

14th Wind Integration Workshop

20 - 22 October 2015

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



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TUESDAY, 20 OCTOBER 2015

09:00 – 13:00 Registration

13:00 – 13:10 Opening: Welcome and Introduction – Thomas Ackermann (Energynautics, Germany)

13:10 – 15:10 SESSION 1 – KEYNOTE SESSION: PREPARING GRIDS FOR OPERATING WITH HIGH LEVELS OF RENEWABLES

> Session Chair: Thomas Ackermann (Energynautics, Germany)

00:00 – 00:00 Presentations (20 min. each)

- **RES Integration: Challenges for the TSOs**
Alejandro J. Gesino (ENTSO-E Vice-Convenor WG Market Design – RES)
- **Nuno Pedro (CORESO, Belgium)**
- **Jan Papsch (Policy & Legal Officer at DG Energy B.2. / European Commission, Belgium)**
- **Delivery of Secondary Control Power by Wind Farms: Technical Pilot**
Jan Voet (Elia, Belgium)

14:50 – 15:10 Discussions

15:10 – 15:40 Coffee Break

15:40 – 17:50 SESSION 2A: PROJECT EXPERIENCE

> Session Chair: Charlie Smith (UVIG, USA)

15:40 – 17:30 Presentations (18 min. each)

- **A TSO Experience with Voltage Control from Wind Power Plants**
C.-E. Langlois (Hydro-Québec TransÉnergie, Canada) (WIW15-198)
- **Onshore Transmission Grid Development for Integration of the Wind Energy: Overview of Ongoing TenneT AC Projects in Schleswig-Holstein**
Y. Nguegan, K. Deitermann, O. Seifert, J.-A. Böttger, B. Herbst, M. Bergmann, (TenneT TSO, Germany) (WIW15-159)
- **Overvoltages in Transmission System Following Integration of Offshore Wind Farms — Cause of Overvoltages and Risk Mitigation**
P. Lilje, M. Pöller, D. Uber (M.P.E., Germany), J. Lümmer, R. Stornowski, J. Weidner (50Hertz Transmission, Germany) (WIW15-80)
- **Stability Monitoring of Commercial Wind Power Plants Connected to Weak Grids**
A. El-Deib, A. Beekmann, M. Fischer (ENERCON, Germany), V. Diedrichs (University of Applied Sciences Wilhelmshaven, Germany) (WIW15-112)
- **Comparison of Stability Behavior of Doubly-fed and Full Converter Wind Generators in Weak AC Systems**
B. Leonardi, N. Miller, R. D'Aquila (GE Energy Consulting, USA) (WIW15-135)
- **The Robust Design and Field Validations on Wind Power Plants Automatic Voltage Control System**
Y. Ye, Y. Qiao, Z. Lu, H. Chen, Y. Min (Tsinghua University, China) Z. Gu, L. Hunag (China Southern Power Grid, China), L Wu (State Grid Jibei Electric Power, China) (WIW15-60)

17:30 – 17:50 Discussions

15:40 – 17:50	SESSION 2B: DC GRIDS FOR INTEGRATION OF LARGE-SCALE WIND POWER
> Session Chair:	Nikolaos Cutululis (DTU Wind Energy, Denmark)
15:40 – 17:20	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Power System Services from VSC-HVDC Connected WPPs: an Overview L. Zeni (DONG Energy/DTU, Denmark), B. Hesselbæk (DONG Energy, Denmark), P. E. Sørensen, A. D. Hansen (DTU, Denmark), P. C. Kjær (Aalborg University/Vestas, Denmark) (WIW15-206) • Investigation of Poorly-Damped Conditions in VSC-HVDC Systems G. Stamatiou, M. Bongiorno (Chalmers University, Sweden) (WIW15-207) • Electricity Market and Power Flow Impact of Offshore Grids in the Baltic Sea Region N. Helistö, S. Uski (VTT, Finland) (WIW15-208) • Transient Analysis of Offshore HVDC Power Transmission Systems W. Z. El-Khatib, J. Holboell, T. W. Rasmussen (DTU, Denmark) (WIW15-209) • Investigation of Dynamic Behaviour of Hybrid AC/DC Power Systems A. G. Endegnanew, K. Uhlen (NTNU, Norway) (WIW15-210)
17:20 – 17:50	Discussions

15:40 – 17:50	SESSION 2C: GRID CODE ISSUES I
> Session Chair:	Eckard Quitmann (Enercon, Germany)
15:40 – 17:20	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Power System Transformation and Grid Code Evolution – Anticipating Future Needs or Adapting Gradually to Changing Requirements? K. Burges, M. Döring (Ecofys, Germany) (WIW15-182) • EU Regulation Establishing a Network Code on Requirements for Grid Connection of Generators R. Pfeiffer (Amprion, Germany), E. Haesen (ENTSO-E, Belgium), J. Kilter (Elering, Estonia), S. Martinez Villanueva (REE Spain, Spain), I. M. Minciuna, H. Urdal (ENTSO-E, Belgium), R. Wilson (National Grid, United Kingdom) (WIW15-162) • National Implementation Challenges and Support by ENTSO-E for European Connection Network Codes H. Urdal, E. Haesen, I. M. Minciuna (ENTSO-E, Belgium), J. Kilter (Elering, Estonia), S. Martinez Villanueva (REE, Spain), R. Pfeiffer (Amprion, Germany), R. Wilson (National Grid, United Kingdom) (WIW15-164) • Network Code RfG — Different Ways and Levels of Verification T. Gehlhaar (DNV GL-Energy, Germany), W. Kuijpers (DNV GL-Energy, the Netherlands) (WIW15-36) • Certification as Part of the Grid Connection Process – Review of Five Years of Experience in Germany F. Scheben, M. Voß, J. Möller (M.O.E., Germany) (WIW15-26)
17:20 – 17:50	Discussion

18:00 Networking & Poster Reception

WEDNESDAY, 21 OCTOBER 2015

08:30 – 10:00	SESSION 3A: MODELLING AND SIMULATION I
> Session Chair:	Debra Lew (GE EnergyUSA)
08:30 – 09:42	Presentations (18 min. each)
	<ul style="list-style-type: none">• Comparison of Grid Calculation Methods Focussing on Large Scale Converter-Dominated Grid Systems C. Heising, R. Bartelt, D. Meyer (Avasition, Germany), V. Staudt (Ruhr-University, Germany) (WIW15-117)• A Danish Case Study: A Multi-terminal HVDC System for Wind Power Integration and Electricity Market Enhancement V. Akhmatov (Energinet.dk, Denmark) (WIW15-183)• Wind Power Plant Control Optimisation with Incorporation of Wind Turbines and STATCOMs L. Petersen (Aalborg University, Denmark), F. Kryezi (Energinet.dk, Denmark), F. Iov (Aalborg University, Denmark), L. Kocewiak (DONG Energy, Denmark) (WIW15-158)• Synthetic Wind Power Production Time Series Based on ARMA-GARCH and Copula Modelling S. Kloibhofer, F. Leimgruber, T. Esterl, S. Übermasser (AIT – Austrian Institute of Technology, Austria), N. Rab (Vienna University of Technology, Austria) (WIW15-203)
09:42 – 10:00	Discussions

08:40 – 10:00	SESSION 3B: SYSTEM BALANCING
> Session Chair:	Flavio Fernández (Digsilent, Germany)
08:40 – 09:40	Presentations (20 min. each)
	<ul style="list-style-type: none">• Study of the Incorporation of Risk-Based Reserves in the Unit Commitment with Application to a Hydraulic System N. Menemenlis, M. Huneault (Hydro-Québec/IREQ, Canada) (WIW15-132)• Supply and Demand Balance Control of Power Systems with Wind Turbines Considering Aggregation Effect by Introducing Congestion Management H. Bae, T. Tsuji, T. Oyama (Yokohama National University, Japan), K. Uchida (Waseda University, Japan) (WIW15-76)• Supply and Demand Balance Control Based on Electricity Market Considering Probabilistic Wind Power Output and Probabilistic Operation Constraint A. Koide, T. Tsuji, T. Oyama (Yokohama National University, Japan), K. Uchida (Waseda University, Japan) (WIW15-83)
09:40 - 10:00	Discussions

08:40 – 10:00	SESSION 3C: ECONOMIC ASPECTS
> Session Chair:	Karsten Burges (Ecofys, Germany)
08:40 – 09:40	Presentations (20 min. each)
	<ul style="list-style-type: none">• Trends in Offshore Wind Economics – the Past and the Future L. Kitzing, P. E. Morthorst (DTU, Denmark) (WIW15-56)• Scenario Robustness and Cost-Benefit Allocation for Multinational Transmission Grid Investments – A North Sea 2030 Case Study M. Kristiansen, M. Korpås (NTNU, Norway), P. Härtel (Fraunhofer IWES, Germany) (WIW15-68)• Offshore HVDC Risk Perceptions: Are they Driving Investments Appropriately? A. Madariaga, O. El Mountassir (ORE Catapult, United Kingdom), N. MacLeod (WSP Parsons Brinkerhoff, United Kingdom) (WIW15-161)
09:40 – 10:00	Discussions

10:00 – 10:30 Coffee Break

10:30 – 12:20 SESSION 4A: OFFSHORE WIND POWER PLANTS

> Session Chair: Lorenzo Zeni (DONG Energy Wind Power, Denmark)

10:30 – 12:00 Presentations (18 min. each)

- **Reactive Power Optimization in HVDC-connected Wind Power Plants Considering Wake Effects**
K. Schönleber, S. Ratés-Palau (Alstom Renewables, Spain), M. de Prada-Gil (Catalonia Institute for Energy Research - IREC, Spain), O. Gomis-Bellmunt (Catalonia Institute for Energy Research – IREC/Polytechnical University of Catalonia, Spain) (WIW15-48)
- **Optimal Design of the Mvar Controller of Far Shore HVAC Grid Connections**
T. Van Acker, B. Rawn, D. Van Hertem (KU Leuven, Belgium), S. Hendrix, E. Lemaire (CG Holdings Belgium, Belgium) (WIW15-125)
- **Transformer Switching – Experiences from Offshore Grids**
M. Greve, M. Koochack Zadeh, A. Menze, C. Rauscher, J. Jung (TenneT TSO, Germany) (WIW15-165)
- **Control of DFIG-Based Off-Shore Wind Power Plants for the Connections to HVDC Diode Rectifiers**
R. Peña (University of Concepción, Chile), S. Añó-Villalba, R. Blasco-Gimenez (Polytechnical University of Valencia, Spain), (WIW15-139)
- **Inter-array Cable Routing Optimization Considering Power Losses**
M. Fischetti (Vattenfall/DTU, Denmark), D. Pisinger (DTU, Denmark), I. Vranceanu (Vattenfall, Denmark) (WIW15-47)

12:00 – 12:20 Discussions

10:30 – 12:20 SESSION 4B: MODEL VALIDATION AND TESTS

> Session Chair: Eckehard Tröster (Energynautics, Germany)

10:30 – 11:50 Presentations (20 min. each)

- **Wind Power Plants Grid Compliance Tests - Hydro-Québec TransÉnergie Experience**
M. Asmine, C.-E. Langlois (Hydro-Québec TransÉnergie, Canada) (WIW15-150)
- **Hydro-Quebec Distribution Type Testing for Type 4 Wind Turbines Performed on Full Scale Wind Turbine and Power System Laboratory**
A. Al-khatib, B. Rohlfing (Wobben Research and Development, Germany), D. Guérette, B. Fazio, C. Morin (Hydro-Québec, Canada), M. Fischer (ENERCON Canada, Canada) (WIW15-121)
- **Validation and Level of Detail Requirements for Stability Models on Wind Power Plant Level**
M. Laubrock, A. Mielke (Nordex Energy, Germany) (WIW15-88)
- **Testing in Demonstrator Power Systems – a Valuable Part in the Development of Grid Integration Technology**
S. Nikolai, A. Al-khatib (Wobben Research and Development, Germany) (WIW15-108)

11:50 – 12:20 Discussions

10:30 – 12:20	SESSION 4C: <u>DISCUSSION SESSION</u> – FUTURE EUROPEAN GRID CODE REQUIREMENT (RFG), ANCILLARY SERVICE CERTIFICATION, AND ASSOCIATED COST
> Session Chair:	Sigrid Bolik (Senvion, United Kingdom)
10:30 – 11:45	Presentations (25 min. each)
	<ul style="list-style-type: none"> • Ancillary Services: Well Defined and Well Paid — GCC Features: Independently Verified to be Well Paid – Basis for Future Market Design Details T. Gehlhaar (DNV-GL Energy, Germany), P. Gardner (DNV-GL Energy, United Kingdom) (WIW15-216) • Wind Turbine Manufacturers Observation Regarding Reactive Power Support and Control Requirements A. Dimov, S. Bolik, N. Duncan, D. Venkov (Senvion, Germany/United Kingdom) (WIW15-215) • The RES Perspective TBA (RES, United Kingdom)
11:45 – 12:20	Discussions
12:20 – 13:20	Lunch
13:20 – 15:10	SESSION 5A: STABILITY STUDIES
> Session Chair:	Slavomir Seman (Siemens, Germany)
13:20 – 14:50	Presentations (18 min. each)
	<ul style="list-style-type: none"> • Post-fault Active Power Ramp Rates of DFIGs for Transient Stability Enhancement in Great Britain K. Johnstone, K. Bell, C. Booth (University of Strathclyde, United Kingdom) (WIW15-96) • Transient Stability Analysis in Japanese Power System with Wind Power Integration T. Tsuji, K. Watanabe, T. Oyama (Yokohama National University, Japan), K. Uchida (Waseda University, Japan) (WIW15-199) • Prediction of Subsynchronous Resonance in Type-III Wind Turbines Connected to Series Compensated Grids I. Vieto, J. Sun (Rensselaer Polytechnic Institute, USA) (WIW15-156) • On the Potential of Subsynchronous Resonance of Voltage-Source Converters with the Grid I. Vieto, H. Liu (Rensselaer Polytechnic Institute, USA), S. Rogalla (Fraunhofer ISE, Germany), J. Sun (Rensselaer Polytechnic Institute, USA) (WIW15-157) • Assessment of Full-Converter Wind Turbines' Immunity against Sub-synchronous Interaction using Eigenvalue Analysis A. El-Deib, A. Trevisan, A. Mendonca, J. Cassoli (Wobben Research and Development, Germany), M. Fischer (ENERCON Canada, Canada) (WIW15-66)
14:50 – 15:10	Discussions
13:20 – 15:00	SESSION 5B: FLEXIBILITY ISSUES
> Session Chair:	Yoh Yasuda (Kansai University, Japan)
13:20 – 14:20	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Flexibility Dispatch from an Agent-Based Perspective S. Becker (Kassel University/ Fraunhofer IWES/FIAS Frankfurt, Germany) (WIW15-167) • Innovative Business Models Making Use of the Flexibility of the Industrial Electricity Demand for Integrating Wind Energy T. Maidonis, M. Papapetrou (WIP Renewable Energies, Germany), P. Frías Marín, M. Vallés Rodríguez (University Pontificia Comillas, Spain), F. Nuño, T. Jezdinsky (European Copper Institute, Belgium) (WIW15-114) • The Influence of Turbine Power Density on the Value Chain — An Offshore Case Study J. De Boer (Energy Watch, the Netherlands) (WIW15-49)
14:20 – 15:00	Discussions

13:20 – 15:00 **SESSION 5C: STANDARDS AND GRID CODE ISSUES**
 > Session Chair: Helge Urdal (ENTSO-E, United Kingdom)

- 13:20 – 14:40** **Presentations (20 min. each)**
- **Overview, Status and Outline of the New Standards Series - IEC 61400 -21 – Measurement and Assessment of Electrical Characteristics - Part I - Wind Turbines and Part II - Wind Power Plants**
 B. Andresen (Aarhus University, Denmark), L. Christensen (Vestas Wind Systems, Denmark), I. Skrypalle (Siemens Wind Power, Denmark), Ł. Kocewiak (Dong Energy, Denmark), F. Santjer (UL-International, Germany) (WIW15-188)
 - **Wind Plant Models in IEC 61400-27-2 and WECC -Latest Developments in International Standards on Wind Turbine and Wind Plant Modelling**
 J. Fortmann (HTW Berlin- University of Applied Sciences, Germany), N. Miller (GE Energy Management, USA), Y. Kazachkov (Siemens PTI, USA), J. Bech, (Siemens Wind Power, Denmark), B. Andresen (Aarhus University, Denmark), P. Pourbeik (EPRI, USA), P. E. Sørensen (DTU, Denmark) (WIW15-129)
 - **Improvement of PGU Simulation Models based on FRT-Test Rig with Adjustable Voltage Vector and Short Circuit Power**
 R. Klosse, K. Küch, J. Jahn, J. Gerdes (WindGuard Certification, Germany) (WIW15-133)
 - **Project Experience with Grid Code Testing of Wind Power Plants in South Africa**
 C. Wessels, B. Hahn (Nordex Energy, Germany) (WIW15-39)

14:40 – 15:00 **Discussions**

15:10 – 15:30 **Coffee Break**

15:30 – 17:30 **SESSION 6A: INERTIA AND FREQUENCY ISSUES**
 > Session Chair: Charles-Éric Langlois (Hydro-Québec TransÉnergie, Canada)

- 15:30 – 16:50** **Presentations (20 min each)**
- **A Novel Approach for Studying Possibilities with Synthetic Inertia from Wind Power Plants**
 D. Wall, E. Lidström, J. Persson (Vattenfall R&D, Sweden) (WIW15-101)
 - **Inertial Response with Improved Variable Recovery Behaviour Provided by Type 4 Wind Turbines**
 S. Engelken, A. Mendonca (Wobben Research and Development, Germany), M. Fischer (ENERCON Canada, Canada) (WIW15-89)
 - **Analysis and Coordination of Delivering Inertial Response by Wind Power Plants**
 D. Deroost, P. Tielens, D. Van Hertem (KULeuven, Belgium), K. Srivastava, G. Velotto (ABB Corporate Research, Sweden) (WIW15-120)
 - **Optimisation of the Concept of a Hydraulic-Pneumatic Flywheel System in a Wind Turbine Rotor**
 S. Hippel, C. Jauch (Flensburg University of Applied Sciences, Germany) (WIW15-128)

16:50 – 17:30 **Discussions**

15:30 – 17:30	SESSION 6B: FORECASTING
> Session Chair:	Juha Kiviluoma (VTT, Finland)
15:30 – 16:50	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Use of the Analog Ensemble Approach to Optimize the Performance of Wind Power Forecasts from an NWP Ensemble S. Young, J. Zack (AWS Truepower, USA) (WIW15-140) • Extreme Value Models for Wind Power Forecast Errors P. Bacher, H. Madsen, P. Pinson (DTU Denmark, Denmark), S. B. Mortensen, H. A. Nielsen (Enfor, Denmark) (WIW15-97) • Beyond MAE: the Value of being Right at the Right Time - Linking Wind Power Forecasting Accuracy to Increased Trading Revenue B. Brailey, J. Collins, C. Collier (DNV GL, United Kingdom) (WIW15-43) • Improving Short-Term Wind Ramp Forecasting in the Tehachapi Wind Resource Area through Targeted Measurements and Next-Generation Prediction Techniques J. Zack (AWS Truepower, USA), C. P. van Dam, S.-H. Chen, C.-Y. Chen (University of California at Davis, USA), C. MacDonald (Sonoma Technology, USA), J. Blatchford (California Independent System Operator, USA) (WIW15-180)
16:50 – 17:30	Discussions

15:30 – 17:40	SESSION 6C: HVDC GRID CONNECTION
> Session Chair:	Peter Wibæk Christensen (Vestas, Denmark)
15:30 – 17:18	Presentations (18 min. each)
	<ul style="list-style-type: none"> • 2nd Generation DC Grid Access for Large Scale Offshore Wind Farms P. Menke, R. Zurowski, T. Christ, S. Seman, G. Giering, T. Hammer, W. Zink, F. Hacker, D. Imamovic (Siemens, Germany), J. Thisted, P. Brogan, N. Goldenbaum (Siemens Wind Power, Denmark) (WIW15-27) • HVDC Grid Protection and Fault Trigger Setup Considerations Comprising DC Circuit Breaker Units S. Wenig, M. Goertz, R. Sander, M. Suriyah, T. Leibfried (Karlsruhe Institute of Technology, Germany) (WIW15-52) • Dynamic Reactive Power Control in Offshore HVDC Connected Wind Power Plants J. Sakamuri, N. A. Cutululis (DTU, Denmark), Z. H. Rather (University College Dublin, Ireland), J. Rimez (Elia, Belgium) (WIW15-59) • Large Offshore Wind Power Plants with VSC-HVDC Grid Connection: Frequency Stability Control Strategy L. J. Cai, X.Z Lei (SGRI Europe, Germany), U. Karaagac, J. Mahseredjian (Polytechnical School of Montréal, Canada) (WIW15-74) • Control of HVDC-Diode Rectifier Connected Wind Power Plants During HVDC Faults R. Vidal-Albalade, E. Belenguer (University Jaume I de Castello, Spain), S. Añó-Villalba, S. Bernal-Perez, R. Blasco-Giménez (Polytechnical University of Valencia, Spain) (WIW15-142) • Background Harmonic Amplification in Large Offshore Wind Power Plants J. Rasmussen, J. Andersson (Solvina, Sweden) (WIW15-217)
17:18 – 17:40	Discussions

19:30 **Wind Dinner**

08:40 – 10:00 SESSION 7A: MODELLING AND SIMULATION II

> Session Chair: Jens Fortmann (HTW Berlin - University of Applied Sciences, Germany)

08:40 – 09:40 Presentations (20 min. each)

- **Comparison of Dynamic Characteristics of Wind-Power Plants with Full-Bridge Converters and Doubly-Fed Induction Generators**
C. Heising, R. Bartelt, D. Meyer (Avasition, Germany), V. Staudt (Ruhr University, Germany) (WIW15-119)
- **Interconnection of Advanced Type 4 WTGs with Diode Rectifier Based HVDC Solution and Weak AC Grids**
S. Seman, R. Zurowski (Siemens, Germany), C. Taratoris (Siemens Transmission & Distribution, United Kingdom) (WIW15-181)
- **Simulation of a Large-Scale Series-Connected Wind Power Plant without Substation**
S. Nishikata, F. Tatsuta, K. Suzuki (Tokyo Denki University, Japan) (WIW15-78)

09:40 – 10:00 Discussions

08:30 – 10:00 SESSION 7B: ECONOMIC AND MARKET ISSUES

> Session Chair: Martina Fischetti (Vattenfall and DTU, Denmark)

08:30 – 09:42 Presentations (18 min. each)

- **Opportunities, Challenges and Risks for Renewables Integration in European Electricity Markets**
A. Flament, T. Chow, R. Verhaegen (3E, Belgium) (WIW15-100)
- **Implications from Changing the Priority Dispatch for Intermittent Energy Sources to a Market Based Approach: Application to the Spanish Case**
J. P. Chaves Avila, F. Banez-Chicharro, K. Dietrich, A. Ramos (University Pontificia Comillas, Spain) (WIW15-105)
- **On the Economics of Curtailment of Wind Power Plants in the European Legislative Context**
J. Spruytte, K. Casier, S. Verbrugge (Ghent University, Belgium), R. Van Caenegem (Eandis, Belgium) (WIW15-106)
- **Cost Optimal Share of Wind Power, PV and Batteries**
J. Kiviluoma, M. Azevedo, E. Rinne, N. Heliö (VTT, Finland) (WIW15-131)

09:42 – 10:00 Discussions

08:40 – 10:00 SESSION 7C: GRID CODE ISSUES II

> Session Chair: Ralph Pfeiffer (Amprion, Germany)

08:40 – 09:40 Presentations (20 min. each)

- **Wind Power Grid Codes – Historic Development, Present State and Future Outlook**
T. K. Vrana, H. G. Svendsen (Sintef, Norway), A. Endegnanew (NTNU, Norway) (WIW15-32)
- **Operational Behavior of Wind Power Plants during Power Black-out in Turkey on 31st of March 2015**
C. Wessels, S. De Rijcke (Nordex Energy, Germany) (WIW15-40)
- **A Dynamic Approach Aiming to Maximize the Integration of Wind Energy in Power Systems**
Q. Cossart, L. Ruiz Gómez, S. Guignard, N. Girard (Maia Eolis, France) (WIW15-169)

09:40 – 10:00 Discussions

10:00 – 10:30 Coffee Break

10:30 – 12:20	SESSION 8A: HARMONICS
> Session Chair:	Jian Sun (Rensselaer Polytechnic Institute, USA)
10:30 – 11:50	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Methodologies for Wind Turbine and STATCOM Integration in Wind Power Plant Models for Harmonic Resonances Assessment F. D. Freijedo, S. K. Chaudhary, J. M. Guerrero, R. Teodorescu, C. L. Bak (Aalborg University, Denmark) (WIW15-192) • Wind Turbine Harmonic Model and Its Application – Overview, Status and Outline of the New IEC Technical Report Ł. Kocewiak (DONG Energy, Denmark), C. Álvarez (Energy to Quality-E2Q, Spain), P. Muszynski (ABB Drives, Finland), J. Cassoli (Enercon, Germany), L. Shuai (Siemens Wind Power, Denmark) (WIW15-163) • Contribution of Background Harmonic Distortion at Wind Power Plant R. Vazquez, H. Amaris, M. Alonso (University Carlos III of Madrid, Spain), C. Alvarez (Energy to Quality-E2Q, Spain) (WIW15-95) • Harmonic Analysis and Active Filtering in Offshore Wind Power Plants S. K. Chaudhary, F. D. Freijedo, J. M. Guerrero, R. Teodorescu, C. L. Bak, (Aalborg University, Denmark), Ł. Kocewiak (DONG Energy, Denmark) C. F. Jensen (Energinet.dk, Denmark) (WIW15-176)
11:50 – 12:20	Discussions

10:30 – 12:20	SESSION 8B: OVERALL POWER SYSTEM ASPECTS I
> Session Chair:	Bernd Weise (Digsilent, Germany)
10:30 – 11:50	Presentations (20 min. each)
	<ul style="list-style-type: none"> • International Comparison of Wind and Solar Curtailment Ratio Y. Yasuda (Kansai University, Japan), L. Bird (NREL, USA), E. M. Carlini (Terna, Italy), A. Estanqueiro (LNEG, Portugal), D. Flynn (University College Dublin, Ireland), A. Forcione (Hydro-Québec-IREQ, Canada), E. Gómez-Lázaro (University of Castilla-La Mancha, Spain), P. Higgins (Queen’s University Belfast, United Kingdom), H. Holttinen (VTT, Finland), D. Lew (GE Energy, USA), S. Martín-Martínez (University of Castilla-La Mancha, Spain), J. McCam (SEAI, Ireland), N. Menemenlis (Hydro-Québec-IREQ, Canada), J. C. Smith (UVIG, USA) (WIW15-111) • Backup, Storage and Transmission Estimates of a Supra-European Electricity Grid with High Shares of Renewables. A. Kies, L. von Bremen, D. Heinemann (University of Oldenburg, Germany), K. Chattopadhyay, E. Lorenz (University of Oldenburg, Germany) (WIW15-138) • Capacity Credit and System Adequacy: The Case of Wind, Wave and Solar PV in the Danish System J. Fernández Chozas (Consulting Engineer, Denmark), B. V. Mathiesen (Aalborg University, Denmark) (WIW15-191) • Integration of Wind and Solar by Multisource Multiproduct Energy Systems K. Hemmes (TU Delft, Netherlands) (WIW15-21)
11:50 – 12:20	Discussions

10:30 – 12:20 **SESSION 8C: COUNTRY STUDIES**
 > Session Chair: **Clemens Jauch (University of Applied Sciences Flensburg, Germany)**

- 10:30 – 12:00** **Presentations (18 min. each)**
- **Impact of Increasing Share of Renewables on the Japanese Electricity System - Model Based Analysis**
 T. Wakeyama (Japan Renewable Energy Foundation, Japan) (WIW15-102)
 - **Technical Feasibility and Reserve Management for Large Scale Wind Power Integration in an African Country**
 W. de Boer, J. Frunt, K. Kumpavat, T. Slot, M. Duvoort (DNV GL - Energy, the Netherlands), A. Suzuki (DNV GL - Energy, United Kingdom) (WIW15-99)
 - **Integrating Renewables in Jiangsu Province, China**
 T. Brown, S. Langanke, T. Ackermann (Energynautics, Germany), S. Teske (Greenpeace International, the Netherlands) (WIW15-212)
 - **Costa Rica: An Outlook on the Integration of Wind Power into a Hydro-Based Power System**
 P.-P. Schierhorn (Energynautics, Germany) (WIW15-211)
 - **Wind Power Integration on Interconnected or Isolated Upstream Facilities**
 S. Barbero, M. B. Barbieri, M. Beroqui, P. L. Arnera (IITREE-LAT, Argentina) (WIW15-175)

12:00 – 12:20 **Discussions**

12:20 – 13:20 **Lunch**

13:20 – 15:10 **SESSION 9A: MODELLING**
 > Session Chair: **Simon De Rijcke (Nordex Energy, Germany)**

- 13:20 – 14:40** **Presentations (20 min. each)**
- **A Miniature Model Demonstration of an Active Resonance Damping Function Using STATCOM in Large-Scale Wind Power Plants**
 K. Kofuji, T. Jintsugawa, C. Nakazawa, T. Tajyuta, H. Shinohara, A. Suzuki (Fuji Electric, Japan) (WIW15-90)
 - **Wind Power Simulation Using Correlated Innovation Matrix and Wavelet Multi-Resolution Analysis Approaches**
 D. McQueen, A. Wood, A. Miller (University of Canterbury, New Zealand) (WIW15-30)
 - **Applicability of Aggregation Modelling for Wind Power Plants Based on Rationales of RGC in Small-signal Analysis**
 J.-Y. Ruan, Z.-X. Lu, Y. Qiao, Y. Min (Tsinghua University, China), R.-Y. Wang (Jibei Power Grid, China) (WIW15-55)
 - **Impact of Variable Speed Wind Power Generators on Short-Term and Long-Term Voltage Stability**
 K. Amarasekara, A. Agalgaonkar, S. Perera (University of Wollongong, Australia), L. Meegahapola (RMIT University, Australia) (WIW15-87)

14:40 – 15:10 **Discussions**

13:20 – 15:10 **SESSION 9B: OVERALL POWER SYSTEM ASPECTS II**
 > Session Chair: **Michael N. Frydensbjerg (Siemens, Denmark)**

- 13:20 – 14:40** **Presentations (20 min. each)**
- **Wind Power Generation Probabilistic Model for Power System Reliability Studies**
 E. Nuño, N. A. Cutululis (DTU Denmark, Denmark) (WIW15-69)
 - **A Novel Approach to Identify Critical Components in Power Grids Due to Large-Scale Integration of Wind Power**
 Y. Yang, P. F. Hansen (DNV GL AS, Norway) (WIW15-193)
 - **Combined Transmission and Reactive Power Planning Considering Wind Curtailment**
 F. Ugranli (DTU Denmark, Denmark), E. Karatepe (Dokuz Eylul University, Turkey), A. Hejde Nielsen (DTU Denmark, Denmark) (WIW15-82)
 - **Integration Strategies for Variable Renewable Energy - Developing an Electricity System Model**
 M. McPherson, B. Karney (University of Toronto, Canada) (WIW15-51)

14:40 – 15:10 **Discussions**

13:20 – 15:10	SESSION 9C: OPERATIONAL ASPECTS
> Session Chair:	Rena Kuwahata (Ecofys, Germany)
13:20 – 14:20	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Case Study of Sequential Wind Power Cut-Out Occurrences in Japan C. Urabe, T. Saitou, K. Kataoka, K. Ogimoto (University of Tokyo, Japan) (WIW15-45) • Influence of Transmission Losses on Frequency Stability after a Generation Outage L. Wagner, E. Tröster (Energynautics, Germany) (WIW15-196) • A Hybrid Physical and Machine Learning Based Forecast of Regional Wind Power S. Vogt, J. Dobschinski, T. Kanefendt, S. Otterson, Y.-M. Saint-Drenan (Fraunhofer IWES, Germany) (WIW15-115)
14:20 – 15:10	Discussions
15:10 – 15:30	Coffee Break

15:30 – 16:30	SESSION 10: CLOSING SESSION – PODIUM DISCUSSION
> Session Chair:	Helge Urdal (ENTSO-E, United Kingdom)
	<ul style="list-style-type: none"> • What are the Next Steps for Implementing the ENTSO-E Network Codes? Participants: R. Pfeiffer (Amprion, Germany), E. Quitmann (Enercon, Germany), T- Gehlhaar (DNV GL, Germany), T. K. Vrana (Sintef, Norway)

WIND POSTER PRESENTATIONS

- **Comparison on Wind Turbine Condition Monitoring Methods Using SCADA Data**
N. Chen, R. R. Yu, Y. Chen (ABB Corporate Research, China) (WIW15-25)
- **An Equation Error-Based Scheme for Online Parameter Tracking of the SCIG Wind Turbine Fed by a Full-rated Converter**
J-Y. Ruan, Z-X. Lu, Y. Qiao, Y. Min (Tsinghua University, China), R.-Y. Wang (Jibei Power Grid, China) (WIW15-38)
- **A Method of Finding Optimal Network Configuration and Wind Generation Dispatch in Grid Security Threatening Conditions**
M. Bajor (Institute of Power Engineering, Poland) (WIW15-50)
- **Flexibility Characterization for High Wind Power Penetration Systems**
S. Martín Martínez, A. Honrubia Escribano, M. Cañas Carretón, E. Gómez Lázaro, (University of Castilla-La Mancha, Spain),
J. P. S. Catalão (University of Beira Interior, Portugal) (WIW15-92)
- **Spatial and Temporal Variation of Wind Power for Norwegian Price Areas**
A. Løvholm, E. Berge, Ø. Byrkjedal, (Kjeller Vindteknikk, Norway) (WIW15-124)
- **Ancillary Services from Renewable Power Plants – RePlan Project Perspective**
M. Altin, A. D. Hansen, N. A. Cutululis, H. W. Bindner (DTU, Denmark), F. Iov, R. L. Olsen (Aalborg University, Denmark)
(WIW15-155)
- **Dynamic Wind Farm Power Simulation**
D. McQueen, A. Wood, A. Miller (University of Canterbury, New Zealand) (WIW15-194)