

1st INTERNATIONAL CONFERENCE ON

Large-Scale Grid Integration of Renewable Energy in India

6 - 8 September 2017

 New Delhi, India

ENDORSED BY:



GOVERNMENT OF INDIA
MINISTRY OF NEW
AND RENEWABLE ENERGY



GOVERNMENT OF INDIA
MINISTRY OF POWER



CONFERENCE PROGRAM

WEDNESDAY, 06 SEPTEMBER 2017		THURSDAY, 07 SEPTEMBER 2017			FRIDAY, 08 SEPTEMBER 2017				
Conference Day 1		Conference Day 2			Conference Day 3				
8:30 – 09:30	Foyer	9:00 – 11:00	TANGO 1	TANGO 2	TANGO 3	9:00–11:00	TANGO 1	TANGO 2	TANGO 3
	Registration process		Session 5A: Storage Issues	Session 5B: Long Term Scenario Planning	Session 5C: Power System Aspects		9A: Open Source Evaluation Tools	Session 9B: Demand Side Management	9C: Ancillary Services with VRE
09:30 – 11:25	TANGO Hall	COFFEE BREAK (15MIN)			COFFEE BREAK (15MIN)				
	SESSION 1: GRID INTEGRATION OF RE – CHALLENGES, ROADMAP AND PROGRESS	11:15 – 13:15	TANGO 1	TANGO 2	TANGO 3	11:15 – 13:15	TANGO 1	TANGO 2	TANGO 3
11:25 – 11:45 Tea/coffee Break	6A: System Balancing & Imbalance Handling		Session 6B: Forecasting Methods and Applications - I	Session 6C: Grid Integration Experience and Tools	Session 10A: Grid Codes		Session 10B: Smart Grid and VPPs	Session 10C: Dynamic System Modelling	
11:45 – 13:20	TANGO Hall	LUNCH 13:15 – 14:00			LUNCH 13:15 – 14:00				
	SESSION 2: POLICY, MARKET AND REGULATORY INTERVENTIONS	14:00 – 15:55	TANGO 1	TANGO 2	TANGO 3	14:00 – 16:00	TANGO 1	TANGO 2	TANGO 3
13:20 – 14:15 Lunch Break	7A: Flexibility of Power Generation & Storage		Session 7B: Forecasting Methods and Applications - II	Session 7C: Regulatory Issues	Session 11A: Grid Code Certification		Session 11B: Hybrid Systems	Session 11C: Wind /PV System Modelling	
14:15 – 16:10	TANGO Hall	COFFEE BREAK (15MIN)			COFFEE BREAK (20MIN)				
	SESSION 3: TECHNICAL PERSPECTIVE IN SYSTEM OPERATION: INTERNATIONAL EXPERIENCE	16:10 – 18:00	TANGO 1	TANGO 2	TANGO 3	16:20 – 17:20	TANGO Hall		
16:10 – 16:30 Tea / Coffee Break	Session 8A: VRE in Distribution Networks		Session 8B: Short Term Economic Modelling	8C: Markets & Ancillary Services	Session 12: Closing Session – Panel Discussion				
16:30 – 17:45	TANGO Hall	18:00 – 19:00 POSTER SESSION							
	SESSION 4: PANEL DISCUSSION / DAY'S ROUNDUP								

WEDNESDAY, 06 SEPTEMBER 2017

08:30 – 09:30 Registration Process & Coffee

09:30 – 11:25 SESSION 1: GRID INTEGRATION OF RE – CHALLENGES, ROADMAP AND WAY FORWARD	
09:30 – 09:50	Welcome Address Dr. Martin Ney (German Ambassador to India) & Mark A. White (Minister Counsellor & Mission Director USAID/India)
09:50 – 10:20	Theme Presentation – Context Setting on International Experience: Thomas Ackermann (CEO, Energynautics, Germany)
10:20 – 10:50	Context Setting on Indian Experience: Pankaj Batra (Member, CEA, India)
10:50 – 11:30	Panel Discussion on RE Grid Integration related Challenges for India and Progress so Far Moderator: Winfried Damm, GIZ R K Verma (Chairperson, CEA) M. Saikumar (CMD, TANGEDCO, India) K. V. S. Baba (CEO, POSOCO) S. K. Chatterjee (JC, CERC, India)

11:30 - 11:45 Tea/coffee Break

11:45 – 13:20 SESSION 2: POLICY, MARKET AND REGULATORY INTERVENTIONS	
> Session Chair	S K Chatterjee (Joint Chief (RA) CERC, India)
11:45 – 13:00	Presentations (25 min. each)
11:45 – 12:10	<ul style="list-style-type: none">RE Grid Integration: International Perspective S. Müller (IEA, France)
12:10 – 12:35	<ul style="list-style-type: none">India Renewable Energy Grid Integration Study J. Cochran (NREL, USA)
12:35 – 13:00	<ul style="list-style-type: none">Regulatory Dimensions to Renewable Energy Integration in India: A US Perspective L. Alagappan (Ethree, USA)
13:00 – 13:20	QUESTIONS FROM THE AUDIENCE TO THE PANEL

13:20 – 14:15 Lunch Break

14:15 – 16:10	SESSION 3: TECHNICAL PERSPECTIVE IN SYSTEM OPERATION: INTERNATIONAL EXPERIENCE
> Session Chair	S K Soonee (Advisor POSOCO, India)
14:15 – 15:55	Presentations (25 min. each)
14:15 – 14:40	<ul style="list-style-type: none"> Challenges and Solutions for System Operations with high share of RE– Chile Experience Ernesto Huber (Chile TSO)
14:40 – 15:05	<ul style="list-style-type: none"> Challenges and Solutions for System Operations with high share of RE – ERCOT (Texas) Sandip Sharma (ERCOT, US-TSO, USA)
15:05 – 15:30	<ul style="list-style-type: none"> Challenges and Solutions for Transmission System Operations with high share of RE – German Experience Johannes Henkel, (50 Hertz, Germany)
15:30 – 15:55	<ul style="list-style-type: none"> Integrating the Distributed RE Generation: A Case for Rooftop Solar Integration in German Distribution System Clemens Hoffmann (Fraunhofer IWES, Germany)
15:55 – 16:10	<ul style="list-style-type: none"> Questions from the audience to the panel

16:10 – 16:30 Tea/Coffee Break

16:30 – 17:45	SESSION 4: PANEL DISCUSSION / DAY'S ROUNDUP
16:30 – 17:30	<ul style="list-style-type: none"> Discussion Session: Lessons Learnt and way forward Moderator- Mr. Michael Satin, USAID <ol style="list-style-type: none"> S K Soonee (Advisor, POSOCO, India) Simon Müller (IEA, France) Jaquelin Cochran (NREL, USA) Markus Wypior (GIZ, India/Germany) Gurdeep Singh (CMD, NTPC, India) Clemens Hoffmann (Fraunhofer IWES, Germany)
17:30 – 17:45	<ul style="list-style-type: none"> Day's roundup and Schedule for Day 2 Thomas Ackermann (CEO Energynautics, Germany)

THURSDAY, 07 SEPTEMBER 2017

09:00 – 11:00	SESSION 5A: STORAGE
> Session Chair	P.C. Pant (MNRE, India) // D. Heinemann (University of Oldenburg, Germany)
09:00 – 10:40	Presentations (25 min. each)
	<ul style="list-style-type: none">• Large Scale Battery Storage for Grid Stability / Backup V.S. Sharma, A. Kumar V (Steag Energy Services, India) (Submission-ID 16)• Battery Energy Storage System Addressing the Power Quality Issue in Grid Connected Wind Energy Conversion System P. Sivaraman (TECh Engineering Services, India), C. Sharmeela (Anna University Chennai, India) (Submission-ID 68)• Peak Power Shaving Using Vanadium Redox Flow Battery for Large-Scale Grid Connected Solar PV Power System A. Bhattacharjee, T. Sarkar, H. Saha (Indian Institute of Engineering Science and Technology, India) (Submission-ID 32)• Valuation of Utility-Scale Energy Storage in Production Cost Models D. Palchak (NREL, USA)
10:40 – 11:00	Discussions

09:00 – 11:00	SESSION 5B: LONG TERM ENERGY SCENARIO PLANNING
> Session Chair	M. Kumar Upadhyay (NITI Aayog, India) // T. Ackermann (Energynautics, Germany)
09:00 – 10:20	Presentations (20 min. each)
	<ul style="list-style-type: none">• Is Long-Term Planning Socialism? C. Hoffmann (Fraunhofer IWES, Germany)• Purpose, Aim and Status of European Ten Year Network Development Plan (TYNDP) in Providing a Foundation Stone for Market Developments which Facilitate High Penetration of Renewables H. Urdal (ENTSO-E, Belgium)• Net Load Ramping Requirements of Southern Region by 2022 A Janardhan, KBV Ramkumar, V. Suresh , G. Anbunesan (POSOCO, India) (Submission-ID 108)• Long-Term Renewable Energy Integration Planning in India: Challenges and Opportunities P. Das, J. Mathur, R. Bhakar (Malaviya National Institute of Technology Jaipur, India), A. Kanudia (KanORS-EMR, NSEZ, India) (Submission-ID 180)
10:20 – 11:00	Discussion

09:00 – 11:00	SESSION 5C: POWER SYSTEM ASPECTS WITH VRE
> Session Chair	A. Axilium Jayamary (TANTRANSCO, India) // D. Manjuré (MISO, USA)
09:00 – 10:48	Presentations (18 min. each)
	<ul style="list-style-type: none"> • Impact of Renewable Energy Sources on Indian Electricity Grid J. Bandyopadhyay, P. Gupta, P. E. Kamla, J. Kapoor (Central Electricity Authority, India) (Submission-ID 19) • Future Challenges in Indian Power Sector Including the Remedial Actions A. Anand, A. Toppo, J. Bandyopadhyay (Central Electricity Authority, India) (Submission-ID 43) • Modelling Transitions to Robust High-VRE Systems C. Silvester, C. Bates, A. Chohan (Uniper, United Kingdom) (Submission-ID 22) • Future Defence Plan Requirements with High Penetration of Renewable Generations K. Das, M. Altin, A. D. Hansen, P. Sørensen (DTU Wind Energy, Denmark) (Submission-ID 87) • HVDC Solutions for Integration of the Renewable Energy Resources M. Haeusler (Siemens, Germany), S. Biswas (Siemens, India) (Submission-ID 81) • An Overlay of MTDC Grid to Relief Congestion of Power System L. Dewangan, H. Bahirat (IIT Bombay, India) (Submission-ID 162)
10:48 – 11:00	Discussions

11:00 – 11:15 Tea/Coffee Break

11:15 – 13:15	SESSION 6A: POWER SYSTEM BALANCING & IMBALANCE HANDLING
> Session Chair	S K Soonee (POSOCO, India) // S. Sharma (ERCOT, USA)
11:15 – 12:15	Presentations: Power System Balancing (20 min. each)
	<ul style="list-style-type: none"> • Initiatives taken for Facilitating Large Scale Integration of Renewable Energy in India S. K. Soonee, K.V.S Baba, S. R. Narasimhan, S. S. Barpanda, S. C. Saxena, M. Joshi, KVN Pawan Kumar (POSOCO, India) (Submission-ID 195) • International Experience on Grid Integration of Large Amounts of Wind and Solar H. Holttinen (VTT, Finland; IEA WIND Task 25 Operating Agent) • Danish experience– How to reach > 40% Wind Energy Share A. Orths (Energinet.dk, Denmark)
12:15 – 12:55	Presentations: Imbalance Handling (20 min. each)
	<ul style="list-style-type: none"> • Power System Balancing Issues in India - Power Balancing Methods and Solutions B. B. Mehta, A. P. Shah, S. P. Nayak (State Load Despatch Centre, GETCO, India) (Submission-ID 119) • Imbalance Handling in Germany B. Ernst (Fraunhofer IWES, Germany)
12:55 – 13:15	Discussion

11:15 – 13:15	SESSION 6B: FORECASTING METHODS AND APPLICATIONS
> Session Chair	R. Katyal (NIWE, India) // D. Heinemann (University of Oldenburg, Germany)
11:15 – 11:55	Presentations: Forecasting Methods and Applications (20 min. each)
	<ul style="list-style-type: none"> IEA PVPS Task 16: Solar Resource for High Penetration and Large Scale Applications Jan Remund (IEA Coordinator Solar) Operational Wind & Solar Power Forecasting – The Perfect Wind Power Prediction Hans-Peter Waldl (Overspeed, Germany)
11:55 – 12:20	Discussion
12:20 – 13:05	Presentations (15 min. each):
	<ul style="list-style-type: none"> Recent Initiative of Solar and Wind Forecasting Using a High Resolution Cloud Resolving Model P. Mukhopadhyay, M. Deshpande, R. Kanase, M. Mukherjee, G. Mohan, M. Ganai (Indian Institute of Tropical Meteorology, India) (Submission-ID 63) Potential Applications of Short-Term Solar, Wind Generation Forecasts and Dynamic Line Rating in Indian Power System A. Roy (National Institute of Wind Energy, India), I. Mitra (GIZ, India) (Submission-ID 134) Importance of Numerical Weather Prediction in Variable Renewable Energy Forecast A. Basu (Integrated Research and Action for Development, India), A. Halder (Thinkthrough Consulting, India) (Submission-ID 164)
13:05 – 13:15	Discussion

11:15 – 13:15	SESSION 6C: GRID INTEGRATION EXPERIENCE AND TOOLS
> Session Chair	R.N. Nayak (ex PGCIL, India) // M. Braun (Fraunhofer IWES University of Kassel, Germany)
11:15 – 13:03	Presentations (18 min. each)
	<ul style="list-style-type: none"> International Experience of Grid Challenges Associated with High Penetrations of Renewable Generation A. Gooding, R. Taljaard, H. Bennett (Smarter Grid Solutions, United Kingdom), U. Rajarathnam (Enzen Global Solutions, India) (Submission-ID 148) Renewable Generation Hosting Capacity Screening Tool for a Transmission Network V. Singhvi, D. Ramasubramanian (Electric Power Research Institute [EPRI], USA) (Submission-ID 91) Journey of a Renewable MegaWatt – from an Interconnection Request to Real-time Market Dispatch D. Manjuré, M. McMullen (MISO Energy, USA) (Submission-ID 90) Role of FACTS Devices in 175 GW Large-Scale Renewable Energy Sources Integration into Indian Power Grid by 2022 P. Sivaraman (TECh Engineering Services, India), S. Selvakumar (ABB Global Industries, India) (Submission-ID 70) Large Scale Implementation of Control Switching Devices in Indian Power System – A Case Study N. S. Sodha (BIS, India) (Submission-ID 137) Renewable Integration and Primary Control Reserve Demand in the Indian Power System A. Kannan, W. Heckmann, D. Strauss-Mincu (Fraunhofer Institute for Wind Energy and Energy System Technology [IWES], Germany) (Submission-ID 26)
13:03 – 13:15	Discussions

13:15 – 14:00 Lunch Break

14:00 – 15:55	SESSION 7A: FLEXIBILITY AND CONTROL OF POWER GENERATION & STORAGE
> Session Chair	K. K. Sharma (NTPC, India) // K. Kappenberg (Energy Research Centre of Lower Saxony, Germany)
14:00 – 15:42	Presentations (17min. each)
	<ul style="list-style-type: none"> • A System-Wide Approach for the Integration of High Shares of Renewable Energy Sources with Particular Regard to Frequency Stabilisation E. Kunle (CUTEC Institute, Germany), C. Yilmaz, R. Simons, K. Kappenberg (Energy Research Centre of Lower Saxony – EFZN, Germany) (Submission-ID 99) • Advanced Power Plant Flexibility – Technical and Market Design Priorities S. Müller (IEA, France) • Flexible Operation – NTPC’s Approach A. Sinha (AGM, NTPC) • Flexibility and Control of Power Generation in Coal Plants: Solutions from the Dispatch Floor K. Parks (Xcel Energy, USA) • Smart Distribution Network Control with Coordinated Storage Infeed E. Tröster (Energynautics, Germany)
15:42 – 15:55	Discussion

14:00 – 15:55	SESSION 7B: FORECASTING METHODS AND APPLICATIONS -II
> Session Chair	P. Mukhopadhyay (IITM, India) // H. P. Waldl (Overspeed, Germany)
14:00 – 15:40	Presentations (25 min. each)
	<ul style="list-style-type: none"> • Introductory Keynote: ISRO’s activities related to renewable energy resource assessment and forecasting” R. Kumar (ISRO, India) • Short-Term Forecasting of Wind Power Plant Generation for System Stability and Provision of Ancillary Services H. Mackenzie (HARD software, Australia), J. Dyson (Greenview Strategic Consulting, Australia) (Submission-ID 53) • Multi Resolution Analysis based Adaptive Wavelet Neural Network Approach for Day-ahead Wind Speed Forecasting S. Madasthu, V. Chintham (National Institute of Technology Warangal, India) (Submission-ID 114) • ANN-Based Techniques for Prediction of Wind Speed of 67 Sites of India P. Arora, B.K. Panigrahi, H. Malik (Indian Institute of Technology Delhi, India) (Submission-ID 207)
15:40 – 15:55	Discussions

14:00 – 15:55	SESSION 7C: REGULATORY ISSUES
> Session Chair	R.V. Shahi (Former Secretary, MoP, India) (*tbc) // L. Alagappan (Ethree, USA)
14:00 – 15:40	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Regulatory Challenges of Large-Scale Integration of Renewables – Governance of Flexibility Markets G. Brunekreeft (Jacobs University Bremen, Germany) (Submission-ID 49) • Impact of Renewable Energy Certificate (REC) Mechanism in India S K. Soonee, K.V.S. Baba,U. K. Verma, M. Garg, S. Kr. Verma, K.C. Saini (POSOCO, India) (Submission-ID 210) • Introduction of Derivative Power Market in India S. P. Bhagat (Ministry of New and Renewable Energy, Government of India, India), S. Agarwal (Central Electricity Regulatory Commission [CERC], Government of India, India) (Submission-ID 187) • California’s Integrated Resource Plan (IRP) & RESOLVE L. Alagappan (Ethree, USA) • IEC SC 8A: Grid Integration of Renewable Energy Generation – Perspective, Activities and Plans B. Ernst (IEC SC 8A), Y. Chi (IEC SC 8A)
15:40 – 15:55	Discussions

15:55 – 16:10 Coffee Break

16:10 – 18:00	SESSION 8A: VRE IN DISTRIBUTION NETWORKS
> Session Chair	G. Prasad (Central Electricity Authority, India) // R. Mackensen (Fraunhofer IWES, Germany)
16:10 – 17:40	Presentations: VRE in Distribution Networks (20 min. each)
	<ul style="list-style-type: none"> • Introductory Keynote: Distribution Reforms G. Prasad (Central Electricity Authority, India) (10 min) • Variable Renewable Energy Sources in Distribution Networks M. Braun (Fraunhofer IWES University of Kassel, Germany) • Roof Top PV in Indian Distribution Networks – A Grid Integration Study for select regions of New Delhi and Bhopal T. Ackermann, E. Tröster, P.-P. Schierhorn, J.-D. Schmidt, B. Narasimhan (Energynautics, Germany), J. Gaebler, H. Bhatnagar, S. Goel, F. Huebner (GIZ, India) • Enhancing the Voltage Profile in Distribution System with 40 GW of Solar PV Rooftop in Indian Grid by 2022: A Review Er. P. Sivaraman (TECh Engineering Services, India), C. Sharmeela (Anna University Chennai, India), D.P. Kothari (J D College of Engineering & Management, Nagpur, India) (Submission-ID 58) • Reactive Power Coordination Strategies with Distributed Generators in Distribution Networks H. Wang, M. Kraiczy, S. Wende – von Berg, E. Kämpf, B. Ernst (Fraunhofer IWES, Germany), S. Schmidt, F. Wirtz (Bayernwerk Netz, Germany), M. Braun (Fraunhofer IWES University of Kassel, Germany) (Submission-ID 130)
17:40 – 18:00	Discussion

16:10 – 18:00	SESSION 8B: SHORT TERM ECONOMIC MODELLING
> Session Chair	K. Parikh (IRADe, India) // J. Cochran (NREL, USA)
16:10 – 17:30	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Cost and Value of Wind and Solar in India's Electric System in 2030 R. Deshmukh (Lawrence Berkeley National Laboratory, USA), D. Callaway (University of California at Berkeley, USA), N. Abhyankar, A. Phadke (Lawrence Berkeley National Laboratory, USA) (Submission-ID 174) • Operation of India's Power System with High Penetrations of Renewable Energy D. Palchak (NREL, USA) • Economic Valuation of Storage in a Power System: A Case of Pumped Storage with Solar PV A. Singh, K. Singh, P. Mathuria (Indian Institute of Technology Kanpur, India) (Submission-ID 168) • Effects of High Penetration of Solar Rooftop PV on Short-Term Electricity Pricing Forecasting by Using ANN-ABC Hybrid Model; Case Study of South Australia P. Chaweewat, J. G. Singh (Asian Institute of Technology, Thailand) (Submission-ID 61)
17:30 – 18:00	Discussion

16:10 – 18:00	SESSION 8C: MARKET MECHANISMS & ANCILLARY SERVICES MARKET ORGANISATION
> Session Chair	S K Chatterjee (CERC, India) // L. Alagappan (Ethree, USA)
16:10 – 17:30	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Introduction: Indian Status S K Chatterjee (CERC, India) • Centralized Energy & Operating Reserves Markets: A MISO Perspective D. Manjuré (MISO, USA) • Ancillary Services Market Mechanism B. Ernst (Fraunhofer IWES, Germany) • Ancillary Services Facilitating Large Scale Integration of Renewable Energy in India K. V. S. Baba, U. K. Verma, S. S. Barpanda, S. C. Saxena, G. Chakraborty, A. Kumar, KVN Pawan Kumar (POSOCO, India) (Submission-ID 208)
17:30 – 18:00	Discussion

18:00 – 19:00 Poster Session in Pre-Function Area

09:00 – 11:00	SESSION 9A: OPEN SOURCE EVALUATION TOOLS AND DEVELOPMENTS
> Session Chair	A. Kumar (ex SECI, India) // N. Miller (GE Energy, USA)
09:00 – 10:40	Presentations (25 min. each)
	<ul style="list-style-type: none">• Python for Power System Analysis (PyPSA): Free Software for Planning Energy Systems with High Shares of Renewables T. Brown, J. Hörsch, D. Schlachtberger (Frankfurt Institute for Advanced Studies, Germany)• Open Source Data and Models for a Sustainable Power Grid Modelling and Analysis W. Medjroubi, T. Vogt (DLR Institute of Networked Energy Systems, Germany) (Submission-ID 152)• pandapower - an Open Source Framework for Automated Evaluations of Future Power Systems L. Thurner (University of Kassel, Germany), A. Scheidler, M. Braun (Fraunhofer IWES University of Kassel, Germany) (Submission-ID 84)• Achieving both Economic and Environmental Objectives for a Solar Farm with Co-located Battery S. Sun, M. Kiaee, A. Cruden (University of Southampton, United Kingdom) (Submission-ID 28)
10:40 – 11:00	Discussion

09:00 – 11:00	SESSION 9B: DEMAND SIDE MANAGEMENT
> Session Chair	P. Sinha (Tata Power Delhi Distribution Company, India) // T. Ackermann (Energynautics, Germany)
09:00 – 10:40	Presentations (20 min. each)
	<ul style="list-style-type: none">• Demand Response - A Viable Alternative to Manage VRE G. Chugh, R. Malhotra (ICF Consulting, India) (Submission-ID 50)• Role of Solar PV Prosumers in Enabling the Energy Transition Towards a Fully Renewables Based Power System for India M. Ram, A. Gulagi, C. Breyer (Lappeenranta University of Technology, Finland), D. Keiner (OTH Regensburg, Germany) (Submission-ID 37)• Smart Integration of Large-Scale Electric Vehicle Storage into the Grid: Challenges and Opportunities P. Jain, T. Jain (Indian Institute of Technology Indore, India) (Submission-ID 44)• Peak Time Demand Management Using Distributed Solar Inverters S. Musunuri, U. Rajarathnam, D. Patel (Enzen Global Solutions, India) (Submission-ID 75)• Demand Side Management N. Kaul (Innovari, USA)
10:40 – 11:00	Discussion

09:00 – 11:00	SESSION 9C: ANCILLARY SERVICES WITH VRE
> Session Chair	I. Mitra (GIZ, India) // B. Ernst (Fraunhofer IWES, Germany)
09:00 – 10:42	Presentations (17 min. each)
	<ul style="list-style-type: none"> • Ancillary Services with Renewable Energy Generators R. Mackensen (Fraunhofer IWES, Germany) • Ancillary Services with VRE (Variable Renewable Energy): Focus PV A. Falk (SMA, Germany) • Emerging Ancillary Service Products in Renewable Energy Integrated Power Systems Z. Hussain (IIT Bombay, India) • Moving Towards Efficient Markets for Wind and Solar-Based Ancillary Services J. Cochran (NREL, USA) • Dynamic Reactive Power From Wind Power Plant: Voltage Control Ancillary Service Support H. Karbouj, Z. Rather (Indian Institute of Technology Bombay [IIT], India) (Submission-ID 139) • Fast Frequency Support from Wind Power Plant H. Agarwal, Z. Rather (Indian Institute of Technology Bombay [IIT], India) (Submission-ID 131)
10:42 – 11:00	Discussion

11:00 – 11:15 Coffee Break

11:15 – 13:15	SESSION 10A: GRID CODES
> Session Chair	P. Batra (CEA, India) // T. Ackermann (Energynautics, Germany)
11:15 – 12:57	Presentations (17 min. each)
	<ul style="list-style-type: none"> • The Role of Grid Codes for VRE Integration into Power Systems T. Ackermann, P.-P. Schierhorn, N. Martensen (Energynautics, Germany) • Purpose, Aim and Status of European Network Codes in Providing a Foundation Stone for Market Developments which Facilitate High Penetration of Renewables H. Urdal (ENTSO-E, Belgium) • Regulatory Grid Connectivity Requirements in India C. Byreddy, V. Vericherla (DNV GL - Energy, Germany) (Submission-ID 199) • Low Voltage Ride-through with High Current Injection A. Falk, C. Puritscher (SMA Solar Technology, Germany) (Submission-ID 24) • A Review on Low Voltage Ride Through Capability in Wind Turbines of India and Challenges in Implementation R. A. Jerin, K. Palanisamy, S. Umashankar (VIT University, India), N. Prabaharan (Madanapalle Institute of Technology and Science Andhra Pradesh, India), A. D. Thirumoorthy (TNERC TANGEDCO, India) (Submission-ID 193) • An Advanced Investigation on LVRT Requirement in Wind Integrated Power Systems A. Jotwani, Z. Rather (Indian Institute of Technology Bombay [IIT], India) (Submission-ID 125)
12:57 – 13:15	Discussion

11:15 – 13:15	SESSION 10B: SMART GRID AND VIRTUAL POWER PLANTS
> Session Chair	S. Sen (PGCIL, India) (*tbc) // M. Braun (Fraunhofer IWES University of Kassel, Germany)
11:15 – 12:35	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Microgrid Architecture in Urban Distribution System to Allow High Penetration Levels of Rooftop Solar PV K. K. Alla, N. Nagpal, B. Kumar, C. Pathak (BSES Rajdhani Power, India) (Submission-ID 59) • Virtual Power Plants – Renewable Energy Production of the Future R. Mackensen (Fraunhofer Institute for Wind Energy and Energy System Technology [IWES], Germany), S. Tripathi (ICF Consulting, India) (Submission-ID 29) • Volatility Prediction and Management by Active Network Management and Future Generation Management D. Ablakovic, M. Reischboeck, H. Zoeller (Siemens, Germany), P. Patil (Siemens, India) (Submission-ID 129) • Simulations and Tests of a Danish Smartgrid – The Cell Controller Pilot Project E. Tröster, N. Martensen, T. Ackermann, (Energynautics, Germany)
12:35 – 13:15	Discussion

11:15 – 13:15	SESSION 10C: DYNAMIC SYSTEM MODELLING
> Session Chair	Mr. Bandhopadhyay (CEA, India) // D. Palchak (NREL, USA)
11:15 – 12:55	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Dynamic Modelling of Variable Renewable Generation for Grid Integration Studies F. Fernandez (Digsilent, Germany) • Large-Scale Stability Modelling of Complex Loads with Embedded PV Nick Miller (GE Energy, USA) • Impact of Wind Power Plants on Voltage Control of Power System M. Sarkar, M. Altin, A. D. Hansen, P. Sørensen (DTU Wind Energy, Denmark) (Submission-ID 88) • Grid Stability Analysis for High Penetration Solar Photovoltaics A. Kumar K, M. P. Selvan (NIT Trichy, India), K. Rajapandiyan (Larsen & Toubro Construction, India) (Submission-ID 98) • Application of STATCOM Systems at Wind Farms – Improving Dynamic Performance to Meet Stringent Grid Codes M. Ghorai, N. Reddy, J. Managoli (American Superconductor Corporation [AMSC], USA) (Submission-ID 185)
12:55 – 13:15	Discussion

13:15 – 14:00 Lunch Break

14:00 – 16:00	SESSION 11A: GRID CODE CERTIFICATION
> Session Chair	A.K. Sharma (Bureau of Indian Standards, India) // E. Tröster (Energynautics, Germany)
14:00 – 15:40	Presentations (20 min. each)
	<ul style="list-style-type: none"> World-wide Project Experience in Certification of Grid Connection T. Gehlhaar, B. Hinzer (DNV GL - Energy, Germany) (Submission-ID 198) Testing Procedure for the Evaluation of Grid Compliance of Power Generating Units According to the Requirements of the Indian Grid Code Nivedh BS (UL India, India), S. Tentzerakis, J. Dirksen, F. Santjer, (UL International [UL DEWI], Germany) (Submission-ID 132) Grid Code Compliance Testing of Renewables – New Requirements and Testing Experiences N. Schäfer, G. Arnold, W. Heckmann (Fraunhofer Institute for Wind Energy and Energy System Technology [IWES] Germany) (Submission-ID 31) Testing Renewable Power Plants on High-Voltage-Ride-Through Capability J. Langstädtler, S. M. Ali (FGH, Germany) (Submission-ID 83) Methodology for the Determination of the Influence of the Background Harmonic Voltage Distortion on the Measured Harmonic Currents of Wind Turbines and PV Inverters S. Tentzerakis, F. Santjer, J. Dirksen, M. Baerschneider (UL International [UL DEWI], Germany), Nivedh BS (UL India, India) (Submission-ID 128)
15:40 – 16:00	Discussions

14:00 – 16:00	SESSION 11B: HYBRID SYSTEMS
> Session Chair	A. Kumar (ex MD, SECI, India) // T. Ackermann (Energynautics, Germany)
14:00 – 15:40	Presentations (20 min. each)
	<ul style="list-style-type: none"> Reconnection of Photovoltaic Systems in Low-Voltage Diesel-Powered Microgrids D. Fetzer, G. Lammert, T. Paschedag, D. Lafferte, K. Fischbach, M. Nuhn, C. Jaehner (University of Kassel, Germany), H. Becker (Fraunhofer IWES, Germany), L. R. Roose (Hawaii Natural Energy Institute, USA), M. Braun (Fraunhofer IWES University of Kassel, Germany) (Submission-ID 85) Black Start and Island Operation of Distribution Grids with Significant Penetration of Renewable Resources D. Lafferte, A. Klingmann, D. Fetzer, G. Lammert, C. Hachmann, T. Paschedag (University of Kassel, Germany), M. Braun (Fraunhofer IWES University of Kassel, Germany) (Submission-ID 186) Hybrid Renewable Energy Systems: A Review S. Lakshmanan, B. K. Gnaanvel, N.Rajarajeswari (Saveetha Engineering College, India) (Submission-ID 38) Hybrid Power Generation Using PV and Fuel Cell A. K. Damral (SSGMCE Shegaon, India) (Submission-ID 140) Vector Control of the Interlinking Converter for the Droop Controlled Power Flow in AC-DC Hybrid Microgrids R.V.S.E. Shravan, C. Vyjayanthi (National Institute of Technology Goa, India) (Submission-ID 78)
15:40 – 16:00	Discussions

14:00 – 16:00	SESSION 11C: WIND /PV SYSTEM MODELLING
> Session Chair	Z. Hussain Rather (IIT Bombay, India) // R. Segal (GE Energy, USA)
14:00 – 15:48	Presentations (18 min. each)
	<ul style="list-style-type: none"> Introductory Keynote: PV/Wind System Modelling Z. Hussain Rather (IIT Bombay, India) Next Edition of IEC 61400-27 – Electrical Simulation Models for Wind Power Plants P. Sørensen, Ö. Göksu (DTU – Technical University of Denmark, Denmark), J. Fortmann, F. J. Buendía (Gamesa, Spain), A. Morales (DIGSILENT Ibérica, Spain) Field Validation of Fast Reactive Response in Wind Plants N. Miller (GE Energy, USA) Transient Stability Improvement by Pre-fault and Post-fault modifications in Wind Power Plant Control N. Patari, D. Chatterjee, T. Bhattacharya (Indian Institute of Technology Kharagpur, India) (Submission-ID 143) Performance Enhancement of Doubly Fed Induction Generator-Based Wind Farm for Grid Voltage Dip and Harmonics Mitigation S. Joshi (Indus University, India), S. Talati (ERDA, India) (Submission-ID 112) Activities of the Joint Working Group CIGRE C4/C6.35/CIREN: Modelling and Dynamic Performance of Inverter Based Generation in Power System Transmission and Distribution Studies G. Lammert (University of Kassel, Germany), K. Yamashita (Central Research Institute of Electric Power Industry, Japan), H. Renner (Graz University of Technology, Austria), S. Martínez Villanueva (Red Eléctrica de España, Spain), J. Carvalho Martins (EDP Distribuição - Energia, Portugal), P. Aristidou (University of Leeds, United Kingdom), T. Van Cutsem (University of Liège, Belgium), L. D. Pabón Ospina (Fraunhofer IWES, Germany), M. Braun (Fraunhofer IWES University of Kassel, Germany), J. C. Boemer (Electric Power Research Institute, USA) (Submission-ID 209)
15:48 – 16:00	Discussion

16:00 – 16:15 Tea/Coffee Break

16:15 – 17:15	SESSION 12: CLOSING SESSION – PANEL DISCUSSION
> Session Chair	Name (Company, Country)
16:15 – 17:10	Discussions
17:10 – 17:15	Closing Remarks
	<p>Winfried Damm (GIZ)</p> <p>Michael Satin (USAID)</p> <p>Detlev Heinemann (University of Oldenburg, Germany)</p> <p>S.K. Soonee (POSOCO)</p>

POSTER PRESENTATIONS

- **Stability Analysis of Island Grid with Wind Energy and Energy Storage to Support Large Scale Deployment of Renewable Energy in Indonesia.**
R. Oswal, P. Jain (Innovative Wind Energy, USA), E. Muljadi (National Renewable Energy Laboratory [NREL], USA), A. Soebagio (Universitas Kristen Indonesia, Indonesia) ([Submission-ID 14](#))
- **Potential and Challenges in Grid Interconnection of Offshore Wind Based Generation in Tamil Nadu and Guarat**
P. Rajagopalan (DNV GL, India, India) ([Submission-ID 23](#))
- **Impact Analysis of Irradiance Dataset Selection on Photovoltaic System Energy Yield Modelling**
I. R. Cole, D. Palmer, B. Goss, E. Koubli, T. R. Betts, M. Thomson, R. Gottschalg (Loughborough University, United Kingdom) ([Submission-ID 30](#))
- **Solar-Wind Complementarity with Optimal Storage and Transmission in Mitigating the Monsoon Effect in Achieving a Fully Sustainable Electricity System for India**
A. Gulagi, M. Ram, C. Breyer (Lappeenranta University of Technology, Finland) ([Submission-ID 35](#))
- **Performance Analysis of Solar Rooftop Power Plants in Smart Cities of India under Changing Climatic Conditions**
M. Chattopadhyay, R. Rajavel (AMET University, India) ([Submission-ID 36](#))
- **Performance Assessment of 5 MW Grid-Connected Photovoltaic Plant in Western Region of India**
V. P. Singh, D. Kumar, B. Ravindra (Indian Institute of Technology Jodhpur, India) ([Submission-ID 45](#))
- **Techno-Commercial Analysis for Determining the Solar Bidding Tariff in India**
A. Gaur (Feedback Infra, India), L. Aggarwal (Smart Roof Solar Solutions, India), M. Kaur (GIZ India, India), P. Srivastava (Feedback Infra, India) ([Submission-ID 67](#))
- **Coordinated, Real-Time Grid Balancing Using Distributed Solar Inverters**
S. K. Musunuri, U. Rajarathnam, D. Patel (Enzen Global Solutions, India) ([Submission-ID 74](#))
- **Renewable Energy Based on Deregulated Electricity Market**
Md Irfan Ahmed (Career Point University Rajasthan India), S. Saurabh (Amity University Ranchi, India), L. Shrivastava, A. K. Gaur (Career Point University Rajasthan, India) ([Submission-ID 76](#))
- **The BIMSTEC Supergrid – Renewable Energy Mix and Regional Economics**
A. Nazar (TERI University, India), A. Halder (Thinkthrough Consulting, India) ([Submission-ID 93](#))
- **Large Scale Integration of Renewable Sources with STATCOM for Reactive Power Compensation and Power Quality Improvement**
S. Joshi (Indus University, India), S. Talati (Electrical Research and Development Association, India) ([Submission-ID 94](#))
- **Impact of Spatial Variation in Wind Generation of Karnataka**
A. Gangopadhyay, J. Srinivasan (Divecha Centre for Climate Change/Indian Institute of Science, India) ([Submission-ID 96](#))
- **Understanding the Impact of Clouds and Atmospheric Aerosols on Solar Energy Generation in India and Finland.**
A. R. Sharma (TERI University, India), S. Devraj (The Energy and Resources Institute [TERI], India), A. Lindfors (Finnish Meteorological Institute [FMI], Finland), S. S. Garud (The Energy and Resources Institute [TERI], India), E. Asmi, H. Lihavainen (Finnish Meteorological Institute [FMI], Finland) ([Submission-ID 100](#))
- **Managing Risk of RE Curtailment in Indian Power Market**
A. Singla, G. Chugh (ICF India Consulting, India) ([Submission-ID 109](#))
- **Renewable Energy Storage Technologies - A Review**
S. Lakshmanan, B K. Gnanavel, , N. Raja Rajeswari, S. Shenbagaraman (Saveetha Engineering College, India) ([Submission-ID 115](#))
- **Energy Storage Systems (ESS) - is India ready?**
G. Chugh, S. Tripathi (ICF Consulting India, India) ([Submission-ID 126](#))
- **Regulatory and Policy Initiatives for Solar Renewable Purchase Obligation (RPO) and Renewable Energy Certificate (REC) Mechanism**
S. Nair, R. Sharma, S. Garud (The Energy and Resources Institute [TERI], India) ([Submission-ID 136](#))
- **Performance Analysis of the Perturb-and-Observe and Incremental Conductance MPPT under Varying Weather Conditions**
P.R. Satpathy, S. Jena, R. Sharma (Siksha 'O' Anusandhan University, India) ([Submission-ID 144](#))

- **Stochastic Scheduling of Primary Frequency Response for Uncertain Low Carbon Power System**
V. Prakash, R. Bhakar, H. Tiwari (Malaviya National Institute of Technology Jaipur, India) (Submission-ID 146)
- **Islanding Detection and Protection with Neutral Point Grounding Using Two Layer Soil Model**
D. K. Saini, M. Yadav (University of Petroleum & Energy Studies, India) (Submission-ID 147)
- **Soft computing Approach for Micro Grid Islanding Detection**
K. Dilavar Basha, R. Madhumitha, K. Jamuna (VIT University, Chennai, India) (Submission-ID 156)
- **A Simple Functional Relationship of Error distribution of Day-Ahead Power Generation Forecast and the Variability of Power Generation**
A. K. Das (Del2infinity Energy Consulting, India) (Submission-ID 157)
- **An Analysis of Opportunities and Barriers of Integrating Renewable Energy with Smart Grid Technologies in India**
I. Arul (TamilNadu Generation and Distribution Corporation [TANGEDCO], India) (Submission-ID 163)
- **Microgrid Resource Management System Using Fuzzy Logic Controller(FLC)**
S. Angalaeswari, K. Jamuna (VIT University Chennai, India) (Submission-ID 165)
- **Geographical Information System based Renewable Energy Integration Planning: Quantifying Solar Energy Potential in North India**
P. Das, J. Mathur, R. Bhakar (Malaviya National Institute of Technology Jaipur, India), A. Kanudia (KanORS-EMR, NSEZ, India) (Submission-ID 178)
- **A Unique Control Strategy for Grid Interactive Voltage Source Converter in a Solar Photovoltaic System Using MPPT**
S. Jena, P. Satpathy, R. Mallick (Siksha 'O' Anusandhan University, India) (Submission-ID 179)
- **Opportunity for Large Scale Grid Integration for Renewable Energy in the North-East India**
B. Kumar, B. K. Choudhury (Indian Institute of Social Welfare and Business Management Kolkata, India), M. Chowdhury (IOCL Assam, India) (Submission-ID 182)
- **Minimizing Impacts of PV Solar Generation in Distribution Grids**
J. Diaz de Leon, N. Reddy, J. Managoli (American Superconductor, USA) (Submission-ID 184)
- **Review and Compliances of Grid Code with Renewable Energy (RE) Integration**
M. Yadav, D. Saini (University of Petroleum & Energy Studies, India), N. Pal (IIT[ISM] Dhanbad, India) (Submission-ID 189)
- **Spatio-Temporal Variations of Winds in Boundary Layer: Relations to Wind Energy Potential over India**
G. Kumar Suman, A. Chakraborty, T. Alam (Indian Institute of Science, India) (Submission-ID 190)
- **Analysis of Offshore Wind Energy Potential using Curve Model**
R. K. Bantha Navas, K V Narayanan, S.Prakash, A. Muruganandam (Sathyabama University, India) (Submission-ID 196)
- **Solar Energy for Electricity Generation – A Comparative Study of Three States in India**
G. Abubakar, M. Muthuchamy (Central University of Kerala, India) (Submission-ID 211)
- **The Interest of Performing LVRT and HVRT Tests Beyond Grid Codes to Improve Power Generation Systems**
D. Lopez, A. Larrén, I. Camino (4fores, Spain) (Submission-ID 212)