

Advantages of HVDC over AC transmission

The advantage of HVDC is the ability to transmit large amounts of power over long distances with lower capital costs and with lower losses than AC. Depending on voltage level and construction details, losses are quoted as about 3% per 1000 km. High-voltage direct current transmission allows use of energy sources remote from load centers.

In a number of applications HVDC is more effective than AC transmission. Examples include:

[Undersea cables](#), where high capacitance causes additional AC losses. (e.g. 250 km [Baltic Cable](#) between [Sweden](#) and [Germany](#)^[9]).

Endpoint-to-endpoint long-haul bulk power transmission without intermediate 'taps', for example, in remote areas.

Increasing the capacity of an existing [power grid](#) in situations where additional wires are difficult or expensive to install.

Allowing power transmission between unsynchronised AC distribution systems.

Reducing the profile of wiring and [pylons](#) for a given power transmission capacity.

Connecting remote generating plant to the distribution grid, for example [Nelson River Bipole](#).

Stabilizing a predominantly AC power-grid, without increasing [maximum prospective short circuit current](#).

Reducing line cost since HVDC transmission requires fewer conductors (i.e. 2 conductors; one is positive another is negative)

Long undersea cables have a high [capacitance](#). While this has minimal effect for DC transmission, the current required to charge and discharge the capacitance of the cable causes additional I^2R power losses when the cable is carrying AC. In addition, AC power is lost to [dielectric](#) losses.

HVDC can carry more power per [conductor](#), because for a given power rating the constant voltage in a DC line is lower than the peak voltage in an AC line. This voltage determines the insulation thickness and conductor spacing. This allows existing transmission line corridors to be used to carry more power into an area of high power consumption, which can lower costs.

[edit] Increased stability of power systems

Because HVDC allows power transmission between unsynchronised AC distribution systems, it can help increase system stability, by preventing [cascading failures](#) from propagating from one part of a wider power transmission grid to another.

Changes in load that would cause portions of an AC network to become unsynchronized and separate would not similarly effect a DC link, and the power flow through the DC link would tend to stabilize the AC network. The magnitude and direction of power flow through a DC link can be directly commanded, and changed as needed to support the AC networks at either end of the DC link. This has caused many power system operators to contemplate wider use of HVDC technology for its stability benefits alone.

[edit] Disadvantages

The required [static inverters](#) are expensive and have limited overload capacity. At smaller transmission distances the losses in the static inverters may be bigger than in an AC transmission line. The cost of the inverters may not be offset by reductions in line construction cost and lower line loss.

In contrast to AC systems, realizing multiterminal systems is complex, as is expanding existing schemes to multiterminal systems. Controlling power flow in a multiterminal DC system requires good communication between all the terminals; power flow must be actively regulated by the control system instead of by the inherent properties of the transmission line.