Tutorial proposal for the EPE 2011 conference

TITLE
Power Electronics for High Voltage Direct Current (HVDC) Applications

NAME AND AFFILIATION OF THE AUTHORS
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WHO SHOULD ATTEND
The intended tutorial audience is power electronics engineers and researchers interested in gaining a better understanding of HVDC applications and the state of the art technology in the field. The attendees should preferably have basic skills and knowledge in power engineering and power electronics.

SCOPE AND BENEFITS
The tutorial will shed light on the requirements and preferences with regard to functionality and performance that are encountered in HVDC applications. Furthermore, the technical solutions in use will be explained and discussed, on the component level as well as the system level.

Current source converter (CSC) based HVDC is a well established technology for efficient long-distance and subsea power transmission since more than fifty years. The more recently introduced voltage source converter (VSC) HVDC systems offer additional attractive features. One of the most important is the possibility to make connections in or between networks by extruded polymer DC cables. Furthermore, pulse width modulation of the output voltage allow for small filters and thereby smaller converter station footprint.

Recent developments in four major technology fields; power semiconductor valves, cable systems, circuit topologies and HVDC control, have opened the possibility to increase the power rating of VSC based HVDC and greatly expand the area of application. In particular, the introduction of topologies based on cascaded cells have allowed for significant loss reductions and increased scalability.

CONTENTS
1. Introduction
2. Applications and requirements for HVDC
3. Hardware & components
4. Thyristor based HVDC
5. VSC HVDC
6. Operational installations worldwide
7. DC grids vision and required technology

(The plan is for a half-day tutorial i.e. 1.5h + 1.5h with a coffee break between topics 4 and 5 above.)

ABOUT THE INSTRUCTORS

Staffan Norrga was born in Lidingö, Sweden, in 1968. He received the M.Sc. degree in applied physics from Linköping Institute of Technology, Linköping, Sweden, in 1993 and the Ph.D. degree in electrical engineering from the Royal Institute of Technology (KTH), Stockholm, Sweden, in 2005. Between 1994 and 2000, he worked as a Development Engineer at ABB in Västerås, Sweden, in various power-electronics-related areas such as railway traction systems and converters for HVDC power transmission systems. Between 2000 and 2005, he returned to academia to engage in research on new power electronic converters employing soft switching and medium frequency transformers, at the Department of Electric Machines and Power Electronics of the Royal Institute of Technology. He is currently with ABB Corporate Research and also with the Royal Institute of Technology. His research interests include new converter topologies for power transmission applications and grid integration of renewable energy sources. He is the inventor or co-inventor of 14 patent filings and has authored or co-authored more than 15 scientific papers published at international conferences or in journals.

Staffan Norrga