

DIGITAL PROCEEDINGS

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19th 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

11 - 12 November 2020

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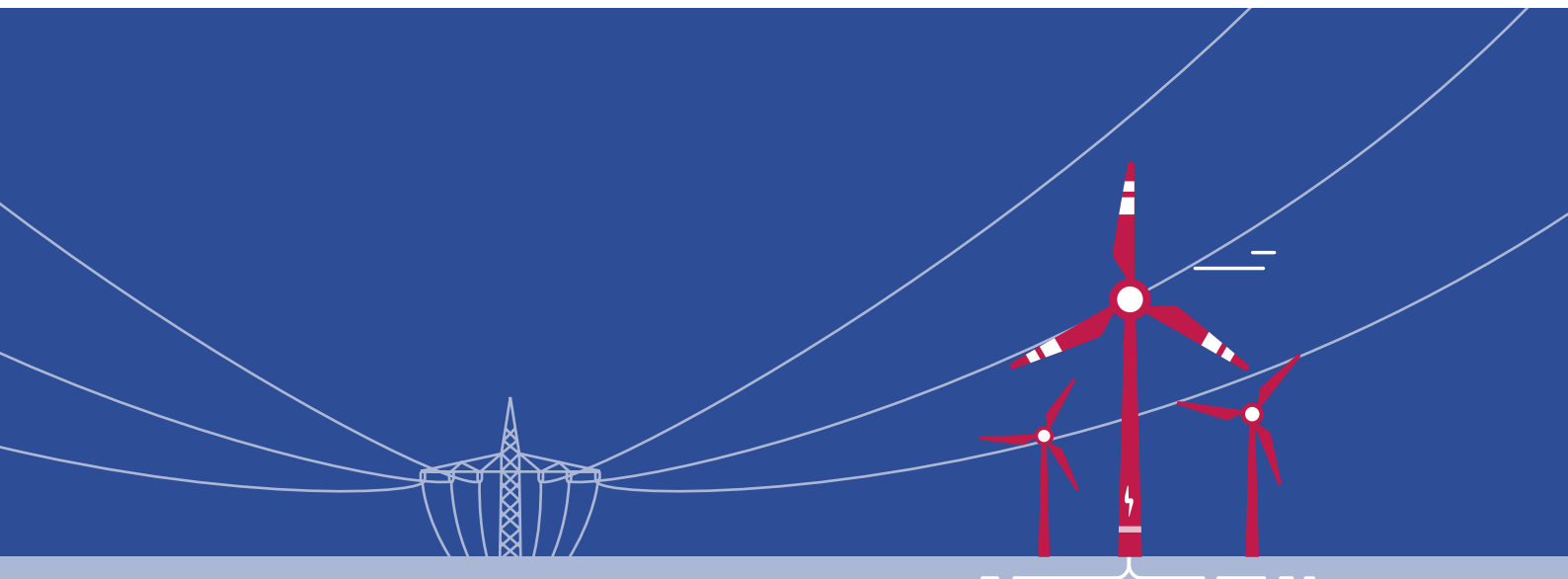


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Published by Energynautics GmbH
www.energynautics.com
ISBN: 978-3-9820080-8-0

Edited by Uta Betancourt & Thomas Ackermann
www.windintegrationworkshop.org

IMPRINT

Digital Proceedings of
the 19th Wind Integration Workshop
published in 2020 by:

Energynautics GmbH
Robert-Bosch-Straße 7
64293 Darmstadt
Germany
www.energynautics.com
info@energynautics.com

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ISBN: 978-3-9820080-8-0

Cover Design by:
Energynautics GmbH, Germany

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SESSION 1 – KEYNOTE SESSION

09:10 – 11:00 | 11 November 2020 | Session Chair: Thomas Ackermann (Energynautics, Germany)

09:10 – 10:30 Presentations (20min. each)

- **Power Systems in Transition – Implications for Electricity Security**
C. A. Hernandez (IEA, France)
- **Resilience of Energy System while moving towards 100% RE**
T. Ackermann (Energynautics, Germany)
- **European Connection Network Codes – ENTSO-E’s Views on Important Amendment Needs**
R. Pfeiffer (Amprion, Germany), J. Sprooten (Elia System Operator, Belgium), R. Wilson (National Grid ESO, United Kingdom), I. Theologitis (ENTSO-E, Belgium) (Submission-ID WIW20-96)
- **Wind in Europe, the Integration Challenges Ahead**
D. Fraile (WindEurope, Belgium)

10:30 – 11:00 Discussions

05:20 New York // 07:20 Rio de Janeiro // 10:20 London // 15:50 New Delhi // 17:20 Jakarta // 18:20 Peking // 19:20 Tokio

SESSION 2A: GRID FORMING ASPECTS I

11:20 – 13:00 | 11 November 2020 | Session Chair: Julia Matevosyan (ERCOT, USA)

11:20 – 12:40 Presentations (20 min. each)

- **An Investigation Case for a Stable Power System with up to 100% Inverter Based Generation with Grid Forming Control**
P. Marinakis (HVDC Technologies, United Kingdom), N. Schofield (University of Huddersfield, United Kingdom) (Submission-ID WIW20-87)
- **Control, Operation, and Stability Characteristics of Grid-Forming Type III Wind Turbines**
S. Shah, V. Gevorgian (NREL, United States) (Submission-ID WIW20-138)
- **Instability Phenomena in Interconnected Power Systems Caused by Current Limitation of Grid-Forming Converters**
C. Schöll, H. Lens (University of Stuttgart - IFK, Germany) (Submission-ID WIW20-59)
- **Practical Experience of Providing Enhanced Grid Forming Services from an Onshore Wind Park**
A. Roscoe, P. Brogan, D. Elliott, T. Kneuppel, (Siemens-Gamesa, United Kingdom), I. Gutierrez, P. Crolla, R. Da Silva (Scottish Power Renewables, United Kingdom), J.-C. Perez Campión (Iberdola Renovables, Spain) (Submission-ID WIW20-57)

12:40– 13:00 Discussions

SESSION 2B: WIND POWER MODELLING

11:20 – 13:00 | 11 November 2020 | Session Chair: Jan-David Schmidt (Energynautics, Germany)

11:20 – 12:40 Presentations (20 min. each)

- **Stability Analysis of Grid-Supporting Control of Type 4 Wind Energy Plants**
M. Gierschner, S. Ganzel, F. Uster, A. Schöley, S. Gierschner, H.-G. Eckel (University of Rostock, Germany) (Submission-ID WIW20-41)
- **Sensitivities of the Regionalized European Wind Onshore Model**
T. Schmid, C. Fiedler, (FFE – Forschungsstelle für Energiewirtschaft e.V., Germany) (Submission-ID WIW20-67)
- **Simplified Waveform Modeling of a Six-Pulse Line-Commutated Bridge Converter for Multirate RMS Simulations of Power Systems with Wind Power Plants**
M. Y Borodulin (KIIP Consulting, United States) (Submission-ID WIW20-23)
- **Short Circuit Model Parameterization of Wind Turbines and VSC-HVDCs for System Level Short Circuit Calculations**
J. B. Kwon, K. Abildgaard, J. Glasdam, C. Flytkjær (Energinet.dk, Denmark) (Submission-ID WIW20-29)

12:40– 13:00 Discussions

SESSION 2C: GERMAN EXPERIENCE

11:20 – 13:00 | 11 November 2020 | Session Chair: Leonard Hülsmann (Energynautics, Germany)

11:20 – 12:50 Presentations (18 min. each)

- **Direct Control of Wind Parks by a Transmission System Operator**
M. Orlishausen, M. Thiele, J. Birkelbach (TenneT TSO, Germany), N. Klein, U. Focken (Energy & Meteo Systems, Germany), H. Forche (Statkraft Markets, Germany), J. Schütt, V. Pankraz, S. Liebehentze (Fraunhofer IEE, Germany), M. Frech (ANE, Germany), H. Großer (ARGE Netz, Germany) (Submission-ID WIW20-114)
- **Congestion Management and its Interdependency with the Energy System in Germany - an Empirical Analysis**
S. Köppl (Research Center for Energy Economics – FFE | TU Munich, Germany), **A. Ostermann** (Research Center for Energy Economics – FFE, Germany), S. Fattler (TU Munich, Germany) (Submission-ID WIW20-42)
- **Forecasting Latent Components of Vertical Power Flows at Transmission Grid Nodes**
D. Beinert, A. Braun (Fraunhofer IEE, Germany) (Submission-ID WIW20-78)
- **Importance of Storage Power Plants (SPP) in Large-scale Renewable Energy Integration**
N. Ahmed, H. Weber (University of Rostock, Germany) (Submission-ID WIW20-79)
- **Site Quality Evaluation of Wind Farms in Germany**
F. Kalverkamp, K. Raumann, S. Ledwon, J. Bünger (FGH GmbH, Germany) (Submission-ID WIW20-70)

12:50– 13:00 Discussions

SESSION 3A: TESTING GRID FORMING CONVERTERS

14:00 – 15:45 | 11 November 2020 | Session Chairs: Sönke Rogalla (Fraunhofer ISE, Germany) /
Hendrik Lens (University of Stuttgart (IFK), Germany)

14:00 – 15:20 Presentations (20 min. each)

- **Testing Characteristics of Grid Forming Converters Part I: Specification and Definition of Behaviour**
M. Kersic, T. Müller (BELECTRIC, Germany), R. Denninger, P. Ernst, S. Reichert, S. Rogalla, R. Singer (Fraunhofer ISE, Germany), A. Dyško, A. Egea Alvarez, Q. Hong (University of Strathclyde, United Kingdom), E. Lewis (Energy Storage Consulting Eric, United Kingdom), A. J. Roscoe (Siemens-Gamesa Renewable Energy, United Kingdom), H. Lens, C. Schöll (University of Stuttgart (IFK), Germany), T. Schaupp (KACO new energy, Germany), K. Jalili (GE Renewable Energy, Germany) ([Submission-ID WIW20-115](#))
- **Testing Characteristics of Grid Forming Converters Part II: Voltage Source Properties and Contribution to Power Quality**
R. Denninger, S. Reichert, S. Rogalla, (Fraunhofer ISE, Germany), K. Jalili (GE Renewable Energy, Germany) ([Submission-ID WIW20-116](#))
- **Testing Characteristics of Grid Forming Converters Part III: Inertial Behaviour**
A. Dyško, A. Egea, Q. Hong, A. Khan (University of Strathclyde, United Kingdom), **P. Ernst**, R. Singer, (Fraunhofer ISE, Germany), A. J. Roscoe (Siemens-Gamesa Renewable Energy, United Kingdom) ([Submission-ID WIW20-117](#))
- **Testing Characteristics of Grid Forming Converters Part IV: Overload Behavior and Response to Grid Faults**
P. Ernst, **R. Singer**, S. Rogalla, R. Denninger (Fraunhofer ISE, Germany), K. Jalili (GE Renewable Energy, Germany) ([Submission-ID WIW20-118](#))

15:20 – 15:45 Discussions

SESSION 3B: FREQUENCY AND BALANCING ASPECTS

14:00 – 15:45 | 11 November 2020 | Session Chair: J. Charles Smith (ESIG, USA)

14:00 – 15:20 Presentations (20 min. each)

- **Flexibility Resources for Integrating VRE – Case Studies**
C. Hart (IEA, France)
- **Parameter Identification of Frequency Response Model and Frequency Response Assessment**
D. Zografos, M. Ghandhari (KTH Royal Institute of Technology, Sweden), R. Eriksson (Svenska kraftnät, Sweden) ([Submission-ID WIW20-2](#))
- **A Study of Power-Frequency Dynamics in Isolated Power Networks with 100% Converter-Interfaced Generation**
R. Musca (University of Palermo, Italy), K. Kouzelis (NEPLAN, Switzerland) ([Submission-ID WIW20-73](#))
- **Recommendations for Balancing Requirements for Future North Sea Countries towards 2050**
K. Das (DTU Wind Energy, Denmark), J. Gea-Bermúdez (DTU Management, Denmark), P. Kanellas, M. Koivisto, J. P. García León, P. E. Sørensen (DTU Wind Energy, Denmark) ([Submission-ID WIW20-86](#))

15:20 – 15:45 Discussions

SESSION 3C: POWER SYSTEM ISSUES I

14:00 – 15:45 | 11 November 2020 | Session Chair: Torsten Lund (Vestas, Denmark)

14:00 – 15:20 Presentations (20 min. each)

- **EMT and RMS Analysis of a Two-Area System with Wind Power Generation**
A. Clark (KTH Royal Institute of Technology, Sweden), P. Mitra (Hitachi-ABB Power Grids, Sweden), N. Johansson (Hitachi-ABB Power Grids Research, Sweden), M. Ghandhari (KTH Royal Institute of Technology, Sweden)
(Submission-ID WIW20-60)
- **Synchronous Condensers in Future High Percentage Renewable Generation Grids**
N. Schofield, X. Chen, P. Marinakis (University of Huddersfield, United Kingdom), N. Zhoa (University College Dublin)
(Submission-ID WIW20-141)
- **Dynamic Capabilities of Distributed Reactive Power Sources**
R. Grab (Fraunhofer ISE, Germany), H. Koeppel (TU Brunswick – elenia, Germany), L. Nielsen (SCADA International Deutschland, Germany), S. Eichner, S. Rogalla (Fraunhofer ISE, Germany), B. Engel (TU Brunswick – elenia, Germany)
(Submission-ID WIW20-44)
- **Solver Requirements in the Study of Power Swing Protection under Wind Integration**
M. Zhao, I. Kocar (Polytechnique Montreal, Canada), A. W. Korai, B. Weise (DIGSILENT, Germany), E. Farantatos, A. Haddadi (EPRI, United States) (Submission-ID WIW20-97)

15:20 – 15:45 Discussions

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SESSION 4A: GRID FORMING ASPECTS II

16:10 – 18:20 | 11 November 2020 | Session Chair: Eckehard Tröster (Energynautics, Germany)

16:10 – 17:50 Presentations (20 min. each)

- **Influence of the Frequency Support Provided by a Grid-Forming Control-Based Wind Turbine on the Loading of its Mechanical System**
A. Avazov (University of Lille, France | KU Leuven ESAT, Belgium), F. Colas, X. Guillaud, (University of Lille, France), J. Beerten (KU Leuven ESAT, Belgium) (Submission-ID WIW20-80)
- **Operator Considerations for the Implementation of Testing Enhanced Grid Forming Services on an Onshore Wind Park**
I. Gutierrez, P. Crolla (ScottishPower Renewables, United Kingdom), A. Roscoe, P. Brogan, D. Elliott, T. Knueppel (Siemens Gamesa, United Kingdom), J. C. Pérez Campión (Iberdrola Renovables, Spain), R. Da Silva (ScottishPower Renewables, United Kingdom) (Submission-ID WIW20-64)
- **Effect of Phase Locked Loop on Dynamic Performance of Grid Forming Converter**
Z. Zhang, R. Schürhuber, L. Fickert, K. Friedl (Graz University of Technology, Austria), G. Chen, Y. Zhang (Shanghai Dianji University, China), F. Wang (Xi'an Jiaotong University, China) (Submission-ID WIW20-16)
- **Analysis of Effects of Grid-Forming Inverters on Power Quality using Inverter Output Impedance Spectroscopy**
S. Reichert, B. Stickan (Fraunhofer ISE, Germany) (Submission-ID WIW20-95)
- **Challenges of Modelling Equivalent Active Distribution Grids under Consideration of Grid Forming Inverters**
J. Ungerland, P. Pant (Fraunhofer ISE, Germany) (Submission-ID WIW20-35)

17:50 – 18:20 Discussions

SESSION 4B: POWER SYSTEM ISSUES II

16:10 – 18:20 | 11 November 2020 | Session Chair: Sigrid Bolik (ITPEnergised, United Kingdom)

16:10 – 17:50 Presentations (18 min. each)

- **Overview, Status and Outline of Stability Analysis in Converter-based Power Systems**
Ł. Kocewiak (Ørsted Offshore, Denmark), R. Blasco-Giménez (Polytechnical University of València, Spain), C. Buchhagen (Tennet TSO, Germany), J. B. Kwon (Energinet, Denmark), Y. Sun (Shell, Netherlands), A. Schwanka Trevisan (Enercon, Germany), M. Larsson (Hitachi ABB Power Grids, Switzerland), X. Wang (Aalborg University, Denmark) ([Submission-ID WIW20-137](#))
- **ERCOT Interconnection Inertia Analysis 2013-2020**
J. Matevosyan (ERCOT, United States) ([Submission-ID WIW20-27](#))
- **Challenges and Solutions for Integration of Wind Power in Weak Grid Areas with High Inverter Penetration**
T. Lund, G. K. Andersen, B. Yin (Vestas Wind Systems, Denmark), M. Gupta (Vestas Wind Systems, India) ([Submission-ID WIW20-84](#))
- **Extension of Emergency Power Supply via Public Medium-Voltage Grids with Support of Decentralized Energy Supply in German Distribution Grids**
D. Buurma, B. Hahn, (Nordex Energy, Germany), T. Christ, T. Schmidt (Westnetz, Germany) ([Submission-ID WIW20-65](#))
- **Delivery of Frequency Support and Black Start Services from Wind Power Combined with Battery Energy Storage**
M. P. S. Gryning (Ørsted Offshore, Denmark), B. Berggren (Hitachi ABB Power Grids, Sweden), Ł. H. Kocewiak (Ørsted Offshore, Denmark), J. R. Svensson (Hitachi ABB Power Grids, Sweden) ([Submission-ID WIW20-146](#))

17:50 – 18:20 Discussions

SESSION 4C: GRID CODE ASPECTS

16:10 – 18:20 | 11 November 2020 | Session Chair: Peter-Philipp Schierhorn (Energynautics, Germany)

16:10 – 17:50 Presentations (20 min. each)

- **Experimental Impedance Measurement of SG DD-167 Variable-Speed Direct-Drive Wind Turbine by Power Electronic Grid Simulator of Fraunhofer IWES DyNaLab**
E. Guest, F. Martin (Siemens Gamesa Renewable Energy, Denmark), **S. Azarian**, P. Borowski, T. Jersch, G. Quistorf, (Fraunhofer IWES, Germany), T. Siepker (Siemens Gamesa Renewable Energy, Germany) ([Submission-ID WIW20-14](#))
- **Comparison of Different OVRT Test Benches in the Context of Realistic Overvoltage Events**
S. Eyhorn, **S. Kaiser**, S. Rogalla (Fraunhofer ISE, Germany), R. Klosse (EESYST, Germany) ([Submission-ID WIW20-111](#))
- **High Voltage Ride Through, Challenges of a 66 kV FRT Test Equipment**
R. Klosse (EESYST, Germany), G. Krause, R. Grune (R&D Test Systems, Germany), S. Heinecke (R&D Test Systems, Denmark) ([Submission-ID WIW20-130](#))
- **Experimental Validation of Current Limitation Methods for Grid Forming Inverters**
F. Rauscher, T. Sauer, B. Engel (TU Braunschweig – elenia, Germany) ([Submission-ID WIW20-113](#))
- **Analysis of the Overvoltage Behavior in Interconnected Operation and Determination of Costs for an Extended Overvoltage Capability of Generation Units**
S. Eichner, A. Salman, Y. Cheng, S. Shahid (Fraunhofer ISE, Germany) ([Submission-ID WIW20-147](#))

17:50 – 18:20 Discussions

SESSION 5A: ANCILLARY SERVICES ASPECTS

09:00 – 10:45 | 12 November 2020 | Session Chair: Peter-Philipp Schierhorn (Energynautics, Germany)

09:00 – 10:20 Presentations (20 min. each)

- **Provision of FCR Reserve by Wind Power Plants: Capability and Performance Assessment Based on Experimental Results**
V. Gomes (ENERCON, France), Y. Wang, A. Breton (EDF R&D, France), M. Mourier (Mines ParisTech, France), L. Holicki, M. Letzel (WRD Management Support, Germany) ([Submission-ID WIW20-32](#))
- **Grid Frequency Stability with Wind Power: Irish Case Study Using a New Closed Loop Simulation Environment**
W. Schoot, W. De Boer (DNV GL, Netherlands), E. Bossanyi (DNV GL, United Kingdom) ([Submission-ID WIW20-4](#))
- **Comparative Study of Hybrid Synchronous Condenser Incorporating Battery Energy Storage System for Ancillary Service Provision**
M. Nuhic, K. Vatta Kkuni, G. Yang (DTU, Denmark), J. Ramachandran (National Grid ESO UK, United Kingdom) ([Submission-ID WIW20-133](#))
- **The „SysAnDUk“-Project: Ancillary Services Provided by Distributed Generators to Support Network Operators in Critical Situations and During System Restoration**
H. Becker, J. Schütt (Fraunhofer IEE, Germany), U. Spanel (DUtrain, Germany), G. Schürmann (WRD Management Support, Germany) ([Submission-ID WIW20-75](#))

10:20 – 10:45 Discussions

SESSION 5B: POWER QUALITY ASPECTS

09:00 – 10:45 | 12 November 2020 | Session Chair: Sigrid Bolik (ITPEnergised, United Kingdom)

09:00 – 10:20 Presentations (20 min. each)

- **Development of a Harmonic Analysis Model for a Meshed Transmission Grid with Multiple Harmonic Emission Sources**
V. Akhmatov, C. S. Hansen, T. Jakobsen (Energinet, Denmark) ([Submission-ID WIW20-39](#))
- **Analysis of Harmonic Behaviour in Wind Power Plants Based on Harmonic Phase Modelling and Measurements**
M. Eltouki, **Ł. Kocewiak**, P. Nielsen (Ørsted, Denmark), E. Guest, L. Shuai (Siemens Gamesa Renewable Energy, Denmark) T. W. Rasmussen (DTU, Denmark) ([Submission-ID WIW20-125](#))
- **Frequency and Sequence Couplings in Type 4 and Type 3 Wind Turbines**
B. Nouri (DTU Wind Energy, Denmark), Ł. Kocewiak (Ørsted Wind Power, Denmark), P. E. Sørensen (DTU Wind Energy, Denmark) ([Submission-ID WIW20-45](#))
- **Assessment Process for Design Specification of FACTS Device and Filters to Meet Grid Code Requirements**
R. Haraguchi, T. Yoshihara, N. Kusuno, M. Nakatani, K. Tomiyasu (Hitachi, Japan) ([Submission-ID WIW20-8](#))

10:20 – 10:45 Discussions

SESSION 5C: ECONOMIC ASPECTS

09:00 – 10:45 | 12 November 2020 | Session Chair: Eamonn Lannoye (EPRI, Ireland)

09:00 – 10:20 Presentations (20 min. each)

- **Findings from the Recent EU SET Wind Workshop: Beyond LCOE**
K. Dykes, L. Kitzing, C. Pons-Seres De Brauwer, M. Andersson (DTU Wind Energy, Denmark), H. Canet (TU Munich, Germany) ([Submission-ID WIW20-142](#))
- **NSON II: Next Steps in Economical Connection and International Integration of Offshore Wind Energy in the North Sea**
D. Mende, Y. Harms, P. Härtel, F. Frischmuth, D. S. Stock, M. Braun (Fraunhofer IEE, Germany), M. Herrmann, L. Hofmann (Leibniz University Hannover, Germany), M. Valois, A. Bley, P. Hahn (University of Kassel, Germany), J. Jurczyk, C. Rathke (Tennet TSO, Germany) ([Submission-ID WIW20-40](#))
- **FarmConnors Market Showcases for Wind Farm Control**
K. Kölle (SINTEF Energy Research, Norway), T. Göçmen (DTU Wind Energy, Denmark), I. Eguinoa (CENER, Spain), K. Das, M. J. Koivisto, J. P. Murcia León (DTU Wind Energy, Denmark), M. Smailes (ORE Catapult, United Kingdom), P. Kanellas (DTU Wind Energy, Denmark) ([Submission-ID WIW20-25](#))
- **ERA5 Reanalysis for Long Term Understanding of Offshore Wind Generation**
L. Hayes, M. Stocks (Australian National University, Australia) ([Submission-ID WIW20-88](#))

10:20 – 10:45 Discussions

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SESSION 6A: IEA WIND TASK 36 – RAISING THE BAR ON INFORMATION TRANSPARENCY AND RECOMMENDED PRACTICES FOR WIND POWER FORECASTING

11:15 – 13:00 | 12 November 2020 | Session Chair: Gregor Giebel (DTU Wind Energy, Denmark)

11:15 – 12:45 Presentations (18 min. each)

- **IEA Wind Task 36 Forecasting – An Overview**
G. Giebel (DTU Wind Energy, Denmark), W. Shaw (PNNL, United States), H. Frank (Deutscher Wetterdienst DWD, Germany), C. Draxl (NREL, United States), J. Zack (UL Services Group, United States), P. Pinson (DTU Elektro, Denmark), C. Möhrle (WEPROG, Denmark), G. Kariniotakis (Mines ParisTech, France), R. J. Bessa (INESC TEC, Portugal) ([Submission-ID WIW20-128](#))
- **Validation of Numerical Model Improvements through Public Data Sets and Code**
C. Draxl, J. Lee (National Renewable Energy Laboratory – NREL, United States), W. Shaw, L. Berg (Pacific Northwest National Laboratory, United States) ([Submission-ID WIW20-124](#))
- **IEA Wind Task 36: Practical Application Examples from the Recommended Practices for Forecast Solution Selection**
J. Zack (UL Services Group, United States), C. Möhrle (WEPROG, Denmark) ([Submission-ID WIW20-108](#))
- **Wind Power Forecasting Data Definitions and Exchange Standards – An Approach for a Recommended Practice Built upon International Standards and an Eye Towards the Future**
J. Lerner, M. Westenholz (ENFOR, Denmark) ([Submission-ID WIW20-126](#))
- **Insight on Human Decision-making from Probabilistic Forecast Games and Experience: an IEA Wind Task 36 initiative**
C. Möhrle (WEPROG, Denmark), N. Fleischhut (Max-Planck Institute for Human Development, Germany), R. J. Bessa (INESC TEC, Portugal) ([Submission-ID WIW20-98](#))

12:45 – 13:00 Discussions

SESSION 6B: GRID CODE TESTING

11:15 – 13:00 | 12 November 2020 | Session Chair: Eckard Quitmann (Enercon, Germany)

11:15 – 12:35 Presentations (20 min. each)

- **Spanish Compliance Standard for RfG Grid Connection**
S. Martinez-Villanueva, L. Coronado-Hernández Red Eléctrica de España – REE, Spain), D. Davi-Arderius (ENDESA, Spain), R. Rivas-Saiz, C. Longás-Viejo (Red Eléctrica de España – REE, Spain), J. L. Borrego-Nadal (ENAC, Spain) (Submission-ID WIW20-18)
- **Evaluation of Grid Compliance Testing of Test Benches and the Need for Standardization of Grid Simulator Testing**
T. Jersch (Fraunhofer IWES, Germany) (Submission-ID WIW20-94)
- **FRT Tests Considering Time to Market Requirements**
R. Klosse (EESYST, Germany), F. Santjer, S. Tentzerakis, J. Dirksen (UL International, Germany) (Submission-ID WIW20-129)
- **Validation of the IEC 61400-27 Model Parameterized According to the Adwen AD8**
S. Frahm (Fraunhofer IWES, Germany), F. Jiménez Buendía (Siemens Gamesa Innovation and Technology, Spain) (Submission-ID WIW20-46)

12:35 – 13:00 Discussions

SESSION 6C: DECARBONIZATION OF ENERGY SECTORS

11:15 – 13:00 | 12 November 2020 | Session Chair: Thomas Ackermann (Energynautics, Germany)

11:15 – 12:45 Presentations (18 min. each)

- **Integration of Renewable Energies through the Production of Hydrogen under Investigation of Disruptive Developments in Investment Costs: A Techno-economic Evaluation**
S. Pichlmaier, M. Ebner, P. Hech (Forschungsstelle für Energiewirtschaft e. V. (FFE), Germany), T. Hübner (Forschungsgesellschaft für Energiewirtschaft mbH (FFE GmbH), Germany) (Submission-ID WIW20-103)
- **Experiences in Planning Carbon-free Systems**
S. Pedder, V. Duboviks (Power Economics - Europe, United Kingdom), S. T. Manz, J. Macdowell (Power Economics, United States) (Submission-ID WIW20-112)
- **100% Renewable Electricity for Japan**
C. Cheng, L. Hayes, M. Stocks, B. Lu, A. Blakers, M. Stocks, D. Silalahi, A. Nadolny (Australian National University, Australia) (Submission-ID WIW20-83)
- **Recovery Plan for Resilient and De-carbonised Society with/after Covid-19 – Analysis on Future Demand and E-mobility in Japan**
H. Hamasaki (Deloitte Tohmatsu Consulting, Japan), Y. Yasuda (Kyoto University, Japan) (Submission-ID WIW20-11)
- **The Contribution of Low-head Pumped Hydro Storage to a successful Energy Transition**
M. Qudaih, B. Engel (TU Brunswick elenia, Germany), D. P. K. Truijen, J. D. M. De Kooning, K. Stockman (Ghent University, Belgium), J. Hoffstädt, A. Jarquin-Laguna (TU Delft, Netherlands), R. Ansorena Ruiz, N. Goseberg (TU Brunswick, Germany), J. D. Bricker (TU Delft, Netherlands), J. Fahlbeck, H. Nilsson (Chalmers University of Technology, Sweden), L. Bossi, M. Joseph, M. Zangeneh (Advanced Design Technology, United Kingdom) (Submission-ID WIW20-69)

12:45 – 13:00 Discussions

SESSION 7A: GRAND CHALLENGES IN THE SCIENCE OF WIND ENERGY: GRID

14:00 – 15:45 | 12 November 2020 | Session Chair: Katherine Dykes (DTU Wind Energy Denmark)

14:00 – 15:15 Presentations (10-15 min. each)

Grand Challenges for Grid integration R&D

- **Introduction to IEA Wind TCP Results of IEA Wind TCP Workshop on a Grand Vision for Wind Energy Technology // Grid Parts / Recent Work on Systems Engineering/Integration**
K. Dykes (DTU, Denmark) (Submission-ID WIW20-154)
- **Wind Power Plant Controls, Converter-Dominated Electric Grid; Integrated Data and Modeling Computational Methods for System Analysis and Operation**
O. Carlson (Chalmers University, Sweden) (Submission-ID WIW20-152)

Toward 100% Renewable Energy: R&D Needs, Challenges and First Recommendations for Study Methodology

- **Toward 100% Renewable Energy Pathways: Key Research Needs – ESIG report**
M. O'Malley (Ireland) and J. C. Smith (ESIG, USA) (Submission-ID WIW20-153)
- **Addressing Technical Challenges in 100% Variable Inverter-Based Renewable Energy Power Systems / First Recommendations for Studying and Modelling a Towards 100% Variable Generation Energy System – Task 25 articles**
H. Holttinen (Operating Agent of Task 25) (Submission-ID WIW20-151)

15:15 – 15:45 Discussions

SESSION 7B: SYSTEM RESTORATION

14:00 – 15:45 | 12 November 2020 | Session Chair: Nicholas Miller (HickoryLedge, USA)

14:00 – 15:20 Presentations (20 min. each)

- **Challenges of Future Distribution Systems with a Large Share of Variable Renewable Energy Sources – Review**
A. Baviskar, A. D. Hansen, K. Das, M. Koivisto (DTU Wind Energy, Denmark) (Submission-ID WIW20-56)
- **Graphical User Interface for operating a Technical Virtual Power Plant in an Active Distribution Network**
J. Schuett, H. Becker, J. Koch, R. Fritz, D. You (Fraunhofer IEE, Germany) (Submission-ID WIW20-68)
- **Challenges and Solutions in Integrating Black Start into Offshore Wind Farms**
D. Pagnani (Ørsted Wind Power, Denmark | Aalborg University, Denmark), Ł. Kocewiak, J. Hjerrild (Ørsted Wind Power, Denmark), F. Blaabjerg, C. L. Bak (Aalborg University, Denmark) (Submission-ID WIW20-15)
- **Application of Phase Shifting Transformer (PST) for Blackstart and Stable Operation of Offshore Wind Farm with Diode-Rectifier Unit HVDC link**
L. Cai (University of Rostock, Germany), X. Meng (SEWPG European Innovation Center Aps, Denmark), Q. A. Latif, H.-G. Eckel, H. Weber (University of Rostock, Germany) (Submission-ID WIW20-127)

15:20 – 15:45 Discussions

SESSION 8 – CLOSING SESSION – PANEL DISCUSSION

16:00 – 17:00 | 12 November 2020 | Session Chair: Jens Fortmann (University of Applied Sciences – HTW Berlin, Germany)

16:00 – 16:50

Increased Demand for Fast Carbon Reduction – Grid Forming Converters as New H/Dogma for Stable Grids?

- Do we need Grid Forming Converters for 100% renewables? (in far future) or do we need them soon?
- Is the technology ready / do we understand the risks?
- Will turbine and overall system cost increase or decrease with Grid Forming Control?

Panelists:

- Torsten Lund (Vestas, Denmark)
- Thyge Knueppel (Siemens-Gamesa, United Kingdom)
- Lukas Kocewiak (Ørsted, Denmark)

16:50– 17:00 Closure: Thomas Ackermann (Energynautics, Germany)

POSTER PAPERS

- **Challenges in RMS Dynamic Simulation of Large Power Systems with High Wind Penetration**
M. Y. Borodulin (KIIP Consulting, USA) ([Submission-ID WIW20-22](#))
- **Dynamic Versus Steady-State Operation Modelling of Power-Biomass to Liquid Fuels Processes : A Techno-Economic Assessment**
O. Ibrahim (The German Aerospace Center (DLR), Germany | TU Berlin, Germany) ([Submission-ID WIW20-30](#))
- **Options to Define “design years” to be Used for Sizing Highly Wind Power Based Supply Systems**
H. G. Beyer (University of the Faroe Islands, Faeroe Islands) ([Submission-ID WIW20-92](#))