

## 2 EXECUTIVE SUMMARY

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Conventional transformers are single-functional devices generally used to transform the voltage from one level to another, such as stepping it down from the high voltages at which power is transformed to the 120 and 140 volt levels used at homes. The novel solid state transformers are multi-functional devices made up of high-powered semiconductor components, high frequency transformers and control circuitry giving it the ability to handle high power levels and fast switching speeds. When software and communication capability is integrated with these devices, they are termed as solid state transformers. Solid state transformers has the ability to step up as well as step down AC voltage levels just like the conventional transformers, but it also provides several important advantages.

**These include:**

- Allow two way or bidirectional power flow
- Input or output AC or DC power
- Actively change power characteristics such as voltage and frequency levels
- Improve power quality (reactive power compensation and harmonic filtering)
- Provide efficient routing of electricity based on communication between utility provider, end user site and other transformers in the network
- Greatly reduce the physical size and weight of individual transformer packages with equivalent power ratings

Solid state transformers have a very niche market. Market growth has kicked off in the recent years. More number of prototypes has been developed by research institutes as well as leading transformer manufacturing companies which have tested successfully.

The major applications where it has a huge potential for growth are Smart grids, Electric vehicle charging stations, and Traction locomotives. Lot of developments in developing SST for smart grid has taken place recently. Many conferences have already been conducted where important officials of prominent players in this field have given valuable insights about the

technology. Many new ventures have received funding, to come up with efficient smart transformers for smart grid. The SST market for smart grids would pick up momentum in next one or two years as nearly 30-50 companies are involved in the development of this technology for smart grids. Electric vehicle charging is another emerging field where solid state transformer technology would be used effectively. It is predicted that there will be a huge market for electrical vehicle charging in two years as more than 70,000 has already entered the market. The application of SST technology in traction locomotives would completely revolutionize the railway network. This development would complement the electrification taking place in railways. North America poses as a potential market, as only 1% of its rail routes have been electrified. It is believed that 35% North American rail route will be electrified in next four years.

Taking the geography into consideration, U.S. would be the largest market for solid state transformers. Smart grids and electric vehicle charging application deploying SSTs, will have a phenomenal market in U.S. for the next two years. Europe will lead traction locomotives application of SST as major chunk of testing of solid state traction transformers has taken place in Europe, Swiss federal railways, being a noted name in this regard.

The major players in the Solid state transformers market include ABB (Switzerland), Siemens AG (Germany), Schneider Electric SA (France), Alstom (France), Avago Technologies Limited (U.S.), Bombardier Inc (Canada), Cooper power systems (U.S.), Mitsubishi electric Corporation (Japan), CREE Inc (U.S.), Infineon Technologies (Germany), STMicroelectronics (U.S.), SPX Transformers (U.S.), GE (U.S.), Duke energy (U.S.), Plasmatechnics Inc (U.S.), Selco (U.S.), Varentec (U.S.) and Gridco Systems (U.S.).