

**A3.5****Latest development of high temperature super conductor (HTSC) cable systems**

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**Summary**

High Temperature Superconducting (HTS) cables promise a number of special benefits in terms of their high current carrying capacity, negligible electrical losses, overall dimensions and weight, and reduced environmental impact.

This paper describes four application-focused HTSC projects in progress within Pirelli Cables and Systems, to demonstrate the feasibility of HTS technology for application in both "warm dielectric" and "cold dielectric" cable systems.

**Introduction**

Demand for bulk-power transmission is growing, not only for systems feeding dense urban areas, but also in meshed transmission networks.

In certain regards, we are already approaching the upper limits of what can be achieved with conventional underground transmission cables, particularly in terms of maximum conductor size (hence current rating), space efficiency, and direct-buried naturally-cooled operation.

The prospect of adopting High Temperature Superconducting (HTS) cables therefore offers a number of attractions and advantages, potentially overcoming constraints of conventional transmission cables.

This paper presents a technical overview of current HTS cable system developments within the Pirelli Group, demonstrating the status of technology in the terms of HTS tape performance, cable design, product development and performance, targeted applications, and initial laboratory/field trials with HTS cable systems.

**Résumé**

Les câbles supraconducteurs à haute température (HTS) présentent des avantages particulièrement intéressants en regard : de leur grande capacité à transporter du courant, de pertes électriques négligeables, de leurs dimensions et poids réduits et d'un impact réduit sur l'environnement.

Cet exposé décrit quatre projets d'applications de HTS, en cours chez Pirelli « Câbles et Systèmes », pour démontrer que la technologie peut s'appliquer dans des systèmes de câbles à isolant chaud et à isolant froid.

**Background**

Whilst the initial motivation to use low-temperature superconducting (LTS) cables had been strong, related developments of LTS cables proved them to be uneconomic for practical application because of the excessive cost and complexity of the helium cooling systems needed to achieve the required operating temperature of 4.2K.

However, since the early 1990s, several studies of potential areas of application of the new generation of HTS materials able to operate in liquid nitrogen at about 77K have shown the potential economic attractiveness of HTS cables in applications such as:-

1. Bulk power transmission for underground cables carrying power of the order of 1GVA or more,
2. "Space-constrained" installations where "retrofitting" of a compact HTS cable into an existing cable duct can more than double the transmitted power rating.

**Pirelli-EPRI Development of 115kV HTS Cable**

The Electric Power Research Institute (EPRI)