

# Hvdc technology to abb and siemens



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## **Benefits / Advantages**

### **Of HVDC Technology To ABB And SIEMENS**

HVDC technology, being the most energy-efficient and reliable way of transmitting a long distant bulk power was developed by some companies like ABB, SIEMENS and ASEA, AEG, BBC etc. Siemens manufacturer call this concept “ HVDC PLUS” while ABB manufacturer calls a similar concept “HVDC Light”. More than 50 years ago, ABB developed HVDC technology in order to increase the power transmission efficiency over long distances and to enhance the stability of voltages in power network. This poses many advantages to ABB and the world at large. In order to cope with the new challenges worldwide, SIEMENS also developed a solution known as HVDC PLUS; this will help protect the climate by limiting the emissions of carbon dioxide and by optimal use of energy resources.

HVDC compared with the conventional alternating current (AC) transmission technology does not lose less electricity. Another major advantage of HVDC technology is that it is able to connect AC power networks which are incompatible thereby increasing the efficiency and stability of each component/ network. Also the electromagnetic fields of HVDC are negligible. It requires lesser transmission lines, hence the need for small space. The technology is very cheaper over long distances, since special equipment is required to convert electricity from alternating current to direct current.

### **ABB HVDC Light**

In 1954, ABB delivered the first installation to convey power between the Swedish mainland and the Gotland Island, and has since led the

development of HVDC. In the 1990's, a further advancement was achieved with the development of HVDC Light, the technology used in Eslink.

HVDC Light is so far the most interesting power transmission technology worldwide, developed for several decades. HVDC Light is a state-of-the-art power system which is developed to transmit power underground and under water, also over long distances. It is currently offered in lower power ranges (10-1, 100 Megawatts), compared to the other HVDC systems at (300-5, 000 Megawatts). Like the traditional HVDC method, the new technology offers similar benefits and provides more secure power control and faster power restoration in the case of blackout. It can also stabilize the unsteadiness in power level and make it a viable technology for stabilizing irregular electricity flows, for instance, those generated by wind farms, which has the ability to upset power networks.

HVDC Light is ultimately a friendly technology, featuring oil-free cables, compact converter stations and cables that can be buried underground as well as underwater. It is recognised as the only technology that allows long-distance underground high-voltage transmission. It provides numerous environmental benefits, such as neutral electromagnetic fields, "invisible" power lines, compact converter stations and oil-free cables. Another benefit derived from this technology is that it is quick to install and provides another option to the traditional AC transmission method and local generation. HVDC Light increases the reliability of power grids, and the technology extends the economical power range of HVDC transmission down to just a few tens of Megawatts. Some of the useful applications include:

- Connecting wind farms to power grids
- Underground power links
- Providing shore power supplies to islands and offshore oil & gas platforms
- Connecting asynchronous grids
- City centre in-feed

### **SIEMENS HVDC PLUS (VSC Technology)**

The Siemens HVDC PLUS is a newly introduced technology in the field of HVDC transmission systems and paves way for new fields of the proven HVDC technology. Its newly development offers both technical and economical advantages. Through the utilization of a new concept of modular multilevel voltage-sourced converters, HVDC PLUS is the favourite solution where shortage of space is a measure. It is ideal for connection of remote offshore platforms and wind farms to the onshore grid as well as for power supply high-density areas such as mega cities. With regard to system security, HVDC PLUS improves the performance of the transmission grid

As an innovation leader in HVDC transmission, Siemens developed HVDC PLUS, an advanced and universally applicable solution for power transmission in the range up to thousand megawatts or higher.

Benefits

### **Technological Aspects**

Some of the technological importance/benefits of HVDC PLUS are as follows:

- It can be operated in AC grids with extremely low short-circuit levels or with passive loads.

- It has independent control of active and reactive power (full four quadrant operation).
- It can be connected to blacked-out networks and re-energize them.
- It can be operated in an unsymmetrical network (e. g. during AC network faults) and it provides unbalance control to compensate unsymmetrical loads.
- With regard to reactive power and offshore voltage control for weak AC grids, it is very flexible.
- It is robust with respect to AC network faults, fault-ride through capability and it serves as firewall for limitation of spread of system disturbances.
- It is completely applicable for Back-to-Back application as well as for long-distance-transmission with DC cables or with DC overhead-line.

### **Economical Aspects**

The VSC technology provides a straight forward AC side connection. The modular multilevel converter principle renders AC harmonic filters superfluous. A standard transformer design can be used without special requirements to withstand DC voltage or harmonic currents. The converter does not produce any significant high frequency noise, so outdoor installation of AC- and DC reactors (if necessary) and switchgear is feasible. The modular rack-type converter arrangement provides flexibility with respect to building height versus -length. It allows to lower building height compared to conventional HVDC converters. The converter modules are operated with a low switching frequency resulting in low converter losses. The converter and the control equipment are designed with a high level of component redundancy.

The features of HVDC PLUS are:

- Low space requirements
- Low height of the installation
- Short installation and commissioning period
- Lower losses in comparison with 2 and 3-level converters
- High Reliability

### **Environmental Aspects & CO2 Reduction:**

As the power industry strives to reduce its environmental impacts by utilizing more renewable energy resources (e. g. large wind farms) the transmission system owners face the difficulties of integrating these often remote and fluctuating energy sources into the grid.

HVDC PLUS is the key solution to these challenges which impede the take-up of renewable energies. In this regard the possibilities to operate with low short-circuit levels, the small footprint, and the independent control of MW and Mvar are of particularly advantages. With HVDC PLUS, islanded networks, such as oil and gas platforms as well as mines, can be connected without the need for local generation which is less efficient. This helps reduce the CO2emissions.

### **Applications**

HVDC PLUS has a wide range of applications. In particular, it aims to fill the gap in the market for flexible DC solutions to simplify the grid access of remote or renewable energy sources.

- Submarine DC Transmission
- Back-to-Back Transmission

- Overhead Line Transmission
- Offshore Applications

### **Multiterminal Configuration**

In summary, the ABB's HVDC Light converter consists of two-level three-phase bridge with six valves, each consisting of series-connected IGBTs. Siemens HVDC Plus system is a new generation of converters using voltage-sourced converter technology and IGBTs. The HVDC Plus and HVDC Light systems offer several advantages including less space requirements, supply of very weak systems and black-start capability that allows restarting a collapsed network. Systems such as HVDC Plus and HVDC Light are suitable for DC links in the low to medium power range application up to 1, 000MW and relatively shorter distances (hundreds of kilometres). Currently various companies are developing IGBT devices for higher power applications

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