

17th 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

17 - 19 October 2018

Stockholm, Sweden



FINAL PROGRAM AS OF 19 OCTOBER 2018

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WEDNESDAY 17 OCTOBER 2018			THURSDAY 18 OCTOBER 2018			FRIDAY 19 OCTOBER 2018			
Wind Workshop Day 1			Wind Workshop Day 2			Wind Workshop Day 3			
			08:30 – 10:40	M1	M2	M3	08:40 – 10:40	Q1	HYLLAN
				SESSION 3A: ANCILLARY SERVICES I – FREQUENCY CONTROL	SESSION 3B: OFFSHORE WIND ASPECTS	SESSION 3C: NEDO FORECASTING PROJECTS		SESSION 7A: GRID CODE ASPECTS II	SESSION 7B: MARKET AND REGULATORY ISSUES
				COFFEE BREAK (20 MIN)				COFFEE BREAK (30MIN)	
9:00 – 14:00	FOYER		11:00 – 13:00	M1	M2	M3	11:10 – 13:10	Q1	HYLLAN
	REGISTRATION			SESSION 4A: STORAGE ISSUES	SESSION 4B: MIGRATE PROJECT	SESSION 4C: MODELLING ASPECTS		SESSION 8A: BALANCING ISSUES	SESSION 8B: POWER QUALITY ISSUES II
	LUNCH 13:00 – 14:00			13:00 GROUP PHOTO // LUNCH 13:15 – 14:15				LUNCH 13:15 – 14:15	
14:00 – 15:50	M1		14:15 – 16:00	M1	M2	M3	14:15 – 15:45	Q1	HYLLAN
	WELCOME & SESSION 1: KEYNOTE SESSION			SESSION 5A: DISTRIBUTED GENERATION	SESSION 5B: GRID CODE ASPECTS I	SESSION 5C: SECTOR COUPLING		SESSION 9A: INTEGRATION SOLUTIONS	SESSION 9B: FORECASTING II
	COFFEE BREAK (30MIN)			COFFEE BREAK (30 MIN)				SHORT BREAK (10 MIN)	
16:20 – 18:30	M1	M2	16:30 – 18:45	M1	M2	M3	15:55 – 16:55	Q1	
	SESSION 2A: IEA TASKS 14 & 25	SESSION 2B: GRID FORMING		SESSION 6A: ANCILLARY SERVICES II	SESSION 6B: POWER SYSTEM STUDIES	SESSION 6C: POWER QUALITY ISSUES I		SESSION 10: CLOSING SESSION – PODIUM DISCUSSION	
19:00	SOLAR & WIND DINNER		18:45	POSTER RECEPTION & NETWORKING					

WEDNESDAY, 17 OCTOBER 2018

09:00 – 14:00 Registration

13:00 – 14:00 Lunch

14:00 – 14:10 Welcome

14:10 – 15:50 SESSION 1 – KEYNOTE SESSION

> Session Chair T. Ackermann (Energynautics, Germany)

14:10 – 15:30 Presentations (20 min. each)

- **Next-Gen Generation System: The Symbiotic Relationship of Solar, Wind & Storage Hybrid Power Plants**
Paulina Asbeck (Vattenfall, Germany)
- **The Path Towards a 100% Renewable Swedish Power System**
Lennart Söder (KTH – Royal Institute of Technology, Sweden)
- **Overview of Renewables in the ERCOT System**
J. Matevosyan (ERCOT, USA)

15:30 – 15:50 Discussions

15:50 – 16:20 Coffee Break

16:20 – 18:30 SESSION 2A – JOINT SESSION OF IEAWIND TASK 25 & PV INTEGRATION TASK 14:

HIGHLIGHTS AND TRENDS FROM INTERNATIONAL COLLABORATION ON SOLAR AND WIND INTEGRATION

> Session Chair Hannele Holttinen (VTT, Finland) / Roland Bründlinger (AIT, Austria)

16:20 – 18:00 Presentations

- **Introduction: Summary of Wind and Solar Integration Study Results – IEA WIND Task 25 and IEA PVPS Task 14 Collaboration**
H. Holttinen (OA Task 25, VTT, Finland), P. B. Eriksen, A. Orths (Energinet, Denmark), A. Estanqueiro (LNEG, Portugal), B. Mather (NREL, USA), M. Kraiczky, A. Scheidler, J. Ulfers, M. Braun, B. Ernst (Fraunhofer IEE, Germany), Y. Ueda (Tokyo University of Science, Japan)
- **Country Highlights and Trends on Solar and Wind Integration – Country experts from (15min each)**
 - USA (B.-M. Hodge, NREL)
 - Japan (Y. Ueda, Tokyo University of Science)
 - Denmark (A. Orths/P. Borre Eriksen – Energinet dk, Denmark),
 - Portugal (A. Estanqueiro – LNEG, Portugal)
- **IEA-PVPS Task 14**
Coordination between Distribution Network and Transmission Network Operation – Relevance for Solar and Wind Integration. IEA-PVPS Task 14

18:00 – 18:30 Discussion:

16:20 – 18:30	SESSION 2B – GRID FORMING
> Session Chair	Helge Urdal (Urdal Power Solutions, United Kingdom) Co-chair: Thomas Ackermann (Energynautics, Germany)
16:20 – 18:00	Presentations (20 min each)
	<ul style="list-style-type: none"> • Grid Forming – Introduction about the need: Essence from Europe / GB H. Urdal (Urdal Power Solutions, United Kingdom) (Submission-ID WIW-344) • E.ON Energy Distribution Microgrid in Southern Sweden – Control, Operation, Management and Power Quality within a 100% Converter, Zero-inertia Microgrid M. Hirst (EON, Sweden) (Submission-ID WIW-345) • Experience of Grid Forming Power Converter Control P. Brogan, T. Knueppel, D. Elliott (Siemens Gamesa Renewable Energy, United Kingdom), N. Goldenbaum (Siemens Gamesa Renewable Energy, Denmark) (Submission-ID WIW-343) • Requirements for Control Strategies of Grid Connected Converters in the Future Power System H. Emanuel, K. Pierros (ENERCON, Germany), J. Brombach, R. Rosso (WRD, Germany) (Submission-ID WIW18-68) • Grid Forming Control for Stable Power Systems with up to 100 % Inverter Based Generation: A Paradigm Scenario Using the IEEE 118-Bus System M. Ndreko, S. Rüberg, W. Winter (TenneT TSO, Germany) (Submission-ID WIW18-172)
18:00 – 18:30	Discussions

16:20 – 18:30	SESSION 2C – FORECASTING I
> Session Chair	Philip-Peter Schierhorn (Energynautics, Germany)
16:20 – 18:08	Presentations (18 min each)
	<ul style="list-style-type: none"> • IEA Wind Recommended Practices for the Implementation of Wind Power Forecasting Solutions – Part 1: Forecast solution selection process C. Möhrle (WEPROG, Denmark) (Submission-ID WIW18-133) • IEA Wind Recommended Practices for the Implementation of Wind Power Forecasting Solutions – Part 2 & 3: Designing and Executing Forecasting Benchmarks and Evaluation of Forecast Solutions C. Möhrle (WEPROG, Denmark), J. Lerner (Vaisala, USA), J. W. Messner (Anemo Analytics, Denmark), J. Browell (University of Strathclyde, United Kingdom), A. Tuohy (EPRI, USA), J. Zack (UL AWS Truepower, USA), C. Collier (DNV GL, USA), G. Giebel (DTU Wind Energy, Denmark) (Submission-ID WIW18-160) • Evaluation of Recent Advancements in Machine Learning Methods in Very Short-term Time Series Forecasts of Wind Power Production J. Zack (UL AWS Truepower, USA) (Submission-ID WIW18-184) • Considering Curtailments in Wind Power Forecasting J. Koch, D. Jost, A. Braun, J. Dobschinski (Fraunhofer IEE, Germany) (Submission-ID WIW18-93) • How to Combine State-of-the-art Multi-Scale Numerical Wind Power Forecasts and Benefits of a Human Meteorological Expertise? O. Vannier, A. Ben Daoud, A. Falgon, G. Bontron (Compagnie Nationale du Rhône, France) (Submission-ID WIW18-197) • Machine Learning Approach for Probabilistic Wind Power Forecasts with Discrete Probability Density Function A. Kaifel, M. Felder, F. Sehnke, K. Ohnmeiß, L. Schröder (Center for Solar Energy and Hydrogen Research – ZSW, Germany) (Submission-ID WIW18- 292)
18:08 – 18:30	Discussions

19:00 – 22:30 WORKSHOP DINNER VASA Museum (Bus departure 18:40)

08:30 – 10:40	SESSION 3A – ANCILLARY SERVICES – FREQUENCY CONTROL
> Session Chair	Eckehard Tröster (Energynautics, Germany)
08:30 – 10:29	Presentations (17 min. each)
	<ul style="list-style-type: none"> • Mixed Grid Forming and Grid Following Wind Power Plants for Black Start Operation J. Martínez-Turégano, S. Añó-Villalba, S. Bernal-Pérez (Universitat Politècnica de Valencia, Spain), R. Peña (University of Concepción, Chile), R. Blasco-Gimenez (Universitat Politècnica de Valencia, Spain) (Submission-ID WIW18-232) • Frequency Services for Grid Support: International Experiences from On-shore and Off-shore Wind Farms S. Bolik (Senvion, United Kingdom), S. Hansen (Senvion, Germany) (Submission-ID WIW18-83) • The Impact of Inertia Emulation on Damping of Inter-Area Power Oscillations during Under-Frequency Events in the Nordic Power System T. Kujansuu, A. Harjula (Fingrid Oyj, Finland), R. Ogiewa, Y. Chompoobutrgool (ENERCON, Germany/Sweden) (Submission-ID WIW18-5) • Potential for Provision of Ancillary Services from Wind Generation Resources in ERCOT J. Matevosyan, C. Anderson (ERCOT, USA) (Submission-ID WIW18-71) • Pen Y Cymoedd Delivery of Enhanced Frequency Response in UK by a Battery Energy Storage System F. Daraiseh, J. Persson (Vattenfall R&D, Sweden), S. Gerhard (Vattenfall, Germany), N. Entwistle (Vattenfall, United Kingdom) (Submission-ID WIW-287) • Comparison of Different Estimation Methods for the Grid Frequency Using the Example of a System Split in the Interconnected Electrical Power System H. Becker, H. Sölter, L. Hofmann (Fraunhofer IEE, Germany) (Submission-ID WIW18-119) • Sneak Preview: PowerDynamics.jl – An Open-Source Library for Analyzing Dynamic Stability in Power Grids with High Shares of Renewable Energy T. Kittel, S. Auer, C. Horn (PIK – Potsdam Institute for Climate Impact Research, Germany) (Submission-ID WIW-290)
10:29 – 10:40	Discussions

08:30 – 10:40	SESSION 3B – OFFSHORE WIND ASPECTS
> Session Chair	Michael Nørtoft Frydensbjerg (Vattenfall, Denmark)
08:30 – 10:18	Presentations (18 min. each)
	<ul style="list-style-type: none"> • Validation and Assessment of the High Definition Modular Multilevel Converter for Offshore Wind Turbines and Other Medium Voltage Applications M. Smiles, C. Ng (Offshore Renewable Energy Catapult, United Kingdom), R. Torres-Olguin, S. D'Arco (SINTEF, Norway), A. Perez-Basante (Tecnalia, Spain), J. L. Dominguez (Catalonia Institute for Energy Research – IREC, Spain) (Submission-ID WIW18-35) • Eigenvalue-based Stability Analysis of Sub-synchronous Oscillation in an Offshore Wind Power Plant L. Shuai, R. Sharma, K. H. Jensen, J. N. Nielsen, D. Murcia (Siemens Gamesa Renewable Energy, Denmark), S. Pirzada, P. Brogan, P. Godridge (Siemens Gamesa Renewable Energy, United Kingdom) (Submission-ID WIW18-148) • Kriegers Flak Combined Grid Solution – Principles of Voltage and Reactive Power Control for HVAC/HVDC Meshed Offshore Grids V. Akhmatov, T. Bentzon Sørensen (Energinet, Denmark), A. K. Marten, R. Stornowski (50Hertz-Transmission, Germany) (Submission-ID WIW18-245) • A Fault Handling Current Control Strategy for Offshore Wind Power Plants with Diode Rectifier HVDC Transmission C. Neumann, H.-G. Eckel (University of Rostock, Germany), S. Achenbach (Siemens, Germany) (Submission-ID WIW18-16) • Stability Analysis of Offshore Wind Farms with Fixed Frequency and Diode Rectifier HVDC Connection C. Prignitz, H.-G. Eckel (University of Rostock, Germany), S. Achenbach (Siemens, Germany) (Submission-ID WIW18-301) • Analysis and Mitigation of Storm and Ramping Risks from Offshore Wind Power in Belgium R. Baetens, S. Declercq, A. Woyte, C. Guerrero (3E, Belgium) (Submission-ID WIW18-125)
10:18 – 10:40	Discussions

08:30 – 10:40	SESSION 3C – NEDO WIND GENERATION FORECASTING PROJECTS
> Session Chair	Kazuhiko Ogimoto (The University of Tokyo, Japan)
08:30 – 10:30	Presentations (15 min. each)
	<ul style="list-style-type: none"> • Japan's R&D Project of Ramp Forecasting Technology: Project Overview T. Suga, Takahiro, N. Hayasaki (ITOCHU Techno-Solutions Corporation, Japan), K. Ogimoto (The University of Tokyo, Japan) (Submission-ID WIW18-168) • Japan's R&D Project of Ramp Forecasting Technology: Probabilistic Forecast Based on Dynamical and Statistical Ensemble Methods D. Nohara, S. Kadokura, M. Ohba, T. Watanabe (Central Research Institute of Electric Power Industry, Japan) (Submission-ID WIW112) • Japan's R&D Project of Ramp Forecasting Technology: Deterministic Forecast with Post-processing Using Real-time Monitoring Data S. Kadokura, D. Nohara, M. Ohba, A. Hashimoto, K. Nakao, Y. Hattori, T. Watanabe, H. Hirakuchi (Central Research Institute of Electric Power Industry, Japan) (Submission-ID WIW18-6) • Japan's R&D Project of Ramp Forecasting Technology: Meteorological Pattern Analysis Method M. Okada, T. Ichizawa, Y. Nakamura, K. Yamaguchi, R. Kodama, N. Ogasawara (Japan Weather Association, Japan), H. Kato, Y. Nagano (Nihon University, Japan), R. Ikeda, V. Q. Doan, H. Kusaka, T. Araki, N. N. Ishizaki (University of Tsukuba, Japan) (Submission-ID WIW18-107) • Japan's R&D Project of Ramp Forecasting Technology: Correction Method with Additive Model for NWP-based Wind Speed Forecast T. Araki, R. Ikeda, V. Q. Doan, N. Ishizaki, H. Kusaka (University of Tsukuba, Japan) (Submission-ID WIW18-122) • Japan's R&D Project of Ramp Forecasting Technology: A Machine Learning Scheme for Ramp Forecast Y. Fujimoto, K. Higashiyama, Y. Hayashi (Waseda University, Japan) (Submission-ID WIW18-156) • Japan's R&D Project of Ramp Forecasting Technology: A Forecast Integration Method T. Takeuchi, Y. Hirata, S. Horai, K. Aihara (The University of Tokyo, Japan) (Submission-ID WIW18-145) • Japan's R&D Project of Ramp Forecasting Technology: Metrics for Evaluating Ramp Forecast K. Yoshida, N. Hayasaki, N. Ushigami (ITOCHU Techno-Solutions Corporation, Japan), N. Ogasawara, M. Okada, Y. Nakamura (Japan Weather Association, Japan) (Submission-ID WIW18-140)
10:30 – 10:40	Discussions

10:40 – 11:00 Coffee Break

11:00 – 13:00	SESSION 4A – STORAGE ISSUES
> Session Chair	Eamonn Lannoye (EPRI , Ireland)
11:00 – 12:40	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Is Cheap Electricity Storage Essential to Build an Energy System Based on Wind and Solar Power? L. Reichenberg, E. Nyholm (Chalmers University of Technology, Sweden) (Submission-ID WIW18-282) • Enabling 80+ Percent Share of Wind and Solar in Lithuanian Power Sector: Role of Storage Technologies J. Jasiūnas, L. Söder (KTH Royal Institute of Technology, Sweden) (Submission-ID WIW18-48) • Role of Motor Loads and Battery Energy Storage for Active Power Controls by Wind Power H. N. Villegas Pico, V. Gevorgian, P. Koralewicz, R. Wallen (NREL, USA) (Submission-ID WIW-32) • Balancing by Wind and Energy Storage A. Linder, A. Kosareva, K. Kunz, D. McMullin (ENERCON, Germany), B. Lenz (Wobben R&D, Germany) (Submission-ID WIW18-103) • Utilization of Battery Energy Storage to Assist Renewable Energy Networks L. O. Shobayo (University of Huddersfield, United Kingdom), N. Zhao (University College Dublin, Ireland), Y. Hu, N. Schofield (University of Huddersfield, United Kingdom) (Submission-ID WIW18-204)
12:40 – 13:00	Discussions

11:00 – 13:00	SESSION 4B – PANEL DISCUSSION: THE MASSIVE INTEGRATION OF POWER ELECTRONIC DEVICES (MIGRATE) IN FUTURE POWER SYSTEMS – CHALLENGES AND SOLUTIONS
> Session Chair	Jako Kilter (Elering/TU Tallinn, Estonia)
11:00 – 12:30	Presentations (15 min. each)
	<ul style="list-style-type: none"> • MIGRATE Project and Future Power Systems J. Kilter (Elering/Tallinn University of Technology, Estonia) (Submission-ID WIW18-329) • Large Disturbance Rotor Angle Stability Analysis in Power Systems with High Penetration Levels of Wind Power D. Wang (TU Delft, Netherlands) (Submission-ID WIW18-330) • Operation of Wide-Area-Controls in Iceland B. Heimisson (Landsnet, Iceland) (Submission-ID WIW18-331) • Experimentation Results : Grid Forming Control Interoperability Tests and Current Limitation T. Prevost (RTE, France) (Submission-ID WIW18-332) • Relay and System Protection Challenges in Future Power Systems R. Andrino Gallego (REE, Spain) (Submission-ID WIW18-333) • Power Quality and Grid Codes in View of Massive Integration of Power Electronic Devices M. Val Escudero (Eirgrid, Ireland) (Submission-ID WIW18-334)
12:30 – 13:00	Discussions

11:00 – 13:00	SESSION 4C – MODELLING ASPECTS
> Session Chair	B.-M. Hodge (NREL, USA)
11:00 – 12:40	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Investment Analysis on Transmission Lines using TIMES-JMRT Grid Model under a Scenario with large amount of Renewable Y. Yasuda (Kyoto University, Japan), H. Hamasaki (Fujitsu Research Institute, Japan) (Submission-ID WIW18-149) • Impact of Technical Parameters and Data Quality on Wind Energy Modeling in Germany D. Beulertz, A. Schnettler (RWTH Aachen University, Germany) (Submission-ID WIW18-255) • DLR Use for Optimization of Network Design with Very Large Wind (and VRE) Penetration A. Estanqueiro, J. Duque, D. Santos (LNEG, Portugal), K. Morozovska, P. Hilber, L. Söder (KTH Royal Institute of Technology, Sweden), C. Ahlrot (E.ON, Sweden), J. P. Gentle, A. W. Abboud (INL – Idaho, USA), T. Kanefendt (Fraunhofer IEE, Germany) (Submission-ID WIW18-263) • North Sea Offshore Grid Development: Combined Optimization of Grid and Generation Investments Towards 2050 M. Koivisto, P. Sørensen, J. Gea-Bermúdez, (DTU, Denmark) (Submission-ID WIW18-142) • A Machine Learning Approach to Low System Strength Grid Identification for Large Scale Power Systems A. Clark (KTH Royal Institute of Technology, Sweden Texas A&M University, USA), Y. Zhang, S. H. Huang (ERCOT, USA), L. Xie (Texas A&M University, USA) (Submission-ID WIW18-191)
12:40 – 13:00	Discussions

13:00 – 13:15 GROUP PHOTO

13:15 – 14:15 LUNCH BREAK

14:15 – 16:10	SESSION 5A – DISTRIBUTED GENERATION ASPECTS
> Session Chair	Eckard Quitmann (ENERCON, Germany)
14:15 – 15:50	Presentations (19 min. each)
	<ul style="list-style-type: none"> • Operational Options to Integrate Decentralized Generation into Restoration Processes after Severe System Black Outs H. Becker, D. Mende (Fraunhofer IEE, Germany), A. Bernhart, U. Spanel (DUtrain, Germany), J. Brombach (I4E: Innovation for Enercon, Germany) (Submission-ID WIW18-118) • The Impact of Renewable Energy Schemes on Electrical Power Networks. P. Marinakis (HVDC Technologies, United Kingdom), N. Schofield (University of Huddersfield, United Kingdom) (Submission-ID WIW-206) • Optimal Provision of Frequency Containment Reserve with Hybrid Power Plants C. Ionita, A. G. Raducu, N. Styliaras, J. Funkquist (Vattenfall R&D, Sweden) (Submission-ID WIW18-265) • Usability of Flexible Demand and Generation in the BDEW Smart Grid Traffic Light Concept L. Hülsmann, J.-D. Schmidt, E. Tröster (Energynautics, Germany), M. Koch, U. Ohl (EWR Netze, Germany) (Submission-ID WIW18-327) • Advanced Inertial Response Control Based on Disturbance Observer in Microgrid with Wind Power J. Qi, T. Tsuji (Yokohama National University, Japan) (Submission-ID WIW18-300)
15:50 – 16:10	Discussions

14:15 – 16:00	SESSION 5B: GRID CODE ASPECTS I
> Session Chair	Jens Fortmann (HTW Berlin – University of Applied Sciences, Germany)
14:15 – 15:35	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Importance of Voltage-dip Knowledge for Improving Fault-ride-through of Wind Power Installations A. Bagheri, M. Bollen, S. K. Rönnerberg (Luleå University of Technology, Sweden), C. Chen (KTH Royal Institute of Technology, Sweden), M. Bongiorno (Chalmers University of Technology, Sweden) (Submission-ID WIW18-102) • Wind Farm Fault Ride Through – An Irish Context J. Whelan, A. McDonnell, J. Kelleher, S. Hunt (ESB International, Ireland) (Submission-ID WIW18-187) • Do we Need a Network Code on Cyber Security? How to Address Cyber Security Requirements in a Power System with High Penetration of Distributed Generation? M. Doering, E. Haesen (Ecofys, Germany), M. Uslar, L. Fischer (OFFIS, Germany) (Submission-ID WIW18-237) • FRT Test System Compact for 27 MVA with Less Grid Burdens R. Klosse (WindGuard Certification, Germany) (Submission-ID WIW18-240)
15:35 – 16:00	Discussions

14:15 – 16:00	SESSION 5C – SECTOR COUPLING AND LARGE SCALE DECARBONIZATION OF POWER SUPPLY
> Session Chair	Ana Estanqueiro (LNEG, Portugal)
14:15 – 15:35	Presentations (20 min. each)
	<ul style="list-style-type: none"> • The Impact of Sector-coupling on Transmission Reinforcement in a Highly Renewable European Energy Scenario J. Hörsch, V. Hagenmeyer, T. Brown (KIT Karlsruhe Institute of Technology, Germany) (Submission-ID WIW18-188) • Sector Coupling: Renewable Gas from Offshore Wind and Offshore Electrolysers to Decarbonise Heat and Transport S. Hill, M. Jansen, I. Staffell (Imperial College London, United Kingdom) (Submission-ID WIW18-257) • Steps to Decarbonise Power Industries Internationally – A sound method for comparing apples and pears K. Burges (RE-xpertise, Germany), M. Hagemann, M. J. Kurdziel, K. Riechers, F. Röser (New Climate Institute, Germany) (Submission-ID WIW18-215) • Modeling the Dynamics and Control of Power Systems with High Share of Renewable Energies S. Auer, T. Kittel (Potsdam Institute for Climate Impact Research – PIK, Germany) (Submission-ID WIW18-143)
15:35 – 16:00	Discussions

16:00 – 16:30 COFFEE BREAK

16:30 – 18:45	SESSION 6A – ANCILLARY SERVICES II
> Session Chair	Julia Matvosyan (ERCOT, USA)
16:30 – 18:30	Presentations (20 min. each)
	<ul style="list-style-type: none">• Reactive Power in High RES-Senarios – Rethinking one of the non-frequency ancillary services K. Burges (RE-xpertise, Germany), M. Döring (Ecofys, Germany) (Submission-ID WIW18-211)• System Services by Wind Power Plants Supporting 75% Wind Penetration in Ireland M. Gilsean, D. McMullin (ENERCON, Ireland), S. Engelken (WRD Wobben Research and Development, Germany) (Submission-ID WIW18-67)• Validation using an Experimental Test-bed System for Ancillary Services of Wind Power Plants L. Rezai, F. Pöschke, M. Andrejewski, M. Engel, J. Fortmann (HTW Berlin – University of Applied Sciences, Germany) (Submission-ID WIW-196)• Frequency Response of Energy Storage Systems in Grids with High Level of Wind Power Penetration – Gotland Case Study F. Daraiseh, V. Gliniewicz, E. Lidström (Vattenfall R & D, Sweden) (Submission-ID WIW18-75)• Frequency Support Provision to Power Systems from HVDC-Based Offshore Wind Power Plants A. Bidadfar, O. Saborío-Romano, M. Altin, N. A. Cutululis, P. E. Sørensen (DTU, Denmark), E. Prieto-Araujo, O. Gomis-Bellmunt (CITCEA-UPC, Spain) (Submission-ID WIW18-81)• Active Power Control for Mitigation of Very-Short-term and Short-term Fluctuation of Wind Power C. T. Urabe, T. Saitou, K. Ogimoto (The University of Tokyo, Japan) (Submission-ID WIW-108)
18:30 – 18:45	Discussions

16:30 – 18:45	SESSION 6B – POWER SYSTEM STUDIES
> Session Chair	J. Charles Smith (ESIG, USA)
16:30 – 18:30	Presentations (20 min. each)
	<ul style="list-style-type: none">• Thailand Renewable Grid Integration Study C. Hart, P. Vithayasrichareon and S. Mueller (IEA, France)• Systemic Issues of Converter-based Generation and Transmission Equipment in Power Systems K. Vennemann, T. Hennig (Amprion, Germany), E. Grebe (External Advisor, Germany), W. Winter, G. Deiml (TenneT TSO, Germany), J. Lehner, H. Abele (TransnetBW, Germany), J. Weidner, R. Stornowski (50Hertz Transmission, Germany) (Submission-ID WIW-92)• Analysis of Power System Oscillation Stability with Large Integration of Renewable Generations L. Cai (University of Rostock, Germany), U. Karaagac (Hong Kong Polytechnic University, Hong Kong), J. Mahseredjian (Polytechnique Montréal, Canada) H.-G. Eckel, H. Weber (Submission-ID WIW18-150)• Continental-Scale Grid Planning and Operations Modeling G. Brinkman, A. Bloom, J. Ho, J. Novacheck (National Renewable Energy Laboratory, USA) (Submission-ID WIW18-298)• Approach to Design and Review the System Defence Plan for Over-frequency to Ensure Frequency Stability in the ENTSO-E Continental Europe Synchronous Area J. Lehner (TransnetBW, Germany), J. Weidner (50Hertz Transmission, Germany), T. Hennig (Amprion, Germany), G. Deiml (Tennet, Germany) (Submission-ID WIW18-64)• Development of Wind Ramp Forecasting Technology in the National R&D Project (in Japan): Evaluation of Developed Forecasts by Power System Operation Simulation Y. Nishitsuji, Y. Udagawa, K. Ogimoto (University of Tokyo, Japan), K. Ukegawa (Kozo Keikaku Engineering, Japan), S. Fukutome (JP Business Service Corporation, Japan) (Submission-ID WIW-180)
18:30 – 18:45	Discussions

16:30 – 18:45	SESSION 6C – POWER QUALITY ISSUES I
> Session Chair	Nicholas Miller (HickoryLedge, USA)
16:30 – 18:30	Presentations (20 min. each)
	<ul style="list-style-type: none"> • How Large Wind Parks Contribute to Harmonic Waveform Distortion D. Schwanz, M. H. J. Bollen, S. Rönnerberg, A. Larsson (Luleå University of Technology, Sweden) (Submission-ID WIW18-101) • Method for Harmonic and TOV Connection Impact Assessment of Offshore Wind Power Plants – Part I: Harmonic Distortion R. de Groot, F. van Erp, K. Jansen, J. van Waes (TenneT TSO, Netherlands), M. Hap, L. Thielman (Tractebel Engineering, Belgium) (Submission-ID WIW18-124) • Method for Harmonic and TOV Connection Impact Assessment of Offshore Wind Power Plants – Part II: TOV Impact Assessment K.Jansen, R. de Groot, B. van Hulst (TenneT TSO, Netherlands), K. Velitsikakis, C. Engelbrecht (DNV GL, Netherlands) (Submission-ID WIW18-129) • Case Study: Reliability of the Summation Method to Assess the Harmonic Current due to a Wind Power Plant K. Redondo, I. Azcarate, J. J. Gutierrez, P. Saiz, L. A. Leturiondo (University of the Basque Country (UPV/EHU), Spain), S. Lodetti (CIRCE University of Zaragoza, Spain) (Submission-ID WIW18-116) • Active Filtering with Large-Scale STATCOM for the Integration of Offshore Wind Power M. Lehmann, M. Pieschel (Siemens, Germany), M. Juamperez, K. Kabel, Ł. H. Kocewiak (Ørsted, Denmark), S. Sahukari (Ørsted, United Kingdom) (Submission-ID WIW-61) • Analysis of Harmonic Summation in Wind Power Plants Based on Harmonic Phase Modelling and Measurements M. Eltouki, T. W. Rasmussen (DTU, Denmark), E. Guest (DTU, Denmark Siemens Gamesa Renewable Energy, Denmark), L. Shuai (Siemens Gamesa Renewable Energy, Denmark), Ł. Kocewiak (Ørsted, Denmark) (Submission-ID WIW18-164)
18:30 – 18:45	Discussions

18:45 POSTER RECEPTION & NETWORKING

08:40 – 10:40	SESSION 7A – GRID CODE ASPECTS II
> Session Chair	Sigrid Bolik (Senvion, United Kingdom)
08:40 – 10:20	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Wind Farm Grid Code Compliance Testing: Different Approaches, Biggest Hurdles and the Foreseeable Future B. Hahn, T. Rösner, J. Fleischhauer, M. Fernandez (Nordex Energy, Germany) (Submission-ID WIW18-96) • Use of Full-order Electro-magnetic Transient Models for Grid Compliance Assessment of Wind Turbines: Part I P. Ghimire, I. Szczesny, R. Sharma, F. Martin, P. Mahat (Siemens Gamesa Renewable Energy, Denmark) (Submission-ID WIW18-195) • Grid Code Certification in Germany – A Recipe for Europe? B. Schowe-von der Brelie, C. Scheefer, C. Lütke-Lengerich, A. Hoppmann (FGH Certification Body, Germany) (Submission-ID WIW18-87) • Comparison of Impedance Characteristics of Medium Voltage Grid Simulator with LVRT-Container during Symmetrical Voltage Dip S. Azarian, T. Jersch, S.Khan (Fraunhofer IWES, Germany) (Submission-ID WIW18-216) • Analysis of HVDC and Wind Turbine Converter Response during Offshore Asymmetrical Faults Ö. Göksu, N. A. Cutululis, P. Sørensen (DTU Wind Energy, Denmark) (Submission-ID WIW18-229)
10:20 – 10:40	Discussions

08:40 – 10:40	SESSION 7B – MARKET AND REGULATORY ISSUES
> Session Chair	Thomas Ackermann (Energynautics, Germany)
08:40 – 10:20	Presentations (20 min. each)
	<ul style="list-style-type: none"> • System Integration Costs – a Useful Concept that is Complicated to Quantify? S. Mueller (IEA, France), H. Holttinen (VTT, Finland), E. Taibi (IRENA, Germany), J. C. Smith (ESIG, USA), D. Fraile (WindEurope, Belgium), T. K. Vrana (SINTEF, Norway) (Submission-ID WIW-241) • Wind Generation in Adequacy Calculations and Capacity Markets in Different Power System Control Zones L. Söder (KTH Royal Institute of Technology, Sweden), A. Estanqueiro (LNEG, Portugal), D. Flynn (University College Dublin, Ireland), B.-M. Hodge (NREL University of Colorado, USA), J. Kiviluoma (VTT, Finland), M. Korpås (NTNU, Norway), E. Neau (EDF, France), A. Cuoto (LNEG, Portugal), D. Pudjianto, G. Strbac (Imperial College London, United Kingdom), D. Burke (National Grid, United Kingdom), T. Gómez (Universidad Pontificia Comillas, Spain), K. Das (DTU, Denmark) (Submission-ID WIW18-63) • A Dispatch Methodology to Secure Power System Inertia in Future Power Systems H. Thiesen, C. Jauch (Flensburg University of Applied Sciences – WETI, Germany) (Submission-ID WIW18-146) • Negative Market Prices and Market Premium Support Schemes – Impacts on Wind Integration in the German Electricity Market M. Klobasa, M. Haendel, L. Pfluger (Fraunhofer ISI, Germany) (Submission-ID WIW18-220) • Comparison of Connection Policies for the Planning of Generation Integration into a Distribution Network J. Wallace, A. Chabrol, C. Molloy (ESB Networks, Ireland) (Submission-ID WIW18-27)
10:20 – 10:40	Discussions

10:40 – 11:10 Coffee Break

11:10 – 13:10	SESSION 8A: BALANCING ISSUES
> Session Chair	Hanna Emanuel (ENERCON, Germany)
11:10 – 12:50	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Balancing Challenges for Future North Sea Offshore Network K. Das, M. Koivisto, P. E. Sørensen, J. Gea-Bermúdez, (DTU, Denmark) (Submission-ID WIW18-217) • Future Flexibility Valuation in Power Systems with High Penetration of Variable Generation L. A. Hurtado, M. F. J. de Ronde, M. R. Duvoort (DNV GL, Netherlands) (Submission-ID WIW18-304) • Finding the Limits to System Flexibility E. Lannoye (EPRI International, Ireland), E. Ela, Q. Wang, A. Tuohy (EPRI, USA) (Submission-ID WIW18-219) • Experiences in the NEM: Practical Considerations for the Successful Integration of Utility-Scale Renewable Storage Solutions H. Mackenzie, J. Dyson (Dispatch Solutions, Australia) (Submission-ID WIW18-105) • Frequency Regulation of Power System in Japan with Large-Scale Integration of Renewables by using Electrolyzers T. Tsuji, J. Qi (Yokohama National University, Japan) (Submission-ID WIW18-309)
12:50 – 13:10	Discussions

11:10 – 13:10	SESSION 8B – POWER QUALITY ISSUES II
> Session Chair	Lennart Söder (KTH – Royal Institute of Technology, Sweden)
11:10 – 12:50	Presentations (16 min. each)
	<ul style="list-style-type: none"> • Analysis of the Flicker Estimation at PCC of a Wind Power Plant K. Redondo, I. Azcarate, J. J. Gutierrez, L. A. Leturiondo, P. Saiz (University of the Basque Country (UPV/EHU), Spain) (Submission-ID WIW18-166) • Analysis of Harmonic Resonance Stability in Power System with Renewable Generations L. Cai (University of Rostock, Germany), U. Karaagac (Hong Kong Polytechnic University, Hong Kong), J. Mahseredjian (Polytechnique Montréal, Canada), H.-G. Eckel, H. Weber (University of Rostock, Germany) (Submission-ID WIW18-26) • Type IV Wind Turbine System Impedance Modelling for Harmonic Analysis L. Beloqui Larumbe, Z. Qin, P. Bauer (Delft University of Technology, Netherlands) (Submission-ID WIW18-198) • Methods to Aggregate Turbine and Network Impedance for Wind Farm Resonance Analysis H. Wang (China Electric Power Research Institute, China), C. Buchhagen, M. Greve (TenneT Offshore, Germany), J. Sun (Rensselaer Polytechnic Institute, USA) (Submission-ID WIW18-177) • An Impedance-Based Active Filter for Harmonic Damping by Type-IV Wind Turbines E. Guest, T. Rasmussen (DTU, Denmark), K. H. Jensen (Siemens Gamesa Renewable Energy, Denmark) (Submission-ID WIW18-20)
12:50 – 13:10	Discussions

13:15 – 14:15 LUNCH BREAK

14:15– 15:45	SESSION 9A – INTEGRATION SOLUTIONS
> Session Chair	Bernd Weise (DIgSILENT, Germany)
14:15 – 15:35	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Synchronous Condensers Applications in Transmission Network with Power Electronics Based Generation A. Atallah (Siemens, Germany) (Submission-ID WIW18-135) • Model-based Control of grid-side Converter: An LMI approach N. Goldschmidt, H. Schulte (HTW Berlin – University of Applied Sciences Berlin, Germany) (Submission-ID WIW-202) • A New Method for Grid Control of a Wind Turbine Facility M. Engel, L. Rezai, J. Fortmann, N. Klaes (HTW Berlin – University of Applied Sciences, Germany) (Submission-ID WIW-199) • Operational Experience with a Type 3 WPP in a Weak Power System Region with Type 2 WPPs and Synchronous Condensers A. Abdellaoui, M. Asmine (Hydro-Québec TransÉnergie, Canada) (Submission-ID WIW18-316)
15:35 – 15:45	Discussions

14:15– 15:45	SESSION 9B – FORECASTING II
> Session Chair	John Zack (UL AWS Truepower, USA)
14:15 – 15:35	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Understanding Uncertainty: the Difficult Move from a Deterministic to a Probabilistic World C. Möhrle (WEPROG, Denmark & Germany), R. Bessa (INESC TEC, Portugal) (Submission-ID WIW18-155) • Bounded Probabilistic Wind Power Forecasting using Mixture Density Recurrent Neural Network S. Haglund El Gaidi, M. Chiru (Greenlytics, Sweden) (Submission-ID WIW-302) • Evaluation of Bi-variate Distributions of GFS and ECMWF Wind Speed Forecasts by Kullback Leibler Divergence and Wind Power Forecasting M. Dione (ParisTech ENGIE Green France, France), E. Matzner-Lober (ParisTech, France), P. Alexandre (ENGIE Green France, France) (Submission-ID WIW18-11) • Benchmark of Spatio-temporal Shortest-Term Wind Power Forecast Models S. Vogt, A. Braun, J. Koch, D. Jost, J. Dobschinski (Fraunhofer IEE, Germany) (Submission-ID WIW18-190)
15:35 – 15:45	Discussions

15:45 – 15:55 SHORT BREAK

15:55 – 16:55	SESSION 10 – CLOSING SESSION
> Session Chair	Peerapat Vithayasrichareon (IEA, France)
15:55 – 16:15	Presentation
	<p>Future Requirements regarding Power System Flexibility and Markets</p> <p>Panellists</p> <ul style="list-style-type: none"> - Peter W. Christensen (Vestas, Denmark) - Bri-Mathias Hodge (NREL, USA) - Luis Hurtado (DNV GL, Netherlands) - Frank Martin (Siemens Gamesa, Denmark) - Nicholas Miller (HickoryLedge, USA)
16:15 – 16:55	Discussions

POSTER PRESENTATIONS

- **Modeling the Arrangement of Turbines for Onshore Wind Power Plants Under Varying Wind Conditions**
M. Celeska, K. Najdenkoski, V. Dimchev, V. Stoilkov (Ss. Cyril and Methodius University in Skopje, Macedonia), L. Fickert, R. Schuerhuber (TU Graz, Austria) ([Submission-ID WIW18-4](#))
- **Passive Houses as Power and Heat Storage in the Smart Grid**
A. Bretzke, R. Höfer (Biberach University of Applied Sciences, Germany) ([Submission-ID WIW18-13](#))
- **Modelling of Large Size Electrolyser for Electrical Grid Stability Studies – A Hierarchical Control Approach**
P. K. S. Ayivor, J. L. Rueda Torres (Delft University of Technology, Netherlands), M. A. M. M. van der Meijden (Delft University of Technology, Netherlands | TenneT TSO, Netherlands) ([Submission-ID WIW18-37](#))
- **Global Geospatial Optimization of the Location of Wind Farms and the Configuration of Transmission Networks**
K. Iwamura, R. Kobayashi, K. Nishiyama, Y. Nakanishi (Waseda University, Japan) ([Submission-ID WIW18-40](#))
- **Operation of Hydrothermal System with Increased Wind Generation –New Zealand System Case Study**
L. Schwartzfeger, A. Wood (University of Canterbury, New Zealand), G. Bickers (Transpower New Zealand, New Zealand) ([Submission-ID WIW18-74](#))
- **Control Solutions for Blackstart Capability and Islanding Operation of Offshore Wind Power Plants**
A. Jain, K. Das, Ö. Göksu, N. A. Cutululis (DTU, Denmark) ([Submission-ID WIW18-97](#))
- **Steady-state Characteristics of Substation-free Wind Power Plant Composed of Series-Connected Wind Turbine Generators and Current-source Thyristor Inverter**
S. Nishikata, F. Tatsuta (Tokyo Denki University, Japan) ([Submission-ID WIW18-106](#))
- **Unconventional High-voltage Ride-Through Technical Retrofitting Scheme for Certain Imported Old Generating Units of the Northeast China Power Grid**
Q. Lv (Columbia University, USA), H. P. Zhang, G. H. Shao, J. Q. Liu, Y. Liu S. B. Du (Northeast Power Dispatching Center of SGCC, China) ([Submission-ID WIW18-109](#))
- **Reducing Operational Costs of Offshore HVDC Energy Export Systems through Optimized Maintenance**
J. F. Unnewehr (University of Freiburg, Germany), H.-P. Waldl, T. Pahlke, (Overspeed, Germany), I. Herráez, (University of Applied Science Emden/Leer, Germany) ([Submission-ID SIW-121](#))
- **Lyapunov-Based Control for Grid Side Inverters of Wind Turbine Systems**
A. Schöley, M. Gierschner, W. Drewelow, T. Jeinsch (University of Rostock, Germany) ([Submission-ID WIW18-134](#))
- **Meteorological Categorization of Wind Power Ramp Events - Case Study of Three Areas of Japan**
M. Okada, K. Yamaguchi, R. Kodama, N. Ogasawara (Japan Weather Association, Japan), K. Ogimoto (University of Tokyo, Japan) ([Submission-ID WIW18-136](#))
- **Onshore Grid Frequency Control Using DC Capacitor in Full-Scale Converter for Offshore Wind Generator and Adjustable Speed Motor for Offshore Plant Connected by Multi-Terminal HVDC**
H. Matsuda, Y. Ota, Yutaka, T. Nakajima (Tokyo City University, Japan) ([Submission-ID WIW18-144](#))
- **On-line Markov Chain Based Thermal Risk Estimation for Offshore Wind Farm Cables**
M. A. Hernandez Colin, J. Pilgrim (University of Southampton, United Kingdom) ([Submission-ID WIW18-163](#))
- **Optimal Allocation of Wind Power Considering its Contribution to Security of Supply**
J. Peter, J. Wagner (University of Cologne – EWI, Germany) ([Submission-ID WIW18-178](#))
- **Energy Control of Modular Multilevel Converters in MTDC Grids for Wind Power Integration**
K. Shinoda, R. Ramachandran, A. Benchaib (SuperGrid Institute, France), J. Dai (SuperGrid Institute, France | University Paris-Saclay, France), B. François (University of Lille, France), S. Bacha (SuperGrid Institute, France | University Grenoble Alpes, France), X. Guillaud (University of Lille, France) ([Submission-ID WIW18-179](#))
- **Experimental Results of a Wind Power Plant Scheduling Method Considering State-of-Charge Transition for an Electricity Market with the Compressed Air Energy Storage System**
M. Ito, Y. Fujimoto, M. Mitsuoka, H. Ishii, A. Kikuchi, Y. Hayashi (Waseda University, Japan) ([Submission-ID WIW18-181](#))
- **Investigation of Transient Energy Storage Sources for Support of Future Electrical Power Systems**
Y. Hu (University of Huddersfield, United Kingdom), N. Zhao (University College Dublin, Ireland), L. O. Shobayo, N. Schofield (University of Huddersfield, United Kingdom) ([Submission-ID WIW18-201](#))
- **Smart Energy Network Demonstrator - SEND**
N. Schofield (University of Huddersfield, United Kingdom), I. Madley, Z. Fan (Keele University, United Kingdom) ([Submission-ID WIW18-209](#))

- **Challenges with the Design of Cost Effective Series DC Collection Network for Offshore Wind Farm**
M. Kharezy (Rise Research Institutes of Sweden, Sweden), T. Thiringer (Chalmers University of Technology, Sweden) (Submission-ID WIW18-246)
- **A Correction Method to Improve the Quality of the Wind Forecast – A Case Study for Wangjiangping Station**
Y. Shen, L. Cao (National Meteorological Information Center, China), X. Yang (Beijing E-techstar, China) (Submission-ID WIW18-256)
- **Operational Planning Strategies of Wind-Powered Electric Vehicle Charging Stations for Charging Demand Dispersion**
Y. Lee (Sangmyung University, Korea [ROK]), Y. Cho (Daegu Catholic University, Korea [ROK]), J. Hur (Sangmyung University, Korea [ROK]) (Submission-ID WIW18-269)
- **A Generic Control Approach to Enable the Participation of Wind Farms in Frequency Control Services**
J. Callec, Y. Wang, G. Delille, Q. Morel (EDF R&D, France), D. Sarvary, C. Shu (EDF Renewables, France) (Submission-ID WIW18-278)
- **A Study on Future Power System Database Construction According to the Renewable Energy Expansion of Korean Electric Power System**
S. Park, J. Han, H. Kwon, H. Sin, Y. Cho (Daegu Catholic University, Korea [ROK]), J. Hur (Sangmyung University, Korea [ROK]), H. Kim (Korea Electric Power Corporation, Korea [ROK]) (Submission-ID WIW18-280)
- **Reactive Power Management of a Large Scale Wind Power Cluster in Northern Sweden**
I. Leisse (E.ON Energy Networks, Sweden) (Submission-ID WIW18-284)
- **Quasi-Monte Carlo Based Probabilistic Power Flow Calculations in Power System Considering the Correlations between Renewable Energy Sources**
A. Otaboev, T. Tsuji (Yokohama National University, Japan) (Submission-ID WIW18-306)
- **Maximum Likelihood Wind Field State Estimator with LIDAR Measurements for Wind Farm Control**
B. Uzunoglu (Uppsala University, Sweden) (Submission-ID WIW18-311)
- **Review of European Grid Codes for Wind Farms and Their Implications for Wind Power Curtailments**
E. Nycander, L. Söder (KTH Royal Institute of Technology, Sweden) (Submission-ID WIW-335)
- **Spine Toolbox and Spine Model for Open Source Energy System Analysis**
J. Kiviluoma (VTT, Finland), M. Amelin (KTH Royal Institute of Technology, Sweden), E. Delarue (KU Leuven, Belgium), J. Dillon (Energy Reform, Ireland), M. Ihlemann, S. Kaminski (KU Leuven, Belgium), T. Lastusilta (VTT, Finland), M. Marin, J. Olauson (KTH Royal Institute of Technology, Sweden), F. Pallonetto (University College Dublin, Ireland), K. Poncelet (KU Leuven, Belgium), E. Rinne, P. T. Savolainen (VTT, Finland), L. Söder (KTH Royal Institute of Technology, Sweden), P. Vennström (VTT, Finland) (Submission-ID WIW-336)