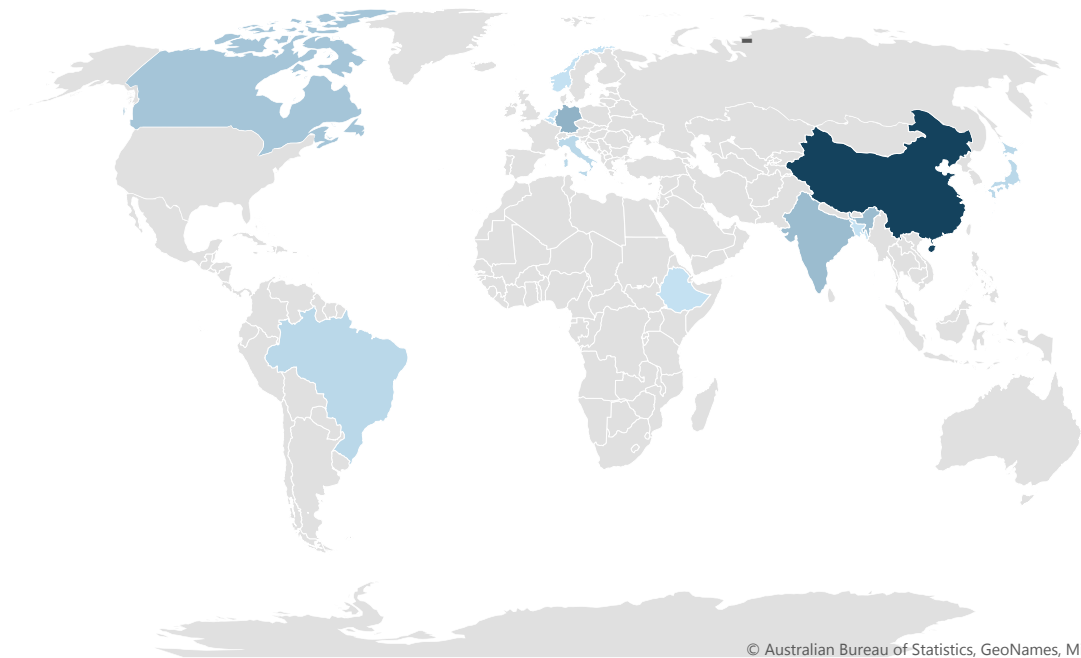




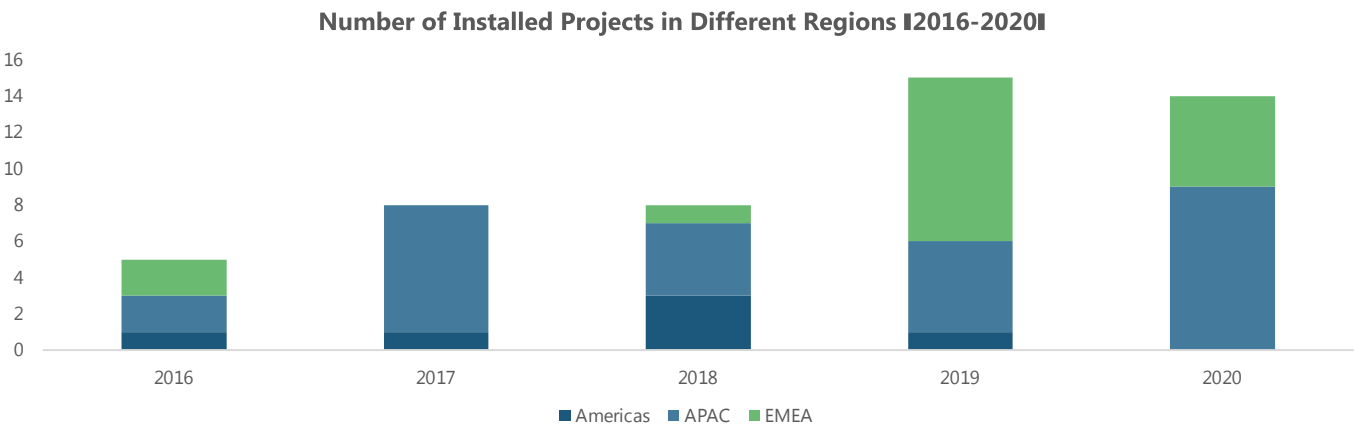
Overview of VSC & LCC Market (2016-2020)

Global Hotspots (2016-2020)



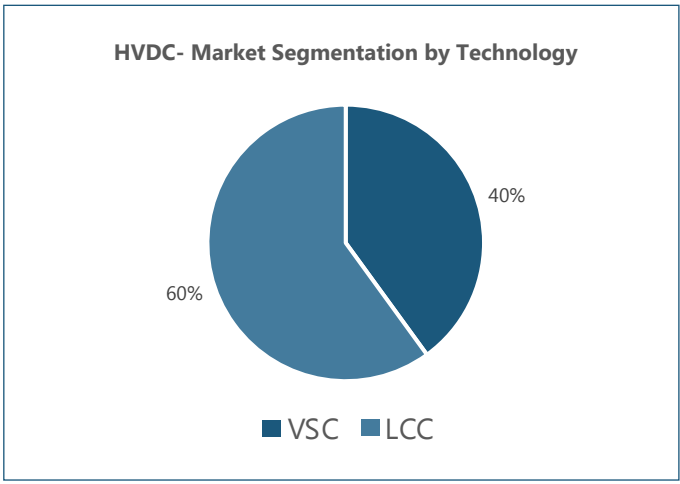
HVDC technology is not a mature technology across the globe. HVDC projects are long term with few projects installed every year depending upon the grid requirements and ability of utilities to spend on new technology. This map depicts where the most installations have been in the last 5 years. China, India, Germany, Canada, and Brazil along with some European markets were the major demand centers during this time period.

Regional Segmentation of Installed HVDC Projects



This market snapshot depicts the number of HVDC projects installed in the last 5 years globally. The APAC region (especially China) and European markets were major demand centers during this time period. APAC dominates the global market as its transmission infrastructure is being developed the most quickly. It accounted for more than one third of the total market over the last few years with the largest installed bases for HVDC. This is especially true for China which had invested approximately USD 57 billion into HVDC projects. According to China’s National Energy Administration, they country will sign nearly 10 new ultra-high voltage projects in the next few years. Moreover, the renewable penetration, majorly offshore wind in the European grid, is also instigating the demand for long distance DC transmission.

Market Segmentation by Technology (2016-2020)



LCC is a more developed technology that has been used in HVDC systems since the 1970s and dominated the market for decades. However, due to the technical advantage of the black start capability of VSC technology, it is rapidly penetrating the market. In the last five years, this technology has captured 40% of the market share.

Key Suppliers (2016-2020)



Siemens and Hitachi ABB have retained its their positions as the top supplier of LCC. That said, new players such as NR Elec- tric are quickly rising as well and captur- ing the market rapidly due to their strong presence in the Chinese market.

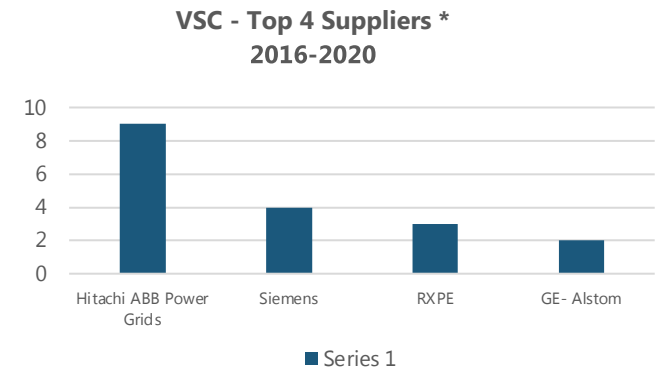


ABB (now Hitachi ABB Power Grids) has been the market leader in the VSC market over the last five years, followed by Siemens. Asian players such as RXPE are also capturing the market at a rapid pace.