

TECHNICAL PROGRAM LUND 2015

*As new data for title and authorship of Papers become available,
adjustments may be made to the program provided*

1.1 NEW HVDC PROJECTS IMPLEMENTATION

Wednesday 27th May (13.00 - 14.45)

- 111 Skagerrak - The Next Generation**
G. Andersson
- 112 Labrador Island Link ± 350 kV HVDC Transmission Scheme - Key Design Aspects**
S. Munshi, A. Garg, R. Suri, R.A. Mukhedkar, J. Coady
- 113 Control and Protection Design Aspects for Parallel Converter Operation of ± 800 kV, 6000MW Champa - Kurukshehra HVDC Link**
V. Singh, M.S. Rao, S. Bhattacharya, M.M. Goswami, O. Chandy
- 114 PJM Planning Study Practices and Market Impacts on the Integration of Renewable Resources With AC-HVDC Systems**
J. Tong, M. Sobotka, W. Qiu, B. Choi, R. Price, A. Keech
- 115 Protection Strategy for HVDC Systems With Dedicated Metallic Return (DMR) Conductors**
V. Pathirana, U. Gnanarathna, K. Nanayakkara

1.2 OPERATING EXPERIENCE OF VSC HVDC

Wednesday 27th May (15.15 - 17.00)

- 121 Delivery of the Nan'ao Multi-terminal VSC-HVDC System**
G.N. Bathurst, P. Bordignon
- 122 The Irish Transmission Networks Enhanced Black Start capability with East West Interconnector HVDC Voltage Source Converter**
J. Egan, D. Joyce, C. McNamee, M. Hogan, N. Cowton
- 123 FACTS and HVDC Technologies for the Development and Enhancement of Spanish Transmission Grid**
A.G. Maza, L.C. López
- 124 Study on Discharge Characteristics of DC System in Zhoushan Multi-Terminal VSC-HVDC Transmission Project**
X. Li, Y. Ma, B. Yue, W. Ma, D. Chen
- 125 Recent Advancement in HVDC VSC Systems**
P. Lundberg, A. Gustafsson, M. Jeroense

1.3 DEVELOPMENTS IN DC CIRCUIT BREAKERS

Thursday 28th May (08.30 - 10.15)

- 131 Laboratory Demonstration of 30kW IGBT DCDC converter as Proof of concept for Interconnecting HVDC Systems Into a Future DC Grid**
M. Fazeli, M. Hajian, D. Jovicic
- 132 The Commutation Booster, a New Concept to Aid Commutation in Hybrid DC Breakers**
J. Magnusson, R. Saers, L. Liljestränd
- 133 Optimisation of Passive System Components to Minimise DC Circuit Breaker Stresses in Multi-terminal HVDC Systems**
F. Page, S.J. Finney, G.P. Adam, D. Holliday, L. Xu, B.W. Williams, K. Tahata, M. Sato, R. Yamamoto, H. Ito

- 134 Lightweight HVDC Transmission System Equipped With Modular DC-DC Boost Converter for Floating Offshore Wind Power Generations**

K. Sano, N. Gibo

- 135 DC Circuit Breakers for HVDC Grid Applications**

S. Tokoyoda, K. Tahata, K. Kamei, K. Kikuchi, D. Yoshida, S. Oukaili, R. Yamamoto, H. Ito*

1.4 CONTROL and PROTECTION OF DC GRIDS

Thursday 28th May (10.45 - 12.30)

- 141 Anti-Windup PI Control of the VSC-based HVDC Converter**
F. Badrkhani Ajaei, R. Iravani
- 142 Control System Interaction in the VSC-HVDC Grid Connected Offshore Wind Power Plant**
J. Glasdam, C.L. Bak, J. Hjerrild, L. Kocewiak
- 143 Protection of HVDC grids**
W. Leterme, D. Van Hertem, K. Koreman
- 144 Protection of Multi-terminal Radial VSC HVDC System**
J.I. Marvik, S. D'Arco, K. Sharifabadi
- 145 Calculation of Short-Circuit Currents in Multi-Terminal HVDC Systems based on Modular Multilevel Converters**
A. Wasserrab, G. Balzer

1.5 ROAD MAP and VISION FOR DC GRIDS

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- 151 A Technological Roadmap for the Development of the European Supergrid**
M. Callavik, M. Boden, J. Corbett, M. Dhesi, R. Huuva, N. Kuljaca, N. Macleod, F. Schettler
- 152 The Role of Embedded VSC-HVDC in the European Power System**
A. L'Abbate, R. Calisti, F. Careri, S. Rossi
- 153 Impacts of VSC-HVDC on AC Grid Performance**
E. Muyembe
- 154 A Systematic Study on Fault Currents in Multiterminal HVDC Grids**
M. Heidemann, D. Eichhoff, C. Petino, M. Stumpe, E. Spahic, F. Schettler
- 155 Fast Reduction of DC Voltage for Half-Bridge MMC HVDC Systems With Symmetrical Monopole During the Non-permanent Pole to Ground DC Fault**
M. Salimi, D.A. Woodford, A.M. Gole

1.6 POWER ELECTRONIC DEVICES and CONVERTER

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- 161 Power Semiconductors for Voltage Source Converters in HVDC and STATCOM Applications**
M.J. Heuvelmans
- 162 A Simplified Second-Order Model of a VSC-HVDC Link for Dynamic Studies**
M. Imhof, E. Iggland, G. Andersson

163 A Controlled DC Fault Clearance Mechanism for Full-Bridge MMC VSC Converters

C. Karawita, D.H.R. Suriyaarachchi, M. Mohaddes, J.L. Velasquez Contreras, K. Vennemann, A. Arnold, J. Lehner

164 Power Electronics for HVDC Grids – An Overview

S. Norrga, L. Ångquist, K. Sharifabadi

165 Continued Operation of Multi-terminal HVDC Networks Based on Modular Multilevel Converter

G.P. Adam, R. Li, D. Holliday, S. Finney, L. Xu, B.W. Williams, K. Tahata, M. Sato, R. Yamamoto, H. Ito

2.1 HVDC PLANNING

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211 Indicators for the Placement of Embedded HVDC Systems in Interconnected AC Networks

H. Barrios Büchel, A. Roehder, H. Natemeyer,

212 Aspects of HVDC Systems in the Nordic Region

J. Lamponen, L. Haarla, R. Hirvonen

213 The Need for HVDC Systems in South Africa and the Region

R. Marais, K. Leask

214 Long-term Planning of the European Power System Considering Different HVDC Installation Costs

P.E. Wiernes, A. Moser

215 Upgrading Existing LCC HVDC Schemes With VSC Technology - Some Aspects

V.S. Pathirana, U.N. Gnanarathna, L.C. Stregger

2.2 GENERAL SYSTEM PLANNING

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221 Receiving-end Transmission Network Expansion Planning Considering Large-scale Wind Power Bases Integration With HVDC Lines

Y. Gao, J. Li

222 A Technical & Economical Study on the Alternative Ways to Solve the Fault Current Problem in Seoul Metropolitan Area

J.G. Lee, B.K. Koo, J.Y. Song, S.W. Han, S.C. Nam, J.H. Shin, T.K. Kim, Y.H. An

223 Planning the Optimal Number and Placement of Embedded VSC-HVDC Links in the German AC Transmission Grid

H. Pluntke, W.H. Wellssow

224 Transmission Expansion Planning Challenges Associated to Belo Monte Power Plant's HVDC Links

M.V.G. da S. Farinha, M. de Fátima de Carvalho Gama, T. de Faria Rocha Dourado Martins

225 Assessment of the Impact on Direct Current and Alternating Current System Followed Change of Bulk Power System

K. Takada, N. Fujioka, A. Matsuda

2.3 MARKET RELATED SYSTEM PLANNING OTHER SYSTEM ISSUES

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231 Increasing Hosting Capacity of Transmission and Subtransmission Systems

M. Bollen, N. Etherden

232 Comparison of Linear and Non-linear Methods For Variable Transfer Limit Calculations

R. Ramanathan, A. Popat, B. Tuck

233 Boosting the Grids Integration Through the Evolution of the Ancillary Service Market Framework for a Smarter Management of VRE

E. Eliaa, P. Portoghesea, G. Sommanticoa, B. Covab, A. Venturinib, P. Vicinib

234 Estimation of System Inertia in the Nordic Power System Using Measured Frequency Disturbances

M. Kuivaniemi

235 Methodology and Case Study for Deciding on Optimum Station Transformer Replacement Timing

D. Curtis, Y. Tsimberg

2.4 ON-LINE MONITORING AND MEASUREMENT METHODS FOR ASSESSING SYSTEM PERFORMANCE

Thursday 28th May (10.45 - 12.30)

241 Experience with Using PMU Data for Online Monitoring of Sub-synchronous Resonance

S. Bengtsson, S. Holmström, M. Chenine, M. Jarl

242 Real-time Testing of Dynamic Security Assessment Algorithms

J. Geeganage, U.D. Annakkage, T. Weekes, B.A. Archer, H. Meiklejohn

243 A Simulation Based Study on the Effect of Data Dropout on the Performance of Synchrophasor Based Power System Stabilizers

A.I. Konara, U.D. Annakkage

244 An Oscillation Monitoring Algorithm to Monitor Power System Oscillations using Synchronized Phasor Measurements

D.P. Wadduwage, U.D. Annakkage

245 Investigating Distance Relay Behaviour on an EHV AC Lines Connected With Voltage Source Converter Based HVDC

M. Meraj Alam, H. Leite, A. Carvalho

2.5 HARMONIC, POWER QUALITY and EMC ISSUES RELATED TO HVDC and CONVERTER BASED TECHNOLOGIES

Thursday 28th May (13.30 - 15.15)

251 Using Transfer Impedances for the study of Wind Power Connection and Harmonic Resonances Due to AC Cables in a Transmission System

M. Bollen, S. Aceky, E. Friman, M. Jonsson

252 Power Quality in the Future Grid – Status Report

M. Bollen, F. Zavoda, S. Rönnerberg

253 Potential Electromagnetic Interference Between Long Wave Radio Services and Overhead Transmission Lines Caused by Operation of HVDC VSC

K. Hermanns

254 A Study on Electromagnetic Field Effects Between EHV AC and DC Lines and Its Impact on Substation Equipment

D. Maheswaran, G. Somasundram

255 Measurement of Transient Voltages in a Substation

J. Plesch, S. Pack, E. Sperling, G. Achleitner

2.6 MODELING and DYNAMIC PERFORMANCE ASPECTS OF INTEGRATING HVDC INTO THE AC POWER SYSTEM

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261 Doubly-fed Induction Generator Wind Power Plant with VSC-HVDC Grid Connection Start-up Procedure

L.J. Cai, U. Karaagac, J. Mahseredjian

262 Standard Model Structures for Power Flow and Stability Analysis of HVDC Systems in Transmission Planning Studies – A WECC Task Force Effort

P. Pourbeik, Y. Kazachkov, J. Senthil, D. Dickmader, J. Sanchez-Gasca, W. Price, J. Weber, D. Davies

263 Analysis of the AC Polish Power System Impact on the HVDC SwePol Link Operation

M. Przygodzki, P. Rzepka, P. Rzepka, W. Lubicki

264 Fault Clearing Strategies in a Multi-terminal HVDC Grid With Integrated DC Circuit Breaker Device

S. Wenig, R. Sander, M. Suriyah, T. Leibfried

- 265 Analysis of Electric Field, Ion Flow Density, Corona Loss, Audible Noise & Radio Interference of ± 800 kV HVDC 3000MW Champa-Kurukshetra Bipolar Station for Busbar Design

P. Kalky, A. Kothari

3.1 MARKET-BASED SOLUTION METHODOLOGIES

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- 311 Capacity Remuneration Mechanisms – Implementations in Europe and Implications for an Integrated European Market
H. Höschle
- 312 Optimal Dynamic Capacity Allocation of HVDC Interconnections for Cross-border Exchange of Balancing Services in Presence of Uncertainty
S. Delikaraoglou, T. Weckesser, P. Pinson, R. Eriksson
- 313 Mathematical Frameworks for Horizontal and Vertical Coordination of Transmission Investment Policies
Y. Tohidi, M. Reza Hesamzadeh
- 314 Network Operation Hierarchies in a Transcontinental Electricity System
G.S. Hawker, K.A. Bell
- 315 Hierarchical Control of Power Plants: A Real-time Competitive Power Sharing Control Strategy based on Price Signal References
A.M. Cantarellas, D. Remon, C. Koch-Ciobotaru, P. Rodriguez

3.2 MARKET EXPERIENCES

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- 321 Market Integration of an HVDC Interconnection Between France and Spain
J. Gaudin
- 322 Market Price Signals and Regulated Frameworks for Coordination of Transmission Investment
M.R. Hesamzadeh, F. Regairaz, J. Riesz, F-P. Hansen, A. Balkwill
- 323 India-Bangladesh Cross Border Exchanges Through High Voltage Direct Current (HVDC) Back-to-back Station - A Success Story
S.K. Soonee, V.K. Agrawal, S.R. Narasimhan, T. Kumar Roy, P. Kumar Roy
- 324 Electricity Market Challenges Under HVDC Multi Bipoles and Multi Vendors Environment Experience Observations in Brazil
M. Szechtman, D.O. C. Brasil
- 325 Developing and Integrating Africa's Regional Electricity Systems and Markets Using HVDC
L.E. Jones, N. Kirby

3.3 PROTECTION and CONTROL OF HVDC and HYBRID NETWORKS FROM A SYSTEM OPERATIONAL PERSPECTIVE *Thursday 28th May (08.30 - 10.15)*

- 331 Multi-Terminal DC Line Protection Requirement and High Speed Protection Solutions
J. Wang, B. Berggren, K. Linden, J. Pan, N. Reynaldo
- 332 System Protection During Contact Faults in Hybrid ACDC Transmission Systems
C. Petino, D. Eichhoff, J. Velasquez, P. Tünnerhoff, A. Schnettler
- 333 Communication-free Control Solutions for Grid Code Compatibility of HVDC
C.L. Moreira, B. Silva
- 334 Investigation of the Influence of embedded VSC-HVDC Transmission on Power System Stability
P. Chodura, R. De Graaff, M. Gibescu, W.L. Kling
- 335 The Research on DC Power Modulation Strategy for Improving Transient Stability in Hybrid AC-DC Interconnected System
W. Zhao

3.4 SYSTEM OPERATION WITH HVDC EMBEDDED IN AC NETWORKS

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- 341 Developing a Concept for Coordinated Operation of Embedded HVDC With Regard to Active Power
M. Thiele, D. Andreas, J. Schäfer, T. Ringelband
- 342 Optimal Operation Strategy for VSC HVDC Links Within an Interconnected Power System
K. Frey, K. Rudion
- 343 Fast Local Converter Set Point Adaptation After AC Grid Disturbances Based on a Priori Optimisation
A.-K. Marten, F. Sass, D. Westermann
- 344 Role of Smart Grid Technology and Corrective Control in Enhancing Network Capacity Utilisation in Great Britain With HVDC Links
Y. Pipelzadeh, R. Moreno, T.C. Green
- 345 The France – Spain HVDC Link Project - Operational Challenges
J. Bola, R. Rivas, R. Fernandez-Alonso, G. Pérez, M.A. De Beir, A. Parisot, L. Issaadi, J. Roguin

3.5 INNOVATIONS IN THE OPERATION OF HVDC and HYBRID INTERCONNECTIONS BETWEEN SYNCHRONOUS AREAS *Thursday 28th May (13.30 - 15.15)*

- 351 Dynamic Interactions Between AC Synchronous Grids Interconnected Through a MTDC
A.G. Endegnanew, J. Beerten, K. Uhlen
- 352 Hybrid Grid Operation in Indian Power System
M. Kumar T., P.R. Raghuram, S.P. Kumar
- 353 Development of Imbalance Netting via HVDC Lines Between Two Synchronous Areas Exemplified by Germany and Nordic
M. Maurer, P. Zolotarev
- 354 Monitoring the Performance of the Generating Units Contributing to Frequency and Voltage Control in the Norwegian Power System
O. Gjerde, D. Whitley, P. Bertolini
- 355 TSO Pan-European Co-operation and Further Steps and Initiatives to Strengthen the Power System Security With ENTSO-E Wide Awareness System
C. Norlander, T. Loxq, J. Albrecht

3.6 SYSTEM OPERATION OF MULTI-TERMINAL HVDC

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- 361 HVDC Grid Controller
E. Spahic, E. Hohenberg, M. Zeller, F. Schettler
- 362 Distributed Voltage Control and Fault Management of Star-connected Multi-terminal VSC MMC Systems
K. Vennemann, D. Meyer, C. Heising, V. Staudt, K. Kleinekorte
- 363 Overview of a Hierarchical Controller Structure for Multi-Terminal HVDC Grids
R. Wiget, M. Imhof, M. Bucher, G. Andersson
- 364 Disturbance Management in a DC Grid Using a Hierarchical Control Structure
E. Karatsivos, J. Svensson, O. Samuelsson
- 365 Real-time Implementation of Optimal Power Flow Calculator for HVDC Grids
H. Fidai, D. Babazadeh, J. Hanning, T.X. Larsson, L. Nordström