HVDC

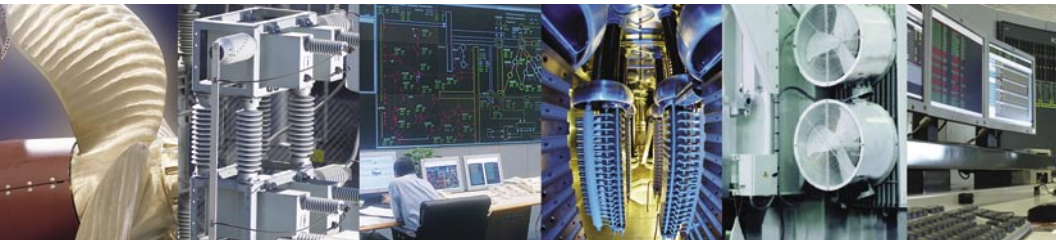

ABB Technology Guide

What is HVDC?

High-voltage direct current (HVDC) is a technology developed by ABB more than 50 years ago to increase the efficiency of power transmission over long distances.

The background and technology

Power stations generate alternating current (AC) and most power lines carry AC that oscillates with 50 or 60 cycles per second, whether for the high, medium or low-voltage distribution grid. Power also reaches consumers in homes, industries and offices as AC.

Direct current doesn't oscillate, so less energy is lost during transmission using DC. The current is changed in a converter station and transmitted to the receiving point by an overhead line or cable. It is then restored to AC in another converter station and injected into the receiving AC network.

ABB completed the first HVDC link in 1954 and has supplied more than half of the world's HVDC projects. ABB in 1997 made the first installation of HVDC Light, a development of the technology that opened up new possibilities for improving the quality of supply in AC networks. HVDC Light uses underground or underwater cables as the transmission link.

HVDC and energy efficiency

HVDC is attractive because less electricity is lost in transmission than with conventional AC technology. It also requires fewer transmission lines, meaning that less land has to be cleared. Because special equipment is needed to convert electricity from alternating current to direct current, HVDC is cheaper only over long distances, typically more than 600 kilometers (373 miles) for overhead lines and more than 50 km for underwater cables.

In the example of a line with a bulk power transmission need of 6 gigawatts (GW), about 5 percent of the electricity will be lost over a distance of 1,500 kilometers when using an 800 kilovolt (kV) DC line. The losses climb to 6 percent with a 500 kV DC link and about 7 percent with conventional 800 kV AC lines.

Demand for long-distance transmission is increasing because of the rising energy needs of developing countries and efforts to tap more renewable sources of energy.

Whereas non-renewable energy sources like coal, oil and gas can be transported and used where the power is needed, hydro, wind, sun and wave energy can only be transported as electricity. In addition, the largest sources of renewable energy tend to be situated far from the urban and industrial centers where electricity is used.

A further advantage of HVDC is that it can be used to connect different alternating current networks and increase the efficiency of each. The technology allows the power flow to be controlled rapidly and accurately in terms of both the power level and the direction. It can compensate fluctuations in the power flow, making it the ideal technology for linking wind farms whose uneven production could otherwise disrupt the reliability of the network.

www.abb.com/energyefficiency