Update on world's first superconducting cable and fault current limiter installation in a German city center

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In recent years significant progress has been made in the development of high temperature superconducting (HTS) power devices, in particular cables and fault current limiters. Several field tests of large scale prototypes for both applications have been successfully accomplished and the technologies are getting closer to commercialization. Especially the application of medium voltage HTS systems as replacement for conventional high voltage cable systems is very attractive and offers many advantages. Besides the increased power density there is only a negligible thermal impact on the environment. In addition, HTS cables do not exhibit outer magnetic fields during normal operation and in combination with HTS fault current limiters the operating safety is also increased. Since HTS cables are in general more compact than conventional cables the required right of way is much smaller, the installation is easier, and the required substation space is reduced as well. Especially in congested urban areas dismantling of substations results in prime location space gains which could be sold or used otherwise.

This paper will give an update on the German AmpaCity project, which started in September 2011. The objective of the project is developing, manufacturing and installing a 10kV, 40 MVA HTS system consisting of a fault current limiter and of a 1 km cable in the city of Essen. Since it is the first time that a one kilometer HTS cable system is installed together with an HTS fault current limiter in a real grid application within a city center area, AmpaCity serves as a lighthouse project. In addition it is worldwide the longest installed HTS cable system. Within the project the development phase was finished in March 2013 with successfully completing the type test of the cable system. Subsequently, all system components were manufactured and the installation on site took about two months finishing at the end of November 2013. Afterwards, the commissioning test of the system was performed in December. In the beginning of March 2014, the system was commissioned into the grid and has since then been supplying energy to the city center of Essen.

The widespread use of HTS cables and fault current limiters depends upon the extent to which it is possible to improve the price performance ratio of HTS materials and to optimize manufacturing of cables as well as the cost and reliability of the required cooling technology. It is expected that relatively large technical advances will be made in the future of the comparatively new HTS technology, which in turn will bring associated cost reductions. For this reason, the AmpaCity pilot project in the downtown area of Essen in Germany will be an important step on the way to achieving more widespread application of HTS technology.