



## SOLAR PROGRAM

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## TIMETABLE SOLAR INTEGRATION WORKSHOP

Monday, 19 October 2015			Tuesday, 20 October 2015		
Solar Workshop Day 1			Solar Workshop Day 2		
08:00 – 09:00	Foyer		08:30 – 09:50	Room Galaxy 1	Room Galaxy 2
	Registration			SESSION 5a: Stability Analysis	SESSION 5b: Power System Flexibility Aspects
Coffee Break (20min)			Coffee Break (20min)		
09:00 – 10:50	Room Galaxy 1 + 2		10:10 – 11:25	Room Galaxy 1	Room Galaxy 2
	WELCOME & SESSION 1: Keynote Session			SESSION 6a: Grid Code Aspects	SESSION 6b: Economic and Environmental Aspects
Coffee Break (30min)			Break (5min)		
11:20 – 13:00	Room Galaxy 1	Room Galaxy 2	11:30 – 12:15	Room Galaxy 1 + 2	
	SESSION 2a: Large-Scale Integration of Solar Power	SESSION 2b: PV and Distribution Networks		SESSION 7: Closing Session – Podium Discussion	
Lunch (1h)			Lunch (1h)		
14:00 – 15:40	Room Galaxy 1	Room Galaxy 2	13:00 – 15:10	Room Galaxy 1 – 3	
	SESSION 3a: Solar Power Plant Issues	SESSION 3b: Forecasting Issues		WELCOME & SESSION 1: Keynote Session  14 <sup>th</sup> Wind Integration Workshop	
Coffee Break (20min)			Coffee Break (20min)		
16:00 – 18:00	Room Galaxy 1	Room Galaxy 2			
	SESSION 4a: Solar Integration Studies	SESSION 4b: Solar Forecasting			
19:30	Solar Dinner Restaurant Cook & Book				

## MONDAY, 19 OCTOBER 2015

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08:00 – 09:00 Registration

09:00 – 09:10 Opening: Welcome and Introduction, Thomas Ackermann (Energynautics, Germany)

09:10 – 10:50	<b>SESSION 1 – KEYNOTE SESSION: LARGE-SCALE SOLAR POWER IN THE EUROPEAN POWER SYSTEM</b>
> Session Chair	Thomas Ackermann (Energynautics, Germany)
09:10 – 10:30	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"><li>• <b>Equipping the Power System for Tomorrow</b> J. Watson (SolarPower Europe, Belgium)</li><li>• <b>Integrating Solar: a TSO's Lessons Learned</b> Patrick Laureys (Elia, Belgium)</li><li>• <b>Solar Eclipse: a Stress Test for Europe's Power Grid</b> Part I: C. Castel Conesa (ENTSO-E, Belgium) Part II: T. Döring (SolarPower Europe, Belgium) et. al.</li><li>• <b>Challenges, Quantification and Outlook of PV Integration in the Power System: a Review by the European PV Technology Platform</b> Pierre-Jean Alet (CSEM, Switzerland) et. al.</li></ul>
10:30 – 10:50	<b>Discussions</b>

10:50 – 11:20 Coffee Break

11:20 – 13:00	<b>SESSION 2A: LARGE-SCALE INTEGRATION OF SOLAR POWER</b>
> Session Chair	Pierre-Jean Alet (CSEM, Switzerland)
11:20 – 12:40	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"><li>• <b>Reaching New Solar Heights - Mitigating the Duck Curve in California</b> D. Lew, M. Schroder, N. Miller, M. Lecar (GE Energy Consulting, USA) (SIW15-62)</li><li>• <b>Application of Grid Studies for the Secure and Optimal Utilisation of Variable Renewables in Islands – Study Case in Samoa</b> J. Gómez, F. Fernández (DlGSILENT, Germany), F. Gafaro (IRENA, Germany), F. Perelini (EPC – Electric Power Corporation, Samoa) (SIW15-170)</li><li>• <b>Operational Impacts of Operating Reserve Demand Curves on Production Cost and Reliability</b> I.Krad, E. Ibanez (NREL, USA), E. Ela (EPRI, USA), W. Gao (University of Denver, USA) (SIW15-178)</li><li>• <b>Impact of High Levels of Solar Generation on Steady State and Dynamic Behavior of the Transmission System: Case Studies and Lessons Learned</b> V. Singhvi, P. Pourbeik, J. C. Boemer, A. Tuohy (EPRI, USA) (SIW15-24)</li></ul>
12:40 – 13:00	<b>Discussions</b>

**11:20 – 13:00**      **SESSION 2B: PV AND DISTRIBUTION NETWORKS**  
 > Session Chair      **Nis Martensen (Energynautics, Germany)**

<b>11:20 – 12:40</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Impact of a 100 % Renewables Strategy on a Distribution Grid in Rhineland-Palatinate</b> L. Wagner, E. Tröster (Energynautics, Germany), J. Krämer, B. Betz (EWR Netz, Germany) (SIW15-197)</li> <li>• <b>Testing the Enhanced Functionalities of Commercial PV Inverters Under Realistic Atmospheric and Abnormal Grid Conditions</b> R. López-Erauskin, T. Geury, A. González, J. Gyselinck (Université Libre de Bruxelles, Belgium), M. E. Hervás, A. Fabre (GreenWatch, Belgium) (SIW15-91)</li> <li>• <b>Effectiveness Evaluation of TVR and Reactive Power Compensation in Japanese Distribution Systems with a Large Number of Photovoltaics</b> A. Moriwaki, T. Tsuji, T. Oyama (Yokohama National University, Japan), S. Uemura (Electric Power Industry, Japan) (SIW15-146)</li> <li>• <b>Clustering of Photovoltaic Generation for the Consideration of Time Changing Geographical Correlation in Probabilistic Analysis of Low Voltage Distribution Systems</b> F. Vallée, F. Moutier, V. Klonari, J.-F. Toubeau, Z. De Grève, J. Lobry, F. Lecron (University of Mons, Belgium) (SIW15-28)</li> </ul>
<b>12:40 – 13:00</b>	<b>Discussions</b>

**13:00 – 14:00**      **Lunch**

**14:00 – 15:40**      **SESSION 3A: SOLAR POWER PLANT ISSUES**  
 > Session Chair      **J. Charles Smith (UVIG, USA)**

<b>14:00 – 15:20</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Comparative Analysis of Various Configurations for Large PV Power Plants</b> M. de Prada Gil, J. L. Domínguez-García, L. Trilla, O. Gomis-Bellmunt (IREC — Catalonia Institute for Energy Research, Spain), V. Aga, F. Miquel, M. Shafiee-Khoor (ALSTOM Renewable, Switzerland) (SIW15-84)</li> <li>• <b>Advanced Active Front-end Rectifier Control for Grid Emulator Application</b> A. González, Y. Mollet, T. Geury, R. López-Erauskin, J. Gyselinck (Université Libre de Bruxelles, Belgium) (SIW15-81)</li> <li>• <b>Proof of Evidence for Solar Plant: Design, Quality and System Operators' Acceptance</b> T. Gehlhaar, B. Hinzer (DNV GL - Energy, Germany), V. K. Vericherla (DNV GL - Energy, India), M.-K. Schwarz (DNV GL - Energy, Germany) (SIW15-37)</li> <li>• <b>Integrated Approach for Smart Grid Data Acquisition, Transmission and Evaluation</b> A. Schmutzer; J. Bogenrieder (Smart Grids — Bavarian Center for Applied Energy Research, Germany), G. Jung (University of Applied Sciences Hof, Germany), P. Luchscheider (Smart Grids — Bavarian Center for Applied Energy Research, Germany), S. Müller (University of Applied Sciences Hof, Germany), R. Schmidt, C. Stegner (Smart Grids — Bavarian Center for Applied Energy Research, Germany), S. Trampler (University of Applied Sciences Hof, Germany) (SIW15-137)</li> </ul>
<b>15:00 – 15:40</b>	<b>Discussions</b>

**14:00 – 15:40**      **SESSION 3B: FORECASTING ISSUES**  
> Session Chair      Bri-Mathias Hodge (NREL, USA)

- 14:00 – 15:20**      **Presentations (20 min. each)**
- **Solar Power Forecasting Trials and Trial Design: Experience from Texas**  
E. Lannoye, A. Tuohy (EPRI, USA), J. Sharp (Sharply Focused, USA), V. Von Schamm, W. Callender, L. Aguirre (CPS Energy, USA) (SIW15-35)
  - **Solar Forecasting Improvements for Numerical Weather Prediction of Coastal Stratocumulus Clouds in California**  
I. Lopez, P. Mathiesen, J. L. Bosch, H. Yang, X. Zhong, J. Kleissl, (University of California, San Diego, USA), R. Fovell (University of California, Los Angeles, USA) B. D’Agostino (San Diego Gas & Electric, USA) (SIW15-71)
  - **Design and Evaluation of the Distributed Solar Power Production Forecast Component of the Solar and Wind Integrated Forecast Tool (SWIFT)**  
J. Zack (AWS Truepower, USA), D. Nakafuji, A. Brightbill (Hawaiian Electric Company, USA) (SIW15-127)
  - **High Resolution Solar Resource Assessment with Sky Imager and Distribution System Simulations**  
A. Nguyen, P. Ubiratan, K. Murray, J. Kleissl (University of California San Diego, USA) (SIW15-67)

**15:20 – 15:40**      **Discussions**

**15:40 – 16:00**      **Coffee Break**

**16:00 – 18:00**      **SESSION 4A: SOLAR INTEGRATION STUDIES**  
> Session Chair      José Gómez (Digsilent, Germany)

- 16:00 – 17:40**      **Presentations (20 min. each)**
- **Analysis of Options for the Future Allocation of PV Farms in South Africa**  
M. Pöller, M. Obert (M.P.E., Germany), G. Moodley (DigSILENT Buyisa, South Africa) (SIW15-122)
  - **A Study on Fluctuation Characteristics of Future Residual Load in Eastern Japan after High-Penetration Wind and Photovoltaic Power Generation**  
T. Kato, Y. Manabe, T. Funabashi, M. Kurimoto, Y. Suzuoki (Nagoya University, Japan) (SIW15-173)
  - **Phasor Domain Modelling of Electronically Coupled Generators for System Protection Studies**  
E. Farantatos (EPRI, USA), T. Kauffmann, U. Karaagac, I. Kocar, J. Mahseredjian (Polytechnique Montréal, Canada) (SIW15-213)
  - **Using Solar Power to Increase Power System Efficiency**  
A. Pramono Jati, N. Martensen (Energynautics, Germany) (SIW15-214)
  - **Probabilistic Swinging Door Algorithm as Applied to Photovoltaic Power Ramping Event Detection**  
A. Florita, J. Zhang, C. Brancucci Martinez-Anido (NREL, USA), M. Cui (Wuhan University, China), B.-M. Hodge (NREL, USA) (SIW15-57)

**17:40 – 18:00**      **Discussions**

<b>16:00 – 18:00</b>	<b>SESSION 4B: SOLAR FORECASTING</b>
> <b>Session Chair</b>	<b>Jan Kleissl (University of California, San Diego, USA)</b>
<b>16:00 – 17:45</b>	<b>Presentations (15 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Ensemble Solar Forecasting Statistical Quantification and Sensitivity Analysis</b> W.-Y. Cheung, J. Zhang, A. Florita, B.-M. Hodge (NREL, USA), S. Lu, H. F. Hamann (IBM TJ Watson Research Center, USA), Q. Sun, B. Lehman (Northeastern University, USA) (SIW15-53)</li> <li>• <b>The Benefits of Intraday Solar Irradiance Forecasting to Adjust the Day-ahead Scheduled PV Power</b> S. Cros, E. Buessler, L. Huet, N. Sébastien, N. Schmutz (Reuniwatt, France) (SIW15-113)</li> <li>• <b>Spatio-Temporal Models for Photovoltaic Power Short-term Forecasting</b> X. Ghislain Agoua, R. Girard, G. Kariniotakis (MINES ParisTech, France) (SIW15-201)</li> <li>• <b>Influence of the Quality of Irradiance Forecasts to the Performance of Forecast Based Control of Grid-connected PV-systems with Storage</b> H. G. Beyer (University of Agder, Norway), A. G. Imenes (Teknova, Norway) (SIW15-85)</li> <li>• <b>Methodology to Stochastically Generate Spatially Relevant 1-Minute Resolution Irradiance Time Series from Mean Hourly Weather Data</b> J. Bright, P. Taylor, R. Crook (University of Leeds, United Kingdom) (SIW15-94)</li> <li>• <b>An Insolation Forecasting Method by Taguchi's T method</b> S. Negishi, S. Takayama, A. Ishigame (Osaka Prefecture University, Japan) (SIW15-46)</li> <li>• <b>Prediction of Solar Power by Using the Extinction Coefficient</b> I. Mathiasson, O. Carlson (Chalmers University of Technology, Sweden) (SIW15-73)</li> </ul>
<b>17:45 – 18:00</b>	<b>Discussions</b>
<b>19:30 – 23:00</b>	<b>Solar Dinner</b>

<b>08:30 – 09:50</b>	<b>SESSION 5A: STABILITY ANALYSIS</b>
> Session Chair	Debra Lew (GE Energy, USA)
<b>08:30 – 09:30</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Transient Analysis in Distribution System with FACTS and Photovoltaic Generation Units</b> Y. Dou, T. Tsuji, T. Oyama (Yokohama National University, Japan) (SIW15-148)</li> <li>• <b>Speedup of Parallel Computing by Parareal Method in Transient Stability Analysis of Japanese Power System with Photovoltaics</b> T. Sekine, T. Tsuji, T. Oyama (Yokohama National University, Japan), F. Magoulès (Ecole Centrale Paris, France), K. Uchida (Waseda University, Japan) (SIW15-147)</li> <li>• <b>A Reactive Power Control Strategy for Preventing Voltage Collapse for Malaysian Power Network with Multiple Photovoltaic Plants</b> N. B. Salim (Yokohama National University, Japan   Technical University Malaysia Melaka, Malaysia), T. Tsuji, T. Oyama, A. Koide, S. Yamashita (Yokohama National University, Japan), K. Uchida (Waseda University, Japan) (SIW15-79)</li> </ul>
<b>09:30 – 09:50</b>	<b>Discussions</b>

<b>08:30 – 09:50</b>	<b>SESSION 5B: POWER SYSTEM FLEXIBILITY ASPECTS</b>
> Session Chair	Eckard Tröster (Energynautics, Germany)
<b>08:30 – 09:30</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Importance of Demand Side Flexibility and Management for Large-Scale Variable PV Integration in Urban Environment</b> J. Salpakari, J. Mikkola, P. Lund (Aalto University, Finland) (SIW15-160)</li> <li>• <b>Energy Management System for a Photovoltaic System With Battery Storage Participating in Grid Voltage Quality Improvement</b> I. Ranaweera, O.-M. Midtgård (Norwegian University of Science and Technology, Norway) (SIW15-54)</li> <li>• <b>Influences of Time Resolution and Recording Period of Energy Consumption on the Assessment of Photovoltaic Battery Systems</b> M. Hinterstocker, S. von Roon (Research Center for Energy Economics, Germany), D. Berner, C. Bruce-Boye (University of Applied Sciences Lübeck, Germany) (SIW15-123)</li> </ul>
<b>09:30 – 09:50</b>	<b>Discussions</b>

**09:50 – 10:10**      **Coffee Break**

<b>10:10 – 11:25</b>	<b>SESSION 6A: GRID CODE ASPECTS</b>
> Session Chair	Nickie Menemenlis (Hydro-Québec/IREQ, Canada)
<b>10:10 – 11:10</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>Recommendation for the Behaviour of PV-Systems during Grid Disturbances Depending on their PCC</b> S. Laudahn, B. Engel (TU Braunschweig, Germany, Germany), T. Bülo, V. Sakschewski, G. Bettenwort, H. Knopf (SMA Solar Technology, Germany) (SIW15-104)</li> <li>• <b>Impact of Fault-ride through Capabilities of Inverter-based Distributed PV on Voltage and Frequency Performance of the Bulk System</b> V. Singhvi, J. C. Boemer, P. Pourbeik, A. Tuohy (EPRI, USA) (SIW15-23)</li> <li>• <b>An Alternative Identification of RMS-Voltage Trajectories based on Real Voltage Dips — Comparison with Grid-Code Requirements</b> T. García-Sánchez, E. Gómez-Lázaro (University of Castilla La Mancha, Spain), A. Molina-Garcia (Polytechnical University of Cartagena, Spain) (SIW15-118)</li> </ul>
<b>11:10 – 11:25</b>	<b>Discussions</b>

<b>10:10 – 11:25</b>	<b>SESSION 6B: FORECASTING AND ECONOMIC ASPECTS</b>
> Session Chair	Eamonn Lannoye (EPRI International, Ireland)
<b>10:10 – 11:10</b>	<b>Presentations (20 min. each)</b>
	<ul style="list-style-type: none"> <li>• <b>CO<sub>2</sub> Emission Savings Resulting from Smart Control of Photovoltaics and Heat Pumps in Residential Dwellings and Office Spaces in Belgium</b> P. Van Dievel, K. De Vos, R. Belmans (KU Leuven, Belgium) (SIW15-151)</li> <li>• <b>A Road Map to PV Integration Using Economic Complexity Principles</b> I. R. Smith, S. McMillan (SM Solar &amp; Wind Energy Systems, Trinidad and Tobago) (SIW15-177)</li> <li>• <b>Advanced Cloud Simulations for Improved Dayahead Solar Power Forecasts</b> J. Schipper, P. Mathiesen (DNV GL - Energy, Germany) (SIW15-41)</li> </ul>
<b>11:10 – 11:25</b>	<b>Discussions</b>

**11:25 – 11:30**      **Short Break**

<b>11:30 – 12:15</b>	<b>SESSION 7 – PODIUMS DISCUSSION</b>
> Session Chair	Thomas Ackermann (Energynautics, Germany)
<b>11:30 – 12:00</b>	<p>Participants:</p> <p>J. C. Smith (UVIG, USA)</p> <p>Y. Yasuda (Kansai University, Japan)</p> <p>M. Manchen (NamPower, Namibia)</p> <p>TBA (Morocco)</p>
<b>12:00 – 12:15</b>	<b>Discussion &amp; Closing Remarks</b>

**12:15**              **Lunch**



## SOLAR POSTER PRESENTATIONS

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- **Probability Characteristic Fitting for Photovoltaic Output Forecasting Errors and Correlations amongst Different Photovoltaic Power Stations**

Y. Yuan, J. Bao (Hohai University, China), X. Zhang (Nantong University, China), J. Zhou, Q. Yang (Hohai University, China)  
(SIW15-63)