

PROCEEDINGS

Edited by Uta Betancourt / Thomas Ackermann

4th Solar Integration Workshop

International Workshop on Integration
of Solar Power into Power Systems



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Session 3A: Concentrating Solar Power and the Power System

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14:00 – 16:00 / 10 November 2014 / Room ECC 2 / Session chair: TBA

Impact of Large Scale Penetration of Concentrated Solar Thermal Power on Oscillatory Stability of the Australian Future Grid

J. W. Shim (University of Sydney, Australia/Yonsei University Korea, South Korea), G. Verbić (University of Sydney, Australia), K. Hur (Yonsei University Korea, South Korea), D. J. Hill (University of Sydney, Australia/University of Hong Kong)

Dynamic Modelling of Concentrated Solar Power and Power Plant Integration

M. Tähtinen, L. Kannari, R. Weiss, H. Mikkonen (VTT, Finland)

The Role of Concentrating Solar Power in Integrating Solar and Wind Energy

P. Denholm, M. Mehos (NREL, USA)

Feasibility of Concentrated Solar Power (CSP) Integration with Coal and Biomass Co-fired Power Plant – Prospects in Different Operation Environments

E. Tsupari, J. Kärki, M. Tähtinen (VTT, Finland)

A PV and Concentrated Solar Power (CSP) Integration Study Experience in a Mediterranean Partner Country

K. Mentesidi, M. Aguado (CENER, Spain), K. Loudiyi, F. Z. Harmouch, K. Loudiyi (Al Akhawayn University, Morocco)

Session 3B: Discussion Session – PV and Ancillary Services

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14:00 – 16:00 / 10 November 2014 / Room ECC 3 / Session chair: Mahesh Morjaria (First Solar, USA)

Grid Support Services from Wind and Solar PV - REserviceS Project Technical Summary

M. Rekinger, I.-T. Theologitis (EPIA, Belgium), F. Van Hulle (XP Wind, Belgium), F. Chapalain (EDSO 4SG, Belgium), N. Cutululis (DTU, Denmark), H. Holttinen, J. Kiviluoma (VTT, Finland), L. M. Faiella (Fraunhofer IWES, Germany), I. Pineda (EWEA, Belgium)

Ancillary Services Study 2030: Security and Reliability of a Power Supply with a High Percentage of Renewable Energy

H. Seidl (Deutsche Energie-Agentur dena, Germany)

Ancillary Services with Regional Renewable Generation and Battery Storage Controlled by Virtual Power Plant

J. Fischer, T. Buschmann, U. Focken, M. Lange (energy & meteo systems, Germany)

Distributed Solar Battery Systems Providing Primary Control Reserve

R. Hollinger, M. Llerena Engesser, L. M. Diazgranados, T. Erge, G. Bopp (Fraunhofer ISE, Germany)

Session 4A: Solar Grid Integration Studies

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16:30 – 18:45 / 10 November 2014 / Room ECC 2 / Session chair: TBA

Large Scale Integration of Solar PV: Fast and Easy Method for Assessing Scenarios and Grid Implications on a National Level

R. van Gerwen, W. van der Veen (DNV GL, the Netherlands)

Theoretical Analysis of the Flexibility Assessment Method Developed by IEA and Guidelines for its Deployment

P. Sawant, F. Usmanov (IBH Engineering, Germany)

Modelling and Analysis of Large Scale Solar Energy Integration in the Moroccan Power System

H. G. Svendsen, O. C. Spro, O. Alstad (SINTEF Energy Research, Norway), K. Loudiyi, A. S. Sennou (Al Akhawayn University, Morocco)

The Solar Power Absorption Capacity of the Seychelles Island Systems

T. Brown, N. Martensen, T. Ackermann (Energynautics, Germany)

The Impact of Improved Solar Forecasts on Bulk Power System Operations in ISO-NE

C. Brancucci Martínez-Anido, A. Florita, B.-M. Hodge (NREL, USA)

Study on the Methods to Suppress the Frequency and Tie-line Power Flow Fluctuation Due to High Penetration of Photovoltaic Generation Using the Existing Thermal Generators

Y. Tsujii, T. Tsuji, T. Oyama (Yokohama National University, Japan), K. Furuta, S. C. Verma (Chubu Electric Power, Japan)

Session 4B: PV and Distribution Networks

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16:30 – 18:45 / 10 November 2014 / Room ECC 3 / Session chair: TBA

A Proposal for New Requirements for the Fault Behaviour of Distributed Generation Connected to Low Voltage Networks

E. van Ruitenbeek, J. C. Boemer, K. Skaloumpakas, J. L. Rueda Torres (Delft University of Technology, the Netherlands), M. Gibescu (Eindhoven University of Technology, the Netherlands), M. van der Meijden (Delft University of Technology, the Netherlands)

Integration of Renewable Energy Resources and Technical Requirements in European Distribution Networks

T. García-Sánchez, E. Gómez-Lázaro (University of Castilla-La Mancha, Spain), A. Gomes (University of Coimbra, Portugal), A. Molina-García (Polytechnical University of Cartagena, Spain)

Innovative Solutions for the Grid Integration of Renewable Energies – Applications for Voltage Control and Reactive Power Compensation in PV Power Plants

T. Smolka, T. Funk, T. Schlegel, M. Sojer (Maschinenfabrik Reinhausen, Germany), J. Langstädter, J. Döll, M. Brennecke (FGH, Germany)

Optimal Coordination of Q(V) Characteristics for PV Systems in Distribution Grids

A. Samadi, L. Söder (KTH Royal Institute of Technology, Sweden)

Systematic Parameterization of Voltage Control Droops Implemented in Photovoltaic Plants

Y. T. Fawzy, D. Mende (SMA Solar Technology, Germany), C. Dierckxsens (3E, Belgium), B. Bletterie (AIT Austrian Institute of Technology, Austria)

High Penetration PV in Local Distribution Grids – Outcomes of the IEA PVPS Task 14 Subtask 2

T. Stetz, M. Kraiczy, K. Diwold (Fraunhofer IWES, Germany), M. Braun (Fraunhofer IWES, Germany/ Basler&Hofmann, Switzerland), B. Bletterie, C. Mayr, R. Bründlinger (AIT Austrian Institute of Technology, Austria), B. Noone, A. Bruce, I. MacGill (University of New South Wales, Australia), B. Mather (NREL, USA), K. Ogimoto (University of Tokyo, Japan), K. Washihara (NEDO, Japan), Y. Ueda (Tokyo Institute of Technology, Japan), A. Iaria, A. Gatti, D. Cirio (RSE, Italy), M. Rekinger, I. Theologitis (EPIA, Belgium), K. De Brabandere (3E, Belgium), S. Tselepis (CRES, Greece), C. Bucher (Basler&Hofmann, Switzerland), W. Yibo (Chinese Academy of Science, China)

Session 5A: Inverter Modelling

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08:00 – 10:00 / 11 November 2014 / Room ECC 2 / Session chair: Nis Martensen
(Energynautics, Germany)

Phasor Domain Modelling of Full Scale Frequency Converters for Protection Studies

I. Kocar, T. Kauffmann, U. Karaagac, J. Mahseredjian (Polytechnical School Montréal, Canada), E. Farantatos (EPRI, USA)

Power Control Flexibilities for Grid-Connected Multi-Functional Photovoltaic Inverters

Y. Yang, F. Blaabjerg, H. Wang (Aalborg University, Denmark), M. Godoy Simões (Colorado School of Mines, USA)

Harnessing PV Inverter Controls for Increased Hosting Capacities of Smart Low Voltage Grids

C. Winter, M. Heidl (Fronius International, Austria), R. Schwalbe (AIT Austrian Institute of Technology, Austria), W. Prüggl (Vienna University of Technology, Austria)

Determination of Advanced Inverter Settings to Improve Distribution System Performance

M. Rylander, J. Smith, H. Li (EPRI, USA)

Smart Inverter Operation for Solving Voltage Regulation Problems in Distribution Systems

E. Ghiani, F. Pilo (University of Cagliari, Italy), A. Rossi (ABB Solar, Italy)

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08:00 – 10:00 / 11 November 2014 / Room ECC 3 / Session chair: Paul Denholm (NREL, USA)

Transient Battery Storage at Low Short Circuit Ratio (SCR)

W. Kuehn, D. Mueller (Frankfurt University of Applied Sciences, Germany)

Potential for Balancing Wind and Solar Power Using Heat Pump Heating and Cooling Systems

D. Fischer (Fraunhofer ISE, Germany/KTH Royal Institute of Technology, Sweden), K. B. Lindberg (NTNU, Norway), S. Mueller, E. Wiemken, B. Wille-Haussmann (Fraunhofer ISE, Germany)

A Hierarchical Coordination Control of Multiple Energy Storage in Distribution Network

D. Liang (DNV GL, Singapore), L. Wang, N. Wade, P. Taylor (Newcastle University, United Kingdom), E. de Jong (DNV GL, the Netherlands), A. Crossland (Durham University, United Kingdom)

Simulation of a Sustainable Energy System in Grafing (Munich Region)

S. Bschorer, F. Samweber (Research Center for Energy Economics, Germany)

Scientific Measuring and Evaluation Program for Photovoltaic Battery Systems (WMEP PV-Speicher)

K.-P. Kairies, D. Magnor, D. U. Sauer (RWTH Aachen, Germany)

Maximizing the Benefits of Li-ion Systems for PV Hybrid Microgrids Thanks to Field Experience and Modelling Expertise

F. Ridou (Saft Batterien, Germany)

Session 5C: Solar Monitoring and Prediction

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08:00 – 10:00 / 11 November 2014 / Room ECC 1 / Session chair: TBA

Advanced Cloud Simulations for Improved Solar Power Forecasts in Germany

K. Rogers (DNV GL, United Kingdom), J. Schipper (DNV GL, Germany)

An Overview of Remote Monitoring PV Systems: Acquisition, Storages, Processing and Publication of Real-Time Data Based on Cloud Computing

S. Manzano, R. Peña-Ortiz, D. Guevara, A. Ríos (Technical University of Ambato)

A Proposed Grid-connection Monitor and Control Solution for Photovoltaic Power Stations

P. Gao, X. Zhao, D. Wu (NR Electric, China)

Approaches and Results to Improve Solar Power Predictions in Difficult Meteorological Situations

H. Wiebe, J. Schmelter, U. Focken, M. Lange (energy & meteo systems, Germany)

Solar Power Forecasting for Smart Grids Considering ICT Constraints

R. Bessa (INESC TEC, Portugal)

Solar Forecast Improvement Project: A Public-Private Collaboration

M. Marquis, S. Benjamin, E. James, J. Olson (NOAA National Oceanic and Atmospheric Administration, USA), A. Heidinger (NOAA NESDIS, USA), C. Molling (University of Wisconsin, USA), J. Michalsky, K. Lantz (NOAA National Oceanic and Atmospheric Administration, USA), V. Banunarayanan (Department of Energy, USA), S. Haupt (National Center for Atmospheric Research, USA), H. Hamann (IBM Research, USA)

Session 6A: Solar Power and Power System Modelling

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10:30 – 12:15 / 11 November 2014 / Room ECC 2 / Session chair: Bernd Weise (DlgsILENT, Germany)

Integration of Future Solar Photovoltaic Generation in Garmisch-Partenkirchen

C. S. Arnemo (NTNU, Norway), E.-M. Bärthlein, M. Hartung (GE Global Research, Germany), T. Toftevaag (NTNU, Norway)

Modular Verification of Grid Code Compliance (GCC-Services)

T. Gehlhaar (DNV GL, Germany), P. Gardner (DNV GL, United Kingdom)

Dynamic Modelling Platform for Integrated Power Plants

M. Jegoroff, M. Tähtinen, H. Mikkonen, T. Leino (VTT, Finland)

Modelling Active and Reactive Power of PV-Systems as Input for State Estimation

W. Biener, S. Killinger, B. Wille-Haussmann, C. Wittwer (Fraunhofer ISE, Germany)

Session 6B: Grid Integration Aspects

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10:30 – 12:15 / 11 November 2014 / Room ECC 3 / Session chair: Nickie Menemenlis (IREQ / Hydro-Québec, Canada)

Fluctuations in Large-Scale Photovoltaic and Wind Power Feed-In

G. Lohmann, J. Kühnert, E. Lorenz, A. Hammer, D. Heinemann (University of Oldenburg, Germany)

Voltage Fluctuation Analysis in Distribution Systems with PVs Considering Smoothing Effect and Tap Control

Y. Hakuto, T. Tsuji, T. Oyama, (Yokohama National University, Japan), Y. Matsuura, K. Abe, M. Minami (Kansai Electric Power, Japan), K. Aiba, K. Mori, K. Ishibashi (Tokyo Electric Power, Japan)

Incorporating Multiple Uncertainties into Iterative Probabilistic Load Flow

K. Dallmer-Zerbe, B. Wille-Haussmann, C. Wittwer (Fraunhofer ISE, Germany)

Predictive Control System for Charging Electric Vehicles Based on Radio Ripple Control integrating Renewable Energie

A. Arnoldt, S. Ritter, O. Warweg, (Fraunhofer IOSB-AST, Germany)

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10:30 – 12:15 / 11 November 2014 / Room ECC 1 / Session chair: Manoël Rekinger (EPIA, Belgium)

Integration of PV Power and Load Forecasts into the Operation of Residential PV Battery Systems

J. Weniger, J. Bergner, V. Quaschning (HTW Berlin University of Applied Sciences, Germany)

Electrical Model Parameter Characterization for Short-term Solar Power Forecasting

J. Sumaili, R. J. Bessa, D. F. Rahman (INESC TEC, Portugal), R. Tomé, J. Sousa (Prewind, Portugal)

Random Forest Prediction in Solar Radiation Forecasting Schemes Applied to Handling Ramps and Large Forecast Errors

M. Kratzenberg, H. H. Zürn (Federal University of Santa Caterina, Brazil), P. P. Revheim, H. G. Beyer (University of Agder, Norway)

Modelling and Simulation of Utility-scale PV Plants under Partial Shading Conditions

L. F. Dominguez (ABB Corporate Research, Switzerland)

Session 7: Closing Session - Podiums Discussions

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12:20 – 13:00 / 11 November 2014 / Room ECC 1

Podium discussions

The contributions and discussions of this session are not part of the proceedings.

Poster Session Papers

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Workshop Participants

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