



Wind Power to the Grid

EPE Joint Wind Energy and T&D Chapters Seminar
Aalborg, Denmark
28, 29 June 2012

Final Programme (Prov. Prog. v. 17, 27 June 2012)

General information: <http://www.epe-association.org/epe/seminars/Wind2012/>



Thursday 28 June 2012

8h15 – 9h00: Registration and coffee (Room)
Upload of presentation and full papers

9h00 – 9h30: Opening session (Room)

Chair: Remus Teodorescu
Co-chair: Philip Kjaer

Opening Addresses:

Opening address by the conference Chairpersons, Remus Teodorescu, Aalborg University and Philip Kjaer, Vestas
Presentation of Aalborg University by Stig-Munk Nielsen, Aalborg University
Opening address by Colin Oates, Chairman of T&D Chapter,

9h30 – 10h20: Lecture session 1: Keynotes (Room): HVDC technology

Chair: Remus Teodorescu, Aalborg University
Co-chair: Philip Kjaer, Vestas

Keynote 1: **The Skagerrak4 project – Connecting renewables with new technology between Denmark and Norway,**
Jens Peter KJAERGAARD, Energinet.dk

Keynote 2: **Cable technology for offshore wind power collection and transmission – ac and dc,** Anders JENSEN, nkt cables,
Director Business Development Application

10h20 – 10h50: Coffee break in Foyer

10h50 – 12h30: Lecture session 2: (Room): Grid connection, compliance and control

Chair: Sarath Tennakoon, Stafford University of Technology, UK

- Generic 12-Bus Test system for Wind Power Integration Studies,** Andrzej Adamczyk, Mufit Altin, Ömer Göksu, Remus Teodorescu, Department of Energy Technology, Aalborg University, Aalborg; Florin Iov, Vestas Wind Systems A/S, Aarhus, Denmark

Our sponsors: **Vestas**® and **ALSTOM**

- 24 **State Control of Modular Multilevel Converters Utilizing Pole Restraining**, Tim Schrader, Roman Bartelt and Carsten Heising, Avasition GmbH, Dortmund & Volker Staudt and Andreas Steimel, Ruhr-University Bochum
- X **European Connection Grid Code – what is going to happen ...**, Peter W. Christensen and Philip C. Kjaer, Vestas, Denmark
- 30 **Introduction to off-shore wind farm project in Korea**, Chulsoo Suh, Power System Lab. □□ Korea Electric Power Company(KEPCO) Research Institute(KEPRI)
- 44 **Inverter Based Test Setup for LVRT Verification of a Full-Scale 2 MW Wind power Converter**, A. Uphues*, K. No'tzold*, R. Wegener*, K. Fink†, M. Bragard†, R. Griessel† S. Soter*
*Institute of Electrical Machines and Drives, University of Wuppertal
†Delta Energy Systems (Germany) Soest GmbH

12h30 – 14h00: Lunch (Room)

14h00 – 15h30: Dialogue session and Exhibition (Foyer)

Topic 1 : Wind Energy Conversion Technologies

- 13 **A Novel Wind Generator System with Six-Phase PMSG and Hybrid Rectifier for Large Offshore Turbines**, Shinji Kato, Keitaro Ueda, Masakazu Michihira, Kobe City College of Technology, Japan
- 23 **State Control of DFIG in Converter-Fixed Reference Frame for Wind-Energy Plants**, Matthias Seifert and Carsten Heising, Avasition GmbH, Dortmund, Germany, Volker Staudt and Andreas Steimel, Ruhr-University Bochum, Germany
- 25 **VIAvento – a Fast and Accurate Simulation Tool for Power-Electronic Systems**, Martin Richter and Christian Schilling, Avasition Software Solutions GmbH, Dortmund, Germany, Roman Bartelt, Stefan Menzner and Carsten Heising, Avasition GmbH, Dortmund, Germany
- 41 **Comparison of Offshore Power Transmission Technologies: a Multi-Objective Optimization Approach**, Silvio Rodrigues, Pavol Bauer, Technical University of Delft, Delft, The Netherlands; Jan Pierik, ECN, Petten, The Netherlands
- 43 **Dc-link voltage selection for a 5 MW PMSG-equipped generating system – Maximum torque per ampere control versus minimum dc-link voltage**, T. Thiringer, P. Roshanfekar & S. Lundmark, Chalmers University of Technology, Göteborg, Sweden

Topic 2: Control of wind power plants and their transmission solutions

- 3 **Modular Multilevel Converter Modeling, Control and Analysis under Grid Frequency Deviations**, Rodrigo Da Silva, Department of Energy Technology, Aalborg University, Aalborg; Lorenzo Zeni, Vestas Wind Systems A/S, Aarhus, Denmark; Michal Szykiel, Department of Energy Technology, Aalborg University, Aalborg, Denmark
- 16 **Simulation model Efficiency Comparison of Phase-Displaced Modulation of Modular Multilevel Converter**
P.C. Kjaer*, D. Vulcan*, L. Helle*, S.K. Chaudhary**
* Vestas Wind Systems A/S, Denmark ** Aalborg University, Denmark

Topic 4: Grid connection and compliance of wind power

- 10 **The Comparison of Polish Grid Codes to Certain European Standards and resultant Differences for WPP Requirements**, Wojciech Jarzyna, and Piotr Lipnicki, Department of Electrical Drive Systems and Electrical Machines, Lublin University of Technology, Poland
- 22 **Assessment-Based Flux Trajectory Optimization for Offshore Line-Side and Machine-Side Converters**, Daniel Meyer and Carsten Heising, Avasition GmbH, Dortmund, Volker Staudt and Andreas Steimel, Ruhr-University Bochum
- 37 **Flexible Arrangement of Static Converters for Grid Connected Wind Energy Conversion Systems**, Felipe B. Grigoletto and Humberto Pinheiro, Power Electronics and Control Research Group, Federal University of Santa Maria, RS, Brazil
- 38 **The Transition Process of Wind Turbine Based on a Squirrel-Cage Induction Generator When Voltage Sag And Its Low Voltage Ride-Through Method**, Xiangwu Yan, Zheng Chen, Liming Yang, Yuzhao Liang, State Key Laboratory of Alternate Electrical Power System with Renewable Energy Sources, North China Electric Power University
- 39 **Grid Code Compliance in MTDC Networks**, R. Teixeira Pinto, P. Bauer, Technische Universiteit Delft, The Netherlands

Topic 5: Reliability of the Electrical Parts of Wind Energy Systems

- 2 **Modelling lifetime of high power press-pack IGBTs used in wind turbines**, Cristian Busca, Remus Teodorescu, Dept of Energy Technology, Aalborg University, Denmark
- 11 **Reliability Evaluation on Wind Farm considering Electrical and Transmission system Layouts**, Je Seok Shin, Seung Tae Cha and Jin O Kim, Hanyang University, Seoul, Korea
- 34 **Optimal Maintenance Strategy for Wind Turbine Considering Fault Tree Analysis and Maintenance Cost**, Yun Seong Lee, Seung Tae Cha and Jin O Kim, Hanyang University, Seoul, Korea

Topic 7: Energy storage for wind power integration

- 9 **Li-Ion Energy Storage – SIESTORAGE**, Karsten Rechenberg, Peter Eckert, Jean-Philippe Macary, Infrastructure & Cities Low & Medium Voltage Solutions, Siemens AG
- 17 **Characterization of LifePO₄ batteries for dynamical and lifetime modeling using EIS technique**, Daniel-Ioan Stroe, Maciej Swierczynski, Ana-Irina Stan, Remus Teodorescu, Dept of Energy Technology, Aalborg University

Topic 8: Future Trends of Wind Energy Conversion and Power Electronic Applications

- 21 **Environmental impacts of intermittent wind energy systems**, S. Rangaraju, M. Messagie, J. Sanfélix, N. Sergeant, J. Van Mierlo, Mobility Logistics and Automotive Technology Research Centre (MOBI), Vrije Universiteit Brussel, Belgium

15h30 – 16h00: Coffee break in Foyer

16h00 – 17h40: Lecture session 3: (Room): Reliability

Chair: Philip Kjaer, Vestas

- 51 **Cost of poor reliability: Do you want to know? Do you dare to know?**, Mr. Peter de Place Rimmen, Reliability Advisor, Danfoss Power Electronics A/S, Denmark (Invited paper)
- 6 **Nonlinear Damage Accumulation for Inverter Lifetime Prediction**, Hui Huang, School of Engineering, University of Warwick, Coventry, UK (The paper will be presented by Mike Jennings, School of Engineering, University of Warwick, Coventry, UK)
- 15 **Power Electronics for Wind Turbines – Designing for reliability**, L. Helle, T. Abeyasekera, T. Lundgren, P. C. Kjaer Vestas Wind Systems A/S, Denmark
- 33 **Life Assessment Methodology for Wind Turbine Power Conversion Building Blocks**, Peter Hansen, Sr. Mechanical Engineer, Victor Donescu, Chief Specialist Converter Development, Vestas Technology R&D Americas Inc., USA, & Lars Helle, Specialist Energy Systems Vestas Technology R&D, Denmark
- 35 **Transformers internal voltage stress during current interruption in wind farm collection grids**, Tarik Abdulahovic & Torbjörn Thiringer, Chalmers University of Technology, Gothenburg, Sweden

18h00 – ... : Gala Evening

Friday 29 June 2012

9h00 – 9h40: Lecture session 4: Keynote (Room): TBD

Chair: Colin Oates, Alstom Grid

Co-chair: Philip Kjaer, Vestas

Keynote 3: **From point to point DC transmission to DC grids**, Philippe ADAM, RTE & Convenor of WG B4-56

Keynote 4: **The revolution of HVDC**, Claes SCHEIBE, ALSTOM Grid Vice President of Strategy, Innovation and Development

9h40 – 11h00: Lecture session 5: (Room): Wind energy conversion

Chair: Torbjörn Thiringer, Chalmers University of Technology, Göteborg, Sweden

- 26 **An Innovative Bidirectional Isolated Multi-Port Converter with Multi-Phase AC Ports and DC Ports**, F. Jauch, J. Biela, Laboratory for High Power Electronic Systems, ETH Zurich, Switzerland
- 31 **High Reliable Multilevel Converter Topologies for a 10 MW, 100 kV Transformer-less Modular Offshore Wind Generator system**, Tore Martin Iversen, Sverre S. Gjerde, Tore Undeland, Norwegian University of Science & Technology, Trondheim, Norway
- 27 **Low Voltage Fault Ride through for offshore wind farms with MMC-HVDC Connection**, S. K. Chaudhary*, U. Gnanarathna**, R. Teodorescu*, A. M. Gole**
*Department of Energy Technology, Aalborg University, Aalborg, Denmark
**University of Manitoba, Winnipeg, Canada
- 18 **Dead-beat control strategy of circuiting-current in three-phase PWM converter of parallel connection**, Zhang xueguang & Xu Dianguo School of Electrical and Engineering in Harbin Institute of Technology, Harbin, China

11h00 – 11h30: Coffee break (Foyer)

11h30 – 12h10: Lecture session 6: (Room): Energy Storage & Power Plants

Chair: Lars Helle, Vestas

- 19 **Selection and impedance based model of a lithium ion battery technology for integration with Virtual Power Plant**, Maciej Swierczynski*, Daniel-Ioan Stroe*, Ana-Irina Stan*, Remus Teodorescu*, Henrik Vikelgaard**
*Department of Energy Technology, Aalborg University, Denmark
** Vestas Wind Systems A/S, Denmark

- 14 **Lem Kær Demonstrator - A view on Virtual Power Plant Concept**, Florin Iov, Philip Carne Kjær, Vestas Wind Systems A/S

12h10 – 12h30: Closing session (Room):

Chair: Remus Teodorescu

Co-chair: Philip Kjaer

12h30 - 14h00: Lunch (Room)

14h00 - 17h00: Tutorial

Multilevel Converter Technology for HVDC applications, Lennart Harnefors, ABB, Sweden

12h20 – 18h10: Technical visit

Chair: Lars Helle

Departure Aalborg

12:20

Arrival in Hammel

14:00

Welcome, intro, coffee and cake:

Martin Kjærbo (VP, factory manager)

14:00 – 14:45

Factory tour:

Steven Juel Hansen (SJH) and Poul Vestergaard

15:00 - 16:00

Departure Hammel

16:30

Arrival Aalborg

18:10