

# 16<sup>th</sup> Wind Integration Workshop

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

25 - 27 October 2017

Berlin, Germany



## PROGRAM

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WEDNESDAY 25 OCTOBER 2017			THURSDAY 26 OCTOBER 2017			FRIDAY 27 OCTOBER 2017				
Wind Workshop Day 1			Wind Workshop Day 2			Wind Workshop Day 3				
			09:00 – 11:00	ALEXANDER 1 SESSION 3A: HARMONICS I	ALEXANDER 2 SESSION 3B: ANCILLARY SERVICES	ALEXANDER 3 SESSION 3C: OFFSHORE WIND INTEGRATION	09:00 – 10:40	ALEXANDER 1 SESSION 7A: HARMONICS II	ALEXANDER 2 SESSION 7B: INERTIA ISSUES II	ALEXANDER 3 SESSION 7C: INTEGRATION EXAMPLES
				COFFEE BREAK (30MIN)				COFFEE BREAK (30MIN)		
9:00 – 13:00	FOYER		11:30 – 13:00	ALEXANDER 1 SESSION 4A: COMPLIANCE TESTING	ALEXANDER 2 SESSION 4B: SOUTH AUSTRALIA BLACK-OUT EVENT	ALEXANDER 3 SESSION 4C: INTERNATIONAL STUDIES	11:10 – 13:00	ALEXANDER 1 SESSION 8A: FREQUENCY ISSUES	ALEXANDER 2 SESSION 8B: GRID INTEGRATION STUDIES II	ALEXANDER 3 SESSION 8C: GRID OPERATION TOOLS I
	REGISTRATION			LUNCH 13:00 – 14:00				LUNCH 13:00 – 14:00		
	LUNCH 11:30 – 13:00									
13:00 – 15:10	ALEXANDER 1 – 3		14:00 – 15:45	ALEXANDER 1 SESSION 5A: MARKET & REGULATORY ISSUES	ALEXANDER 2 SESSION 5B: GRID INTEGRATION STUDIES I	ALEXANDER 3 SESSION 5C: MODELLING	14:00 – 15:15	ALEXANDER 1 SESSION 9A: WIND POWER DEVELOPMENTS	ALEXANDER 2 SESSION 9B: GRID OPERATION TOOLS II	
	WELCOME & SESSION 1: KEYNOTE SESSION			COFFEE BREAK (30 MIN)				SHORT BREAK (20 MIN)		
	COFFEE BREAK (30MIN)									
15:40 – 18:00	ALEXANDER 1 SESSION 2A: ENTSO-E	ALEXANDER 2 SESSION 2B: RECOMMENDED PRACTICES FOR INTEGRATION STUDIES	16:15 – 18:20	ALEXANDER 1 SESSION 6A: FORECASTING	ALEXANDER 2 SESSION 6B: INERTIA ISSUES I	ALEXANDER 3 SESSION 6C: GRID CODE ISSUES	15:35 – 16:35	ALEXANDER 1 – 2 SESSION 10: CLOSING SESSION – PODIUM DISCUSSION		
19:00	SOLAR & WIND DINNER		18:20	POSTER RECEPTION & NETWORKING						

## WEDNESDAY, 25 OCTOBER 2017

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**09:00 – 13:00 Registration**

**11:30 – 13:00 Lunch**

**13:00 – 13:10 Welcome**

<b>13:10 – 15:10</b>	<b>SESSION 1 – KEYNOTE SESSION</b>
> Session Chair	T. Ackermann (Energynautics, Germany)
<b>13:10 – 14:50</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"><li>• <b>The Big Picture 2030 – What Do We Need from the Wind Sector?</b> F. Peter (Agora Energiewende, Germany)</li><li>• <b>Status and Prospects of Offshore Wind in Germany</b> A. Wagner (Stiftung OFFSHORE-WINDENERGIE, Germany)</li><li>• <b>Grid Stresstest – Outcome and Further Options</b> C. Siebels (TenneT TSO, Germany) (Submission-ID WIW17-315)</li><li>• <b>North Sea Wind Power of the Future</b> M. van der Meijden (TenneT TSO, Netherlands) (Submission-ID WIW17-316)</li><li>• <b>Social Acceptance is the Achilles' Heel of the Energy Transition</b> L. Hartman (TenneT TSO, Germany) (Submission-ID WIW17-317)</li></ul>
<b>14:50 – 15:10</b>	<b>Discussions</b>

**15:10 – 15:40 Coffee Break**

<b>15:40 – 17:40</b>	<b>SESSION 2A – ENTSO-E: SYSTEM CHALLENGES &amp; SOLUTIONS TO MOVE TOWARDS 100% RES PENETRATION</b>
> Session Chair	L. Söder (KTH Royal Institute of Technology, Sweden)
<b>15:40 – 17:00</b>	<b>Presentations (20 min each)</b>
	<ul style="list-style-type: none"><li>• <b>Present status of European Wide Guidance from ENTSO-E on HPoPEIPS</b> J. Jahn (Tennet, Germany)</li><li>• <b>Implications of High Penetration of Power Electronic Interfaced Sources on Power System Analysis</b> B. Weise (DlG SILENT, Germany) (Submission-ID WIW17-319)</li><li>• <b>Wind Industry Input on Issues in Dealing with High Penetration Challenges</b> Wind Europe / P. Christensen (Vestas, Denmark)</li><li>• <b>Possible Ways Forward for Solar PV Contribution to Coping with Impact of High Penetration</b> T. Buelo (SMA, Germany)</li></ul>
<b>17:00 – 17:40</b>	<b>Discussion:</b> <b>HOW SHOULD THE INDUSTRY MOVE FORWARD WITH THE EXPECTED HIGH PENETRATION CHALLENGE?</b>

<b>15:40 – 18:00</b>	<b>SESSION 2B – IEA TASK 14 AND TASK 25: RECOMMENDED PRACTICES FOR WIND /PV INTEGRATION STUDIES</b>
> Session Chair	J. C. Smith (UVIG, USA)
<b>15:40 – 17:40</b>	<b>Presentations (30 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Getting Wind and Solar onto the Grid – An IEA Manual for Policy Makers</b> S. Mueller, P. Vithayasrichareon (International Energy Agency, France) (Submission-ID WIW17-301)</li> <li>• <b>Recommendations for Wind and Solar Integration Studies</b> H. Holttinen, J. Kiviluoma (VTT, Finland), T. K. Vrana (SINTEF, Norway), E. Neau (EdF, France), D. Flynn, J. Dillon (UCD, Ireland), L. Söder (KTH Royal Institute of Technology, Sweden), N. Cutululis (DTU, Denmark), B. Mather, B.-M. Hodge (National Renewable Energy Laboratory – NREL, USA), K. Ogimoto (University of Tokyo, Japan), J. C. Smith (UVIG, USA) (Submission-ID WIW17-209)</li> <li>• <b>IEA PVPS Recommended Practices for Wind/PV Integration Studies – Focus on PV Integration</b> R. Bründlinger, Ch. Mayr (AIT, Austria) (Submission-ID WIW17-000)</li> <li>• <b>Transmission Grid and System Dynamics: Recommended Practices for Wind/PV Integration Studies</b> D. Flynn (University College Dublin, Ireland), H. Holttinen (VTT, Finland) (Submission-ID WIW17-283)</li> </ul>
<b>17:40 – 18:00</b>	<b>Discussions</b>

<b>15:40 – 18:00</b>	<b>SESSION 2C – HVDC ISSUES</b>
> Session Chair	B. Ernst (Fraunhofer IWES, Germany)
<b>15:40 – 17:40</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Interaction Analysis between MMC-Based VSC-HVDC Links and DFIG-Based WPPs within the AC Network</b> E. Prieto-Araujo, E. Sánchez-Sánchez, S. Galceran-Arellano, O. Gomis-Bellmunt (Polytechnical University of Catalonia, Spain) (Submission-ID WIW17-43)</li> <li>• <b>Auxiliary Power Supply in a FixReF Controlled Offshore Wind Power Plant with Diode Rectifier HVDC Transmission</b> C. Neumann, H.-G. Eckel (University of Rostock, Germany), S. Achenbach, F. Augsburg (Siemens, Germany) (Submission-ID WIW17-172)</li> <li>• <b>Offshore Wind Farms and HVDC Grids Modelling as a Feedback Control System for Stability Analysis</b> A. Bidadfar, O. Saborío-Romano, M. Altin, Ö. Göksu, N. A. Cutululis, P. E. Sørensen (DTU, Denmark) (Submission-ID WIW17-144)</li> <li>• <b>Harmonic Resonance Interactions in HVDC-Connected Offshore Wind Power Plants</b> M. Cheah-Mane, E. Prieto-Araujo, O. Gomis-Bellmunt L. Sainz (Polytechnical University of Catalonia, Spain) (Submission-ID WIW17-44)</li> <li>• <b>Harmonic Stability and Interactions in Meshed VSC-HVDC Dominated Power Systems</b> A. J. Agbemuko, J. L. Dominguez-García (Catalonia Institute for Energy Research – IREC, Spain), E. Prieto-Araujo, O. Gomis-Bellmunt (Polytechnical University of Catalonia, Spain) (Submission-ID WIW17-38)</li> <li>• <b>Transient Stability Enhancement by Active/Reactive Power Control of Hybrid HVDC in the Egyptian Power Grid with Wind Power Integration</b> H. Aboelsoud, T. Tsuji (Yokohama National University, Japan) (Submission-ID WIW17-95)</li> </ul>
<b>17:40 – 18:00</b>	<b>Discussions</b>

**19:00 – 22:30      WORKSHOP DINNER (Bus departure 18:30)**

## THURSDAY, 26 OCTOBER 2017

09:00 – 11:00	SESSION 3A – HARMONICS I
> Session Chair	T. Lund (Vestas, Denmark)
09:00 – 10:40	Presentations (20 min. each)
	<ul style="list-style-type: none"><li>• <b>Impedance Modelling and Simulation of Wind Turbines for Power System Harmonic Analysis</b> J. Sun (Rensselaer Polytechnic Institute, USA), C. Buchhagen, M. Greve (TenneT Offshore, Germany) (Submission-ID WIW17-210)</li><li>• <b>Large Scale Investigation of Harmonic Summation in Wind- and PV-Power Plants</b> F. Ackermann, H. Moghadam, S. Rogalla (Fraunhofer-ISE, Germany), F. Santjer (UL International [DEWI], Germany), I. Athamna (FGW, Germany), R. Klosse (WindGuard Certification, Germany), K. Malekian (Technical University of Chemnitz, Germany), S. Adloff (WRD Wobben Research and Development, Germany), M. F. Meyer, G. Kaatz, D. Schulz (Helmut Schmidt University, Germany), A. Bitz, N. Schaefer (Fraunhofer IWES, Germany), B. Fricke (M.O.E., Germany), M. El Ghouti (DNV-GL, Germany) (Submission-ID WIW17-211)</li><li>• <b>Harmonic Emission of Wind Turbines and PV Inverters</b> F. Santjer, S. Tentzerakis, K. Nolopp, M. Baerschneider, R. Foreman (UL International [DEWI], Germany), K. Malekian, F. Safargholi (Technical University of Chemnitz, Germany), S. Adloff (WRD Wobben Research and Development, Germany), I. Athamna, M. Muehlberg (FGW, Germany), M. F. Meyer, M. Jordan, D. Schulz (Helmut Schmidt University, Germany), F. Ackermann (Fraunhofer ISE, Germany) (Submission-ID WIW17-147)</li><li>• <b>Wind Power Plant Transmission System Modelling for Harmonic Propagation and Small-signal Stability Analysis</b> Ł. Kocewiak (DONG Energy Wind Power, Denmark), B. Gustavsen, A. Hofdyk (SINTEF Energy Research, Norway) (Submission-ID WIW17-229)</li><li>• <b>Sideband-Harmonic Instability of Paralleled Inverters with Asynchronous Carriers</b> D. Yang X. Wang, F. Blaabjerg (Aalborg University, Denmark) (Submission-ID WIW17-145)</li></ul>
10:40 – 11:00	Discussions

09:00 – 11:00	SESSION 3B – ANCILLARY SERVICES AND MARKETS
> Session Chair	J. Matevosyan (ERCOT, USA)
09:00 – 10:40	Presentations (20 min. each)
	<ul style="list-style-type: none"><li>• <b>Market Mechanisms for Frequency Control</b> T. George (DigSILENT Pacific, Australia), S. Wallace (SW Advisory, Australia), S. A. Hagaman (DigSILENT Pacific, Australia), H. Mackenzie (HARD software, Australia) (Submission-ID WIW17-150)</li><li>• <b>Ancillary Services Provision with Wind Power Plants in Spain and its Coordination with Congestion Management</b> M. Sánchez Llorente, R. Fernández-Alonso López, M. de la Torre Rodríguez, J. Bola Merino (Red Eléctrica de España – REE, Spain) (Submission-ID WIW17-103)</li><li>• <b>Storage Technologies for Enabling Grid-tied Renewable Energy Sources to Grid ancillary Services Supply: a Successful Case</b> A. Tizzanini, L. Rambaldi, L. Lanuzza, D. Consoli, F. Bizzarri, A. De Cristofaro, F. Fioretti (Enel Green Power, Italy) (Submission-ID WIW17-194)</li><li>• <b>Short Term Forecasting of Wind Power Plant Generation for System Stability and Provision of Ancillary Services</b> H. Mackenzie, J. Dyson (Dispatch Solutions, Australia) (Submission-ID WIW17-87)</li><li>• <b>Review of regulated Ancillary Service Market in India</b> S. Sharma (GIZ India, India), A. Nandy (Solar Energy Corporation of India, India) (Submission-ID WIW17-183)</li></ul>
10:40 – 11:00	Discussions

09:00 – 11:00	SESSION 3C – OFFSHORE WIND INTEGRATION
> Session Chair	M. N. Frydensbjerg (Vattenfall Vindkraft, Denmark)
09:00 – 10:40	Presentations (20 min. each)
•	TBA NN
•	<b>Fault Ride-Through of Unbalanced AC Grid Faults in HVDC-Connected Offshore Wind Power Plants</b> K. Schönleber (GE, Spain), E. Prieto Araujo, O. Gomis-Bellmunt (Polytechnical University of Catalonia, Spain) (Submission-ID WIW17-117)
•	<b>Harmonic Active Filtering and Impedance-based Stability Analysis in Offshore Wind Power Plants</b> D. Dhua, G. Yang, Z. Zhang, (DTU, Denmark), Ł. Kocewiak, A. Timofejevs (DONG Energy Wind Power, Denmark) (Submission-ID WIW17-162)
•	<b>Parameterization and Dynamic Analysis of Coordinated Voltage Control for Offshore Wind Power Integration</b> V. Akhmatov (Energinet.dk, Denmark), Q. Wu, A. Kotsonias, J. M. Røge (DTU, Denmark) (Submission-ID WIW17-83)
•	<b>Black Start and Island Operation Capabilities of Wind Power Plants</b> Ö. Göksu, O. Saborío-Romano, N. Cutululis, P. Sørensen (DTU Wind Energy, Denmark) (Submission-ID WIW17-243)
10:40 – 11:00	Discussions

## 11:00 – 11:30 Coffee Break

11:30 – 13:00	SESSION 4A – COMPLIANCE TESTING
> Session Chair	E. Tröster (Energynautics, Germany)
11:30 – 12:30	Presentations (20 min. each)
•	<b>Overview of Actual Development and Discussions of Electrical Certification of Wind Turbines on Test Benches</b> T. Jersch, C. Mehler, M. Neshati (Fraunhofer IWES, Germany) (Submission-ID WIW17-199)
•	<b>A Test-bed System for Validation of Ancillary Services of Wind Power Plants under Realistic Conditions</b> A. Kisser, M. Engel, L. Rezai, M. Andrejewski, J. Fortmann, H. Schulte (University of Applied Sciences (HTW) Berlin, Germany) (Submission-ID WIW17-94)
•	<b>Setting Standards – Perspectives for Future Energy Grids</b> S. Kosslers (DKE German Commission for Electrical, Electronic & Information Technologies of DIN and VDE, Germany) (Submission-ID WIW17-231)
12:30 – 13:00	Discussions

11:30 – 13:00	SESSION 4B – REVIEW OF THE SOUTH AUSTRALIA BLACK-OUT
> Session Chair	T. Ackermann (Energynautics, Germany)
11:30 – 12:50	Presentations
•	<b>Analysis of the South Australian Black-out (40 min)</b> B. Badrzadeh (AEMO, Australia) (Submission-ID WIW17-327)
•	<b>Lessons Learnt From the Australian Frequency Control Ancillary Service Market (20 min)</b> K. Summers, R. Jennings (Pacific Hydro, Australia), J. Peters (Monash University, Australia) (Submission-ID WIW17-262)
•	<b>Integration of Non-Synchronous Generation into the Australian National Electricity Market (20 min)</b> J. Eggleston (Australian Energy Market Commission – AEMC, Australia) (Submission-ID WIW17-133)
12:50 – 13:00	Discussions

11:30 – 13:00	<b>SESSION 4C – INTERNATIONAL STUDIES</b>
> Session Chair	M. van der Meijden (TenneT, Netherlands)
11:30 – 12:30	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Modelling and Analysing Future Energy Systems with High Shares of Variable Renewables – a South African case study</b> K. Knorr, B. Zimmermann, S. Bofinger (Fraunhofer IWES, Germany), C. Mushwana, T. Bischoff-Niemz (Council for Scientific and Industrial Research – CSIR, South Africa) (Submission-ID WIW17-25)</li> <li>• <b>Quantifying the Benefits of Wind Power Diversity in New Zealand</b> D. McQueen A.Wood (University of Canterbury, New Zealand) (Submission-ID WIW17-5)</li> <li>• <b>Evaluating the Impacts of Priority Dispatch Rule on Renewable Energy Curtailment in Japan</b> T. Wakeyama (Renewable Energy Institute, Japan) (Submission-ID WIW17-178)</li> </ul>
12:30 – 13:00	<b>Discussions</b>

## 13:00 – 14:00 LUNCH BREAK

14:00 – 15:45	<b>SESSION 5A – MARKET, ECONOMIC &amp; REGULATORY ISSUES</b>
> Session Chair	D. Flynn (University College Dublin, Ireland)
14:00 – 15:20	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>The Effect of Wind Generation on Wholesale Electricity Prices in Ireland</b> R. Kernan, X. Liu, S. McLoone, B. Fox (Queen's University Belfast, United Kingdom) (Submission-ID WIW17-27)</li> <li>• <b>Smart Markets as an Efficient Concept to Address Network Congestion in Regions with High Penetration Levels of Wind Power</b> M.-L. Arlt (University of Freiburg, Germany), M. Doering, C. Nabe (Ecofys, Germany), S. Ropenus (Agora Energiewende, Germany), K. Burges (Ecofys, Germany) (Submission-ID WIW17-274)</li> <li>• <b>Simulation Analysis of Wind Power Integration in Isolated Grids: a Case Study</b> I. Di Fresco, J. Radcliffe, Y. Ding (University of Birmingham, United Kingdom) (Submission-ID WIW17-89)</li> <li>• <b>German Paradox Demystified: Why is Need for Balancing Reserves Reducing despite Increasing VRE Penetration?</b> R. Kuwahata, P. Merk (Elia Grid International, Germany) (Submission-ID WIW17-19)</li> </ul>
15:20 – 15:45	<b>Discussions</b>

14:00 – 15:45	<b>SESSION 5B – GRID INTEGRATION STUDIES I</b>
> Session Chair	J. C. Smith (UVIG, USA)
14:00 – 15:20	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Comparison of Integration Studies of 30-40 Percent Energy Share from Variable Renewable Sources</b> L. Söder (KTH Royal Institute of Technology, Sweden), M. Milligan (National Renewable Energy Laboratory – NREL, USA), A. Orths (Energinet.dk, Denmark), C. Pelling (Forschungsstelle für Energiewirtschaft, Germany), J. Kiviluoma (VTT, Finland), V. Silva, M. Lopez-Botet Zulueta (EDF, France), D. Flynn (University College Dublin, Ireland), B. O'Neill (National Renewable Energy Laboratory – NREL, USA) (Submission-ID WIW17-49)</li> <li>• <b>U.S. Interconnections Seam Study and the North American Renewable Integration Study</b> J. Novacheck, G. Brinkman, A. Bloom (National Renewable Energy Laboratory – NREL, USA) (Submission-ID WIW17-132)</li> <li>• <b>Reducing Power System Expansion Problems via Variable Parameterization</b> B. U. Schyska (University of Oldenburg, Germany), P. Pinson (DTU, Denmark), A. Kies (Frankfurt Institute for Advanced Studies, Germany), L. von Bremen (University of Oldenburg, Germany) (Submission-ID WIW17-196)</li> <li>• <b>Novel Node Selection Approach for Continent-Wide Power System Studies Using Spatio-Temporal Clustering</b> M. Krutova, L. von Bremen (University of Oldenburg, Germany), S. Chatzivasileiadis (DTU, Denmark) (Submission-ID WIW17-271)</li> </ul>
15:20 – 15:45	<b>Discussions</b>



<b>14:00 – 15:45</b>	<b>SESSION 5C – MODELLING</b>
> Session Chair	J. Fortmann (HTW Berlin, Germany)
<b>14:00 – 15:20</b>	<b>Presentations (20 min. each)</b>
•	<b>Generalized Reduced Order Modelling of AC-DC-AC Converters with Application to Fault Diagnosis</b> N. Goldschmidt, S. Betker, H. Schulte (University of Applied Sciences (HTW) Berlin, Germany) (Submission-ID WIW17-275)
•	<b>Practical Experiences in Developing and Using a Wind Turbine Model based on IEC 61400-27-1</b> D. Masendorf, E. Tröster (Energynautics, Germany) (Submission-ID WIW17-255)
•	<b>Control Hardware-in-the-Loop Simulation for Turbine Impedance Modelling and Verification</b> G. Li (China Electric Power Research Institute, China), J. Sun (Rensselaer Polytechnic Institute, USA) (Submission-ID WIW17-280)
•	<b>Co-simulation and Dynamic Model Exchange with Consideration for Wind Projects</b> M. Cvetković, H. Krishnappa, C. David, López, R. Bhandia, J. Rueda Torres, P. Palensky (TU Delft, Netherlands) (Submission-ID WIW17-149)
<b>15:20 – 15:45</b>	<b>Discussions</b>

## 15:45 – 16:15 COFFEE BREAK

<b>16:15 – 18:30</b>	<b>SESSION 6A – FORECASTING</b>
> Session Chair	N. Menemenlis (Hydro Québec/IREQ, Canada)
<b>16:15 – 18:21</b>	<b>Presentations (18 min. each)</b>
•	<b>IEA Wind Task 36 Forecasting</b> G. Giebel (DTU, Denmark), J. Cline (Department of Energy, USA), H. Frank (Deutscher Wetterdienst, Germany), W. Shaw (Pacific Northwest National Laboratory, USA), B.-M. Hodge, C. Draxl (National Renewable Energy Laboratory – NREL, USA), P. Pinson, J. Messner (DTU, Denmark), G. Kariniotakis (MINES ParisTech, France), C. Möhrle (WEPROG, Denmark) (Submission-ID WIW17-202)
•	<b>Impact of Targeted Measurements and Advanced Machine Learning Techniques on 0-3 Hr Ahead Rapid Update Wind Generation Forecasts in the Tehachapi Wind Resource Area</b> J. Zack, S. Young (AWS Truepower, USA) (Submission-ID WIW17-259)
•	<b>Forecasting Available Wind Power for Grid Regions</b> A. Zien, O. Steinert, J. Rosenkranz, U. Focken, M. Lange (energy & meteo systems, Germany) (Submission-ID WIW17-268)
•	<b>Wind Power Forecasting Performed by Operador Nacional do Sistema Elétrico – ONS</b> A. M. L. Barros, C. O. Machado, H. Camargo, P. Nascimento (Brazilian Power System Operator – ONS, Brazil) (Submission-ID WIW17-134)
•	<b>Swedish Wind Power Forecasts: Procedure, Error Distribution and Spacio-Temporal Correlation</b> L. Herre, T. Matusevičius, L. Söder (KTH Royal Institute of Technology, Sweden) (Submission-ID WIW17-124)
•	<b>Uncertainty Forecasting Practices for the Next Generation Power System</b> C. Möhrle (WEPROG, Denmark), R. Bessa (INESC, Portugal), G. Giebel (DTU, Denmark), J. Jørgensen (WEPROG, Denmark), G. Giebel (DTU, Denmark) (Submission-ID WIW17-288)
•	<b>Breakthrough Accuracy of Shorter-Term Power Forecasting Using Deep Learning</b> W. S. Wadman, A. Deng, G. V. Maniachari, Y. Kim, (Utopus Insights, USA) (Submission-ID WIW17-282)
<b>18:21 – 18:30</b>	<b>Discussions</b>

16:15 – 18:20	SESSION 6B – INERTIA ISSUES I
> Session Chair	K. Summers (Pacific Hydro, Australia)
16:15 – 17:55	Presentations (20 min. each)
	<ul style="list-style-type: none"> <li>• <b>A Survey on Inertia Related Challenges and Mitigation Measures</b> E. Ørum (Energinet, Denmark), M. Kuivaniemi, L. Haarla, M. Laasonen (Fingrid Oyj, Finland), A. Jerkø, I. Stenkløv (Statnett, Norway), F. Wik, R. Eriksson, N. Modig, K. Elkington (Svenska kraftnät, Sweden), P. Schavemaker (E-Bridge Consulting, Netherlands) (Submission-ID WIW17-92)</li> <li>• <b>Grid Frequency Extreme Event Analysis and Modelling</b> M. Folgueras, E. Wenger, A. Florita, K. Clark, V. Gevorgian (National Renewable Energy Laboratory – NREL, USA) (Submission-ID WIW17-11)</li> <li>• <b>ERCOT Future Synchronous Inertia Projections</b> J. Matevosyan, C. Anderson, W. Li (ERCOT, USA) (Submission-ID WIW17-206)</li> <li>• <b>Emergency Islanding Scenario with df/dt-based Inertia Emulation, different Load Types and additional Load Control</b> T. Rump, H.-G. Eckel (University of Rostock, Germany), D. Duckwitz, C. Glöckler (Fraunhofer IWES, Germany) (Submission-ID WIW17-69)</li> <li>• <b>Transient Energy Sources to Support Renewable Energy Conversion Systems</b> N. Schofield (University of Huddersfield, United Kingdom) (Submission-ID WIW17-281)</li> </ul>
17:55 – 18:20	Discussions

16:15 – 18:20	SESSION 6C – GRID CODE ISSUES
> Session Chair	E. Quitmann (ENERCON, Germany)
16:15 – 17:55	Presentations (20 min. each)
	<ul style="list-style-type: none"> <li>• <b>The Underestimated Relevance of Wind Turbine Fault Ride Through – Review of International Requirements, Current Performances and Future Capabilities</b> R. Ogiewa (ENERCON, Sweden), M. Fischer (ENERCON Canada, Canada), S. Nikolai, I. Mackensen (WRD Wobben Research and Development, Germany) (Submission-ID WIW17-65)</li> <li>• <b>PLL Dynamics in Low Inertia Weak Grid</b> Y. Sun, E. de Jong (Eindhoven University of Technology   DNV GL, Netherlands), W. Kuijpers (DNV GL, Netherlands), X. F. Wang, F. Blaabjerg (Aalborg University, Denmark), V. Cuk (Eindhoven University of Technology, Netherlands), J. Cobben (Eindhoven University of Technology   Alliander, Netherlands) (Submission-ID WIW17-91)</li> <li>• <b>Bandwidth Requirements for Accurate Flicker Measurements in Wind Turbines during Switching Operations</b> K. Redondo, I. Azcarate, J. J. Gutierrez, P. Saiz, L. A. Leturiondo (University of the Basque Country – UPV, Spain) (Submission-ID WIW17-113)</li> <li>• <b>On the Inability of the Short-Circuit Current Calculation Standard IEC 60909-0:2016 to Reflect German Grid Code Requirements in the Negative Sequence for Power Station Units with Full Size Converters</b> B. Weise, M. Zhao, N. Wilson, S. Weigel (DlG SILENT, Germany) (Submission-ID WIW17-15)</li> <li>• <b>Development of a Generic Future Grid Code regarding Wind Power in Europe</b> T. K. Vrana (SINTEF Energi, Norway), L. Trills (IREC, Spain), A. Attya (University of Strathclyde, United Kingdom) (Submission-ID WIW17-13)</li> </ul>
17:55 – 18:20	Discussions

## 18:20 POSTER RECEPTION & NETWORKING

09:00 – 10:40	SESSION 7A – HARMONICS II
> Session Chair	J. Sun (Rensselaer Polytechnic Institute, USA)
09:00 – 10:30	Presentations (18 min. each)
	<ul style="list-style-type: none"> <li>• <b>Harmonic Requirements of International Grid Codes and Assessment of Harmonics for Wind Power Plants</b> I. Szczesny, R. S. Nielsen, F. Martin, L. Shuai, (Siemens Gamesa Renewable Energy, Denmark), T. Dreyer (Siemens Wind Power, Germany) (Submission-ID WIW17-192)</li> <li>• <b>Using Prevailing Angle of Harmonics to Distinguish between Background Noise and Emission from a Turbine</b> L. S. Christensen, J. G. Nielsen, T. Lund (Vestas Wind Systems, Denmark) (Submission-ID WIW17-173)</li> <li>• <b>Evaluating the Influence of the Grid's Background Distortion on the Wind Turbine's Harmonic Emission</b> M. El Ghouti, T. Heesch (DNV GL, Germany) (Submission-ID WIW17-109)</li> <li>• <b>Probabilistic Harmonic Modelling of Wind Power Plants</b> E. Guest, T. Rasmussen (Technical University of Denmark, Denmark) K. H. Jensen (Siemens Gamesa Renewable Energy, Denmark) (Submission-ID WIW17-16)</li> <li>• <b>On Aggregation Requirements for Harmonic Stability Analysis in Wind Power Plants</b> M. K. Bakhshizadeh, J. Hjerrild, Ł. Kocewiak (DONG Energy Wind Power, Denmark), F. Blaabjerg, C. L. Bak (Aalborg University, Denmark) (Submission-ID WIW17-215)</li> </ul>
10:30 – 10:40	Discussions

09:00 – 10:40	SESSION 7B – INERTIA ISSUES II
> Session Chair	P. W. Christensen (Vestas, Denmark)
09:00 – 10:30	Presentations (18 min. each)
	<ul style="list-style-type: none"> <li>• <b>Optimization of Inertial Response from WPPs in Power Systems with High Wind Power Penetration</b> J. Kuhlmann, M. Altin, A. D. Hansen (DTU Wind Energy, Denmark) (Submission-ID WIW17-46)</li> <li>• <b>Wind Power Plant Level Testing of Inertial Response with Optimized Recovery Behavior</b> P. Godin, M. Fischer (ENERCON Canada, Canada), H. Röttgers, A. Mendonca, S. Engelken (WRD Wobben Research and Development, Germany) (Submission-ID WIW17-131)</li> <li>• <b>Limitations for the Continuous Provision of Synthetic Inertia with Wind Turbines</b> A.Gloe, C. Jauch (University of Applied Science Flensburg, Germany), B. Craciun, J. Winkelmann (Suzlon Energy, Germany) (Submission-ID WIW17-143)</li> <li>• <b>Field Experience with Synchronous Wind Turbines in New Zealand and Scotland: Instances of Short-Circuit Current Contributing to System Stability, and an Instance of Frequency Instability</b> G. Henderson (Windflow Technology, New Zealand) (Submission-ID WIW17-213)</li> <li>• <b>Investigation of the Frequency Response of an All Converter-based Generation Power Grid Using a Stochastic Simulation Framework</b> D. Ramasubramanian, E. Farantatos, A. Tuohy (Electric Power Research Institute – EPRI, USA), V. Vittal (Arizona State University, USA) (Submission-ID WIW17-115)</li> </ul>
10:30 – 10:40	Discussions

<b>09:00 – 10:40</b>	<b>SESSION 7C – INTEGRATION EXAMPLES</b>
> Session Chair	A. Estanqueiro (LNEG, Portugal)
<b>09:00 – 10:20</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Integrating Energy Storage Solutions into Wind Power Plants: the Faroe Islands Case Study</b> D. McMullin, B. Lenz, D. Gamboa, E. Quitmann, J. Anderlohr (ENERCON, Germany), T. Nielsen (Elfelagið SEV, Faeroe Islands) (Submission-ID WIW17-140)</li> <li>• <b>Modular Multilevel Converter with Energy Storage System for Grid Support Services in Wind Farms – Main Features and Computational Simulations</b> S. Rodríguez González (GPTech, Spain), P. Carlos, P. Castro (EDP – NEW R&amp;D, Portugal), B. Silva, J. Aguiar (INESC TEC, Portugal) (Submission-ID WIW17-122)</li> <li>• <b>Integrating High Shares of Variable Renewable Energy in Costa Rica</b> P.-P. Schierhorn, T. Ackermann (Energynautics, Germany), F. Fernandez (DIgSILENT, Germany), C. Echevarría Barbero, J. R. Paredes, C. Tagwerker (Inter-American Development Bank IDB, USA/Costa Rica) (Submission-ID WIW17-xxx)</li> <li>• <b>Enhancing the Value of Wind and PV Generation through Optimal Aggregation</b> A.R. Machado, A. Couto, J. Duque, A. Estanqueiro (LNEG, Portugal) (Submission-ID WIW17-239)</li> </ul>
<b>10:20 – 10:40</b>	<b>Discussions</b>

## 10:40 – 11:10 Coffee Break

<b>11:10 – 13:00</b>	<b>SESSION 8A – FREQUENCY ISSUES</b>
> Session Chair	B. Weise (DIgSILENT, Germany)
<b>11:10 – 12:30</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>A Statistical Method for Aggregated Wind Power Plants to Provide Secondary Frequency Control</b> J. Hu, C. Ziras, H. W. Bindner (DTU, Denmark), X. Han (National Development and Reform Commission, China) (Submission-ID WIW17-52)</li> <li>• <b>Frequency Support from OWPPs connected to HVDC via Diode Rectifiers</b> O. Saborío-Romano, A. Bidadfar, Ö. Göksu, M. Altin, N. A. Cutululis (DTU, Denmark) (Submission-ID WIW17-40)</li> <li>• <b>Coordinated Frequency Control by Inertial Response of Wind Power and Electric Vehicles in Japanese Power System</b> J. Qi, T. Tsuji (Yokohama National University, Japan) (Submission-ID WIW17-205)</li> <li>• <b>Impact of Large Scale Integration of Wind Inertia on Power System Frequency Stability</b> R. Denninger, P. Dubucq, G. Ackermann (Hamburg University of Technology, Germany) (Submission-ID WIW17-50)</li> </ul>
<b>12:30 – 13:00</b>	<b>Discussions</b>

<b>11:10 – 13:00</b>	<b>SESSION 8B – GRID INTEGRATION STUDIES II</b>
> Session Chair	Y. Yasuda (Kyoto University, Japan)
<b>11:10 – 12:30</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>A Quantitative Method for Evaluation of Variation Management Strategies for Integration of Variable Renewable Electricity</b> V. Johansson, L. Thorson, L. Göransson (Chalmers University of Technology, Sweden) (Submission-ID WIW17-179)</li> <li>• <b>Experimental Stability Assessment of Converter-Dominated Electrical Grids</b> L. Reguera Castillo, A. Roscoe (University of Strathclyde, United Kingdom) (Submission-ID WIW17-12)</li> <li>• <b>Following the Demand by Using Strategical Wind and Solar Complementarity – the Case of Portugal</b> A.Couto, J. Silva, A. Estanqueiro (LNEG, Portugal) (Submission-ID WIW17-291)</li> <li>• <b>Impact of Climate Change on a Future Highly Renewable European Power System</b> M. Schlott, A. Kies, T. Brown, D. Schlachtberger, J. Hoersch, S. Schramm (Frankfurt Institute for Advanced Studies, Germany), M. Greiner (Aarhus University, Denmark) (Submission-ID WIW17-184)</li> </ul>
<b>12:30 – 13:00</b>	<b>Discussions</b>

<b>11:10 – 13:00</b>	<b>SESSION 8C – GRID OPERATION TOOLS I</b>
> Session Chair	N. Cutululis (DTU, Denmark)
<b>11:10 – 12:40</b>	<b>Presentations (18 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Demand Side Response in Multi-Energy Sustainable Systems to Support Power System Stability</b> V. García Suárez, P. Ayivor, J. L. Rueda Torres (Delft University of Technology, Netherlands), M.A.M.M. van der Meijden (Delft University of Technology   TenneT TSO, Netherlands) (<a href="#">Submission-ID WIW17-182</a>)</li> <li>• <b>Can Benchmarks and Trials Help Develop new Operational Tools for Balancing Wind Power?</b> C. Möhrle (WEPROG, Denmark), C. Collier (DNV GL, USA), J. Zack (AWS Truepower, USA), J. Lerner (Vaisala, USA) (<a href="#">Submission-ID WIW17-292</a>)</li> <li>• <b>Active Power Control for Mitigation of Short-term Fluctuation of Wind Power</b> C. T. Urabe, T. Saitou, K. Kataoka, K. Ogimoto (University of Tokyo, Japan), T. Ikegami (Tokyo University of Agriculture and Technology, Japan) (<a href="#">Submission-ID WIW17-96</a>)</li> <li>• <b>Loss-Reduced Reactive Power Control Strategies for Transmission System Support with Renewable Energy Sources</b> H. Köppe, B. Engel (Technical University Braunschweig, Germany), R. Grab, S. Rogalla (Fraunhofer ISE, Germany), (<a href="#">Submission-ID WIW17-77</a>)</li> </ul>
<b>12:40 – 13:00</b>	<b>Discussions</b>

## 13:00 – 14:00 LUNCH BREAK

<b>14:00 – 15:15</b>	<b>SESSION 9A – WIND POWER DEVELOPMENTS</b>
> Session Chair	N. Martensen (Energynautics, Germany)
<b>14:00 – 15:00</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Implementation of Current Signature Analysis to Monitor DFIG Wind Turbines</b> E. Artigao (Renewable Energy Research Institute – IIER, Spain), A. Honrubia-Escribano, E. Gomez-Lazaro (University of Castilla – La Mancha, Spain) (<a href="#">Submission-ID WIW17-86</a>)</li> <li>• <b>Limit Voltage Dips &amp; Inrush Currents When Energizing Power Transformers – Controlled Switching of Gang Operated Switches —Theory and Case Study</b> P. Taillefer, L. Poutrain (Vizimax, Canada), J. Sanchez (France) (<a href="#">Submission-ID WIW17-260</a>)</li> <li>• <b>The Evolving Role of Simulation and Data Analytics in Wind Power System Development and Operation</b> G. Dudgeon (MathWorks, USA), G. Schrabberger (MathWorks, Germany) (<a href="#">Submission-ID WIW17-123</a>)</li> </ul>
<b>15:00 – 15:15</b>	<b>Discussions</b>

<b>14:00 – 15:15</b>	<b>SESSION 9B – GRID OPERATION TOOLS II</b>
> Session Chair	E. Tröster (Energynautics, Germany)
<b>14:00 – 15:00</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>TenneT SINTEG Projects</b> M. Kurt (TenneT, Germany)</li> <li>• <b>Wind Power Quality Testing – Testing according to FGW-TR3 and IEC61400-21</b> B. Grasel, R. Schwarz (DEWEsoft, Austria) (<a href="#">Submission-ID WIW17-76</a>)</li> <li>• <b>Improving the Reactive Power Balance between a German MV and HV Grid through Coordinated Reactive Power Provision by Wind Power Plants</b> L. Hülsmann, E. Tröster (Energynautics, Germany), U. Ohl, M. Koch (EWR Netz, Germany) (<a href="#">Submission-ID WIW17-250</a>)</li> </ul>
<b>15:00 – 15:15</b>	<b>Discussions</b>

## 15:15 – 15:35 SHORT BREAK

15:35 – 16:35	SESSION 10 – CLOSING SESSION
> Session Chair	J. Jahn (TenneT, Germany)
15:35 – 15:45	Presentation
100% Renewables in the Grid: What are the Main Challenges?	
Panelists:	
- H. Holttinen (VTT, Finland)	
- J. Matevosyan (ERCOT, USA)	
- B. Badrzadeh (AEMO, Australia)	
- P. van de Rijt (Tennet, Netherlands)	
- E. Quitmann (ENERCON, Germany)	
15:45 – 16:35	Discussions

## POSTER PRESENTATIONS

- **A Feasibility Study about Loss Standardization Technique Based on Practical Wind Farm Operation**  
S. Jung (Hanbat National University, South Korea [ROK]) ([Submission-ID WIW17-39](#))
- **The Provision of Synthetic Inertia by Wind Turbine Generators: An Analysis of the Energy Yield and Costs**  
H. Thiesen, A. Gloe, C. Jauch (Flensburg University of Applied Sciences, Germany), J. Viebeg (University of Rostock, Germany) ([Submission-ID WIW17-59](#))
- **Basic Investigations on Substation-free Offshore Wind Power Plant for HVDC System Composed of Series-Connected Wind Turbine Generators and Current-Source Thyristor Inverter**  
S. Nishikata, F. Tatsuta (Tokyo Denki University, Japan) ([Submission-ID WIW17-64](#))
- **Some Engineering Cases on Facilitating CHP Flexibility to Promote Wind Power Integration by Means of Peak Regulation Ancillary Service Market in the Northeast China Grid**  
H. Zhang, Y. Liu, J. Zhang, Z. Li, D. Gao, J. Zhang, Q. Li, S. Du, Y. Jun (Northeast Power Dispatching Center of SGCC, China) ([Submission-ID WIW17-67](#))
- **Implementation of Standard Type 1 Wind Turbine Models in Different Power System Analysis Tools**  
A. Lorenzo-Bonache, R. Villena-Ruiz, A. Honrubia-Escribano, E. Gómez-Lázaro, E. Artigao-Andicoberry (University of Castilla-La Mancha, Spain) ([Submission-ID WIW17-106](#))
- **Design and Tuning Methodology of Active Power Controller in Wind Power Plants**  
C. Ionita, A. G. Raducu (Vattenfall, Denmark), F. Iov (Aalborg University, Denmark) ([Submission-ID WIW17-128](#))
- **Assessment of Energy Production and Damage on Wind Turbines in Complex Terrain**  
Y. Otake, N. Kusuno, M. Kimura (Hitachi, Japan) ([Submission-ID WIW17-141](#))
- **Supplemental Power System Frequency Control by DC Voltage Control of Converter Driven Wind Generator**  
T. Fujinoki, Y. Ota, T. Nakajima (Tokyo City University, Japan) ([Submission-ID WIW17-159](#))
- **Assessment of the Option Wind Power to Heat with Respect to Meteorological Conditions in Different Regions in Europe**  
H. G. Beyer, B. Niclasen (University of the Faeroe Islands, Faeroe Islands) ([Submission-ID WIW17-164](#))
- **Impact of Wind Farms with Full-Size Converters on Short-Circuit Currents During Line-to-Line Short Circuits**  
B. Niersbach, D. Batorowicz, J. Hanson (Technical University Darmstadt, Germany) ([Submission-ID WIW17-174](#))
- **Assessment of on Site Solar and Wind Energy at a Manufacturing Facility in Ireland**  
A. Sgobba, C. Meskill (Trinity College Dublin, Ireland) ([Submission-ID WIW17-193](#))
- **Concert – Control and Uncertainties in Real-time Power Curves of Offshore Wind Power Plants**  
G. Giebel, T. Göcmen, J. Kazda, N. Cutululis, T. Larsen, C. Galinos (DTU Wind Energy, Denmark) ([Submission-ID WIW17-203](#))

- **Frequency Regulation with Balancing Market for Secondary and Tertiary Control in Power Systems with Wind Power Integration**  
B. Jie, T. Tsuji, T. Oyama (Yokohama National University, Japan), K. Uchida (Waseda University, Japan) (Submission-ID WIW17-208)
- **Sizing Secondary Reserve Capacity in Grids with Increasing Shares of Variable Renewable Energy**  
D. Radu (KTH Royal Institute of Technology, Sweden), N. Martensen, P.-P. Schierhorn (Energynautics, Germany) (Submission-ID WIW17-224)
- **Proofing the Concept of a Lightweight Generator for High Power Wind Applications in a Test Bench**  
J. Steffen, A. Seibel (Fraunhofer IWES, Germany) (Submission-ID WIW17-237)
- **Optimal Control of Wind Turbines in Distribution Networks during Network Maintenance**  
M. Altin, K. Das, A. D. Hansen (DTU Wind Energy, Denmark), G. W. Thybo (ENIIG, Denmark) (Submission-ID WIW17-277)
- **An AVC Strategy Adopted to Dispersed Wind Power Generators Integrated into Distributed Grid**  
Q. Liu, W. Mao, Y. Gao, Y. Zhao (North China Electric Power University, China) (Submission-ID WIW17-294)
- **Value of Wind Revisited: A System-planning View**  
T. Bischof-Niemz, J. Calitz, J. G. Wright, (Council for Scientific and Industrial Research – CSIR, South Africa) (Submission-ID WIW17-309)
- **Evaluating the Capacity Factor and Capacity Credit of Wind and PV Generation in Germany**  
H. Aghaie (AIT Austrian Institute of Technology, Austria) (Submission-ID WIW17-330)