

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



PRELIMINARY CONFERENCE PROGRAM

as of July 18, 2017

Please note that this program is a preliminary version of the program.

Times and presentation slots are subject to changes.

WEDNESDAY, 06 SEPTEMBER 2017		THURSDAY, 07 SEPTEMBER 2017			FRIDAY, 08 SEPTEMBER 2017				
Conference Day 1		Conference Day 2			Conference Day 3				
9:00 – 09:30	Foyer	9:00 – 11:00	Room A	Room B	Room C	9:00 – 11:00	Room A	Room B	Room C
	Registration process		Session 5A: Storage Issues	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 – 11:40	Room A+B+C	COFFEE BREAK (15MIN)			COFFEE BREAK (15MIN)				
	SESSION 1: GRID INTEGRATION OF RE – CHALLENGES, ROADMAP AND PROGRESS	11:15 – 13:15	Room A	Room B	Room C	11:15 – 13:15	Room A	Room B	Room C
Tea/coffee served in the room during the session	6A: System Balancing & Imbalance Handling		SESSION 6B: Forecasting Methods and Applications - I	6C: Grid Integration Experience and Tools	Session 10A: Grid Codes		Session 10B: Smart Grid and VPPs	SESSION 10C: Power System Modelling	
11:40 – 13:40	Room A+B+C	LUNCH 13:15 – 14:00			LUNCH 13:15 – 14:00				
	SESSION 2: POLICY, MARKET AND REGULATORY INTERVENTIONS	14:00 – 15:55	Room A	Room B	Room C	14:00 – 16:00	Room A	Room B	Room C
13:40 – 14:30 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	
14:30 – 16:00	Room A+B+C	COFFEE BREAK (15MIN)			BREAK (15MIN)				
	SESSION 3: TECHNICAL PERSPECTIVE IN SYSTEM OPERATION: INTERNATIONAL EXPERIENCE	16:10 – 18:00	Room A	Room B	Room C	16:20 – 17:20	Room A+B+C		
16:00 – 16:15 Tea / Coffee Break	8A: VRE in Distribution Networks		8B: Short Term Economic Modelling	8C: Markets & Ancillary Services	SESSION 12: Closing Session – Panel Discussion				
16:15 – 17:30	Room A+B+C								
	SESSION 4: MINISTER'S WELCOME / DISCUSSION SESSION / DAY'S ROUNDUP								

WEDNESDAY, 06 SEPTEMBER 2017

08:30 – 09:30 Registration Process & Coffee

09:30 – 11:40	SESSION 1: GRID INTEGRATION OF RE – CHALLENGES, ROADMAP AND PROGRESS
> Session Chair	Name (Company, Country)
09:30 – 09:40	Welcome to the delegates : Winfried Damm (Country Director, GIZ) & Mark A. White (Mission Director, USAID)
09:40 – 10:10	Theme Presentation – Context Setting on International Experience: Thomas Ackermann (CEO, Energynautics, Germany)
10:10 – 10:40	Context Setting on Indian Experience: Pankaj Batra (Member, CEA & POSOCO, India)
10:40 – 11:25	Panel Discussion on RE Grid Integration related Challenges for India and Progress so Far Moderator - Damm, GIZ

11:25 – 11:35 Tea/Coffee Break

11:35 – 13:30	SESSION 2: POLICY, MARKET AND REGULATORY INTERVENTIONS
> Session Chair	S Chatterjee (CERC, India)
11:30 – 13:15	Presentations (30 min. each) <ul style="list-style-type: none">• Policy and Regulatory drivers for RE Grid Integration World-Wide TBA (25 min.)• RE Grid Integration: International Perspective S. Müller (IEA, France) (25 min.)• India Renewable Energy Grid Integration Study J. Cochran (NREL, USA) (25 min.)• Policy and Regulatory Pathway for RE Grid Integration: US Perspective C. Godfrey (NARUC, USA) (25 min.)
13:15 – 13:30	Questions from the audience

13:30 – 14:15 Lunch Break

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

16:10 – 16:25 Tea/Coffee Break

16:25 – 18:00	SESSION 4: MINISTER’S WELCOME / DISCUSSION SESSION / DAY’S ROUNDUP
> Session Chair	Name (Company, Country)
16:25 – 17:10	<ul style="list-style-type: none"> • Keynote (FLOATING SESSION) Welcome of Minister (US/German Ambassador) Minister’s Speech (Backup – Secretary, MoP & MNRE) Vote of Thanks (US/German Ambassador)
17:10 – 17:55	<ul style="list-style-type: none"> • Discussion Session: Lessons Learnt and way forward Moderator- Mr. Mark Newton, USAID / Shubhranshu Patnaik, RISE <ol style="list-style-type: none"> 1. S. K. Soonee, Advisor, POSOCO 2. S Chatterjee, (CERC), 3. Jaquelin Cochran, NREL 4. EU Expert – tbd 5. Markus Wypior, GIZ 6. Kevin Porter, Exeter Associates, U.S.A.
17:55 – 18:00	<ul style="list-style-type: none"> • Day’s roundup and Schedule for Day 2 Thomas Ackermann (Energynautics, Germany)

THURSDAY, 07 SEPTEMBER 2017

09:00 – 11:00	SESSION 5A: STORAGE
> Session Chair	P.C. Pant (MNRE, India) // TBA
09:00 – 10:40	Presentations (20 min. each)
	<ul style="list-style-type: none">• Status of Electrical Energy Storage in Power Network and its Strategy Support for Large-Scale Deployment H. Bhatnagar (Sudhanshu Mishra (GIZ, India) (Submission-ID 121))• Large Scale Battery Storage for Grid Stability / Backup V.S. Sharma (Steag Energy Services, India) (Submission-ID 16)• Battery Energy Storage System Addressing the Power Quality Issue in Grid Connected Wind Energy Conversion System C. Sharmeela (Assistant Professor, 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)• Introduction of Battery Energy Storage System in Low Voltage Distribution System for Loss Optimization A. Mangla (Raychem RPG, India) (Submission-ID 166)
10:40 – 11:00	Discussions

09:00 – 11:00	SESSION 5B: LONG TERM ENERGY SCENARIO PLANNING
> Session Chair	A. Jain (NITI Aayog, India) // TBA
09:00 – 10:00	Presentations (20 min. each): Long Term Energy Scenario Planning
	<ul style="list-style-type: none">• TBA (German Aerospace Center, Germany)• Purpose, Aim and Status of the European Ten Year Network Development Plan (TYNDP). Providing a Foundation Stone for Market Developments which Facilitate High Penetration of Renewables H. Urdal (ENTSO-E, Belgium)• Technical Feasibility of Integrating Aggressive Renewable Energy Targets into the Indian Grid by 2047 R. Gupta, H. Kumar (NITI Aayog, India), N. Abhyankar (LBNL, USA) (Submission-ID 79)
10:00 – 10:10	Discussion
10:10 – 10:40	Presentations (15 min. each)
	<ul style="list-style-type: none">• Load Ramping Requirements of Southern Region by 2022 with High RE-Penetration J. Asudi, KBV. Ramkumar, G. Anbunesan, V. Suresh (SRLDC 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)
10:40 – 11:00	Discussion

09:00 – 11:00	SESSION 5C: POWER SYSTEM ASPECTS WITH VRE
> Session Chair	Jayamary (TANTRANSCO, India) // TBA
09:00 – 10:50	Presentations (18 min. each)
	<ul style="list-style-type: none"> • Impact of Renewable Energy Sources on Indian Electricity Grid P. Gupta, E. K. Prathipati, J. Kapoor (Central Electricity Authority, Ministry of Power, Government of India, India) (Submission-ID 19) • Future Challenges in Indian Power Sector Including the Remedial Actions A. Anand, A. Toppo (Central Electricity Authority, India) (Submission-ID 43) • Modelling Transitions to Robust High-VRE Systems C. Silvester, A. Chohan, Arjun, C. Bates (Uniper, United Kingdom) (Submission-ID 22) • Future Defence Plan Requirements with High Penetration of Renewable Generations K. Das, M. Altin, A. Hansen, P. Sørensen (DTU Wind Energy, Denmark) (Submission-ID 87) • HVDC Solutions for Large Scale Grid Integration of Renewable Energy S. Biswas (Siemens, India), M. Haeusler (Siemens, Germany) (Submission-ID 81) • An Overlay of MTDC Grid to Relief Congestion of Power System H. Bahirat (IIT Bombay, India) (Submission-ID 162)
10:50 – 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) // TBA
11:15 – 12:10	Presentations: Power System Balancing
	<ul style="list-style-type: none"> • Regulatory Framework in India for Facilitating Large Scale Integration of Renewable Energy K.V.S Baba, S K Soonee, S R Narasimhan, S S Barpanda, S C Saxena, M. Joshi, KVN Pawan Kumar (POSOCO, India) (Submission-ID 195) (15 min.) • International Experience on Grid Integration of Large Amounts of Wind and Solar H. Holttinen (VTT, Finland) (20 min.) • Danish experience– How to reach > 40% Wind Energy Share A. Orths (Energinet.dk, Denmark) (20 min.)
12:10 – 13:05	Presentations (18 min. each): Imbalance Handling
	<ul style="list-style-type: none"> • Power System Balancing Issues in India - Power Balancing Methods and Solutions. B. Mehta, A. Shah, S. Nayak (State Load Despatch Centre, GETCO, India) (Submission-ID 119), (15 min.) • Imbalance Handling in Germany (20 min.) B. Ernst (Fraunhofer IWES, Germany) • TBA (20 min.)
13:05 – 13:15	Discussion

11:15 – 13:15	SESSION 6B: FORECASTING METHODS AND APPLICATIONS
> Session Chair	S. Mathew (NIWE, India) // D. Heinemann (University of Oldenburg, Germany)
11:15 – 12:10	Presentations: Forecasting Methods and Applications
	<ul style="list-style-type: none"> • Jan Remund (IEA Coordinator Solar) (20 min.) • Hans-Peter Waldl (Overspeed, Germany) (20 min.)
12:10 – 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) • Application of Generation and Dynamic Line Rating Forecasts in Indian Power System A. Roy (TERI University, India), I. Mitra (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), India) (Submission-ID 134) • Importance of Numerical Weather Prediction in Variable Renewable Energy forecast A. Halder (Integrated Action and Action for Development, 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) // TBA
11:15 – 12:55	Presentations (20 min. each)
	<ul style="list-style-type: none"> • International Experience of Grid Challenges Associated with High Penetrations of Renewable Generation A. Gooding, R. MacDonald (Smarter Grid Solutions Limited, United Kingdom), U. Rajarathnam, A. Manohar (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) • Role of FACTS Devices in 175 GW Large-Scale Renewable Energy Sources Integration into Indian Power Grid by 2022 S. Selvakumar (India) (Submission-ID 70) • Large Scale Implementation of Control Switching Devices in Indian Power System- A Case Study N.S. Sodha (ETD-50, LVDC Systems Committee, BIS Power System T & D, Smart Grid, 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)
12:55 – 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) // TBA
14:00 – 14:55	Presentations: Flexibility and control of power generation
	<ul style="list-style-type: none"> • A Technical and Economic System-Wide Approach Toward Grid Stability Under High Shares of Intermittent Renewable Energy Supply J. Ahmels, K. Kappenberg (Energy Research Centre of Lower Saxony, Germany), E. Kunle (CUTEC Institut GmbH, Germany Clausthal University of Technology, Germany), R. Simons, C. Yilmaz (Energy Research Centre of Lower Saxony, Germany) (Submission-ID 99); (20 min.) • Advanced Power Plant Flexibility – Technical and Market Design Priorities Simon Müller (IEA, France) (20 min.) • Sudip Nag (NTPC, India) (15 min.)
14:55 – 15:00	Discussion
15:00 – 15:50	Presentations: Storage
	<ul style="list-style-type: none"> • Accelerating the Energy Transition: The Role of Flexibility and Storage Michael Taylor (IRENA) (20 min.) • Smart Distribution Network control with Coordinated Storage Infeed E. Tröster (Energynautics, Germany) (20 min.) • Battery Energy Storage System (BESS) and its use cases/ applications in context of Renewable Integration (10 min.) P. Denholm (NREL, USA)
15:50 – 15:55	Discussion

14:00 – 15:55	SESSION 7B: FORECASTING METHODS AND APPLICATIONS -II
> Session Chair	P. Mukherjee (IITM, India) // H. P. Waldl (Overspeed, Germany)
11:00 – 15:40	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Time-Varying Wind Power Generation: Simulation Versus Reality P. Beaucage, J. Zack, K. Pennock (AWS Truepower, USA) (Submission-ID 52) • Solar Radiation Assessment and Forecasting Over India A. Bansal (IIT Mandi, India) (Submission-ID 103) • Short-Term Forecasting of Wind Farm 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 Model for Short-term Wind Speed Prediction V. Chintham (National Institute of Technology Warangal, India) (Submission-ID 114) • Application of ANN-Based Techniques for Prediction of Wind Speed of 67 Sites of India P. Arora (NSIT, India) (Submission-ID 207)
15:40 – 15:50	Discussions

14:00 – 15:55	SESSION 7C: REGULATORY ISSUES
> Session Chair	Mr. Bakshi (CERC, India) // TBA
14:00 – 15:20	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Large-scale Integration of Renewables – Regulatory Challenges G. Brunekreeft (Jacobs University Bremen, Germany) (Submission-ID 49) • Regulatory Impact of Renewable Energy Certificate (REC) Mechanism in India K.V.S. Baba, S K Soonee, U K Verma, M. Garg, S. Verma, K.C. Saini (POSOCO, India) (Submission-ID 210) • Introduction of Derivative Markets in Indian Power Market S. Bhagat (Ministry of New and Renewable Energy, Government of India, India), A. Agarwal (Central Electricity Regulatory Commission, Government of India, India) (Submission-ID 187) • Viability of Wind Energy Integration in Deregulated Electricity Market L. Chinmoy, S. Iniyani (Anna University, India) (Submission-ID 123)

15:20 – 15:55 Discussions

15:55 – 16:10 Poster Session & Coffee Break

16:10 – 18:00 SESSION 8A: VRE IN DISTRIBUTION NETWORKS

> Session Chair V. Kapoor (MoP, India) // R. Mackensen (Fraunhofer IWES, Germany)

16:10 – 17:00 Presentations: VRE in Distribution Networks

- **VRE in Distribution Networks**
M. Braun (Fraunhofer IWES, Germany) (20 min.)
- **Roof Top PV in Indian Distribution Networks – A Grid Integration Study for New Delhi and Bhopal**
E. Tröster (Energynautics, Germany) (20 min.)
- **Pankaj Batra, CEA (TBC) (15 min.)**

17:00 – 17:10 Discussion

17:10 – 17:55 Presentations (15 min. each):

- **Effect of Large-Scale Integration of Distributed Generation on Protection System and Remedial Adaptive Scheme**
J. S. Savier (College of Engineering Trivandrum, India) (Submission-ID 102)
- **Enhancing the Voltage Profile in Distribution System with 40 GW of Solar PV Rooftop in Indian Grid by 2022: a Review**
D.P. Kothari, C. Sharmeela (India) (Submission-ID 58)
- **Set-Point and Droop Curve Reactive Power Control Methods in Distributed Generation Models**
A. Roy (TERI University, India), S. Wende von Berg, H. Wang (Fraunhofer IWES, Germany) (Submission-ID 155)
- **Reactive Power Coordination Strategies with Distributed Generators (DGs) in Distribution Networks**
S. Wende - von Berg, H. Wang, E. Kämpf, M. Kraiczy, B. Ernst, M. Braun (Fraunhofer IWES | University of Kassel, Germany) (Submission-ID 130)

17:55 – 17:00 Discussion

16:10 – 18:00 SESSION 8B: SHORT TERM ECONOMIC MODELLING

> Session Chair K. Parekh (IRADE, India) // TBA

16:10 – 17:00 Presentations: Short Term Economic Modelling

- **Cost and Value of Wind and Solar in India's Electricity Futures**
R. Deshmukh (Lawrence Berkeley National Laboratory, USA), D. Callaway (Lawrence Berkeley National Laboratory, USA | University of California at Berkeley, USA), N. Abhyankar, A. Phadke (Lawrence Berkeley National Laboratory, USA) (Submission-ID 174), (20 min.)
- **TBA**
D. Palchak (NREL, USA)
- **R.N. Nayak (Power Grid Corporation of India, India) (20 min.)**

17:10 – 17:20 Discussion

17:20 – 17:55 Presentations (18 min. each):

- **Assessing Impact of Energy Storage on System Operational Cost with Large scale PV Integration**
K. Singh, A. Singh (Indian Institute of Technology Kanpur, India) (Submission-ID 168)
- **Methodology to Determine the Optimal Array Configuration Based on Least Cost of Electricity Produced**
E. S. Sreeraj (National Institute of Technology Goa, India) (Submission-ID 150)

17:55 – 18:00 Discussion

16:10 – 18:00 SESSION 8C: MARKET MECHANISMS & ANCILLARY SERVICES MARKET ORGANISATION

> Session Chair S. K. Chatterjee (CERC, India) // J. Cochran (NREL, USA)

16:10 – 17:00 Presentations: Market Mechanisms

- **Journey of a Renewable MegaWatt – from an Interconnection Request to Real-time Market Dispatch**
D. Manjure, M. McMullen (MISO, USA) (Submission-ID 90) (20 min.)
- **TBA (10 min.)**
- **S. K. Chatterjee (CERC, India) (TBC) (20 min.)**

17:00 – 17:05 Discussion

17:05 – 17:45 Presentations (20 min. each): Ancillary Services Market Organization

- **Ancillary Services Market Mechanism**
B. Ernst (Fraunhofer IWES, Germany) (20 min.)
- **Ancillary Services Facilitating Large Scale Integration of Renewable Energy in India**
K.V.S. Baba, S K Soonee, U K Verma, S S Barpanda, S C Saxena, G. Chakraborty, A. Kumar, KVN Pawan Kumar (POSOCO, India) (Submission-ID 208), (20 min.)

17:45 – 18:00 Discussion

09:00 – 11:00	SESSION 9A: OPEN SOURCE EVALUATION TOOLS AND DEVELOPMENTS
> Session Chair	S. N. Singh (M.M. Malvy University, India) // D. Palchak (NREL, USA)
09:00 – 09:55	Presentations:
	<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) (20 min.) • Open Source Data and Models for a Sustainable Power Grid Modelling and Analysis W. Medjroubi, Wided, T. Vogt (DLR Institute of Networked Energy Systems, Germany) (Submission-ID 152)- (20 min.) • TBA (15 min.)
09:55 – 10:10	Discussion
10:10 – 10:50	Presentations (18 min. each)
	<ul style="list-style-type: none"> • pandapower - an Open Source Framework for Automated Evaluations of Future Power Systems L. Thurner (University of Kassel, Germany), A. Scheidler (Fraunhofer Institute for Wind Energy and Energy System Technology (IWES), Germany), M. Braun (University of Kassel, Germany Fraunhofer Institute for Wind Energy and Energy System Technology (IWES), Germany) (Submission-ID 84) • Representing Battery Degradation in Open-Source Models of Modern Energy Systems A. Cruden, S. Sharkh (University of Southampton, United Kingdom) (Submission-ID 28)
10:50 – 11:00	Discussion

09:00 – 11:00	SESSION 9B: DEMAND SIDE MANAGEMENT
> Session Chair	P. Sinha (tata power delhi distribution company, India) // TBA
09:00 – 10:50	Presentations (15 min. each): Demand Side Management
	<ul style="list-style-type: none"> • Demand Response - A Viable Alternative to Manage VRE G. Chugh, R. Malhotra (ICF Consulting India, India) (Submission-ID 50) • RE Integration Driven through Demand-Response Initiatives S. Shukla (MP Ensystems Advisory, India) (Submission-ID 71) • Role of Solar PV Prosumers in Enabling the Energy Transition Towards a Fully Renewables Based Power System for India A. Gulagi (OTH Regensburg, Germany) (Submission-ID 37) • Electric Vehicle Developments in India- Case Study with V2G Parking Lot A. Ramanan, I. Mitra (GIZ, India) (Submission-ID 158) • 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 A. Manohar, S.K. Musunuri (Enzen Global Solutions, India) (Submission-ID 75)
10:50 – 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 – 09:55	Presentations: Ancillary Services with VRE
	<ul style="list-style-type: none"> • Ancillary with RE Generators (20 min.) R. Mackensen (Fraunhofer IWES, Germany) • Provision of Ancillary services from PV Plants (15 min.) A. Falk (SMA, Germany) • Zakir Hussain (IIT Bombay, India) (15 min.)
09:55 – 10:00	Discussion
10:00 – 10:54	Presentations (18 min. each):
	<ul style="list-style-type: none"> • TBA Jaquelin Cochran (NREL, USA) • Dynamic Reactive Power (Ancillary Service) from Wind Power Plant in Renewable Energy Integrated Power System 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) • A New LVRT Control Strategy for Variable Speed Wind Generator and Critical Review of Existing LVRT Requirement A. Jotwani, Z. Rather (Indian Institute of Technology, India) (Submission-ID 125)
10:54 – 11:00	Discussion

11:00 – 11:15 Poster Session & Coffee Break

11:15 – 13:15	SESSION 10A: GRID CODES
> Session Chair	P. Batra (CEA, India) // T. Echartd (Energynautics, Germany)
11:15 – 12:10	Presentations: Grid Codes
	<ul style="list-style-type: none"> • The Role of Grid Codes for VRE Integration into Power Systems T. Ackermann (Energynautics, Germany) (20 min.) • Purpose, Aim and Status of Network Codes in Europe. Providing a Foundation Stone for Market Developments which Facilitate High Penetration of Renewables H. Urdal (ENTSO-E, Belgium) (20 min.) • TBA (15 min.)
12:10 – 12:20	Discussion
12:20 – 13:05	Presentations (15 min. each)
	<ul style="list-style-type: none"> • 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 (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, N. Prabakaran, K. Palanisamy, S. Umashankar (VIT University, India), A.D. Thirumoorthy (TNERC TANGEDCO, India) (Submission-ID 193)
13:05 – 13:15	Discussion

11:15 – 13:15	SESSION 10B: SMART GRID AND VIRTUAL POWER PLANTS
> Session Chair	S. Sen (PGCIL, India) // M. Braun (University of Kassel, Germany)
11:15 – 12:55	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 B. Sharma, C. Pathak (BSES Rajdhani Power, India) (Submission-ID 59) • Virtual Power Plants – Renewable Energy Production of the Future R. Mackensen (Fraunhofer IWES University of, Kassel, Germany), S. Tripathi (ICF Consulting India, India) (Submission-ID 29) • Predicting, Solving and Informing of Volatility in Distribution Networks Based on State Estimation and Active Network Management D. Ablakovic, M. Reischboeck, H. Zoeller (Siemens, India) (Submission-ID 129) • TBA Jay Waghela(Innovari, USA) • Framework Design for Smart Micro-Grids T. Ackermann (Energyntautics, Germany), S. Al-Agtash (German Jordanian University, Jordan), B. Azzopardi (Malta College of Arts, Science and Technology (MCAST), Malta), D. Ioannidis (Center for Research and Technology Hellas / Information Technologies Institute, Greece), A. Önen (Abdullah Gul University, Turkey), J. L. Martinez Ramos (University of Seville, Spain), K. Mounir (ENP d'Oran, Algeria), L. Hadjidemetriou (University of Cyprus, Cyprus), T. Camilleri (GeoSYS, Malta), N. Borg (Electronic Systems Design, Malta) (Submission-ID 104)
12:55 – 13:15	Discussion

11:15 – 13:15	SESSION 10C: DYNAMIC SYSTEM MODELLING
> Session Chair	Mr. Bandhopadhyay (CEA, India) // TBA
11:15 – 12:10	Presentations: Dynamic System Modelling
	<ul style="list-style-type: none"> • Dynamic Modelling of Variable Renewable Generation for Grid Integration Studies F. Fernandez (Digsilent, Germany) (20 min.) • TBA (20 min.) • Pankaj Batra (CEA) (TBC) (15 min.)
12:10 – 12:20	Discussion
12:20 – 13:05	Presentations (15 min. each): System Aspects
	<ul style="list-style-type: none"> • Impact of Wind Power Plant on Voltage Stability of Power System M. Sarkar, M. Altin, A. Hansen, P. Sørensen (DTU Wind Energy, Denmark) (Submission-ID 88) • Grid Stability Analysis for High Penetration Solar Photovoltaics M.P. Selvan (National Institute of Technology, India), K. Rajapandiyam (Solar EDRC, Larsen & Toubro Construction, India) (Submission-ID 98) • Exploring how STATCOM Systems Have been Used at Wind Farms within the US and Other Regions to Meet Dynamic Reactive Power Requirements Imposed on Wind Farms. M. Ghorai, N. Reddy, J. Managoli (American Superconductor, USA) (Submission-ID 185)
13:05 – 13:15	DISCUSSION

13:15 – 14:00 Lunch Break

14:00 – 16:00	SESSION 11A: GRID CODE CERTIFICATION
> Session Chair	TBA // E. Tröster (Energynautics, Germany)
14:00 – 15:50	Presentations (16 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 N. BS (UL India, India), S. Tentzerakis, F. Santjer, J. Dirksen (UL International, Germany) (Submission-ID 132) • Grid Code Compliance Testing of Renewables – New Requirements and Testing Experiences F. Niedermeyer, N. Schäfer, G. Arnold, W. Heckmann (Fraunhofer Institute for Wind Energy and Energy System Technology [IWES], Germany) (Submission-ID 31) • Testing HVRT-Capability on Distributed Renewable Energy Systems J. Langstaedtler, S. M. Ali (FGH, Germany) (Submission-ID 83) • Design, Modelling and Commercial Aspects of Grid Connected High Power Solar Inverter in Compliance with Indian Grid Code K. Raval, K. Ramachandra Sekhar (Hitachi India, India) (Submission-ID 42) • 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, Germany), N. BS (UL India, India) (Submission-ID 128)
15:50 – 16:00	Discussions

14:00 – 16:00	SESSION 11B: HYBRID SYSTEMS
> Session Chair	A. Kumar (SECI, India) // TBA
14:00 – 15:40	Presentations (20 min. each)
	<ul style="list-style-type: none"> • Impact of Photovoltaic Systems onto the Frequency Behavior in Diesel Powered Low Voltage Microgrids D. Fetzer, G. Lammert, D. Lafferte, M. Nuhn, C. Jaehner, K. Fischbach, T. Paschedag (University of Kassel, Germany), M. Braun (University of Kassel, Germany Fraunhofer IWES, Kassel, Germany) (Submission-ID 85) • Black Start and Island Operation of Distribution Grids with Significant Penetration of Renewable Resources D. Lafferte, D. Fetzer, G. Lammert, C. Hachmann (University of Kassel, Germany), M. Braun (University of Kassel, Germany Fraunhofer Institute for Wind Energy and Energy System Technology (IWES), Germany) (Submission-ID 186) • Hybrid Renewable Energy Systems: A Review S. Lakshmanan (Saveetha Engineering College, India) (Submission-ID 38) • Hybrid Power Generation Using PV and Fuel Cell S. Anand, A. Damral (Shri sant Gajana Maharaj College, India) (Submission-ID 140) • Operation of AC and DC Subgrids for Controlled Power Exchange in a Hybrid Microgrid B. Rushikesh, 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	Zakir Hussain Rather (IIT Bombay, India) // Dr. Segal (GE Energy, USA)
14:00 – 14:55	Presentations: Wind /PV System Modelling
	<ul style="list-style-type: none"> • Next Edition of IEC 61400-27 Electrical Simulation Models for Wind Power Plants P. Sørensen (DTU - Technical University of Denmark, Denmark) (20 min.) • Field Validation of Fast Reactive Response in Wind Plants, Nick Miller Nick Miller (GE Energy, USA) (20 min.) • S.N. Singh (IIT Kanpur, India) (15 min.)
14:55 – 15:10	Discussion
15:10 – 15:55	Presentations (15 min. each):
	<ul style="list-style-type: none"> • Power System Transient Stability Improvement Using Modified Power Exchange by PMSG Based Wind Power Plant N. Patari, T. Bhattacharya, D. Chatterjee (Indian Institute of Technology, India) (Submission-ID 143) Name (Company, Country) • Performance Enhancement of Doubly Fed Induction Generator-Based Wind Farm for Grid Voltage Dip and Harmonics Mitigation S. Talati (ERDA, India) (Submission-ID 112) • Activities of the Joint Working Group CIGRE C4/C6.35/CIRED: 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) (Submission-ID 209)
15:55 – 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

POSTER PRESENTATIONS

- **Design, Development and Grid connection of Tri-Generation System**
S. Tamke (Sensycon Controls, India) ([Submission-ID 7](#))
- **Stability Analysis of Island Grid with Wind Energy and Energy Storage to Support Large Scale Deployment of Renewable Energy in Indonesia.**
A. Soebagio (Universitas Kristen Indonesia, Indonesia), P. Jain, R. Oswal (Innovative Wind Energy, USA), E. Muljadi (National Renewable Energy Lab. (NREL), USA) ([Submission-ID 14](#))
- **Offshore Wind - Potential & Challenges in Tamil Nadu & Gujarat**
P. Rajagopalan (DNV GL, India | FOWIND, India) ([Submission-ID 23](#))
- **Power Quality Disturbance Analysis**
N. Nag, M. K. Laha, S. Sarkar (Narula Institute of Technology, India) ([Submission-ID 27](#))
- **PV System Performance Predictions - Analysis of Variations**
I. Cole, D. Palmer, T. Betts, R. Gottschalg (CREST - Loughborough University, United Kingdom) ([Submission-ID 30](#))
- **Zigbee Based Wireless Protection Scheme for Grid Connected Distributed Solar PV and Centralized Diesel Generator System**
A. Sen (IEST, India), T. K. Biswas (SBI, LHO, India), K. Das Bhattacharya, H. Saha (IEST, India) ([Submission-ID 33](#))
- **Solar-Wind Complementarity with Optimal Storage and Transmission in Mitigating the Monsoon Effect in Achieving a Fully Sustainable Electricity System for India**
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 Different Climatic Conditions**
M. Chattopadhyay, R. Rajavel (AMET University, India) ([Submission-ID 36](#))
- **System Development and Performance Optimization of 500KVA/ 1MW Off-Grid DG-PV Hybrid Power Plant: A Case Study**
K. Pareek, M. Vyas (Sumeet Kumar, India) ([Submission-ID 40](#))
- **Short-Term Wind Speed Forecasting: Application of Linear and Non-Linear Time Series Models**
S. Sharma (Management Development Institute, India) ([Submission-ID 41](#))
- **Performance Assessment of 5 MW Grid-Connected Photovoltaic Plant in Western Region of India**
D. Kumar, B. Ravindra (Indian Institute of Technology Jodhpur, India) ([Submission-ID 45](#))
- **Preparing Indian Power System for Large Scale Integration of Offshore Wind Power**
A.K. Mishra, A. Ranjan (DNV GL, India) ([Submission-ID 47](#))
- **Design and Control of Multi-area AC/LVDC Network**
V. Nageeti (JNTU College of Engineering Anantapuramu, India), P. Gautam (Pvt. Ltd., India), P. Sujatha (JNTU College of Engineering Anantapuramu, India) ([Submission-ID 51](#))
- **Effects of High Penetration of Solar Rooftop PV on Short-Term Electricity Pricing Forecasting and Price Spike Forecasting on Hybrid Model; Case Study of South Australia**
J. G. Singh, W. Ongsakul (Asian Institute of Technology, Thailand) ([Submission-ID 61](#))
- **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 (Gesellschaft für Internationale Zusammenarbeit (GIZ) India, India), P. Srivastava (Feedback Infra, India) ([Submission-ID 67](#))
- **Modeling and Simulation of VSC HVDC Converters for Wind Energy Applications**
V.R. Jayanthi, K. Palanisamy (VIT University, India) ([Submission-ID 72](#))
- **Sizing of Energy Storage System for Wind Farms**
H. Bahirat (IIT-Bombay, India) ([Submission-ID 73](#))
- **Coordinated, Real-Time Grid Balancing Using Distributed Solar Inverters**
A. Manohar, S.K. Musunuri (Enzen Global Solutions, India) ([Submission-ID 74](#))
- **Renewable Energy Based on Deregulated Electricity Market**
Md Irfan Ahmed (Assistant Professor Career Point University Kota Rajasthan India), S. Saurabh (Amity University Ranchi Jharkhand, India), L. Shrivastava, A.K. Gaur (Career Point University Kota Rajasthan, India) ([Submission-ID 76](#))
- **Electricity Network System Design Approach to Remove Artificial Network Constraints**
M. Williams, A. Scobie, J. Porch (Faraday Grid Limited, United Kingdom), P. Ezekiel (AMP Solar Group, USA) ([Submission-ID 77](#))
- **Renewable Energy Resources (Solar/Wind) Grid Integration Studies – Methods Challenges and Issues.**
G. Saini, I. Ahmed, S. Singh (Career Point University Kota, India) ([Submission-ID 82](#))

- **Supergrid: The Case of India with Reference to BIMSTEC Nations**
A.Nazar (TERI University, India) (Submission-ID 93)
- **Large Scale Integration of Renewable Sources with STATCOM for Reactive Power Compensation and Power Quality Improvement**
S. Talati (Electrical Research and Development Association, India) (Submission-ID 94)
- **Forecasting Wind Power Generation in 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, Finland), S. S. Garud (The Energy and Resources Institute (TERI), India), E. Asmi, H. Lihavainen (Finnish Meteorological Institute, Finland) (Submission-ID 100)
- **Managing Risk of RE Curtailment in Indian Power Market**
A. Singla, G. Chugh (ICF India Consulting, India) (Submission-ID 109)
- **Performance Analysis of 143 MW Solar Photovoltaic Power Plant: A conceptual performance analysis**
C. Chavan, R. Shimpi (SVKM's NMIMS Mukesh Patel School of Technology Management and Engineering (M.S.), India) (Submission-ID 110)
- **Renewable Energy Storage Technologies - A Review**
B K. Gnanavel, S. Lakshmanan, N. Raja Rajeswari (Saveetha Engineering College, India) (Submission-ID 115)
- **Computational Simulation and Analysis of Smart Controller for Hybrid Solar-Wind Power Generation System using MATLAB/SIMULINK**
S. Shobana, B K Gnanavel, N. Raja Rajeswari (Saveetha Engineering College, India), P. Malliga (Anna University, India) (Submission-ID 116)
- **Design of Smart Grid in Rural Areas Using Homer**
T. Tilak (PEC University of Technology, India) (Submission-ID 118)
- **Optimal sizing of PV-Wind-Battery/Ultracapacitor Hybrid Renewable Energy System Based on Reliability Study.**
S. Kundu, A. Banerjee, G. Konar (Jadavpur University, India) (Submission-ID 120)
- **Energy Storage Systems (ESS) - is India ready?**
G. Chugh (ICF Consulting India, India) (Submission-ID 126)
- **Impact of Targeted Measurements and Next-Generation Prediction Techniques on Short-Term Wind Ramp Forecasting in the Tehachapi Wind Resource Area of California**
J. Zack, K. Pennock (AWS Truepower, USA) (Submission-ID 127)
- **DREAMS for Managing Variability and Uncertainty of Distributed Generation Resources**
J. Zack (AWS Truepower, USA), D. Nakafuji, L. Gouveia (Hawaiian Electric, USA), M. Shakarjian (AWS Truepower, USA) (Submission-ID 133)
- **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)
- **Effect of Partial Shading on Grid Connected MPPT Based Solar Charge Controllers**
P.R. Satpathy, S. Jena, R. Sharma (Siksha 'O' Anusandhan University, India) (Submission-ID 144)
- **Grid Integration of Renewable Energy Technologies for Rural India: benefits & challenges**
A. Aggarwal (YMCA University of Science&Technology Faridabad, India), A. Ghanshyam Das (Malviya National Institute of Technology Jaipur, India) (Submission-ID 145)
- **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)
- **Opportunities and Benefits Case for Active Management of Renewable Energy in Indian Grids**
A. Gooding, R. MacDonald (Smarter Grid Solutions, United Kingdom), U. Rajarathnam, A. Manohar (Enzen Global Solutions, India) (Submission-ID 149)
- **A Comparative Study of Market Design and Regulatory Framework of Variable Renewable Energy**
J. Bardhan (India) (Submission-ID 154)
- **Soft computing Approach for Micro Grid Islanding Detection**
R. Madhumitha, K. Dilavar Basha (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.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 (Renewable Energy, India) (Submission-ID 163)
- **Micro Grid Resource Management System Using FLC/MPC**
K. Jamuna (VIT University Chennai Campus, India) (Submission-ID 165)
- **Wind Integration in Power Systems: Challenges, Methodology& Strategies for incorporating higher levels of wind generation**
J. Bisht (Sterlite Power Transmission, India) (Submission-ID 169)
- **A Hybrid Method Based on Clustering, STL and Nearest Neighbor Regression for Hourly Solar Radiation Forecasting**
V. Vijay (Indian Institute of Technology, India) (Submission-ID 172)
- **Virtual Power Plant – a New Way of Power Generation**
S. Tejeshwar (Jnuth, India) (Submission-ID 176)
- **Minimization of Power Output Fluctuations in PV Systems with Micro-Energy Storage**
A. Sankar (L&T Construction, India) (Submission-ID 177)
- **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 Photo-voltaic system and System Performance using different types MPPT and under the Effect of Shadowing**
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**
M. Chowdhury, B.K. Choudhury (Indian Institute of Social Welfare and Business Management, India) (Submission-ID 182)
- **Estimation of Short-Term Usage of Electricity and Heat with Machine Learning**
Y. Sisik (Hamburg University of Applied Sciences, Germany) (Submission-ID 183)
- **Minimizing Impacts of PV Solar Generation in Distribution Grids**
J. Diaz de Leon, N. Reddy, J. Managoli (American Superconductor, USA) (Submission-ID 184)
- **Grid Integration of Combined Hybrid Solar Photovoltaic and Concentrating Solar Power Systems**
V. Balaraju (SV University, India) (Submission-ID 188)
- **Review and compliances of Grid code with Renewable Energy (RE) integration**
M. Yadav, D. Saini (University of Petroleum & Energy Studies, India) (Submission-ID 189)
- **Spatio-Temporal Variations of Winds in Boundary Layer: Relations to Wind Energy Potential over India**
A. Chakraborty, G. Kumar Suman, T. Alam (Indian Institute of Science, India) (Submission-ID 190)
- **Wind and Solar Power Purchase to Support Grid Integration**
T. Mishra (Doon University, India) (Submission-ID 191)
- **Analysis of Offshore Wind Energy Potential using Curve Model**
R. K. Bantha Navas, K V Narayanan (Sathyabama University, India) (Submission-ID 196)
- **How to Verify Reactive Power Capabilities of VRE**
Y. Xiao, T. Gehlhaar (DNV GL - Energy, Germany) (Submission-ID 200)
- **A Matrix to Track International Grid Code Requirements**
T. Gehlhaar, B. Hinzer (DNV GL - Energy, Germany) (Submission-ID 204)
- **LVRT-Tests and Load Cases of Wind Turbines**
K. Ramachandran, G. Kumar Vasanta (DNV GL - Energy, Germany) (Submission-ID 205)
- **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: In Search of Excellence**
A. Larrén, D. Lopez, A. Aparicio, Q. Esteve, I. Camino, C. Aliaga (4fores, Spain) (Submission-ID 212)
- **Investigations on Hysteresis-based Voltage/Current Control Techniques for Grid Connected Solar Photovoltaic Systems**
S. Rajamohamed (King Faisal University, Saudi Arabia), P. A. Jeyanthi, D. Devaraj (Kalasalingam University, India) (Submission-ID 213)