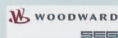


PROCEEDINGS

8th International Workshop on Large-Scale Integration
of Wind Power into Power Systems
as well as on Transmission Networks
for Offshore Wind Farms

14 - 15 October, 2009
Bremen, Germany

Sponsored by



Supported by



Organized by



Edited by Uta Betancourt / Thomas Ackermann

PROCEEDINGS

**8th International Workshop on Large-Scale Integration
of Wind Power into Power Systems
as well as on Transmission Networks
for Offshore Wind Farms**

**14 - 15 October, 2009
Bremen, Germany**

Edited by Uta Betancourt / Thomas Ackermann



Supported by

Table of Contents

Session 1: Keynote Session & Panel

1

09:00 – 11:00 / 14 October 2009 / Room Hanse / Discussion Leader: Thomas Ackermann,
(Energynautics, Germany)

Europe Going Renewable: The TSOs' Power Transmission Challenges

A. G. Orths, P. B. Eriksen (Energinet.dk, Denmark)

European Wind Integration Study

L. Dale (National Grid, United Kingdom), L. Fischer (Vattenfall, Germany), D. Klaar (Tennet, the Netherlands), O. Alonso (REE, Spain), H. Vanderbroecke (ELIA, Belgium), K. Kolharkar (Transpower, Germany), W. Winter (Transpower, Germany), M. Uusitalo (NORDEL, Finland)

European Electrical Transmission System Export Capability for Increasing Wind Power Penetration

S. Beharrysingh, F. Van Hulle (EWEA, Belgium)

Transmission Planning for Wind Energy: Status and Prospects

J. C. Smith (UWIG, USA), D. Osborn (MISO, USA), R. Piwko (GE, USA), R. Zavadil (Enernex, USA), B. Parsons (NREL, USA), D. Hawkins (CAISO, USA), W. Lasher (ERCOT, USA), B. Nickell (WECC, USA)

Session 2a: Grid Integration Studies & Experience: Europe

29

11:25 – 13:00 / 14 October 2009 / Room Hanse / Discussion leader: to be announced

Wind Energy Integration in the Spanish Electrical System

O. Alonso Garcia, M. de la Torre Rodríguez, E. Prieto García, S. Martínez Villanueva, J. M. Rodríguez García (REE, Spain)

Efficient Integration of Wind Energy at EnBW TSO

D. Graeber, O. Chatillon (EnBW, Germany)

Integrating Massive Wind Power in the Electric System: Acciona Experience in Spain

E. Giraut Ruso, J. Ruiz Guillén, G. Quiñones Varela, I. Armendáriz Otazu, A. Navarrete Pablo-Romero, C. Moreira Prada, G. Alday Aracama, R. Sánchez Ardoiz, J. Moreno Fernandez (Acciona Energía, Spain)

Future Challenges of the Danish Power System – Results of Ecogrid.dk – Phase 1

T. Ackermann (Energynautics, Germany), K. Norregaard (Teknologisk Institute, Denmark), P.-F. Bach, M. Lind (CET-DTU, Denmark), P. Sorensen (Risø-DTU, Denmark), B. Tennbakk (Econ Pöyry, Denmark), M. Tøgeby (EA Energy Analyses, Denmark), J. Ostergaard (CET-DTU, Denmark)

Session 2b: Connection of Offshore Wind Farms

57

11:25 – 13:00 / 14 October 2009 / Room Kaisen / Discussion leader: to be announced

Experience of Transpower Offshore with the First Two Grid Connection Projects for Offshore Wind Parks (Alpha Ventus as an HVAC Single Connection and BARD Offshore 1 as an HVDC Cluster Connection)

T. J. Lebloda, D. Zhang (transpower, Germany)

Feasibility Study for a Three-Phase AC Connection of the Off-Shore Borkum West II Wind Park to the Transmission Grid

S. Prinz (P & M Power Consulting, Germany), G. Hentschel (Areva, Germany)

Integration of Offshore Wind with Modern HVDC Technology

G. Stark (ABB, Germany)

International Grid solution at Kriegers Flak involving both Offshore Wind Power Plant and Interconnector Capacity

H. K. Nielsen, P. B. Eriksen (Energinet.dk, Denmark)

11:25 – 13:00 / 14 October 2009 / Room Borgward / Discussion leader: to be announced

Reduction of Wind Power Induced Reserve Requirements by Advanced Shortest-Term Forecasts and Prediction Intervals

J. Dobschinski, A. Wessel, B. Lange, L. von Bremen (IWES/ISET, Germany)

Performance and Benefits of Ensemble Prediction Systems

M. Denhard (ECMWF, United Kingdom), T. I. Petroligias, J. Tambke (ForWind/University of Oldenburg, Germany), R. Hagedorn (ECMWF, United Kingdom)

A new algorithm for Upscaling and Short-term forecasting of Wind Power Using Ensemble Forecasts

C. Möhrlen (WEPROG, Germany), J. U. Jørgensen (WEPROG, Denmark)

Integration of Offsite Wind Speed Measurements in Shortest-term Wind Power Prediction Systems

A. Wessel, J. Dobschinski, B. Lange (IWES/ISET, Germany)

Operational Experience with the Optimal Combination of Weather Models for Improved Wind Power Predictions

M. Lange, U. Focken, K. Peters (energy & meteo systems, Germany)

Session 3a: HVDC

115

14:00 – 15:20 / 14 October 2009 / Room Hanse / Discussion leader: to be announced

HVDC with Voltage Source Converters – A Desirable Solution for connecting Renewable Energies

Y. Jiang-Häfner, R. Ottersten (ABB, Sweden)

Multi-Terminal HVDC System for Large Offshore Wind Farm Integration and Transmission Network Support

L. Xu (Queen's University Belfast, United Kingdom), Y. Wang (North China Electric Power University, China), L. Yao, J.-L. Rasolonjanahary (AREVA, United Kingdom)

Grid connection of Krieger's Flak

Å. Larsson (Vattenfall, Sweden)

Session 3b: German Grid Code Issues

137

14:00 – 15:40 / 14 October 2009 / Room Kaisen / Discussion leader: to be announced

Compliance with Technical Codes Becomes Obligatory for Receipt of Feed-in Tariff and Ancillary Services Bonus for Wind Power Plants in Germany

J. C. Boemer, K. Burges (Ecofys, Germany), T. Kumm (VDE/FNN, Germany), M. Pöller (DIGSILENT, Germany)

Validation of an RMS DFIG Simulation Model According to New German Model Validation Standard FGW TR4 at Balanced and Unbalanced Grid Faults

J. Fortmann (REpower, Germany), S. Engelhardt, J. Kretschmann (Woodward, Germany), C. Feltes, I. Erlich (University of Duisburg-Essen, Germany)

Certification of Advanced Electrical Characteristics based on Validation of WEC Models and Simulation of Wind Farms

B. Schowe-von der Brelle, H. Vennegeerts (FGH, Germany) M. Schellschmidt (ENERCON, Germany)

Role of Regulations and Standards for the Grid Connection of Wind Turbines - Integrating more Wind Energy

M. Ibsch, K. Nohme (WINDTEST, Germany)

14:00 – 15:40 / 14 October 2009 / Room Borgward / Discussion leader: to be announced

Transformer Congestion Forecast Based on Highly Localized Wind Power Predictions
U. Focken (energy & meteo systems, Germany), J. Jahn (EWE, Germany), M. Schaller (energy & meteo systems, Germany)

Impact of Wind Power Forecasting on Unit Commitment and Dispatch
J. Wang, A. Botterud, G. Conzelmann (Argonne National Laboratory, USA), V. Miranda, C. Monteiro, G. Sheble (INESC Porto, PORTUGAL)

Estimation of the Increased Ampacity of Overhead Power Lines in Weather Conditions with High Wind Power Production
M. Lange, U. Focken (energy & meteo systems, Germany)

Temporal Forecast Uncertainty for Ramp Events
B. Gréaves, J. Collins, J. Parkes, A. Tindal (Garrad Hassan, United Kingdom)

16:00 – 18:20 / 14 October 2009 / Room Hanse / Discussion leader: to be announced

Strategies for Offshore Windpark Clustering and Cluster Grid Connection
T. Ahndorf, R. Witzmann (Technical University of Munich, Germany)

Optimising Redundancy of Offshore Electrical Infrastructure Assets by Assessment of Overall Economic Cost
A. R. Henderson, L. Greedy, F. Spinato, C. A. Morgan (Garrad Hassan, United Kingdom)

Analysis of Switching Overvoltages in Offshore Transmission Systems
H. Brakelmann, T. Dong (University of Duisburg-Essen, Germany)

Offshore Transformer Platform Design
T. Boehme, G. MacAngus-Gerrard (Det Norske Veritas, United Kingdom)

Optimisation of Onshore Bipolar HVAC Cable Systems
H. Brakelmann (University of Duisburg-Essen, Germany)

Onshore Continuation of Bipolar Cable Systems for Bulk Wind Power Transmission
H. Brakelmann, J. Brüggmann, J. Stammen (University of Duisburg-Essen, Germany)

16:00 – 18:20 / 14 October 2009 / Room Kaisen / Discussion leader: Charles Smith (UWIG, USA)

How do Wind and Solar Power Affect Grid Operations: The Western Wind and Solar Integration Study
D. Lew, M. Milligan (National Renewable Energy Laboratory, USA), G. Jordan, L. Freeman, N. Miller, K. Clark, R. Piwko (GE Energy, USA)

Eastern Wind Integration and Transmission Study - Preliminary Findings
D. Corbus, M. Milligan, E. Ela (National Renewable Energy Laboratory, USA), M. Schuerger (Energy Systems, USA), B. Zavadil (EnerNex, USA)

Impacts of Large Scale Integration of Wind Power into the Power System of British Columbia
T. Broer, N. Djilali, A. Rowe (University of Victoria, Canada)

Assessment of AGC and Load-Following Definitions for Wind Integration Studies in Québec

I. Kamwa, A. Heniche, M. de Montigny (Hydro-Québec/IREQ, Canada)

Wind Power Integration into Los Angeles Electric System
M. J. Beshir (Los Angeles Department of Water and Power, USA)

Risks of Extreme Wind Generation Output Changes in the ERCOT Market
R. A. Walling, L. A. Freeman, N. W. Miller (GE Energy, USA), J. Freedman (AWS Truewind, USA), W. Lasher (ERCOT, USA)

16:00 – 18:00 / 14 October 2009 / Room Borgward / Discussion leader: to be announced

Impacts of Intra-day Rescheduling of Unit Commitment and Cross Border Exchange on Operational Costs in European Power Systems

P. Meibom (Riso-DTU, Denmark), C. Weber (University of Duisburg-Essen, Germany)

Estimating Tertiary Reserves in the Danish Electricity System

T. K. Kristoffersen, P. Meibom (Riso-DTU, Denmark), A. Gottig (Energinet.dk, Denmark)

Network and Power Plant Investments - Country Case Study With High Wind Power Penetration

J. Apfelbeck (University of Stuttgart, Germany), P. Vogel (University of Duisburg-Essen, Germany),
R. Barth (University of Stuttgart, Germany), D. Bechrakis (HTSO, Greece), H. Brand (University of Stuttgart, Germany),
J. Kabouris (HTSO, Greece)

Load-flow Based Market Coupling with Large-scale Wind Power in Europe

R. Barth, J. Apfelbeck (University of Stuttgart, Germany), P. Vogel (University of Duisburg-Essen, Germany), P. Meibom (Riso-DTU, Denmark), C. Weber, (University of Duisburg-Essen, Germany)

Investmentplanning of Interconnectors under Consideration of Wind Power Extensions in Europe

S. Spiecker, P. Vogel, C. Weber (University of Duisburg-Essen, Germany), C. Obersteiner (Technical University Vienna, Austria)

Session 4c: Part II: Windgrid - Wind on the Grid: An Integrated Approach

18:00 – 19:00 / 14 October 2009 / Room Borgward / Discussion leader: to be announced

These papers are not included in the printed version, but they will be available during the workshop:

Project presentation and overview

M. Lorenzo (REE, Spain)

System security management

E. Dohejo, E. Martin (Deloitte)

Technical Solutions: Wind Cluster Management System

N.N. (IWES/ISET, Germany)

Field Tests

E. Quitmann (Enercon, Germany)

Session 5a: IEA Task 25

08:30 – 10:40 / 15 October 2009 / Room Hanse / Discussion leader: Hannele Holttinen (VTT, Finland)

Impacts of Large Amounts of Wind Power on Design and Operation of Power Systems, Results of IEA Collaboration

H. Holttinen (VTT, Finland), P. Meibom (Riso-DTU, Denmark), A. Orths (Energinet.dk, Denmark),
B. Lange (IWES/ISET, Germany), M. O'Malley (University College Dublin, Ireland), J. O. Tande (SINTEF, Norway), A.
Estanqueiro (INETI, Portugal), E. Gomez (University Castilla-La Mancha, Spain), L. Söder (Royal Institute of
Technology/KTH, Sweden), G. Strbac (DG&SEE, UK), J. C. Smith (UWIG, USA), F. Van Hulle (EWEA, Belgium)

Large-Scale Wind Integration Studies in the United States: Preliminary Results

M. Milligan, D. Lew, D. Corbus (NREL, USA), R. Piwko, N. Miller, K. Clark, G. Jordan, L. Freeman
(GE Energy, USA), B. Zavadil (EnerNex, USA), M. Schuerger (Energy Systems, USA)

Calculation of Balancing Reserve Incorporating Wind Power into the Hydro-Quebec System over the Time Horizon of 1-48 Hours

N. Menemenlis, M. Huneault (Hydro-Québec/IREQ, Canada), J. Bourret, A. Robitaille (Hydro-Québec, Canada)

Coping with Wind Power Variability: How Plug-in Electric Vehicles Could Help

J. Kiviluoma (VTT, Finland), P. Meibom (Riso-DTU, Denmark)

Evaluating which Forms of Flexibility most Effectively Reduce Base-load Cycling at Large Wind Penetrations

N. Troy (University College Dublin, Ireland), E. Denny (Trinity College Dublin, Ireland), M. O'Malley (University College Dublin, Ireland)

08:30 – 10:40 / 15 October 2009 / Room Kaisen / Discussion leader: to be announced

Grid Connection of Large Wind Power Plants: a European Overview

A. R. Ciupuliga, M. Gibescu (Delft University of Technology, the Netherlands), G. Fulli (DG Joint Research Centre – European Commission, the Netherlands), A. L'Abbate (ERSE, Italy), W. L. Kling (Delft University of Technology, the Netherlands)

Grid Code Compliance Beyond LVRT

T. Gehlhaar (Germanischer Lloyd, Germany)

The Development of Connection Requirements for Offshore Generation and Transmission in Great Britain

A. Johnson, N. Tleis, J. Greasley (National Grid, United Kingdom)

Grid Code Compliance Process of Wind Farms in Great Britain

S. M. Bolik (REpower UK, United Kingdom)

Compliance of REE's Operational Procedure 12.3 Regarding Fault Ride-Through Capability: The Experience of a Multi-technology Owner

J. Ruiz Guillén, E. Giraut Ruso, G. Quiñones-Varela, Á. Navarrete Pablo-Romero, I. Rebollo Rico, T. Hernández Fernández de la Pradilla (Acciona Energía, Spain), M. P. Comench, M. García-Gracia (CIRCE/University of Zaragoza, Spain)

08:30 – 10:40 / 15 October 2009 / Room Borgward / Discussion leader: to be announced

Rules and Mechanisms for Integrating Wind Power in Electricity Markets

A. Waltham (IPA Energy + Water Economics, United Kingdom)

A Modeling Approach to Compute Scenarios of Electricity Generation from Wind and other Renewable Energy Sources in Europe

C. Golling, D. Lindenberger (University of Cologne, Germany)

Imbalance Costs in the Swedish System with Large Amounts of Wind Power

F. Carlsson, V. Neimane (Vattenfall, Sweden)

Allocation of Interconnector Capacity with In-between Stochastic Generation

S. T. Schröder (Risø - DTU, Denmark)

Effect of Wake Consideration on Estimated Cost of Wind Energy Curtailments

M. Ali (University of Manchester, United Kingdom), J. Matevosyan (Parsons Brinckerhoff, United Kingdom), J. V. Milanović (University of Manchester, United Kingdom), L. Söder (Royal Institute of Technology/KTH, Sweden)

11:00 – 13:00 / 15 October 2009 / Room Hanse / Discussion leader: to be announced

The IEE Project OffshoreGrid: Objectives, Approach and First Results

J. De Decker, A. Woyte (3E, Belgium), C. Srikantham, J. Völker, C. Funk (dena, Germany), K. Michalowska-Knap (EC BREC IEO, Poland), J. Tambke (ForWind/University of Oldenburg, Germany), G. Rodrigues (EWEA, Belgium)

Cluster Interconnection of Offshore Wind Farms using Direct AC High Frequency Links

A. Garcés Ruiz, M. Molinas (Norwegian University Of Science and Technology Trondheim, Norway)

Interconnection of Direct-Drive Wind Turbines Using DC Grid

E. Veilleux, P. W. Lehn (University of Toronto, Canada)

6 GW Offshore Wind Power in The Netherlands - Technology Options and Connection Configurations

K. Burges (Ecofys, Germany), D. Schoenmakers (Ecofys, the Netherlands), G. Papaefthymiou (Ecofys, Germany)

11:00 – 13:00 / 15 October 2009 / Room Kaisen / Discussion leader: to be announced

Reduced Order Model of Wind Turbines based on Doubly-Fed Induction Generators during Voltage Imbalances

S. Engelhardt (Woodward SEG, Germany), C. Feltes (University of Duisburg-Essen, Germany), J. Fortmann (REpower, Germany), J. Kretschmann (Woodward SEG, Germany), I. Erlich (University of Duisburg-Essen, Germany)

Contribution of Wind Energy Converters with Inertia Emulation to Frequency Control and Frequency Stability in Power Systems

S. Wachtel, A. Beekmann (ENERCON, Germany)

Models and Simulations for the Danish Cell Project: Running PowerFactory with OPC and Cell Controller

N. Martensen, E. Tröster (Energynautics, Germany), P. Lund (Energinet.dk, Denmark), R. Holland (Spirae, USA)

Large Wind Power Plants Modeling Techniques for Power System Simulation Studies

R. Larose, R. Gagnon, G. Turmel, P. Giroux, J. Brochu (Hydro-Québec/IREQ, Canada), D. McNabb, D. Lefebvre (Hydro-Québec, Canada)

11:00 – 13:00 / 15 October 2009 / Room Borgward / Discussion leader: to be announced

A Full Renewable Power Supply Scenario for Europe: The Weather Determines Storage and Transport

L. von Bremen (IWES/ISET, Germany), M. Greiner (Siemens, Germany), K. Knorr (IWES/ISET, Germany), C. Hoffmann (Siemens, Germany), S. Bofinger, B. Lange (IWES/ISET, Germany)

Wide-Area Energy Storage and Management System to Balance Intermittent Resources in the Bonneville Power Administration and California ISO Control Areas

Y. V. Makarov, B. Yang, J. G. DeSteele (Pacific Northwest National Laboratory, USA), P. Nyeng (Technical University of Denmark - DTU, Denmark), C. H. Miller (Pacific Northwest National Laboratory, USA), J. Ma, S. Lu, V. V. Viswanathan, D. J. Hammerstrom (Pacific Northwest National Laboratory, USA), B. McManus, J. H. Pease (Bonneville Power Administration, USA), C. Loutan, G. Rosenblum (California ISO, USA)

Grid Scale Energy Storage in Salt Caverns

F. Crotagino, S. Donadei (KBB Underground Technologies, Germany)

Operational Experience with Virtual Power Plants – Efficient Integration of Small Scale Generation and Medium Scale Demand into the Power System

U. Focken, T. Klose (energy & meteo systems, Germany), W. Krause (EWE, Germany)

14:00 – 15:40 / 15 October 2009 / Room Hanse / Discussion leader: to be announced

Assessing the Value of Regulation Resources Based on Their Time Response Characteristics

Y. V. Makarov, J. Ma, S. Lu, T. B. Nguyen (Pacific Northwest National Laboratory, USA), C. Loutan, G. Rosenblum, S. Chowdhury (California ISO, USA), J. H. Eto (Lawrence Berkeley National Laboratory, USA), M. Gravelly, M. Brown (California Energy Commission, USA)

Balancing with 6000 MW off shore Wind Energy in The Netherlands; an analysis of the flexibility of production

W. W. de Boer, W. van der Veen (KEMA, The Netherlands)

Wind Power in the North Sea: Smoothing Effects and Penetration Rates in a 2020 Scenario

N. Brodersen, K. Burges (Ecofys, Germany), O. Hohmeyer (Flensburg University, Germany)

Self-Regulating Wind Power: Matching Generation at Load

R. Dackiw, S. V. Pasupulati, J. Soto (Oak Creek Energy Systems, USA)

14:00 – 15:40 / 15 October 2009 / Room Kaisen / Discussion leader: to be announced

Small-Signal Stability Analysis of Full-Load Converter Interfaced Wind Turbines

T. Knuppel (Siemens Wind Power, DTU, Denmark), V. Akhmatov, J. N. Nielsen, K. H. Jensen (Siemens Wind Power, Denmark), A. Dixon (National Grid, UK), J. Østergaard (DTU, Denmark)

Harmonic Analysis of Offshore Wind Farms with Full Converter Wind Turbines

Ł. H. Kocewiak, J. H. Hjerrild (DONG Energy, Denmark), C. Leth Bak (Aalborg University, Denmark)

Investigating Power Control in Autonomous Power Systems with Increasing Wind Power Penetration

I. D. Margaritis (NTUA, Greece), A. D. Hansen, P. Sørensen (Risø-DTU, Denmark), N. Hatzigiorgiou (NTUA, PPC, Greece)

Voltage Dips Ride-Through Capability: Model Validation of a Resistance-Commutated Rotor Wind Turbine Generator from In-Field Testing Results

M. A. Martinez Guillén, M. Paz Comech, J. Ruiz Guillén, E. Giraut Ruso, M. García-Gracia (C.P.S. University of Zaragoza, Spain)

14:00 – 15:40 / 15 October 2009 / Room Borgward / Discussion leader: to be announced

Dynamic Simulations of Wind Farms with Standardized Test Routines in PSS@NETOMAC

G. Duschl-Graw (Beuth University of Applied Sciences, Germany), D. Pannhorst (Ingenieurbüro Pannhorst, Germany), O. Ruhle (Siemens, Germany)

Aggregated MoIs of a Large deWind Farm Consisting of Variable Speed Wind Turbines for Power System Stability Studies

A. Perdana, O. Carlson (Chalmers University of Technology, Sweden)

Transformers for Offshore Wind Platforms: Expected Problems and Possible Approaches

B. Valov (ISET/IWES, Germany)

Wind Turbine Transformer Admittance Characterization Based on Online Time-domain Measurements and Preliminary Results from Measurements done in two Transformers using a SFRA

I. Arana (DONG Energy, Denmark), J. Holball (Technical University of Denmark - DTU, Denmark), T. Sørensen (DONG Energy, Denmark), A. H. Nielsen (Technical University of Denmark - DTU, Denmark)

Modeling and Power System Stability of VSC-HVDC Systems for Grid-Connection of Large Offshore Windfarms

Y. Xue (Vestas China, China), V. Akhmatov (Technical University of Denmark - DTU, Denmark)

Determination of the Phenomena Involved when De-energizing Transformers for Wind-farms: Modelling, Residual Fluxes Calculation and Validation by On-site Tests

M. Rioual (EDF, France), J.-C. Reveret (SUDRIA, France)

Stochastic Unit Commitment Considering Uncertain Wind Production in an Isolated System

K. Dietrich, J.-M. Latorre, L. Olmos, A. Ramos, I. Pérez-Arriaga (Comillas University, Spain)

Grid Connection-Oriented Modelling and Simulation of Frequency Response and Inertial Behaviour for Full Converter Wind Turbines

D. D. Banham-Hall (Brunel University, United Kingdom), C. A. Smith (Converteam UK, United Kingdom), G. A. Taylor M. R. Irving (Brunel University, United Kingdom)

Pumped Heat Energy Storage of Electricity

J. Ruer (SAIPEM, France)

A Methodology for Calculating Harmonic Emissions from a Wind farm Connected to an External Grid Defined by Impedance plots

D. T. Johnsen (DONG Energy, Denmark)

Improvement in Reactive Power Consumption of Line Commutated HVDC Converters for Integration of Offshore Wind-Power

M. Jafar, M. Molinas (Norwegian University of Science & Technology, Norway)

Possibilities and Analysis of Integration of Large-Scale Offshore Wind Parks into Estonian Power System

J. Kilter (Tallinn University of Technology, Estonia), O. Tšernobrovkin, M. Landsberg (Elering, Estonia), H. Agabus (Nelja Energia, Estonia), I. Palu (Tallinn University of Technology, Estonia)

Coordinated Parallel and Series Flexible AC Transmission Systems (FACTS) to Support a Power Grid with a Large Amount of Wind Power

M. Mora-Cantallos, O. Gomis-Bellmunt, A. Sumper, J. Rull-Duran (Politechnical University of Catalunya, Spain)

Battery Applications as a Backup of Large Offshore Wind Farms

A. Danesh Shakib, G. Balzer (Technical University of Darmstadt, Germany), E. Spahić (ABB, Germany)

Optimal Location of Shunt FACTS Devices in a Power System with High Wind Feeding

A. Danesh Shakib, G. Balzer (Technical University of Darmstadt, Germany)

An Optimal Model for Balancing Fluctuating Power of Large Wind Parks

H. Tammoja, I. Palu (Tallinn University of Technology, Estonia), H. Agabus (Nelja Energia, Estonia), M. Keel, R. Oldram (Tallinn University of Technology, Estonia)

Operating Experience with Interharmonic Emissions from Wind Farms

D. Hodson, R. Balanathan, S. Ogten, P. Zhang (Suzlon Energy Australia, Australia)

A Dynamical Approach to Wind Power Generation

P. Milan, M. Wächter (ForWind/University of Oldenburg, Germany), J. Gottschall (Riso-DTU, Denmark), J. Peinke (University of Oldenburg, Germany)

Power Curves for Wind Energy Converters using LIDAR Measurements

M. Wächter (ForWind/University of Oldenburg, Germany), A. Rettenmeier (University of Stuttgart, Germany), J. Peinke (ForWind/University of Oldenburg, Germany)

A Small-Signal Stability Analysis of DFIG Wind Generation

E. Vittal, M. O'Malley, A. Keane (University College Dublin, Ireland)

Developing a Type-III Wind Turbine Model for Stability Studies of the Hydro-Québec Network

C.-E. Langlois, D. Lefebvre (Hydro-Québec, Canada), L. Dube (DEI Technology, Canada), R. Gagnon (Hydro-Québec IREQ, Canada)

Regulation Techniques for Smoothing Active Power in Aggregated Wind Farms Distributed within Spain

S. Martín-Martínez, A. Viguera-Rodríguez, E. Gómez-Lázaro (University of Castilla-La Mancha, Spain)

STATCOM and Energy Storage in Grid Integration of Wind Farms

S. S. Gjerde, T. M. Undeland (Norwegian University of Science and Technology, Norway)

Simulation Study of Wind Power Plant, VSC-HVDC and Grid Integrated System

S. K. Chaudhary, R. Teodorescu, R. N. Mukerjee (Aalborg University, Denmark), P. Rodríguez (Technical University of Catalonia, Spain), P. C. Kjaer, P. W. Christensen (Vestas, Denmark)

Wind Power Integration and the Application of Storages

E. Spahić (ABB, Germany), S. K. Kondiparthi (BARD Engineering, Germany), A. Danesh Shakib (Technical University of Darmstadt, Germany), T. Benz (ABB, Germany), G. Balzer (Technical University of Darmstadt, Germany)

Minimising Transmission Reactive Support Required by High Penetration of Distributed Wind Power Generation

L. F. Ochoa (University of Edinburgh, United Kingdom), A. Keane (University College Dublin, Ireland), C. Dent, G. P. Harrison (University of Edinburgh, United Kingdom)

A Data-Driven Analysis of Wind Integration Challenges in America's Pacific Northwest

M. Goggin (AWEA – American Wind Energy Association, USA)

Consequences of the New Balancing Regulation on Renewables in Scandinavian Market – Case of the Havøygavlen Wind Park

N. Keseric, S. Trollnes, K. K. Haglerød (StatoilHydro, Norway)

Variability Forecasts for Wind Farms Using High Resolution Initial Conditions

C. Draxl, C. L. Vincent, A. N. Hahmann, G. Giebel (Riso-DTU, Denmark), P. Pinson (Technical University of Denmark – DTU, Denmark)

Adding Forecasts to the IEC 61400-25 Communication Standard

G. Giebel, O. Gehrke (Riso-DTU, Denmark)