provided with both inside and outside cooling channels.

This article will focus on all the civil aspects of the installation of this long distance HTS application. Due to limited space and other practical issues in urban areas, several cooling systems along the cable are not allowed. Therefore, only two cooling systems (one at each end) will be used.

REASON FOR INVESTMENT

In Amsterdam's electrical network, an important cable lacks adequate capacity. This 150 kV gas pressure (GP) cable is 6 km long and has a capacity of 100 MVA. In recent years the load fed by this cable has considerably increased. Due to the increased load, this portion of the network lacks full (N-2) reliability (figure 1).

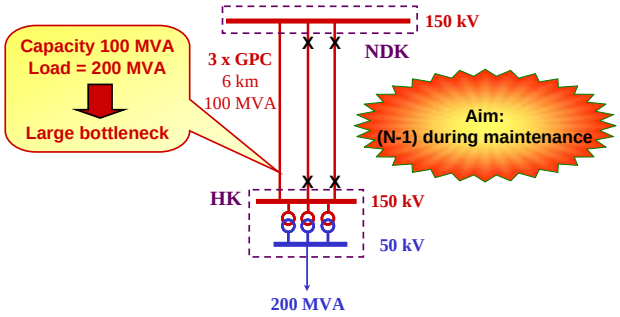

Figure 1. Capacity bottleneck in the network of Amsterdam

To solve this capacity bottleneck, a major investment is required. Because the cable will have to cross a very crowded downtown with numerous canals, a conventional cable installed in a new trench in Amsterdam is prohibitively expensive (figure 2). Additionally, obtaining permits for a project of this magnitude will be expensive, time consuming, and difficult.

Figure 2. Substations in crowded down town Amsterdam

RETROFITTING WITH HTS CABLE

A solution which reuses the existing steel conduit avoids many civil issues. A technology with large power capacity that will fit into this pipe was necessary. HTS cable, due to its very large power handling capacity in a small diameter, is the most promising solution.

The existing 150 kV GP cable will be removed from the steel duct (figure 3) and replaced with a new 50 kV HTS cable with more than twice the power carrying capacity.