History of inverters

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By the time HVdc transmission was technically feasible with the availability of high-power mercury-arc valves, the stability problems in ac systems were more or less overcome. Hence, dc had to compete with ac in economic terms as well. An overhead transmission distance of at least 500 mi (~800 km) was necessary to create significant incentive to proceed with HVdc. Also, over the years the requirement of power systems changed. DC transmission was not to connect dc source to dc load; instead it had to connect power systems which carried ac currents.

figure 4. English Electric Co. mercury-arc valves at Dorsey Station, Nelson River 1 project, Manitoba, Canada [from J. M. Ferguson, "Corridors of power," Proc. Inst. Elec. Electron., vol. 120, no. 1, Jan. 1973, p. 49, photo courtesy of the Institution of Engineering and Technology (IET)].

There were also environmental -issues associated with the operation of mercury-arc valves. Each sealed mercury-arc valve contained 2.64 qt (2.5 l) of mercury. During operation and maintenance of the valves, several pounds of mercury vapors were released to the atmosphere each year; hence careful monitoring around valve halls was required to manage mercury exposure. The mercury-arc-valve-based dc transmission systems were limited to the early 1970s (see Table 1). As of today, mercury-arc valves in all HVdc systems have been replaced by thyristor valves, except for one link.

The advances in the thyristor manufacturing process improved thyristor characteristics and allowed rapid growth in device rating in the 1960s. By the late 1960s, thyristors with a blocking capability of 1.6 kV and a current rating of 900 A, equivalent to the current of a three-anode mercury-arc valve, were developed. It made solid-state technology an economical proposition for HVdc applications up to a voltage of 50 kV per valve, above which thyristors were still inferior to mercury-arc valves because of higher losses.

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