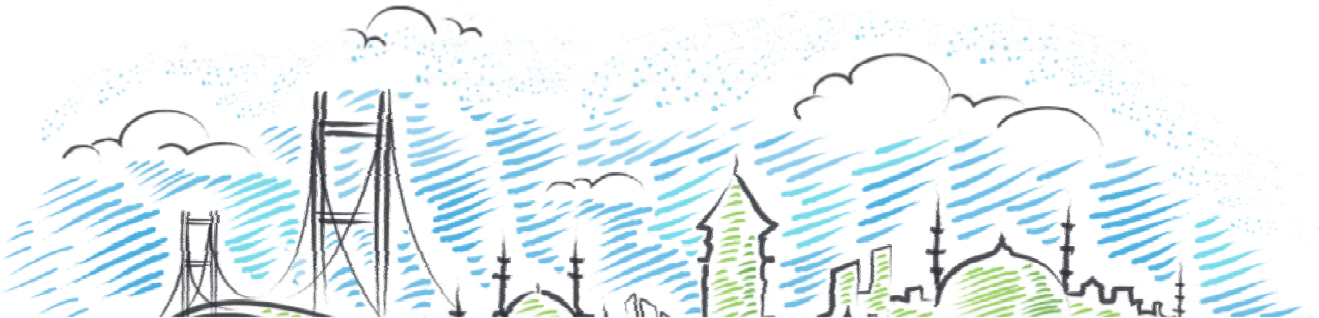
IEEE PES Innovative Smart Grid Technologies, Europe

October, 12-15, 2014 Istanbul

Istanbul Technical University



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IEEE PES Innovative Smart Grid Technologies, Europe, 2014

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MESSAGE FROM THE GENERAL CHAIR

Dear Colleagues,

On behalf of IEEE and the Organization Committee, we are pleased to welcome you to the 5th Innovative Smart Grid Technologies (ISGT 2014) Conference. It is a great honor for us to see you here at Istanbul Technical University's Main Campus. The first of IEEE PES ISGT Europe conference was held in Gothenburg in 2010. Then very successful series of conferences took place in Manchester, Berlin and Copenhagen respectively.

The ISGT Europe 2014 forms a technical platform for the participants from all around the world to discuss the recent theoretical studies in the area of smart grid and associated technical developments to transform the existing grid into a smart grid including an increasing number of distributed energy resources and electric storage facilities.

Approximately 400 high quality papers were submitted to ISGT 2014 from all around the world. Due to the limitation of space, 263 papers were accepted for poster and oral presentation. The ISGT Europe 2014 has 29 paper sessions and 2 groups of poster sessions, 3 tutorials, 3 keynote speeches, 3 plenaries and 9 panels. These cover electric generation & storage technologies, integration of electric vehicles, demand side management, micro-grid operation and integration, smart grid communications and network security, energy management and electricity market, wide area network monitoring-operation and control, smart grid protection and control.

In the frame of social events, in addition to the welcome reception in SDKM, two dinner receptions will take place during the conference. The first dinner will be on a cruise boat traveling through the Bosphorus on the evening of the second day of the conference. The gala dinner on the other hand, will be held in Baltalimanı Portaxe Restaurant on October 15th, Wednesday evening.

I would like to thank the Rector of Istanbul Technical University for providing us the university facilities for every stage of ISGT Europe 2014. I would like to thank our Platinum supporter EAE Electric, Gold supporter Makel Electric and Silver supporters Alstom Grid and ENTES Electronic. I also thank all Panel Supporters. My special thanks go to my colleagues for their great effort in organizing this conference.

I hope your attendance at this conference will give you an opportunity to contact directly with the professionals dealing with smart grid and also have nice days in Istanbul where the continents meet.

Yours Sincerely,

CONFERENCE COMMITTEES

Conference General Chair

Prof. Dr. Ömer Usta, Istanbul Technical University (ITU)

Local Organizing Committee

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Fuat Küçük, ITU, TR

John D. McDonald, GE Energy, USA

Okan Özgönenel, Ondokuz Mayıs University, TR

INFORMATION FOR PARTICIPANTS

The ISGT Europe 2014 conference will be held in Suleyman Demirel Cultural Center (SDKM) at Istanbul Technical University Maslak Campus. Registration and information desks will be available in the entrance (level 0) throughout the conference. Keynotes, plenary and panel sessions will take place in the main conference hall. Paper sessions will be held in the senate room, seminar room, and room A and B. Poster sessions A and B will be in the second floor. Exhibitation stands will be in the first floor throughout the conference.

For the paper sessions the authors need to have their presentation in a memory stick in the format of *.ppt, *.pptx or *.pdf. Presentation file should be named using the following format; Paper ID followed by underscore then followed by presenter last name, such as 2014ISGTEU0XXX_last name. Presenters for oral sessions are requested to upload their presentation in the related room 15 minutes prior to the beginning of the session.

It is recommended to meet the Poster Session Chair at least 30 minutes before **the poster session** to find your assigned poster location and arrange your materials on the poster board. Presenters are kindly required to setup and take down their posters on their own. **Plenary and panel** speakers should send their presentation to the session chair befor the conference started.

Wireless LAN will be provided within SDKM. Login information will be obtained from the registration desk.

The welcome reception will take place in SDKM on Monday, October 13 between 17:15-19:30. **The Cruise Dinner** through the Bosphorus will be on Tuesday, October 14 between 19:00-23:00. The transfer from SDKM to Istinye port will be provided by busses at 18:00 in front of SDKM. After the dinner participants can take the busses at Istinye port to their hotels. **The Gala Dinner** by the Bosphorus will be on Wednesday, October 15 between 19:00-23:00. The transfer from SDKM to Baltalimanı will be on busses at 18:00. After the dinner participants can take the busses at Baltalimanı to their hotels.

A **certificate of attendance** will be given to participants on request. Please make your request when you get registered. The certificates will be available from the information desk on Wednesday, October 15, 2014.

Saturday, October 11, 2014	Program Summary
10:00 - 17:00	**IEEE PES Executive Meeting**-Hotel Hyatt, Taksim

Sunday, October 12, 2014	Program Summary
9:30 - 17:00	**Registration**-SDKM, ITU
10:00 - 17:00	**IEEE PES Chapter Training Meeting**-SDKM Senate Room, ITU
13:30 - 15:00	**IEEE ISGT Europe 2014 Istanbul Tutorial A, B, C**-SDKM, ITU
	Tutorial A, SDKM Room A **"Evolution of EMS Control Centers – Managing the Future Smart Grid PMU Synchro-phasor Measurements at Control Centers"** Jay Giri, ALSTOM
	Tutorial B, SDKM Room B **"Cyber Security of Smart Grid"** Chen-Ching Liu, Washington State University
	Tutorial C, SDKM Room C **"EVs Charging Integration in Distribution Grid"** Johan Driesen, KU Leuven
15:00 - 15:30	**Coffee Break**
15:30-17:00	**Tutorial A, Tutorial B, Tutorial C** (Continued)

Tutorial A

Sunday, 13:30 – 17:00
Workshop Room A

Evolution of EMS Control Centers -Managing the future Smart Grid PMU- Synchro-Phasor Measurements at Control Centers

Jay Giri, Alstom Grid, USA

Dr. Jay Giri (M'78-F'00) Jay is Director of Power Systems Technology and Strategic Initiatives at Alstom Grid's NMS business in Redmond, Washington. In 1978, Jay and 11 other engineers co-founded Energy System Computer Applications (ESCA). In 2010, ESCA after a few corporate mergers became part of Alstom Grid. He has a PhD from Clarkson University in New York and a B.Tech from the Indian Institute of Technology (IIT), Madras. In 2002, he was elected IEEE Fellow and is a member of the IEEE PES Governing Board. He is an Alstom Grid Senior Fellow.

Abstract: Energy Management Systems (EMS) have been deployed for decades at utility control centers to monitor and manage the electricity grid in real-time. Today these EMS capabilities are posed to be enhanced quite dramatically with growth of synchrophasor PMU measurements. This tutorial will describe:

- The history and evolution of the EMS from its digital genesis in the 1970's.
- The primary functions of a modern EMS:
- Emerging new industry drivers
- Emerging new technology trends
- Impact of growth of microgrids, renewables and distributed generation on the EMS
- Growth of Phasor Measurement Units (PMUs) and synchrophasor measurements worldwide
- Wide Area Monitoring (WAMS)
- The EMS for the future grid

Tutorial B

Sunday, 13:30 – 17:00
Workshop Room B

Cyber Physical Systems Security for the Smart Grid

Chen-Ching Liu, Washington State University, USA, and University College Dublin, Ireland

Prof. Dr. Chen-Ching Liu is Boeing Distinguished Professor at Washington State University, Pullman, and Director of Energy Systems Innovation (ESI) Center. He is also Professor of Power Systems at University College Dublin, Ireland. During 1983-2005, he was a Professor of EE at University of Washington, Seattle. Dr. Liu was Palmer Chair Professor at Iowa State University from 2006 to 2008. In 2008, he joined University College Dublin, where he was Deputy/Acting Principal of Engineering, Mathematical and Physical Sciences. Chen-Ching completed his Ph.D. from the University of California, Berkeley. He received an IEEE Third Millennium Medal in 2000 and the Power and Energy Society Outstanding Power Engineering Educator Award in 2004. Professor Liu received a Doctor Honoris Causa from Polytechnic University of Bucharest, Romania, in 2013. He chaired the IEEE Power and Energy Society Fellow Committee, Technical Committee on Power System Analysis, Computing and Economics, and Outstanding Power Engineering Educator Award Committee. Professor Liu is a Fellow of the IEEE.

Abstract: The electric power grid is a complex cyber physical system (CPS) that forms the lifeline of a modern society. Its reliable and secure operation is of paramount importance to national security and economic well-being. The power grid today is a highly automated network, wherein a variety of communication networks and information systems are interconnected to the physical grid for the purpose of monitoring, protection, control, and market functions. Numerous publications - from government, industry, and academics - have indicated the growing concern of cyber threats to the electric power grid and the critical need to protect the grid against cyber attacks. Moreover, the increased reliance on information and communication technologies in the smart grid will significantly increase the attack surface, which further underscores the importance of cyber security.

As a result, cyber security of the power grid — encompassing attack prevention, detec-

Sunday, 13:30 – 17:00
Workshop Room C

Electric Vehicle Charging in Electricity Distribution Systems

Johan Driesen, KU Leuven, ESAT-ELECTA, Belgium

Professor Johan Driesen (S'93–M'97-SM'12) was born in 1973 in Belgium. He received the M.Sc. degree in 1996 as Electrotechnical Engineer from the K.U. Leuven, Belgium. He received the Ph.D. degree in Electrical Engineering at K.U.Leuven in 2000 on the finite element solution of coupled thermal-electromagnetic problems and related applications in electrical machines and drives, microsystems and power quality issues. Currently he is a professor at the K.U.Leuven and teaches power electronics, renewables and drives. In 2000-2001 he was a visiting researcher in the Imperial College of Science, Technology and Medicine, London, UK. In 2002 he was working at the University of California, Berkeley, USA. Currently he conducts research on distributed energy resources, including renewable energy systems, power electronics and its applications, for instance in renewable energy and electric vehicles.

Abstract: This tutorial starts with an overview of the main charging principles that are in use for powering up battery electric vehicles and plug-in electric vehicles. After a short introduction on e-mobility, the main standardized systems (AC, DC, different modes) and advanced principles such as wireless charging are discussed, referring to practical cases where vehicles have to be charged in different environments and different use cases or business models. The link with power system integration is made by addressing the impact of this new type of power consumption on the power flow and stability. "Smart" solutions are proposed, such as droop control and demand side management implementation. Modelling techniques and hardware implementations are briefly discussed. Examples from on-going research and living-lab trials are given. This tutorial intends to make a bridge between developments in smart grids, e-mobility and intelligent hard- and software solutions enabling the deployment of electric vehicles.

Monday, October 13, 2014			
08:30 - 09:30	**Registration**-SDKM, ITU		
09:30 - 10:00	**Welcoming Remarks** **Omer Usta**, Chair IEEE PES ISGT Europe 2014 **Miroslav Begovic**, IEEE PES President **Mehmet Karaca**, Rector, ITU		
10:00 - 10:30	**Keynote A** : **"Energy Storage Market"** **Andrew Jones**, Managing Director, S&C Electric Europe		
10:30 - 11:00	**Coffee Break**		
11:00 - 12:30	**Plenary A** : **"Future Trends in Smart Grid"** **Damir Novosel,** President of Quanta Technology Expert		
12:30 - 13:30	**Lunch Break**		
ROOM	**Conference Main Hall**	**Room A**	
13:30 - 15:00	**Panel 1** **Smart Grid Reliability** Chair: **Sasa Djokic**	**Paper Session 1** **Smart Grid Experiences and Field Tests** Chair: **Miroslav Begovic**	
15:00 - 15:30	**Coffee Break**		
15:30 - 17:15	**Panel 2** **Development in Energy Storage Technologies** Chair: **Ahmet Cansız**	**Paper Session 5** **Computational Intelligence in Smart Grid** Chair: **Noel Schulz**	

	Seminar Room	Senate Room	Room B
	Paper Session 2 **Integration of Electrical Vehicles into Smart Grid** Chair: **Henry M Louie**	**Paper Session 3** **Power System Stability and Security 1** Chair: **Costas Vournas**	**Paper Session 4** **Residential Demand Response 1** Chair: **Ehab El-Saadany**
	Paper Session 6 **Microgrid Operation** Chair: **Fabio Massaro**	**Paper Session 7** **Power System Monitoring, Operation and Control** Chair: **Ali Abur**	**Paper Session 8** **Power Quality and Reliability** Chair: **Geert Deconinck**

Keynote A

Monday, 13, 10:00 – 10:30
Conference Main Hall

Energy Storage Market

Andrew Jones, S&C Electric Europe LTD Managing Director, S&C Electric Europe

Mr. Jones received his MBA from Sheffield Hallam University in 1993. Andrew Jones has exceptional technical knowledge in the energy sector, specialising in smart grid technology, and has published over 30 papers and he has been involved as a BEAMA, British Standard, CIGRE and IEC bodies. Andrew has a mechanical engineering degree from Swansea University and an MBA from Sheffield. He started his career with an apprenticeship on mechanical engineering with Aluminium Wire and Cable in Swansea before taking an HND in mechanical engineering. He then held a number of roles at Alcan Wire and Conductor and became commercial manager responsible for sales of all electrical products including Middle East, Africa and parts of Asia. During this time he also completed the Institute of Quality Assurance Membership Exams and MBA. Following this he worked at CCL as Business Development Manager, before the company was purchased by Ancon and he was made Commercial Director of the Electrical Division and Wire Rope Splicing Divisions responsible for full P&L and sales on a global basis. In 2004 Andrew joined S&C as Territory Manager before setting up the European business in 2008, taking the role of Managing Director. Andrew regularly speaks across a wide range of energy topics, including smart grid.

Abstract: Current state of storage technology? Current and emerging markets. A personal opinion on what are the key areas to watch in the near future. Although Energy Storage has become the 'buzz word' of the industry, there is still a lot of confusion surrounding: technology, costs, markets, and how to use storage. This speech will be a quick run through of the current energy storage landscape and will cover the global electrical network changes are happening now. I will cover, changes in storage adoption, the current state of technology, applications and markets already served, and will end with a personal prediction of the future.

Plenary A

Monday, 11:00 – 12:30
Conference Main Hall

Future Trends in Smart Grid

Chair: Damir Novosel, Quanta Technology, USA

Damir Novosel (SM 1994, F 2003) is president of Quanta Technology. Previously, he was vice president of ABB Automation Products and president of KEMA T&D US. He is elected to National Academy of Engineers in 2014. Dr. Novosel is IEEE PES President Elect. He served as chair of the PES Technical Council, vice president of technology, and a member of the PES Governing Board from 2010 to 2012. Damir is also member of the CIGRE US National Committee. Damir holds 16 US and international patents and published over 100 articles in Transactions, Journals and Proceedings, receiving PES 2011 and 2013 Prize Paper Awards. Damir has led or participated in numerous IEEE standards, publications and other initiatives, such as keynotes and panels. Damir has been continuing contributor to education, including an adjunct professorship of Electrical Engineering at North Carolina State University, sponsorship of college scholarship programs, and support to industry courses and tutorials. He holds PhD, MSc, and BS degrees in electrical engineering from Mississippi State University, where he was a Fulbright scholar, the University of Zagreb, Croatia, and University of Tuzla, Bosnia and Herzegovina, respectively.

Transitioning to the Grid of the Future

Wanda Reder, VP – Power Systems Solutions, S&C Electric Company

Wanda Reder is the Vice President of the Power Systems Solutions at S&C Electric Company. In her role she oversees the activity for S&C to design, integrate and install self-healing distribution technologies, develop microgrids, and interconnect renewable and storage facilities. An exemplary volunteer leader, Wanda Reder's initiatives as president of the IEEE Power and Energy Society helped grow membership, established

RTE and TSOs as key players of the Smart Grids Deployment in Europe

Michel Bena, Smart Grids Director for RTE, the French TSO.

Michel Béna has been Smart Grids Director for RTE, the French TSO, since 2012. He's in charge of the involvement of RTE in technical pilot projects and in the discussions around the evolution of the French Electric System related to Smart Grids. Before that, he's been working in power system transmission R&D field, such as long term planning, dynamic security and voltage control. He graduated from SUPELEC (1990).

How one state in the US (Vermont) is integrating Smart Grid technologies into daily operations

Chris Root, The Chief Operating Officer for Vermont Electric Power Company

Mr. Root has over 30 years of utility operations and engineering leadership experience. He is currently the Chief Operating Officer for Vermont Electric Power Company in Rutland, VT. He is responsible for the engineering, construction and operation of the transmission system in the state of Vermont. Previously, he was the Senior Vice President of Network Strategy at National Grid responsible for engineering and asset management of the electric and gas networks in the US. He was a Senior VP for 17 years in various roles in Transmission and Distribution Operations, Engineering and Construction. He oversaw several operational mergers and was Emergency Director for over 70 significant events through the years. Mr. Root has a BS in Electrical Engineering from Northeastern University and a MEng in Electric Power Engineering from Rensselear Polytechnic Institute. He attended the Program for Management Development at the Harvard Business School. Mr. Root is a registered Professional Engineer in the states of MA and RI.

Grid modernization and the role of photovoltaics

Miroslav Begovic, University Center of Excellence in Photovoltaic Research at Georgia Tech.

Dr. Miroslav M. Begovic is a Professor in the School of Electrical and Computer Engineering and a faculty member of the University Center of Excellence in Photovoltaic Research at Georgia Tech, one of two such centers in the United States. He received a PhD from Virginia Tech and MS and Dipl. Ing. from Belgrade University. His research interests are in monitoring, analysis, and control of power systems, as well as development and applications of renewable and sustainable energy systems. Dr. Begovic has published over 125 publications and completed numerous research projects during his career at Georgia Tech. He has been a member of the IEEE PES Power System Relaying Committee for two decades and chaired many of its working groups. Dr. Begovic is currently a Chair of the Electric Energy Technical Interest Group at Georgia Tech., former Chair of the Emerging Technologies Coordinating Committee of IEEE PES, member of the IEEE Smart Grid Task Force, IEEE PES Distinguished Lecturer, and Treasurer of the IEEE Power and Energy Society in 2010-2011 and candidate for IEEE Power and Energy Society President. He is a Fellow of the IEEE and member of Sigma Xi, Eta Kappa.

Power flow control in transmission network

Frank Lambert, Associate Director of NEETRAC at Georgia Tech.

Frank C. Lambert (S'70-M'73-SM'87) Mr. Lambert serves as the Associate Director of the National Electric Energy Testing Research and applications Center (NEETRAC) at Georgia Tech (Atlanta). He is responsible for interfacing with NEETRAC's members to develop and conduct research projects dealing with transmission and distribution issues. Mr. Lambert previously worked at Georgia Power Company for 22 years in transmission / distribution system design, construction, operation, maintenance and automation. He participates in the IEEE PES Distribution Subcommittee and the PES Switchgear Committee and is serving on the PES Governing Board as the Vice President for Chapters. Mr. Lambert holds a bachelors and M.S. degree in Electrical Engineering from the Georgia Institute of Technology

Plenary Abstract: Reliable and efficient electrical grid operation is critical to society. Electrical utility industry has been experiencing significant changes in the last decade caused by new technology trends, environmental drivers and weather patterns, changing public needs, and regulatory requirements. The electrical power and energy industry in the next decades will be different than it is today to meet the demands of the society and address challenges. As "Smart Grid" technologies are required to manage grid complexity, there have been a number of 'smart grid" deployment initiatives world-wide. This plenary panel includes technology and business leaders that address holistic

Panel 1

Monday, 13:30 – 15:00
Conference Main Hall

Smart Grid Reliability

Chair: **Sasa Djokic**, University of Edinburgh, UK

Co-Chair: **Alfredo Testa**, The Second University of Napoli, Italy

Dr. Sasa Djokic is a Reader in Electrical Power Systems and Programme Director for MSc Studies in Sustainable Energy Systems in the School of Engineering at the University of Edinburgh, UK. He received Dipl-Ing and MSc degrees in electrical engineering from the University of Nis, Serbia, and PhD degree in the same area from the University of Manchester, UK. From 1993 to 2001 he was with the Faculty of Electronic Eng. of the University of Nis. From 2001 to 2005 he was with the School of Electrical and Electronic Engineering at the University of Manchester. He joined the University of Edinburgh in October 2005.

In the general area of Power System analysis, Dr Djokic's research focuses on the assessment of reliability and power quality performance of networks with distributed energy generation/storage resources, including highly dispersed micro-generation systems, as well as on the development of improved system load models, fully incorporating demand-side management and responsive demand functionalities. Dr Djokic is a Senior Member of IEEE, Member of IET, Associate Member of IESNA and SaRS, and also actively participates in a number of IEEE, CIGRE, CIRED, UIE and BSI/IEC International Committees and Working Groups.

Panel Abstract: Improved Reliability Performance is often assumed to be one of the very basic aspects of the future "smart grids", which should also provide functionalities and services for reducing CO2 emissions and other drivers of climate change, while maintaining the highest possible levels of power quality, sustainability and affordability of electricity supply for customers. However, "smart grids" (SG) will result in increasingly complex electricity networks, featuring significantly higher penetration levels of variable renewable-based distributed generation (DG) technologies, introducing new highly efficient, intelligent and flexible control, monitoring and communication systems and incorporating various demand-responsive and demand-manageable

Presentations

Incorporating Regular Requirements in Reliability Analysis of Smart Grids
Sasa Djokic, the University of Edinburgh, UK

Self-Healing City Networks and Distribution Automation
Matti Lehtonen, Aalto University, Finland

Distribution System Reliability Improvement by Car Park Storage Facilities
Aydogan Özdemir, ITU, Turkey

Enabling Methodologies for Large Scale Reliability Analysis in Smart Grids
Alfredo Vaccaro, University of Sannio, Italy
Claudio Canizares, University of Waterloo, Canada

Supply Interruptions and Voltage Dips in a Smart Grid Scenario
Alfredo Testa, Second University of Naples, Italy

Paper Session 1: Smart Grid Experiences and Field Tests

Date Monday, 13:30 – 15:00
Chair **Miroslav Begovic**

2014ISGTEU0153
Multifunctional Operation of a Virtual Power Plant in an Active Distribution Grid: Modelling Approaches and First Field Test Experiences from the SmartRegion Pellworm Project
Simon Koopmann (RWTH Aachen, Germany), **Steffen Nicolai** (Fraunhofer IOSB, Germany), **Armin Schnettler** (RWTH Aachen, Germany)

2014ISGTEU0599
Experience from Real Tests on Multiple Smart Meter Switching
Yasir Arafat (Chalmers University of Technology, Sweden), **Lina Bertling Tjernberg** (KTH Stockholm, Sweden), **Per-Anders Gustafsson** (Gothenburg Energy, Sweden)

2014ISGTEU0495
Experience of Communication Problems in PLC-based AMR Systems in Finland
Bashir Siddiqui (Tampere University of Technology, Finland)

2014ISGTEU0375
Multi-Goal Optimization in Power Matching City: A Smart Living Lab
Jan Pieter Wijbenga (TNO, Netherlands), **Pamela MacDougall** (TNO, Netherlands), **René Kamphuis** (TNO, Netherlands), **Albert van den Noort** (DNV GL, Netherlands), **Tjerk Sanberg** (DNV GL, Netherlands), **Elke Klaassen** (TU Eindhoven, Netherlands)

2014ISGTEU0465
Experimental Validation of a Single Phase Intelligent Power Router
Francesc Girbau-Llistuella (CITCEA-UPC, Spain), **Joan-Marc Rodriguez-Bernuz** (CITCEA-UPC, Spain), **Eduardo Prieto-Araujo** (CITCEA-UPC, Spain), **Andreas Sumper**, Electrical Engineering (CITCEA-UPC, Spain)

2014ISGTEU0430
Thermal Behaviour of Low Voltage Cables in Smart Grid - Related Environments
Nicolas Höning (CWI Amsterdam, Netherlands), **Erik De Jong** (Flex Power Grid Lab, Netherlands), **Gabriël Bloemhof** (DNV GL, Netherlands), **Han La Poutré** (CWI Amsterdam, Netherlands)

Paper Session 2: Integration of Electrical Vehicles into Smart Grid

Date Monday, 13:30 – 15:00
Chair **Henry M Louie**

2014ISGTEU0141
Stochastic Impact Assessment of the Heating and Transportation Systems Electrification on LV grids
Iker Diaz de Cerio Mendaza (Aalborg University, Denmark), **Birgitte Bak-Jensen** (Aalborg University, Denmark), **Zhe Chen** (Aalborg University, Denmark), **Allan Jensen** (HEF Net A/S, Denmark)

2014ISGTEU0460
Estimating Plug-in Electric Vehicle Demand Flexibility through an Agent-Based Simulation Model
Gonzalo Bustos-Turu (Imperial College London, UK), **Koen H. Van Dam** (Imperial College London, UK), **Salvador Acha** (Imperial College London, UK), **Nilay Shah** (Imperial College London, UK)

2014ISGTEU0479
A Review of Plug-in Electric Vehicles as Distributed Energy Storages in Smart Grid
Xianjun Zhang (MISO, USA), **Qin Wang** (MISO, USA), **Guangyue Xu** (Siemens Industry Inc., USA), **Ziping Wu** (Denver University, USA)

2014ISGTEU0545
The Nikola project - Intelligent Electric Vehicle Integration
Peter Bach Andersen (DTU, Denmark), **Mattia Marinelli** (DTU, Denmark)

2014ISGTEU0544
Vehicle-to-Grid Automatic Load Sharing with Driver Preference in Micro-Grids
Yubo Wang (University of California, USA), **Hamidreza Nazaripouya** (University of California, USA), **Chi-Cheng Chu** (University of California, USA), **Rajit Gadh** (University of California, USA), **Hemanshu Pota** (University of New South Wales, Australia)

2014ISGTEU0476
Autonomous Reactive Power Control by Electric Vehicles
Robert Kohrs (Fraunhofer ISE, Germany), **Kilian Dallmer-Zerbe** (Fraunhofer ISE, Germany), **Michael Mierau** (Fraunhofer ISE, Germany), **Christof Wittwer** (Fraunhofer ISE, Germany)

Paper Session 3: Power System Stability and Security 1

Date Monday, 13:30 – 15:00
Chair **Costas Vournas**

2014ISGTEU0628
Analysis on the Effect of Rotor Angle Control for Transient Stability Enhancement
Qiang Wei (Shandong University, China), **Weimin Guo** (HAEPC Electric Research Institute, China), **Xueshan Han** (Shandong University, China), **Tianya Li** (Queensland University of Technology Brisbane, Australia), **Ming Yang** (Shandong University, China)

2014ISGTEU0297
Interval Based Network Operation Respecting N-1 Security Criterion
Premysl Vorac (University of West Bohemia, Czech Republic), **Eduard Janecek** (University of West Bohemia, Czech Republic), **Daniel Georgiev** (University of West Bohemia, Czech Republic)

2014ISGTEU0038
Sensitivity Analysis on Short-Circuit Current Contribution from VSC-HVDC Systems Connecting Far and Large Offshore Wind Power Plants
Mario Ndreko (TU Delft, Netherlands), **Marjan Popov** (TU Delft, Netherlands), **Jens C. Boemer** (TU Delft, Netherlands), **Mart A. M. M. van der Meijden** (TU Delft, Netherlands)

2014ISGTEU0366
Wide Area Prosumption Control and Sensitivities of Aperiodic Small Signal Stability Indicators
Martin Wittrock (DTU, Denmark), **Hjörtur Arne** (DTU, Denmark), **Hejde Nielsen** (DTU, Denmark)

2014ISGTEU0551
Linking Damping of Electromechanical Oscillations to System Operating Conditions using Neural Networks
Francesco Sulla (Lund University, Sweden), **Emil Måsbäck** (Lund University, Sweden), **Olof Samuelsson** (Lund University, Sweden)

2014ISGTEU0117
A Three-layer Severity Index for Power System Voltage Stability Assessment using Time-series from Dynamic Simulations
Luigi Vanfretti (KTH Stockholm, Sweden), **Felix Rafael Segundo Sevilla** (KTH Stockholm, Sweden)

Paper Session 4: Residential Demand Response 1

Date Monday, 13:30 – 15:00
Chair **Ehab El-Saadany**

2014ISGTEU0260
Modelling of Household Electro - Thermal Technologies for Demand Response Applications
Lingxi Zhang (University of Manchester, UK), **Nicholas Good** (University of Manchester, UK), **Alejandro Navarro-Espinosa** (University of Manchester, UK), **Pierluigi Mancarella** (University of Manchester, UK)

2014ISGTEU0326
Challenges in Utilisation of Demand Side Response for Operating Reserve Provision
Hassan Qazi (University College Dublin, Ireland), **Daniel Burke** (University College Dublin, Ireland), **Damian Flynn** (University College Dublin, Ireland)

2014ISGTEU0125
A Home Energy Management Algorithm in a Smart House Integrated with Renewable Energy
Avijit Saha (Virginia Tech, USA), **Murat Kuzlu** (Virginia Tech, USA), **Warodom Khamphanchai** (Virginia Tech, USA), **Manisa Pipattanasomporn** (Virginia Tech, USA), **Saifur Rahman** (Virginia Tech, USA), **Onur Elma** (Yıldız Technical University, Turkey), **Ugur S. Selamogullari** (Yıldız Technical University, Turkey), **Mehmet Uzunoglu** (Yıldız Technical University, Turkey), **Bunyamin Yagcitekin** (Yıldız Technical University, Turkey)

2014ISGTEU0389
Large-scale Residential Demand Response Pilot ICT Architecture
Matthias Strobbe (Ghent University, Belgium), **Koen Vanthournout** (Ghent University, Belgium), **Tom Verschueren** (Ghent University, Belgium), **Wim Cardinaels** (VITO-EnergyVille, Belgium), **Chris Develder** (Ghent University, Belgium)

2014ISGTEU0419
Non-Intrusive Load Curve Disaggregation using Sparse Decomposition with a Translation-Invariant Boxcar Dictionary
Simon Arberet (CSEM, Switzerland), **Andreas Hutter** (CSEM, Switzerland)

2014ISGTEU0502
Study of Load Curves Concerning the Influence of Socioeconomic and Cultural

Panel 2

Monday, 15:30 – 17:15
Conference Main Hall

Developments in Energy Storage Technologies

Chair: **Ahmet Cansız**, ITU, Turkey

Prof. Dr. Ahmet Cansız is a professor in the Electrical Engineering Department, Istanbul Technical University, Turkey. He obtained Ph.D. degree from the Illinois Institute of Technology, USA, in 1999. He has a wide experience in thermodynamics of the cryogenics systems, superconductivity applications such as superconducting levitation, superconducting bearing system, superconducting MagLev, superconducting magnetic energy storage and superconducting flywheel energy storage. His research area also focuses on interdisciplinary subjects such as heat transfer phenomena in heat exchangers, integration of renewable energy with grids and energy storage technologies. He has more than 40 publications in the subject of electromagnetics, electromechanics, thermodynamics and energy storage related topics. He is a member of IEEE and IEEE Magnetic Society.

Panel Abstract: Major challenges on the integration of the energy distribution and energy storage technologies with the smart grids are the major focus of the panel. Variety of energy storage devices associated with the smart grids will be discussed such as superconducting devices of flywheels, superconducting magnetic energy storage, fault current limiters and superconducting power cables. Implementations of not only renewable energy sources such as wind turbine and solar energy but also energy storage devices such as electrochemical storage will be discussed for the power grids. The batteries, supercapacitors, chemical storage will be discussed from point of view of the stable operation of power grid. To ensure the generation and load in balance at all times new approaches will be discussed. The stability and security are one of the main concerns in the panel for the power system operations to ensure the grid withstands contingency events. In this respect, how the energy storage systems can be used to enhance the stability and security of energy delivery will be discussed. The related issues about stability, regulation, congestion, loss and heating will be discussed. The panel will also cover the surrounding issues such as costs, markets, applications and predictions for the future.

Challenges in the Integration of High Temperature Superconducting Devices with the Smart Grid
Ahmet Cansız, Istanbul Technical University, Faculty of Electrical and Electronics, Electrical Engineering Department, Istanbul.

Fuel Cells and Sustainable Development
Can Erkey, Koç University, Chemical and Biological Engineering Department, Istanbul.

Energy storage for the provision of fast-acting instantaneous reserve
R.B. Buckley, the Robinson Research Institute, Victoria University of Wellington, Wellington, New Zealand.

Energy Storage Technologies for Smart Grid
Andrew Jones, Managing Director, S&C Electric Europe.

Basics of Flow Batteries and Field Demonstration
Mariesa L. Crow, Electrical and Computer Engineering Department, Missouri S&T. MO, USA.

Paper Session 5: Computational Intelligence in Smart Grid

Date Monday, 15:30 – 17:15
Chair **Noel Schulz**

2014ISGTEU0324
Optimal Placement of Multi-Terminal HVDC Interconnections for Increased Operational Flexibility
Matthias Bucher (ETH Zurich, Switzerland), **Roger Wiget** (ETH Zurich, Switzerland), **Gabriel Hidalgo-Barquero Pérez** (ETH Zurich, Switzerland), **Göran Andersson** (ETH Zurich, Switzerland)

2014ISGTEU0305
Synthetic Generation of Solar States for Smart Grid: A Multiple Segment Markov Chain Approach
Wayes Tushar (Singapore University of Technology and Design, Singapore), **Shisheng Huang** (Singapore University of Technology and Design, Singapore), **Chau Yuen** (Singapore University of Technology and Design, Singapore), **Jian Andrew Zhang** (CSIRO, Australia), **David Smith** (NICTA, Australia)

2014ISGTEU0026
Application of Hybrid Heuristic Optimization Algorithms for Solving Optimal Hydrothermal System Operation
Martha Camargo (Universidad Nacional de San Juan, Argentina), **Jose Rueda** (TU Delft, Netherlands), **Osvaldo Año** (Universidad Nacional de San Juan, Argentina), **István Erlich** (University of Duisburg-Essen, Germany)

2014ISGTEU0591
A Combined GA and IPM Approach for Unit Commitment Problem
Worawat Nakawiro (King Mongkut's Institute of Technology Ladkrabang, Thailand)

2014ISGTEU0390
Impact of Distributed Generation on the Operational Planning of Medium Voltage Distribution Networks Using Genetic Algorithms
Alexandre Souza (Polytechnic School of Sao Paulo University, Brazil), **Nelson Kagan** (Polytechnic School of Sao Paulo University, Brazil), **Miguel Udaeta** (Polytechnic School of Sao Paulo University, Brazil), **Klaus de Geus** (Federal University of Parana, Brazil)

2014ISGTEU0243
Adaptive Decentralized Coordinated Neural Control of Hybrid Wind Thermal

Paper Session 6: Microgrid Operation

Date Monday, 15:30 – 17:15
Chair **Fabio Massaro**

2014ISGTEU0405
Integration of a Hybrid Power Station in the Insular Power System of Crete
Andreas Ntomaris (Aristotle University of Thessaloniki, Greece), **Stylianos Vagropoulos** (Aristotle University of Thessaloniki, Greece), **Anastasios Bakirtzis** (Aristotle University of Thessaloniki, Greece)

2014ISGTEU0346
A Control Algorithm for the Stable Operation of Interfaced Converters in Microgrid Systems
Edris Pouresmaeil (University of Southern Denmark, Denmark), **Majid Mehrasa** (Babol University of Technology, Iran), **Bo Nørregaard Jørgensen** (University of Southern Denmark, Denmark), **Ozan Erdinç** (Arel University, Turkey), **Joao Catalao** (University of Beira Interior, Portugal)

2014ISGTEU0097
Active Synchronization Control for Microgrid Reconnection after Islanding
Di Shi (NEC Laboratories America, USA), **Yusheng Luo** (Florida State University, USA), **Ratnesh Sharma** (NEC Laboratories America, USA)

2014ISGTEU0115
Scalable and Optimal Coalition Formation of Microgrids in a Distribution System
Shantanu Chakraborty (NEC Corporation, Japan), **Shin Nakamura** (NEC Corporation, Japan), **Toshiya Okabe** (NEC Corporation, Japan)

2014ISGTEU0403
Microgrid Design Considerations for a Smart-Energy University Campus
Rosa Morales Gonzalez (TU Eindhoven, Netherlands), **Dennis van Goch** (TU Eindhoven, Netherlands), **Farooq Aslam** (TU Eindhoven, Netherlands), **Anna Blanch** (TU Eindhoven, Netherlands), **Paulo Ribeiro** (TU Eindhoven, Netherlands)

2014ISGTEU0317
Switching Frequency Optimized Granular Maximum Power Point Tracking for PV Systems
Moustafa Adly (TU Berlin, Germany), **Kai Strunz** (TU Berlin, Germany)

Paper Session 7: Power System Monitoring, Operation and Control

Date Monday, 15:30 – 17:15
Chair **Ali Abur**

2014ISGTEU0602
Estimation of Load Model Parameters from PMU Measurements
Pawel Regulski (University of Manchester, UK), **Peter Wall** (University of Manchester, UK), **Zina Rusidovic** (University of Manchester, UK), **Vladimir Terzija** (University of Manchester, UK)

2014ISGTEU0552
Analysis of a Centralized Control Strategy in Mitigating Inter-Area Power Oscillations
Otso Mäki (Aalto University, Finland), **Janne Seppänen** (Fingrid, Finland), **Liisa Haarla** (Aalto University, Finland), **Kai Zenger** (Aalto University, Finland), **Jukka Turunen** (Statnett, Norway), **Antti-Juhani Nikkilä** (Fingrid, Finland)

2014ISGTEU0562
Grid-Constrained Optimal Predictive Power Dispatch in Large Multi-Level Power Systems with Renewable Energy Sources, and Storage Devices
Philipp Fortenbacher (ETH Zurich, Switzerland), **Andreas Ulbig** (ETH Zurich, Switzerland), **Stephan Koch** (ETH Zurich, Switzerland), **Göran Andersson** (ETH Zurich, Switzerland)

2014ISGTEU0341
Use of Air Chamber in Gas-Turbine Units for Frequency Control and Energy Storage in a System with High Wind Penetration
Ioannis Kandiloros (National Technical University of Athens, Greece), **Costas Vournas** (National Technical University of Athens, Greece)

2014ISGTEU0485
Real Time Simulation of a Robust LQG based Wide Area Damping Controller in Power System
Mahendra Bhadu (Indian Institute of Technology Delhi, India), **Nilanjan Senroy** (Indian Institute of Technology Delhi, India)

2014ISGTEU0331
Online Optimal Control of Reactive Power Sources Using Measurement-Based Approach
Van Hoan Pham (University of Duisburg-Essen, Germany), **István Erlich** (University of Duisburg-Essen, Germany)

Paper Session 8: Power Quality and Reliability

Date Monday, 15:30 – 17:15
Chair **Geert Deconinck**

2014ISGTEU0601
The Effect of Temporal and Spatial Variation of Harmonic Sources on Annual Harmonic Performance of Distribution Networks
Sami Abdelrahman (University of Manchester, UK), **Huilian Liao** (University of Manchester, UK),
Jovica Milanovic (University of Manchester, UK)

2014ISGTEU0264
Combination of Skeletonization and Morphology Edge Detection for Detecting Time Location of Power Disturbances
I Gusti Ngurah Agung Dwijaya Saputra (The University of Liverpool, UK), **Jeremy Smith** (The University of Liverpool, UK), **Qinghua Wu** (The University of Liverpool, UK)

2014ISGTEU0265
Detection and Classification of Power Disturbances Using Mathematical Morphology with Trapezoid Structuring Elements and Signal Envelopes
Jie Zhu (The University of Liverpool, UK), **Tianyao Ji** (South China University of Technology, China), **Mengshi Li** (South China University of Technology, China), **Qinghua Wu** (South China University of Technology, China), **Jeremy Smith** (The University of Liverpool, UK)

2014ISGTEU0325
Comparison of Voltage Sag and Outage Cost in Urban Meshed 110-kV Subtransmission Network Planning
Bruno de Oliveira e Sousa (Aalto University, Finland), **Atte Pihkala Helen** (Helsinki Energy, Finland), **Matti Lehtonen** (Aalto University, Finland)

2014ISGTEU0611
Causality Assessment for Power Quality Stationary Disturbances
Andrés Pavas (Universidad Nacional de Colombia, Colombia), **Camilo Garzón** (Universidad Nacional de Colombia, Colombia)

2014ISGTEU0622
Incorporating Regulator Requirements in Reliability Analysis of Smart Grids Part 1: Input Data and Models
Sasa Djokic (The University of Edinburgh, UK), **Mohd Ikhwan Muhammad Ridzuan** (The University of Edinburgh, UK), **Ignacio Hernando-Gil** (The University of Edinburgh, UK), **Roberto Langella** (Second University of Naples, Italy), **Alfredo Testa** (Second

Poster Session A

Date Monday, 17:15 – 19:30
Chair **Omer Usta/Belgin Turkay**

2014ISGTEU0025
Eigen-Analysis Based Power Quality Event Data Clustering and Classification
Ebrahim Balouji (Gazi University, Turkey), **Ozgul Salor** (Gazi University, Turkey)

2014ISGTEU0061
A Fuzzy Based Maximal Preventive Reactive Power Allocation Procedure
Ragab El Sehiemy (Kafrelsheikh University, Egypt), **Adel Abou El Ela** (University of Minoufiya, Egypt), **Abdul Allah Shaheen** (South Delta Electricity Distribution Company Ministry of Electricity Tanta, Egypt)

2014ISGTEU0070
Optimal Bidding Strategies of a Mixed RES Portfolio by Stochastic Programming
Evaggelos Kardakos (Aristotle University of Thessaloniki, Greece), **Christos Simoglou** (Aristotle University of Thessaloniki, Greece), **Anastasios Bakirtzis** (Aristotle University of Thessaloniki, Greece)

2014ISGTEU0078
Assessing and Comparing Smart Grid Demonstration Projects
Ruben Lopez (Grenoble-Alpes University, France), **Damien Picault** (Grenoble-Alpes University, France), **Oussama Accouche**, (Grenoble-Alpes University, France), **Didier Boeda**, (Grenoble-Alpes University, France), **Nouredine Hadjsaıd**, (Grenoble-Alpes University, France)

2014ISGTEU0081
Identification of Electric Power System Stress through Feeder Voltage Measurement
Ren Kang (University of Oxford, UK), **Malcolm McCulloch** (University of Oxford, UK)

2014ISGTEU0092
Applying Heuristics and Stochastic Optimization for Load-Responsive Charging in a Smart Grid Architecture
Tobias Küster (Technische Universität Berlin, Germany), **Marco Lützenberger** (Technische Universität Berlin, Germany), **Marcus Voß** (Technische Universität Berlin, Germany), **Daniel Freund** (Technische Universität Berlin, Germany), **Sahin Albayrak** (Technische Universität Berlin, Germany)

2014ISGTEU0110

Conceptual Architecture of Building Energy Management Open Source Software (BEMOSS)

Warodom Khamphanchai (Virginia Tech, USA), **Avijit Saha** (Virginia Tech, USA), **Kruthika Rathinavel** (Virginia Tech, USA), **Manisa Pipattanasomporn** (Virginia Tech, USA), **Murat Kuzlu** (Virginia Tech, USA), **Saifur Rahman** (Virginia Tech, USA), **Bora Akyol** (Pacific Northwest National Laboratory, USA), **Jereme Haack** (Pacific Northwest National Laboratory, USA)

2014ISGTEU0132

Process Approaches for the Integration of Controllable Resources

Oliver Warweg (Fraunhofer IOSB, Germany), **Alexander Arnoldt** (Fraunhofer IOSB, Germany), **Jens Ehrhardt** (Mitteldeutsche Energie AG, Germany)

2014ISGTEU0138

Comparative Analysis of Multiband Stabilizer for Damping of Power System Oscillations

Hasan Ul Banna (Universitat Politècnica de Catalunya, Spain), **Alvaro Luna** (Universitat Politècnica de Catalunya, Spain), **Hamidreza Ghorbani** (Universitat Politècnica de Catalunya, Spain), **Pedro Rodriguez** (Universitat Politècnica de Catalunya, Spain), **Shaoqing Ying** (Universitat Politècnica de Catalunya, Spain)

2014ISGTEU0154

Distributed Optimization Algorithm for Heat Pump Scheduling

Michael Diekerhof (RWTH Aachen, Germany), **Stefanie Vorkampf** (RWTH Aachen, Germany), **Antonello Monti** (RWTH Aachen, Germany)

2014ISGTEU0163

Optimal Operation Tracking Energy Management System for a Battery-Equipped BTS Microgrid

Alexander Viehweider (NEC Corporation, Japan), **Koji Kudo** (NEC Corporation, Japan)

2014ISGTEU0178

Protection Coordination of Directional Overcurrent Relays Considering Fault Current Direction

Hebatallah Sharaf (Cairo University, Egypt), **H.H. Zeineldin** (Cairo University, Egypt), **Doaa Khalil** (Cairo University, Egypt), **Essam El Din Abo El Zahab** (Cairo University, Egypt)

2014ISGTEU0200

Review of Congestion Management Methods for Distribution Networks with High Penetration of Distributed Energy Resources

Shaojun Huang (Technical University of Denmark, Denmark), **Qiuwei Wu** (Technical University of Denmark, Denmark), **Zhaoxi Liu** (Technical University of Denmark, Denmark), **Arne Nielsen** (Technical University of Denmark, Denmark)

Poster Session A (continued)

Date Monday, 17:15 – 19:30

2014ISGTEU0218
A Demand Side Prediction Method for Persistent Scheduled Power-cuts in Developing Countries
Takuma Kogo (NEC Corporation, Japan), **Shin Nakamura** (NEC Corporation, Japan), **Pravinraj S.** (SRM Technologies Private Limited, India), **Arumugam B.** (SRM Technologies Private Limited, India)

2014ISGTEU0219
Uncertainty in Real-Time Voltage Stability Assessment Methods Based on Thevenin Equivalent due to PMU's Accuracy
Angel Perez (Technical University of Denmark, Denmark), **Jakob Møller** (Technical University of Denmark, Denmark), **Hjörtur Jóhannsson** (Technical University of Denmark, Denmark), **Jacob Østegaard** (Technical University of Denmark, Denmark)

2014ISGTEU0227
Exploring Methods to Evaluate the Carbon Impact of Network Investment Deferral
Laura Daniels (University of Reading, UK), **Ben Potter** (University of Reading, UK), **Phil Coker** (University of Reading, UK)

2014ISGTEU0228
Feeder Load Balancing in MV Distribution Networks Using Soft Normally-Open Points
Wanyu Cao (Cardiff University, UK), **Jianzhong Wu** (Cardiff University, UK), **Nick Jenkins** (Cardiff University, UK)

2014ISGTEU0235
Inertia Estimation using PMUs in a Laboratory
Peter Wall (The University of Manchester, UK), **Pawel Regulski** (The University of Manchester, UK), **Zina Rusidovic** (The University of Manchester, UK), **Vladimir Terzija** (The University of Manchester, UK)

2014ISGTEU0237
Balancing Power Consumption and Production in Smart Grids
Markus Bestehorn (Landis+Gyr, Switzerland), **Theodor Borsche** (ETH Zürich, Switzerland)

2014ISGTEU0241
The Value of Flexibility in the Distribution Grid

2014ISGTEU0246

Evaluation of Peak-Shifting Techniques for Residential Air Conditioning Demand in Saudi Arabia

Gareth McLorn (Saudi Aramco, Saudi Arabia), **Abdullah Sheikh** (Saudi Aramco, Saudi Arabia), **Rafat Rob** (Saudi Aramco, Saudi Arabia)

2014ISGTEU0254

Complex Bid Model and Strategy for Dispatchable Loads in Real Time Market Base Demand Response

Muhammad Babar (Eindhoven University of Technology, Netherlands), **Phuong Nguyen** (Eindhoven University of Technology, Netherlands), **Vladimir Cuk** (Eindhoven University of Technology, Netherlands), **Rene Kamphuis** (Eindhoven University of Technology, Netherlands), **Wil Kling** (Eindhoven University of Technology, Netherlands)

2014ISGTEU0276

Pseudo-Measures Modeling Using Neural Network and Fourier Decomposition for Distribution State Estimation

Francesco Adinolfi (University of Genova, Italy), **Fabio D'Agostino** (University of Genova, Italy), **Andrea Morini** (University of Genova, Italy), **Matteo Saviozzi** (University of Genova, Italy), **Federico Silvestro** (University of Genova, Italy)

2014ISGTEU0277

Optimization of Generation and Aggregated Consumption Shifting for Demand Response Programs Definition

Pedro Faria (Polytechnic of Porto, Portugal), **Zita Vale** (Polytechnic of Porto, Portugal)

2014ISGTEU0283

Demand Response for Different Power Supply Systems

Vladimir Stepanov (Irkutsk State Technical University, Russia), **Konstantin Suslov** (Irkutsk State Technical University, Russia), **Elena Stashkevich** (Irkutsk State Technical University, Russia), **Nikolai Voropai** (Institute SB RAS, Russia), **Zbigniew Styczynski** (Otto von Guericke University, Germany)

2014ISGTEU0290

Optimum Allocation of FCB Thermal Power Plant Using Ordinal Optimization Theory

En Lu (South China University of Technology, China), **Mingbo Liu** (South China University of Technology, China), **Jian Ning** (Hohai University, China), **Haoming Liu** (Hohai University, China), **Yunhe Hou** (The University of Hong Kong, Hong Kong)

2014ISGTEU0292

Mixed Integer Linear Programming Formulation for Robust State Estimation

Poster Session A (continued)

Date Monday, 17:15 – 19:30

2014ISGTEU0343
Planned Communities as Microgrid Applications
Panayiotis Moutis (University of Greenwich, UK), **Spyros Skarvelis-Kazakos** (University of Greenwich, UK), **Maria Brucoli** (Arup, UK), **Joel Hung** (Arup, UK), **Shu-Wei Wu** (Arup, UK)

2014ISGTEU0344
On The Roadmap to Supergrid in Sicily: LIDAR Technology and HTLS Conductors for Uprating the 150 kV Lines
Andrea Puccio (University Of Palermo, Italy), **Mariano Giuseppe Ippolito** (University Of Palermo, Italy), **Fabio Massaro** (University Of Palermo, Italy), **Giovanni Filippone** (Terna S.p.A., Italy)

2014ISGTEU0355
Agent-Based Control for Building Energy Management in the Smart Grid Framework
Luis Hurtado (Eindhoven University of Technology, Netherlands), **Phuong Nguyen** (Eindhoven University of Technology, Netherlands), **Wil Kling** (Eindhoven University of Technology, Netherlands)

2014ISGTEU0358
A Study on the Power System Security with Increased PV Penetration by Applying the Robust Power System Security
Yoshiharu Okumoto (Chugoku Electric Power Co., Japan), **Naoto Yorino** (Hiroshima University, Japan), **Yoshifumi Zoka** (Hiroshima University, Japan), **Yutaka Sasaki** (Hiroshima University, Japan), **Tomohisa Akiyoshi** (Hiroshima University, Japan), **Tomohiro Isoya** (Hiroshima University, Japan)

2014ISGTEU0359
Increasing the Penetration Level of Distributed Generation without Violating Overcurrent Based Protection System Coordination
Ahmed Abu Elanien (Alexandria University, Egypt)

2014ISGTEU0364
Charging Optimization of Battery Electric Vehicles including Cycle Battery Aging
Annette Trippe (TUM CREATE, Singapore), **Raghavendra Arunachala** (TUM CREATE,

2014ISGTEU0374

Load Kick-Back Effects due to Activation of Demand Response In View of Distribution Grid Operation

Xue Han (Technical University of Denmark, Denmark), **Fabrizio Sossan** (Technical University of Denmark, Denmark), **Henrik Bindner** (Technical University of Denmark, Denmark), **Shi You** (Technical University of Denmark, Denmark), **Henrik Hansen** (Danish Energy Association, Denmark), **Peder Cajar** (DONG Energy, Denmark)

2014ISGTEU0377

An Improved Analytical Method of Generators Aggregation Based on Structure Preserving Technique

Lin Zhu (South China University of Technology, China), **Sha Li** (South China University of Technology, China), **Zexiang Cai** (South China University of Technology, China)

2014ISGTEU0379

Functionality Identification for the Testing Systems with Large-scale Highly-concentrated Wind Power Integration by Long-distance Transmission Lines

Jiabing Hu (Huazhong Univ. of Sci. & Tech., China), **Yunhe Hou** (The University of Hong Kong, Hong Kong), **Feng Liu** (Tsinghua University, China), **Yongning Chi** (China Electric Power Research Institute, China), **Shuanglei Feng** (China Electric Power Research Institute, China), **Haiyan Tang**(China Electric Power Research Institute, China), **Guobing Song** (X'an Jiaotong University, China), **Xiaoming Yuan** (Huazhong Univ. of Sci. & Tech., China)

2014ISGTEU0381

The Feasibility of the Composite Insulator with Fiber Bragg Grating Embedded in the Rod

Heming Deng (State Grid Electric Power Research Institute, China), **Wei Cai** (State Grid Electric Power Research Institute, China), **Chunxiang Liu** (State Grid Electric Power Research Institute, China), **Jinhai He** (State Grid Electric Power Research Institute, China)

2014ISGTEU0384

Electric Space Heating Scheduling for Real-time Explicit Power Control in Active Distribution Networks

Giuseppe Tommaso Costanzo (Technical University of Denmark, Denmark), **Andrey Bernstein** (Ecole Polytechnique Federale de Lausanne, Switzerland), **Lorenzo Enrique Reyes Chamorro** (Ecole Polytechnique Federale de Lausanne, Switzerland), **Henrik Bindner** (Technical University of Denmark, Denmark), **Jean-Yves Leboudec** (Ecole Polytechnique Federale de Lausanne, Switzerland), **Mario Paolone** (Ecole Polytechnique Federale de Lausanne, Switzerland)

2014ISGTEU0394

A Review of Demand Response Business Cases

Poster Session A (continued)

Date Monday, 17:15 – 19:30

Balancing Asymmetrical Load Using a Static Var Compensator
Amar Alsulami (ABB, Sweden), **Muhamad Reza** (ABB, Sweden), **Kailash Srivastava** (ABB, Sweden), **Massimo Bongiorno** (Chalmers University of Technology, Sweden)

2014ISGTEU0413
Analysis of Latency for Cellular Networks for Smart Grid in Suburban Area
Niwas Maskey (Technical Research Center of Finland, Finland), **Seppo Horsmanheimo** (Technical Research Center of Finland, Finland), **Lotta Tuomimäki** (Technical Research Center of Finland, Finland)

2014ISGTEU0416
Smooth Energy Consumption for Demand Side Sceduling Using Heuristic Optimization
Yuefang Du (University of Liverpool, UK), **Lin Jiang** (University of Liverpool, UK), **Yanbing Bi** (University of Liverpool, UK), **Yuanzheng Li** (University of Liverpool, UK)

2014ISGTEU0418
Load Shifting in the Existing Distribution Network and Perspectives for EV Charging– Case Study
Lauri Kütt (Aalto University School of Electrical Engineering, Finland), **Eero Saarijärvi** (Aalto University School of Electrical Engineering, Finland), **Matti Lehtonen** (Aalto University School of Electrical Engineering, Finland), **Argo Rosin** (Tallinn University of Technology, Finland), **Heigo Mõlder** (Tallinn University of Technology, Finland)

2014ISGTEU0586
Impact of Non-Programmable Renewable Sources in Day-Ahead Market in Sicily. Reasons to Make More Flexible and Smarter the National Transmission Grid
Salvatore Favuzza (University of Palermo, Italy), **Mariano Giuseppe Ippolito** (University of Palermo, Italy), **Antonino Madonia** (University of Palermo, Italy), **Fabio Massaro** (University of Palermo, Italy), **Enrico Maria Carlini** (TERNA S.p.A., Italy), **Cristiano Quaciari** (TERNA S.p.A., Italy)

Tuesday,
October 14,
2014

Tuesday, October 14, 2014			
09:00 - 09:30	**Keynote B** : **"Smart Grid Standards and Interoperability"** **John D. McDonald,** P.E. GE Energy Management Digital Energy Director, Technical Strategy & Policy		
09:30 - 11:00	**Plenary B** : **"Innovative Smart Grids – From Concept to Implementation in Eurasi** **Kai Strunz,** TU Berlin		
11:00 - 11:30	**Coffee Break**		
ROOM	**Conference Main Hall**	**Room A**	
11:30 - 13:00	**Panel 3** **Smart Energy Supply Networks** Chair: **: Jianzhong Wu**	**Panel 4** **Women in Power Activities**	
13:00 - 14:30	**Poster Session B, SDKM 2nd Floor,** Chair: Ahmet Cansız **Lunch Break**		
14:30 - 16:00	**Panel 5** **Smart Grid Security** Chair: **Lucie Langer**	**Paper Session 12** **Smart Grid Communications** Chair: **Li Haiyu**	
16:00 - 16:30	**Coffee Break**		
16:30 - 18:00	**Panel 6** **Smart Distribution Networks** Chair: **Hasan Basri Çetinkaya**	**Paper Session 16** **Physical and Cyber Security of Smart Grid**	

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	Seminar Room	Senate Room	Room B
	Paper Session 9 **Electrical Vehicle Charging** Chair: **Dragan Jovcic**	**Paper Session 10** **Voltage Control 1** Chair: **Frank C. Lambert**	**Paper Session 11** **Electricity Market** Chair: **Osman Sevaioğlu**
	Paper Session 13 **Power Generation and Energy Storage Technologies** Chair: **Kai Strunz**	**Paper Session 14** **Power System Stability and Security 2** Chair: **Lin Jiang**	**Paper Session 15** **Demand Side Management 1** Chair: **Koen Kok**
	Paper Session 17 **Network Integration of Dist. Energy Resources**	**Paper Session 18** **DC Grid and Power Electronic Applications**	**Paper Session 19** **Energy Management** Chair: **Aydoğan Özdemir**

Keynote B

Tuesday, 09:00 – 09:30
Conference Main Hall

Smart Grid Standards and Interoperability

John D. McDonald, P.E., GE Energy Management Digital Energy
Director, Technical Strategy & Policy Development

John D. McDonald, P.E., is Director, Technical Strategy and Policy Development for GE Energy Management's Digital Energy business. John has 40 years of experience in the electric utility industry. John joined GE in 2008 as General Manager, Marketing for GE Energy's Transmission and Distribution (now Digital Energy) business. In 2010, John accepted his current role of Director, Technical Strategy and Policy Development where he is responsible for setting and driving the vision that integrates GE's standards participation, and Digital Energy's industry organization participation, thought leadership activities, regulatory/policy participation, education programs, and product/systems development into comprehensive solutions for customers.

Abstract: The purpose of this talk is to familiarize participants with Smart Grid concepts and solutions, including Distribution Optimization, Transmission Optimization, Asset Optimization, Demand Optimization, Smart Meters and Communications, and Workforce and Engineering Design Optimization. Smart Grid industry standards efforts will be discussed, including NIST, IEEE, CIGRE and IEC. An overview of recent Smart Grid deployments will be given, including the lessons learned from the deployments.

Plenary B

Tuesday, 09:30 – 11:00
Conference Main Hall

Innovative Smart Grids – From Concept to Implementation in Eurasia

Chair: Kai Strunz, Technische Universität Berlin, Germany

Prof. Kai Strunz graduated with the Dipl.-Ing. Degree from Saarland University in Saarbrücken, Germany, in 1996, and he was awarded the Dr.-Ing. Degree with summa cum laude from the same university in 2001. From 1995 to 1997, Dr. Strunz pursued research at Brunel University in London. From 1997 to 2002, he worked at the Division Recherche et Développement of Electricité de France (EDF) in the Paris area. From 2002 to 2007, he was Assistant Professor of Electrical Engineering at the University of Washington in Seattle. Since September 2007, he has been Professor for Sustainable Electric Networks and Sources of Energy at Technische Universität Berlin. He was the chairman of the conference IEEE PES Innovative Smart Grid Technologies held at TU Berlin from 14 to 17 October 2012. He is the Chairman of the IEEE Power & Energy Society Subcommittee on Distributed Generation and Energy Storage and Chairman of the IEEE Power & Energy Society Subcommittee on Research in Education. On behalf of the Intergovernmental Panel on Climate Change (IPCC), Dr. Strunz acted as Review Editor for the Special Report on Renewable Energy Sources and Climate Change Mitigation. Kai Strunz received the Dr.-Eduard-Martin Award from Saarland University in 2002, the National Science Foundation (NSF) CAREER Award in 2003, and the Outstanding Teaching Award from the Department of Electrical Engineering of the University of Washington in 2004.

Family of Energy Management Systems for Smart Grids: Concept and Implementation in China

Hongbin Sun, Tsinghua University, China

Prof. Hongbin Sun received his double B.S. degrees from Tsinghua University in 1992, the Ph.D. from Dept. of E.E., Tsinghua University in 1997. He is now Changjiang Chair Professor of Education Ministry of China, full professor of electrical engineering in Tsinghua Univ. and assistant director of State Key Laboratory of Power Systems in China. He is IET Fellow and IEEE Senior Member. In recent 20 years, he led a research group in Tsinghua

Project SUSTAINABLE: Smart Distribution System Operation for Maximizing the Integration of Renewables

Nuno Silva, Efacec, Portugal

Nuno Silva graduated from University of Porto in 2003 with a specialization in Power Systems, finished his PhD in Electrical Engineering at the Control and Power Group, Imperial College London in 2009 and complimented his skills with an executive MBA at Catolica Porto Business School in 2014. He currently works at EFACEC, where he is Deputy Director of Strategic Projects of the Switchgear & Automation Business Unit. He is project manager on several national and international smart grids initiatives and electrical mobility projects. Distributed Generation, Smart Grids, automation and power systems economics are his areas of activity.

Markets with Different Speeds: Selected Electric Vehicle Projects and Development Perspectives

Tina Zierul, E.ON, Germany

Tina Zierul is Program Manager E-Mobility and coordinates the technical and economic European R&D research and demonstration programs for German private energy utility E.ON. She also addresses the policy framework around electric vehicles as member of the National Platform E-Mobility, the German government's consultancy body. In order to align e-mobility issues with both the larger clean transportation debate in the European Union and the smart grid developments, she is also a Member of the Task Force E-Mobility within Eurelectric, the European Utilities' association. Tina Zierul got her Master in Economics from Cologne University in 2003 and Trinity College Dublin and also holds university degrees in Journalism and in Wind Energy Studies (2012). At Cologne University, she worked as a research fellow for the Energy Economics Institute.

First Returns of Experience on the Nice Grid Demonstration Project

Rodolphe de Beaufort, Alstom, France

Rodolphe de Beaufort joined Alstom Grid in 2013, as Smart Grid and Smart Cities Marketing Director in the Innovation & Strategy transversal team. Rodolphe is in charge of business development, innovative offering definition, strategic partnership identification and regulatory policy influence. He is a specialist

Rodolphe de Beaufort holds a Masters Degree in Engineering from Arts et Métiers – ParisTech, with a specialization in Innovative Products.

Plenary Abstract: What is the status of Smart Grid projects in Europe and Asia? The plenary gives answers by highlighting selected key smart grid developments and plans across the region. The EU-project SUSTAINABLE paves the way for active distribution networks with a high penetration of renewables in Europe. The Nice Grid project leads to an innovative smart solar-energy district in Southern France. Further discussions focus on European electric vehicle projects as well as the successful implementation of Energy Management Systems in smart grids of China.

Panel 3

Tuesday, 11:30 – 13:00
Conference Main Hall

Smart Energy Supply Networks

Chair: Jianzhong Wu, Cardiff University, UK

Dr. Jianzhong Wu joined Cardiff University in June 2008 (Lecturer 2008; Senior Lecturer 2013; Reader 2014). From 2006 to 2008, he was a Research Fellow in the University of Manchester. He received his PhD in 2004 from Tianjin University, China and then worked there from 2004 to 2006. His final position in Tianjin University was Associate Professor. Dr. Wu researches on power system analysis and control, Smart Grid and energy infrastructure. One of his research focuses is in the area of modelling, analysis and design of integrated smart energy supply networks. He has contributed to a number of EU and UK funded projects as a Principal Investigator or a Co-Investigator. He has published more than 80 papers in refereed journals and conferences. He is a co-author of book "Smart Grid: Technology and Applications" (2012, Wiley). His professional involvements include, Secretary-General and Vice Chairman of the UK Branch of China Electrotechnical Society, member and Section 3 leader of the CIGRE Working Group WG C6.21 smart metering – state of the art, regulation, standards and future requirements, member of the Organizing Committee of 2013 5th International Conference on Applied Energy (ICAE), Vice-Chair of the Organizing Committee of 2012 IEEE PES Innovative Smart Grid Technologies (ISGT Asia).

Panel Abstract: Energy supply networks are beginning to undergo a radical transformation which includes: the introduction of new components, new network configurations, new design and operation philosophies, and new incentives and business models. This revolution is in response to energy demand growth, climate change and fuel security concerns. It is influenced by advances in low carbon technologies including renewable energy technologies, information and communication technologies and is supported by government energy policies and strategies. This revolution is affecting all energy vectors, e.g., electric power networks, heating and cooling systems, gas and hydrogen networks, and is significantly increasing the coupling and interactions between them.

Presentations

Landscape overview of integrated smart energy supply networks

Jianzhong Wu, Cardiff University, UK

Energy Hub model for neighbourhood community energy systems

Turhan Demiray, ETH Zurich, Switzerland

Smart energy networks in China

Hongjie Jia, Tianjin University, China

Options for Addressing the balancing Challenges: Integrated analysis of gas and electricity networks

Meysam Qadrdan, Imperial College London, UK

Panel 4

Tuesday, 11:30 – 13:00
Senate Room

Women in Power: Smart Distribution Applications

Chair: Simay Akar

Presentations

Smart Distribution Applications
Noel Schultz, Kansas State University

Smart Distribution Applications
Shay Bahramirad, PES WIP Committee Chair, Manager Smart Grid and Technology

Paper Session 9: Electrical Vehicle Charging

Date Tuesday, 11:30 – 13:00
Chair **Dragan Jovcic**

2014ISGTEU0122
Optimal Scheduling of Electrical Vehicle Charging Under Two Types of Steering Signals
Thijs van der Klauw (University of Twente, Netherlands), **Marco E. T. Gerards** (University of Twente, Netherlands), **Johann L. Hurink** (University of Twente, Netherlands), **Gerard J. M. Smit** (University of Twente, Netherlands)

2014ISGTEU0233
Load Profile for a Bus Rapid Transit Flash Station of Full-Electric Buses
Mario Ríos (Universidad de Los Andes, Colombia), **Luis Muñoz** (Universidad de Los Andes, Colombia), **Sergio Zambrano** (Universidad de Los Andes, Colombia), **Adrián Albarracín** (CODENSA S.A. ESP, Colombia)

2014ISGTEU0594
Decentralized Control of Plug-in Electric Vehicles under Driving Uncertainty
Marina González Vayá (ETH Zurich, Switzerland), **Göran Andersson** (ETH Zurich, Switzerland), **Stephen Boyd** (Stanford University, USA)

2014ISGTEU0295
Analysis of the Impacts of Plug-in Electric Vehicle Charging on the Part of a Real Medium Voltage Distribution Network
Adnan Bosovic (Elektroprivreda, Bosnia and Herzegovina), **Salih Sadovic** (Elektroprivreda, Bosnia and Herzegovina), **Mustafa Music** (Elektroprivreda, Bosnia and Herzegovina)

2014ISGTEU0404
Charging Strategies to Minimize the Energy Cost for an Electric Vehicle Fleet
Van-Linh Nguyen (University Grenoble-Alpes, France), **Tuan Ttan-Quoc** (University Grenoble-Alpes, Farance), **Seddik Bacha** (University Grenoble-Alpes, France), **Ngoc-An Luu** (University Grenoble-Alpes, France)

2014ISGTEU0274
Impact of Electric Vehicles on Household Voltage Profiles and Possible Mitigation Approaches
Warodom Khamphanchai (Virginia Tech, USA), **Manisa Pipattanasomporn** (Virginia Tech, USA), **Saifur Rahman** (Virginia Tech, USA), **Ali T. Al-Awami** (King Fahd University of Petroleum & Minerals, Saudi Arabia)

Paper Session 10: Voltage Control 1

Date Tuesday, 11:30 – 13:00
Chair **Frank C. Lambert**

2014ISGTEU0365
Voltage Control in LV Networks: An Initial Investigation
Andreas T. Procopiou (University of Manchester, UK), **Chao Long** (University of Manchester, UK), **Luis F. Ochoa** (University of Manchester, UK)

2014ISGTEU0554
Comparison of the Low Voltage Distribution Network Voltage Control Schemes
Juho Tuominen (Tampere University of Technology, Finland), **Sami Repo** (Tampere University of Technology, Finland), **Anna Kulmala** (Tampere University of Technology, Finland)

2014ISGTEU0363
Method for Instantly Determining Line Drop Compensator Parameters of Low-Voltage Regulator Using Multiple Classifiers
Hiroshi Kikusato (Waseda University, Japan), **Naoyuki Takahashi** (Waseda University, Japan), **Jun Yoshinaga** (Waseda University, Japan), **Yu Fujimoto** (Waseda University, Japan), **Yasuhiro Hayashi** (Waseda University, Japan), **Shinichi Kusagawa** (Takaoka Toko Co., Japan), **Noriyuki Motegi** (Takaoka Toko Co., Japan)

2014ISGTEU0457
Controller Hardware in the Loop Approaches Supporting Rapid Prototyping of Smart Low Voltage Grid Control
Mario Faschang (Vienna University of Technology, Austria), **Alfred Einfalt** (Siemens AG Austria, Austria), **Roman Schwalbe** (Austrian Institute of Technology, Austria), **Ralf Mosshammer** (Siemens AG Austria, Austria)

2014ISGTEU0338
Voltage Control of Active MV Networks Integrating Res and Storage Units: Advanced Algorithm and Lab Tests
Diana Moneta (RSE, Italy), **Claudio Carlini** (RSE, Italy), **Giacomo Viganò** (RSE, Italy), **Daniele Stein** (ENEL, Italy), **Lilia Consiglio** (ENEL, Italy)

2014ISGTEU0556
Frequency and Voltage Control in Microgrids: Modeling and Simulations in Islanded Mode

Paper Session 11: Electricity Market

Date Tuesday, 11:30 – 13:00
Chair **Osman Sevaioğlu**

2014ISGTEU0426
Analysis and Models of Electricity Prices in the Italian Ancillary Services Market
Federico Moscetti (Università di Siena, Italy), **Simone Paoletti** (Università di Siena, Italy), **Antonio Vicino** (Università di Siena, Italy)

2014ISGTEU0587
Local Electricity Market Design for the Coordination of Distributed Energy Resources at District Level
Michail Ampatzis (TU Eindhoven, Netherlands), **Phuong Hong Nguyen** (TU Eindhoven, Netherlands), **Wil Kling** (TU Eindhoven, Netherlands)

2014ISGTEU0013
Cyclone Dagmar of 2011 and Its Impacts in Finland
Sinan Küfeoğlu (Aalto University, Finland), **Matti Lehtonen** (Aalto University, Finland)

2014ISGTEU0548
Optimising Market Share and Profit Margin: SMDP-based Tariff Pricing under the Smart Grid Paradigm
Rodrigue T. Kuate (Aston University, UK), **Maria Chli** (Aston University, UK), **Hai H. Wang** (Aston University, UK)

2014ISGTEU0071
Hydrothermal Producer Offering strategy in a Transmission-Constrainted Electricity Market - An MPEC Approach
Evaggelos Kardakos (Aristotle University of Thessaloniki, Greece), **Christos Simoglou** (Aristotle University of Thessaloniki, Greece), **Anastasios Bakirtzis** (Aristotle University of Thessaloniki, Greece)

2014ISGTEU0616
Impact Assessment of Wind Power and Demand Side Management on Day-Ahead Market Prices
David Steen (Chalmers University of Technology, Sweden), **Pavan Balram** (Chalmers University of Technology, Sweden), **Le Anh Tuan** (Chalmers University of Technology, Sweden), **Lina Reichenberg** (Chalmers University of Technology, Sweden), **Lina Bertling Tjernberg** (KTH, Stockholm, Sweden)

Poster Session B

Date Tuesday, 13:00 – 14:30
Chair **Ahmet Cansız**

2014ISGTEU0349
A Multi-Agent Model for Assessing Electricity Tariffs
Ioana Pisica (Brunel University, UK), **Colin Axon** (Brunel University, UK), **Peter Hobson** (Brunel University, UK), **Gareth Taylor** (Brunel University, UK), **David Wallom** (University of Oxford, UK)

2014ISGTEU0353
A Study on Short-term Electric Load Forecasting using Wavelet transform
Bon-gil Koo (Pusan National University, South Korea), **Heung-seok Lee** (Pusan National University, South Korea), **Juneho Park** (Pusan National University, South Korea)

2014ISGTEU0422
Design Aspects of a Medium Voltage Hybrid DC Breaker
Jesper Magnusson (KTH Stockholm, Sweden), **Ara Bissal** (KTH Stockholm, Sweden), **Göran Engdahl** (KTH Stockholm, Sweden), **Juan A. Martinez Velasco** (Universitat Politecnica de Catalunya, Spain)

2014ISGTEU0427
Challenges & Opportunities towards Smart Grid in Turkey; Distribution System Operator Perspective-Final
Tugrul Atasoy (Baskent Electricity Distribution, Turkey), **Hülya Erdener Akinç** (Baskent Electricity Distribution, Turkey), **Erdeniz Erol** (Baskent Electricity Distribution, Turkey), **Özden Erçin** (Baskent Electricity Distribution, Turkey), **Ozan Güreç** (Baskent Electricity Distribution, Turkey), **Okan Benli** (Baskent Electricity Distribution, Turkey)

2014ISGTEU0431
A Power Grid Enterprise Control Method for Energy Storage System Integration
Aramazd Muzhikyan (Masdar Institute of Science and Technology, UAE), **Amro Farid** (Masdar Institute of Science and Technology, UAE), **Kamal Youcef-Toumi** (Massachusetts Institute of Technology, USA)

2014ISGTEU0432
Influence of Supply Security Requirements on Underground Cabling Rates in Finland
Juha Haakana (Lappeenranta University of Technology, Finland), **Jukka Lassila**

2014ISGTEU0435
Managing Energy in Time and Space in Smart Grids Using TRIANA
Gerwin Hoogsteen (University of Twente, Netherlands), **Albert Molderink** (University of Twente, Netherlands), **Johann L. Hurink** (University of Twente, Netherlands), **Gerard J. M. Smit** (University of Twente, Netherlands)

2014ISGTEU0439
Developing Situation Awareness in Major Disturbances of Electricity Supply
Heidi Krohns-Välimäki (Tampere University of Technology, Finland), **Hanna Aalto** (Tampere University of Technology, Finland), **Kaisa Pylkkänen** (Tampere University of Technology, Finland), **Janne Strandén** (Tampere University of Technology, Finland), **Pekka Verho** (Tampere University of Technology, Finland), **Janne Sarsama** (Technical Research Centre of Finland, Finland)

2014ISGTEU0440
Bad Data Processing When Using the Coupled Measurement Model and Takahashi's Sparse Inverse Method
Ali Abur (Northeastern University, USA), **Bulent Bilir** (Northeastern University, USA)

2014ISGTEU0450
Distributed Model Predictive Control for Active Power Control of Wind Farm
Haoran Zhao (Technical University of Denmark, Denmark), **Qiuwei Wu** (Technical University of Denmark, Denmark), **Claus Nygaard Rasmussen** (Technical University of Denmark, Denmark), **Qinglai Guo** (Tsinghua University, China), **Hongbin Sun** (Tsinghua University, China)

2014ISGTEU0458
Investigation of Load-Frequency-Control with Increasing Penetration of Converter-Based Generators
Theresa Noll (TU Dortmund, Germany), **Dominik Hilbrich** (TU Dortmund, Germany), **Ulf Häger** (TU Dortmund, Germany), **Marco Greve** (TU Dortmund, Germany), **Johannes Schwippe** (TU Dortmund, Germany), **Christian Rehtanz** (TU Dortmund, Germany)

2014ISGTEU0477
A Novel Approach for Distributed Renewable Generation and Shunt Capacitor Placing in Smart-Grid
Okan Ozgonenel (Ondokuz Mayıs University, Turkey), **Serap Karagol** (Ondokuz Mayıs University, Turkey), **Umit Kemalettin Terzi** (Marmara University, Turkey)

2014ISGTEU0482
Local Control of Fully Inverter Based Micro Grids in İslanding Operation Mode Considering Generation Disturbances in RES

Poster Session B (continued)

Date Tuesday, 13:00 – 14:30

Technology, Iran), **Moein Moeini-Aghtaie** (Sharif University of Technology, Iran), **Aydogan Ozdemir** (Istanbul Technical University, Turkey)

2014ISGTEU0491
Voltage Support Control of Unbalanced Distribution Systems by Reactive Power Regulation
Vito Calderaro (University of Salerno, Italy), **Vincenzo Galdi** (University of Salerno, Italy), **Giorgio Graditi** (ENEA, Italy), **Francesco Lamberti** (University of Salerno, Italy), **Antonio Piccolo** (University of Salerno, Italy)

2014ISGTEU0505
Battery Energy Storage System Size Optimization in Microgrid using Particle Swarm Optimization
Thongchart Kerdphol (Kyushu Institute of Technology, Japan), **Yaser Qudaih** (Kyushu Institute of Technology, Japan), **Yasunori Mitani** (Kyushu Institute of Technology, Japan)

2014ISGTEU0510
Advanced Energy Storage and Demand-Side Management in Smart Grids using Buildings Energy Efficiency Technologies
Dimitrios Tsiamitros (TEI of West Macedonia, Greece), **Dimitrios Stimoniaris** (TEI of West Macedonia, Greece), **Nikolaos Poulakis** (TEI of West Macedonia, Greece), **M. Alparslan Zehir** (Istanbul Technical University, Turkey), **Alp Batman** (Istanbul Technical University, Turkey), **Mustafa Bagriyanik** (Istanbul Technical University, Turkey), **Aydogan Ozdemir** (Istanbul Technical University, Turkey), **Evaggelos Dialynas** (National Technical University of Athens, Greece)

2014ISGTEU0516
Optimization of an air conditioning unit operation according to renewable energy availability and user's comfort
Ana Cabrera (Technical University of Cataluna, Spain), **Cosmin Koch-Ciobotaru** (Technical University of Cataluna, Spain), **Hassan ul Banna** (Technical University of Cataluna, Spain), **Siddharta Ghosh** (University of Southampton)

2014ISGTEU0527
Unsynchronized Fault Location Independent on Line Parameters for Transmission Systems

2014ISGTEU0537
Electrical Load Clustering: the Italian Case
Luca Semeraro (University of Pisa, Italy), **Emanuele Crisostomi** (University of Pisa, Italy), **Alessandro Franco** (University of Pisa, Italy), **Giuseppe Giunta** (enel Spa, Italy), **Alberto Landi** (University of Pisa, Italy), **Marco Raugi** (University of Pisa, Italy), **Mauro Tucci** (University of Pisa, Italy)

2014ISGTEU0539
Risk Assessment of Smart Energy Transfer in Distribution Networks
Muhammad Buhari (University of Manchester, UK), **Kostantinos Kopsidas** (University of Manchester, UK), **Chomba Tumelo-Chakonta** (University of Manchester, UK), **Alexandra Kapetanaki** (University of Manchester, UK)

2014ISGTEU0549
PSS Tuning Method based on Power System Model Identification using PMU
Pavel Chusovitin (Ural Federal University, Russia), **Valery Tashchilin** (Ural Federal University, Russia), **Grigory Shabalin** (Ural Federal University, Russia), **Andrey Pazderin** (Ural Federal University, Russia)

2014ISGTEU0558
Modeling the Optimal Behavior of PEV Parking Lots in Energy and Reserve Market
Nilufar Neyestani (Univ. Beira Interior, Portugal), **Maziar Yazdani Damavandi** (Univ. Beira Interior, Portugal), **Miadreza Shafie-khah** (Univ. Beira Interior, Portugal), **Joao Catalao** (Univ. Beira Interior, Portugal), **Javier Contreras** (University of Castilla-La Mancha, Spain)

2014ISGTEU0561
Optimization of Robust Power Oscillation Dampers for DFIG Wind Turbines Considering N-1 Outage Contingencies
Issarachai Ngamroo (King Mongkut's Institute of Technology Ladkrabang, Thailand), **Tossaporn Surinkaew** (King Mongkut's Institute of Technology Ladkrabang, Thailand)

2014ISGTEU0573
Reactive Power Capability of a Sub-Transmission Grid Using Real-Time Embedded Particle Swarm Optimization
Rengin Cabadag (Dresden University of Technology, Germany), **Uwe Schmidt** (Dresden University of Technology, Germany), **Peter Schegner** (Dresden University of Technology, Germany)

2014ISGTEU0577
Evaluation of Enhancements to Thevenin Equivalent Based Methods for Real-Time Voltage Stability Assessment

Poster Session B (continued)

Date Tuesday, 13:00 – 14:30

2014ISGTEU0582
Future Demand for Prospective Providers of Control Reserves
Stefan Kippelt (TU Dortmund, Germany), **Thorsten Schlueter** (TU Dortmund, Germany), **Christian Rehtanz** (TU Dortmund, Germany)

2014ISGTEU0592
A Modelling Study of Renewable and Stored Energy Sharing and Pricing Management System Developed for Multi-Apartment Complexes
Vedat Kiray (Turgut Ozal University, Turkey), **Taner Topal** (Kırıkkale University, Turkey), **Lutfu Sagbansua** (Turgut Ozal University, Turkey), **Ismail Atacak** (Gazi University, Turkey)

2014ISGTEU0660
Tri-generation and Solar Power for an Efficient and Environmental Friendly Power Generation
Essam Al-Ammar (King Saud University, Saudi Arabia)

2014ISGTEU0603
An Integrated Control for Overvoltage Mitigation in the Distribution Network
Mohamed Mansoor Viyathukattuva Mohamed Ali (Eindhoven University of Technology, Netherlands), **Phuong Nguyen** (Eindhoven University of Technology, Netherlands), **Wil Kling** (Eindhoven University of Technology, Netherlands)

2014ISGTEU0606
Unified Hybrid (AC/DC) Distribution Networks Droop-Based Load-Sharing Strategy
Victor Maryama (CERTI Foundation, Brazil), **Vítor Zeni** (CERTI Foundation, Brazil), **Cesare Pica** (CERTI Foundation, Brazil), **Marcelo Heldwein** (Federal University of Santa Catarina, Brazil), **Márcio Ortmann** (Federal University of Santa Catarina, Brazil)

2014ISGTEU0610
Local Control of Active and Reactive Power in Inverter Based Micro Grids
Hamed Maleki (Shahid Beheshty University, Iran), **Mojtaba Khederzadeh** (Shahid Beheshty University, Iran), **Vahid Asgharian** (Istanbul Technical University, Turkey)

2014ISGTEU0612
Methodology for Service Restoration in Large-Scale Distribution Systems with

2014ISGTEU0618

Parameter Estimation for Low-Order Models of Complex Buildings

Anita Martincevic (University of Zagreb, Croatia), **Antonio Starcic** (University of Zagreb, Croatia), **Mario Vasak** (University of Zagreb, Croatia)

2014ISGTEU0620

Symplectic Numeric Integration for Coarse-grained Event-driven Electricity Metering

Mikhail Simonov (Istituto Superiore Mario Boella, Italy)

2014ISGTEU0641

A PQ Control Strategy of Voltage-Controlled Inverters

Yang Chen (Shanghai University of Electric Power, China), **Jinbin Zhao** (Shanghai University of Electric Power, China), **Wei Cao** (Shanghai University of Electric Power, China), **Keqing Qu** (Shanghai University of Electric Power, China), **Fen Li** (Shanghai University of Electric Power, China)

2014ISGTEU0654

An Adaptive Control Strategy of Converter based DG to Maintain Protection Coordination in Distribution System

Chi Su (Aalborg University, Denmark), **Zhou Liu** (Aalborg University, Denmark), **Zhe Chen** (Aalborg University, Denmark), **Yanting Hu** (Glyndwr University, UK)

Panel 5

Tuesday, 14:30 – 16:00
Conference Main Hall

Smart Grid Security

Chair: Lucie Langer, AIT, Austria

Dr. Lucie Langer (CISSP) has been with the Safety & Security Department of AIT Austrian Institute of Technology since 2012. She is currently responsible for several applied research projects on IT security aspects of critical infrastructures and smart grids. Before joining AIT she has been working as a Technology Consultant in the private sector for two years, focusing on access rights and infrastructure management in large-scale IT projects. From 2006 to 2010 she was a Research Assistant with the Cryptography & Computer Algebra Group at Technische Universität (TU) Darmstadt. She received her PhD in 2010 from the Computer Science Department of TU Darmstadt, and holds a master's degree in Mathematics from TU Darmstadt (2006) and Darmstadt University of Applied Sciences (2004).

Panel Abstract: This panel brings together academic, applied research and industry experts with different viewpoints on the area of securing future smart grids, including those with deep knowledge of cyber-security, resilience and future energy systems. They will reflect on existing efforts to secure smart grids and argue the case for areas where they see future research and standardisation is of paramount importance. Additionally, the panellists will be asked to comment on how organisations, such as Distributed Systems Operators (DSOs), are supposed to navigate and prioritise the myriad of security standards that are available from bodies such as NIST, IEC, ISO, etc.; how do we effectively address security in the smart grid when it is a combination of legacy systems, which cannot be readily changed and are quite insecure, and new ICT systems? Moreover, from an operational perspective, how do we address the cross-cutting issues that smart grid security introduces when managing the grid, i.e., different organisational departments must coordinate, etc. Also, more generally, how do we manage the multidisciplinary knowledge that is required for ensuring the security of a smart grid (and ensuring the effectives of security solutions)?

Presentations

Privacy Challenges in Smart Grids
Dominik Engel, Josef Ressel Center for User-Centric Smart Grid Privacy, Austria

Smart Grid Security Analytics
Robert Griffin, RSA - the Security Division of EMC, UK

Smart Grid Security Standardization
Ralph Eckmaier, Independent Consultant, Austria

Where to Stop Securing the Smart Grid
Mehmet Tahir Sandıkkaya, ITU, Turkey

Paper Session 12: Smart Grid Communications

Date Tuesday, 14:30 – 16:00
Chair **Li Haiyu**

2014ISGTEU0566
Investigation of Current Variation Effect on PLC Channel Characteristics of Low-Voltage High Power Busbar Systems
Zeynep Hasırcı (Karadeniz Technical University, Turkey), **İsmail Hakkı Çavdar** (Karadeniz Technical University, Turkey), **Nermin Suljanovic** (University of Tuzla, Turkey), **Aljo Mujcic** (University of Tuzla, Turkey)

2014ISGTEU0225
Performance Analysis of Data Processing Architectures for the Smart Grid
Akshay Uttama Nambi (TU Delft, Netherlands), **Matteo Vasirani** (EPFL, China), **Venkatesha Prasad** (TU Delft, Netherlands), **Karl Aberer** (EPFL, China)

2014ISGTEU0352
MIMO Modeling and Data Rates for Medium-Voltage Narrowband-PLC in Smart Distribution Grids
Theofilos Papadopoulos (Aristotle University of Thessaloniki, Greece), **Andreas Chrysochos** (Aristotle University of Thessaloniki, Greece), **Grigoris Papagiannis** (Aristotle University of Thessaloniki, Greece), **Ahmed Elsamadouny** (University of Texas, USA), **Naofal Al-Dhahir** (University of Texas, USA)

2014ISGTEU0420
Transfer Function of Power Line Channel – Influence of Topology Parameters and Power Line Topology Estimation
Petr Mlynek (Brno University of Technology, Czech Republic), **Jiri Misurec** (Brno University of Technology, Czech Republic), **Martin Koutny** (Brno University of Technology, Czech Republic), **Radek Fujdiak** (Brno University of Technology, Czech Republic)

2014ISGTEU0238
Permutation Coding with Differential Quinary Phase Shift Keying for Power Line Communication
Kehinde Ogunyanda (University of Johannesburg, South Africa), **Ayokunle. D. Familua** (University of the Witwatersrand, South Africa), **Theo, G. Swart** (University of Johannesburg, South Africa), **Hendrik, C. Ferreira** (University of Johannesburg, South Africa), **Ling Cheng** (University of the Witwatersrand, South Africa)

Paper Session 13: Power Generation and Energy Storage Technologies

Date Tuesday, 14:30 – 16:00
Chair **Kai Strunz**

2014ISGTEU0494
Multi-Period Three-Phase Unbalanced Optimal Power Flow
Alison O'Connell (University College Dublin, Ireland), **Andrew Keane** (University College Dublin, Ireland)

2014ISGTEU0019
Distributed Energy Storage using Domestic Hot Water Tanks and a Novel Thermocline Sensor
Peter Armstrong (Oxford University, UK), **Malcolm McCulloch** (Oxford University, UK)

2014ISGTEU0607
Wind Farm Associated with Flywheel Energy Storage Plants
Michal Chudy (University of Pretoria, South Africa), **Lynette Herbst** (University of Pretoria, South Africa), **Jorg Lalk** (University of Pretoria, South Africa)

2014ISGTEU0441
Coordinating Control for a Wind-Hydro-Storage System Considering the Constraint of SOC
Tianyi Chen (Tsinghua University, China), **Laijun Chen** (Tsinghua University, China), **Tianwen Zheng** (Tsinghua University, China), **Shengwei Mei** (Tsinghua University, China)

2014ISGTEU0392
Integration of Compressed Air Energy Storage with Wind Turbine to Provide Energy Source for Combustion Turbine Generator
Troy Nguyen (Florida Institute of Technology, USA)

2014ISGTEU0361
Microgrid Power Balancing with Redox Flow Batteries
Spyros Skarvelis-Kazakos (University of Greenwich, UK), **Babatunde Giwa** (University of Greenwich, UK), **David Hall** (C-Tech Innovation Ltd., UK)

Paper Session 14: Power System Stability and Security 2

Date Tuesday, 14:30 – 16:00
Chair **Lin Jiang**

2014ISGTEU0434
Assessment of the Effectiveness of Asymmetrical Line Compensation for Mitigation of SSR in Meshed Networks
Atia Adrees (University of Manchester, UK), **Jovica Milanovic** (University of Manchester, UK)

2014ISGTEU0320
A Novel Approach to Account for Uncertainty and Correlations in Probabilistic Power Flow
Emanuele Ciapessoni (Ricerca sul Sistema Energetico RSE S.p.A., Italy), **Diego Cirio** (Ricerca sul Sistema Energetico RSE S.p.A., Italy), **Stefano Massucco** (University of Genova, Italy), **Andrea Pitto** (Ricerca sul Sistema Energetico RSE S.p.A., Italy), **Federico Silvestro** (University of Genova, Italy)

2014ISGTEU0459
Vertical Provision of Reactive Power for Voltage Stability
Marco Greve (TU Dortmund, Germany), **Johannes Schwippe** (TU Dortmund, Germany), **Theresa Noll** (TU Dortmund, Germany), **Christian Rehtanz** (TU Dortmund, Germany)

2014ISGTEU0528
Syncrophasor Measurement Based Small Signal Stability Assessment using FFT-CWT Approach in Japan-Campus-WAMS
Khairudin Khairudin (Kyushu Institute of Technology, Japan), **Yasunori Mitani** (Kyushu Institute of Technology, Japan)

2014ISGTEU0596
Global Initialization Technique in Waveform Relaxation Method for Transient Stability Analysis of a Japanese Power System
Takao Tsuji (Yokohama National University, Japan), **Frédéric Magoulès** (Ecole Centrale Paris, France), **Takanori Sakamoto** (Yokohama National University, Japan), **Tsutomu Oyama** (Yokohama National University, Japan), Kenko Uchida (Waseda University, Japan)

2014ISGTEU0463

Paper Session 15: Demand Side Management 1

Date Tuesday, 14:30 – 16:00
Chair **Koen Kok**

2014ISGTEU0146
Economic Assessment of Distribution Network Reinforcement Deferral through Post-Contingency Demand Response
Eduardo Marinez (University of Manchester, UK), **Pierluigi Mancarella** (University of Manchester, UK)

2014ISGTEU0443
Discrete Elastic Residential Load Response under Variable Pricing Schemes
Killian McKenna (University College Dublin, Ireland), **Andrew Keane** (University College Dublin, Ireland)

2014ISGTEU0333
Contract Design for Demand Response
Tobias Haring (ETH Zurich, Switzerland), **Göran Andersson** (ETH Zurich, Switzerland)

2014ISGTEU0541
Security Constrained Economic Dispatch with Flexible Thermostatically Controlled Loads
Vincenzo Trovato (Imperial College London, UK), **Simon Tindemans** (Imperial College London, UK), **Goran Strbac** (Imperial College London, UK)

2014ISGTEU0597
Reliability Evaluation of DR and TVTR Considering the Cost of Interruptions
Alexandra Kapetanaki (University of Manchester, UK)

2014ISGTEU0027
Economic Evaluation of Active Network Management Alternatives for Congestion Avoidance - the DSO Perspective
Lode Van Halewyck, (Universiteit Gent, Belgium), **Johan Verstraeten** (Eandis CVBA, Belgium), **Matthias Strobbe** (Universiteit Gent, Belgium), **Chris Develder** (Universiteit Gent, Belgium)

Panel 6

Tuesday, 16:30 – 18:00
Conference Main Hall

Smart Distribution Networks

Chair: Hasan Basri Çetinkaya, Smart Grid, System Dynamics, Siemens, Turkey.

Mr. Çetinkaya is a Power Sector Specialist with about 6 years of university and 7 years of SIEMENS experience of energy both in utility scale and industrial scale projects especially focused on stability, transients, smart grids and large scale renewable integration to the grid. Mr. Çetinkaya also worked on Turkish Transmission System for 5 years in university as a research assistant. The study was including 380 kV and 154 kV levels to study FACTS devices primarily on UPFC and its effects on a real system as a doctor of philosophy. Mr. Çetinkaya has been involved in a number of projects in the following areas. MV projects (primary/ secondary design & equipment selection), steady-state and dynamic network analysis for utility / industrial scale projects, transient analysis, renewable integration challenges & grid compliance. Mr. Çetinkaya is also an instructor of several internal / external technical courses. He also has so many publications in national/ international journals and conference proceedings related with system dynamics, renewables and smart grid.

Panel Abstract: The new era of electricity requires a smart structure for transmission and distribution system. Control is a key enabling technology for the deployment of renewable energy systems. Solar and wind power require advanced control techniques for high-performance and reliable operation. In future power systems, there should also be a management system which control and optimize dispersed generations regarding to technical and economic aspects.

Grid management is facing challenges like an unclear, fluctuating direction of load flow and, more and more often, critical voltage violations. There is a growing risk of voltage range infringement and thus malfunctions or even damaged equipment on the consumer side. At the same time, the danger of overloads on lines, transformers and other equipment is growing, which can even result in grid failure. Processes in the distribution grids must be made visible at all times in order to reliably assess the status

Presentations

Renewables Integration and the Challenges
Hasan Basri Çetinkaya

Decentralized Energy Management Systems
Mete Taşpınar, Smart Grid Group Manager, Siemens, Turkey

Closed-Loop Volt-Var Control (VVC)
Yusuf Üçyüz, Smart Grid Control Center, Siemens, Turkey

Orchestration of Distributed Network Applications for Fault Handling
Burcu Ardıç Serpen, **Senem Yüzbaşıoğlu**, Smart Grid Research & Development, Siemens, Turkey

Paper Session 16: Physical and Cyber Security of Smart Grid

Date Tuesday, 16:30 – 18:00
Chair **Robert Griffin**

2014ISGTEU0234
Threat Assessment and Response for Physical Security of Power Substations
Jing Xie (University College Dublin, Ireland), **Chen-Ching Liu** (Washington State University, USA), **Marino Sforna** (TERNA, Italy), **Martin Bilek** (CEPS, Czech Republic), **Radek Hamza** (CEPS, Czech Republic)

2014ISGTEU0425
A Survey of Electric Power Synchrophasor Network Cyber Security
Christopher Tate Beasley (Clemson University, USA), **Xingsi Zhong** (Clemson University, USA), **Juan Deng** (Clemson University, USA), **Richard Brooks** (Clemson University, USA), **Kumar Venayagamoorthy** (Clemson University, USA)

2014ISGTEU0142
Distributed Specification-Based Firewalls for Power Grid Substations
Shinn-Shyan Wu (University College, Dublin, Ireland), **Chen-Ching Liu** (University College, Dublin, Ireland), **Alexandru Stefanov** (University College, Dublin, Ireland)

2014ISGTEU0513
Cross-Layer Security Framework for Smart Grid: Physical Security Layer
Mohammed Farag (Alexandria University, Egypt), **Bassem Mokhtar** (Alexandria University, Egypt), **Mohamed Azab** (The City of Scientific Research and Technological Applications, Egypt)

2014ISGTEU0127
On Security of a Home Energy Management System
Avijit Saha (Virginia Tech, USA), **Saifur Rahman** (Virginia Tech, USA),
Manisa Pipattanasomporn (Virginia Tech), **Murat Kuzlu,** (Virginia Tech)

Paper Session 17: Network Integration of Distributed Energy Resources

Date Tuesday, 16:30 – 18:00
Chair **Sasa Djokic**

2014ISGTEU0029
On the Use of Wind Energy Conversion Systems for Mitigating Subsynchronous Resonance and Subsynchronous Interaction
Xuan Gao (University of Saskatchewan, Canada), **Ulas Karaagac** (École Polytechnique de Montréal, Canada), **Sherif Faried** (University of Saskatchewan, Canada), **Jean Mahseredjian** (École Polytechnique de Montréal, Canada)

2014ISGTEU0595
Impact of the Integration of Renewable Energies on the Reactive Power Demand in the German Transmission Grid
Marie-Louise (TU Dortmund, Germany)

2014ISGTEU0288
Optimum Shunt Capacitor Placement in Distribution Networks with High Penetration of Renewable Energy Resources Using Genetic Algorithms
Hany Farag (York University, Canada), **Ehab El-Saadany** (University of Waterloo, Canada)

2014ISGTEU0090
Provision of Primary Control Reserve by DFIG-Based Wind Farms in Compliance with ENTSO-E Frequency Grid Codes
Davood Raoofsheibani (Technical University of Kaiserslautern, Germany), **Ehsan Abbasi** (TU Berlin), **Klaus Pfeiffer** (Brandenburg Technical University, Germany)

2014ISGTEU0302
Distributed Generation Hosting Capacity Calculation of MV Distribution Feeders in Turkey
Mufit Altin (DTU, Denmark), **Emre Utku Oğuz** (METU, Turkey), **Erdal Bizkevelci** (Alstom, Turkey), **Bilal Şimşek** (TEDAŞ, Turkey)

2014ISGTEU0043
Recommended Strategies for Grid Operators Using Reactive Power Capabilities from Photovoltaic Plants
Yehia Tarek Fawzy (SMA, Germany), **Kevin V. Roey** (Infrax, Belgium), **Annick Dexters**

Paper Session 18: DC Grid and Power Electronic Applications

Date Tuesday, 16:30 – 18:00
Chair **Tankut Yalçınöz**

2014ISGTEU0583
30kW, 200V/900V LCL IGBT DC/DC Converter Prototype Design and Testing
Masood Hajian (University of Aberdeen, UK), **Dragan Jovcic** (University of Aberdeen, UK)

2014ISGTEU0455
Control Strategy and Application of Power Converter System in Battery Energy Storage System
Tianwen Zheng (Tsinghua University, China), **Laijun Chen** (Tsinghua University, China), **Shengwei Mei** (Tsinghua University, China)

2014ISGTEU0309
A General Control System Structure for Multi-terminal VSC-HVDC Systems
Evripidis Karatsivos (Lund University, Sweden), **Jörgen Svensson** (Lund University, Sweden), **Olof Samuelsson** (Lund University, Sweden)

2014ISGTEU0438
Fault Ride through During Loss of Converter in a 4-VSC Based HVDC Transmission
Olusegun Olowookere (University of Greenwich, UK), **Spyros Kazakos Skarvelis-Kazakos** (University of Greenwich, UK), **Yehdego Habtay** (University of Greenwich, UK), **Stephen Woodhead** (University of Greenwich, UK)

2014ISGTEU0261
Smart Micro-Grid Integration in DC Railway Systems
Sarah Nasr (Alstom Transport, France), **Marc Petit** (SUPELEC, France), **Marius Iordache** (Alstom Transport, France)

2014ISGTEU0575
Interconnecting Subsea DC Collection Systems into a High Reliability DC Grid
Huibin Zhang (University of Aberdeen, UK), **Dragan Jovcic** (University of Aberdeen, UK)

Paper Session 19: Energy Management

Date Tuesday, 16:30 – 18:00
Chair **Aydoğan Özdemir**

2014ISGTEU0130
Hierarchical MPC-based Energy Management and Frequency Regulation Participation of a Virtual Power Plant
Tian Zhang (Nanyang Technological University, Singapore), **Hoay Beng Gooi** (Nanyang Technological University, Singapore)

2014ISGTEU0198
Towards Railway-Smartgrid Energy Management Optimization for Hybrid Railway Power Substations
Petronela Pankovits (SNCF, France), **Julien Pouget** (SNCF, France), **Benoit Robyns** (HEI, France), **Florent Delhaye** (Ecole Centrale de Lille, France), **Stephane Brisset** (Ecole Centrale de Lille, France)

2014ISGTEU0347
Energy Management System (EMS) for Real-time Operation of DC Microgrids with Multiple Slack Terminals
Jianfang Xiao (Nanyang Technological University, Singapore), **Peng Wang** (Nanyang Technological University, Singapore), **Leonardy Setyawan** (Nanyang Technological University, Singapore), **Fook Hoong Choo** (Nanyang Technological University, Singapore)

2014ISGTEU0452
Coordination of Control and Energy Management Methods for Microgrid Systems
Jordi Pegueroles (IREC, Spain), **Lucia Igualada González** (IREC, Spain), **Cristina Corchero García** (IREC, Spain), **Miquel Cruz Zambrano** (IREC, Spain), **Gerard del Rosario Calaf** (IREC, Spain)

2014ISGTEU0585
Distributed Energy Management of Microgrids with Dantzig-Wolfe Decomposition
Can Altay (Bogaziçi University, Turkey), **Hakan Deliç** (Bogaziçi University, Turkey)

2014ISGTEU0391
Energy Limits in Primary Frequency Control with Short-Term Frequency-Band Allocation
Arnaud Latiers (Université catholique de Louvain, Belgium), **Francois Glineur**

Wednesday,
October 15,
2014

Wednesday, October 15, 2014			
09:00 - 09:30	**Keynote C : "Implementing Smart Grid Communications"** **Li Haiyu,** The University of Manchester		
09:30 - 11:00	**Plenary C : "Wide Area Monitoring, Protection and Control"** **Jay Giri,** Alstom Grid		
11:00 - 11:30	**Coffee Break**		
ROOM	**Conference Main Hall**	**Room A**	
11:30 - 13:00	**Panel 7** **Smart Transmission Technologies** Chair: **Herman Koch**	**Paper Session 20** **IEC 61850 Based Applications** Chair: **John D. McDonald**	
13:00 - 14:00	**Lunch Break**		
14:00 - 15:30	**Panel 8** **Transactive Energy: Market-based Approaches to Smart Grids,** the University Perspective Chair: **Koen Kok**	**Paper Session 24** **Smart Metering Applications** Chair: **Serhat İkizoğlu**	
15:30 - 16:00	**Coffee Break**		
16:00 - 17:30	**Panel 9** **Transactive Energy: Market-based Approaches to Smart Grids,** the Industrial Perspective Chair: **Koen Kok**	**Paper Session 27** **Smart Grid Automation** Chair: **Mehmet Bayrak**	
17:45 - 18:00	**Closing Session, Main Conference Hall** **Omer Usta, ITU**		

	Seminar Room	Senate Room	Room B
	Paper Session 21 **Smart Grid Protection** Chair: **Desire Rasolomampionona**	Paper Session 22 **Voltage Control 2** Chair: **Matti Lehtonen**	Paper Session 23 **Demand Side Management 2** Chair: **Canbolat Uçak**
	Paper Session 25 **Smart Grid Modelling and Simulation** Chair: Ömer Usta/Belgin Turkay	Paper Session 26 **Residential Demand Response 2** Chair: **Anastasios Bakirtzis**	
	Paper Session 28 **Wind Power** Chair: **Deniz Yıldırım**	Paper Session 29 **Load Forecasting** Chair: **Serhat Şeker**	

Keynote C

Wednesday, 09:00 - 09:30
Conference Main Hall

Implementing Smart Grid Communications Need of Flexible Communication Architectures and Intelligent Solutions

Li Haiyu, University of Manchester

Dr H L (M'99) is a Senior Lecturer and the director of EEPS group MSc course in the school of Electrical and Electronic Engineering, The University of Manchester, UK. His is a leading expert of "Power System Automations and Communication Systems" with emphasis on the applied sciences for the development of more flexible, sustainable and intelligent power system automation systems or "Smart Grids" for the future. His previous industry career included 5 years (1985-1989) telecommunications R&D in the First Research Institute of Ministry of Information Industry, China and 2 years (3/1998- 1999) power R&D experience in GEC-ALSTOM T&D Power System Protection and Control Ltd, Stafford, UK. Since obtained his PhD degree in 1994 from Bath University, UK, his entire career has been devoted to power systems research and development to gain the deep understanding of the difference research issues between telecommunications industry and power systems R&D industry requirements. Currently he is leading three projects funded by Ofgem LCNF: Tier 1 "Voltage control options on low voltage busbars"; Tier 2 "Customer load active system services - CLASS", National Grid sponsored "Smart/Digital Substection Testing and Training" platform, and involved in two Ofgem LCNF projects: Tier 1 "Low voltage integrated automation - LoVIA"; and Tier 2 "network efficiency - eta". He has also been involved in many consultancy activities for the UK industries. He has published 80 + Journals and international conferences papers, 2 Technical Brochures in CIGRE and CIRED, 2 Patents. He is a Chartered Engineer, a Member of IEEE and IET.

Abstract: To maximise the integration of renewable energy sources (RESs) and to encourage the customer to adopt new low carbon technologies (LCT) loads (e.g. heat pumps and electric vehicles) have led the governments in the world supporting the Smart Grid development. Information and communications technologies (ICTs) are at the core of the Smart Grid development as they will support the future power grids with two-way energy and information flow, detecting, isolating, controlling and restor-

Plenary C

Wednesday, 09:30 - 11:00
Conference Main Hall

Wide Area Monitoring, Protection and Control

Chair: Jay Giri, Alstom Grid

Synchrophasor Solutions for Grid Management

Dr. Jay Giri (M'78-F'00) Jay is Director of Power Systems Technology and Strategic Initiatives at Alstom Grid's NMS business in Redmond, Washington. In 1978, Jay and 11 other engineers co-founded Energy System Computer Applications (ESCA). In 2010, ESCA after a few corporate mergers became part of Alstom Grid. He has a PhD from Clarkson University in New York and a B.Tech from the Indian Institute of Technology (IIT), Madras. In 2002, he was elected IEEE Fellow and is a member of the IEEE PES Governing Board. He is an Alstom Grid Senior Fellow.

Fault location using sparsely distributed synchronized measurements in power networks.

Ali Abur, Northeastern University in Boston.

Prof. Dr. Ali Abur obtained his B.S. degree from Orta Doğu Teknik Üniversitesi, Turkey in 1979 and both his M.S. and Ph.D. degrees from the Ohio State University in 1981 and 1985 respectively. He was a Professor at Texas A&M University during 1985-2005, and the Chair of the Electrical and Computer Engineering Department at Northeastern University in Boston until September 2013. Currently, he is a Professor in the same department. His research and educational activities have been in the area of power systems. He is a Fellow of the IEEE for his work on power system state estimation. He co-authored a book and published widely in IEEE journals and conferences. He serves as an IEEE PES Distinguished Lecturer and was on the Editorial Board of IEEE Transactions on Power Systems during 1999-2011.

Practical examples of Synchro Phasor Measurements and Integration of IT and OT,

Bas Kruimer, Senior Manager, Accenture Smart Grid Services EAL

Bas Kruimer is Senior Manager at Accenture Smart Grid Services in Europe with 25 years of international experience in the energy and electrical utility sector in commercial, product and business development and management roles. Bas achieved his Master of Science degree in Power Engineering at Delft University of Technology and started working at ABB in The Netherlands to later take on an international role as Global Product Manager Protection and Substation Automation Products & Systems. Moving his focus back to The Netherlands he joined KEMA T&D Consulting to manage the Substations and HV Installations/Connections design and engineering teams and support business development. For some years he lead the KEMA Quality Management System Certification business before he rejoined the utility market working for Eneco/Joulz in the unbundling and commercialization process in which he set up and ran the Sales team for Complex Energy and Electrical Projects. He then joined Quant Technology to become responsible for the grid consultancy business towards the European market. In 2014 Bas joined the Accenture Smart Grid Services team.

Wide Area Defense with Self-Healing Capabilities

Chen-Ching Liu, Washington State University, USA, and University College Dublin, Ireland

Prof. Dr. Chen-Ching Liu is Boeing Distinguished Professor at Washington State University, Pullman, and Director of Energy Systems Innovation (ESI) Center. He is also Professor of Power Systems at University College Dublin, Ireland. During 1983-2005, he was a Professor of EE at University of Washington, Seattle. Dr. Liu was Palmer Chair Professor at Iowa State University from 2006 to 2008. In 2008, he joined University College Dublin, where he was Deputy/Acting Principal of Engineering, Mathematical and Physical Sciences. Chen-Ching completed his Ph.D. from the University of California, Berkeley. He received an IEEE Third Millennium Medal in 2000 and the Power and Energy Society Outstanding Power Engineering Educator Award in 2004. Professor Liu received a Doctor Honoris Causa from Polytechnic University of Bucharest, Romania, in 2013. He chaired the IEEE Power and Energy Society Fellow Committee, Technical Committee on Power System Analysis, Computing and Economics, and Outstanding Power Engineering Educator Award Committee. Professor Liu is a Fellow of the IEEE.

Panel 7

Wednesday, 11:30 – 13:00
Conference Main Hall

Smart Transmission Technologies

Chair: Herman Koch, Siemens, Germany.

Dr.-Ing. Hermann Koch was born in November 1954 in Hauswurz, Germany. In 1979 he graduated in Industrial Control Engineering at the Fachhochschule Rüsselsheim. From 1980-1981 he studied at New Jersey Institute of Technology, Newark, New Jersey, USA. 1986 he graduated in Electrical Engineering at the Technical University of Darmstadt. He received his Dr. Ing. degree in 1990 from the Technical University of Darmstadt at the High Voltage Institute. Since 1991 he is working with Siemens High Voltage Division in different responsibilities including Gas Insulated Switchgear and Transmission Lines. Currently he is Principle Expert of Standards and Regulations of the Transmission Division.

Hermann Koch is Past-Chairman of the IEEE PES Substations Committee. In IEC he is Secretary of SC 17C High Voltage Switchgear Assemblies and member of SG 2 Ultra High Voltages. In CIGRE he is member of the Strategic Advisory Group of SC B3 Substations. He has published more than 130 technical papers at International Conferences and magazines and holding 31 patents in the field of gas insulated technology which is his area of expertise. He is engaged in studies, innovations, and R&D activities for high voltage gas insulated power transmission systems. Hermann Koch is principle on standards and innovations of Siemens Power Transmission Division.

Panel Abstract: The changes in the electric power system related to the so called smart grid will cover not only distribution and metering topics these changes will also strongly impact the transmission system. The interaction between the requirements coming from decentralized power generation, local large scale wind and solar power generation and the need of inter regions electric power exchange to stabilize the power system and minimize the need of energy storage can only be solved with intelligent power transmission systems.

New topologies of AC and DC transmission systems in parallel in meshed network require technology who are fast reacting to changes in the network coming from failures or from fast changing power generation of renewable energy sources like wind and solar. HV DC converter technologies are developing fast with new technical features and higher power transmission at lower power losses with every new project

HVDC – Converter Technologies, Configurations and Trends
Jörg Dorn, Siemens AG

Operation of meshed HVDC grids - Challenges and First Solutions
Anne-Katrin Marten, TU Ilmenau

High Power Compact Underground Transmission
Denis Imamovic, Siemens AG

New ICT (Information Communication Technology) Architectures & Tools for Efficient Smart Grid Management: First Lessons from our International Deployments
Lauvent Schmitt, Alstom Turkey

Future of Power Transmission Technologies and the role of Power Semiconductors
Menia Beier-Möbius, TU Chemnitz

Paper Session 20: IEC 61850 Based Applications

Date Wednesday, 11:30 – 13:00
Chair **John D. McDonald**

2014ISGTEU0469
Standard-based Secondary Substation Automation Unit – the ICT Perspective
Shengye Lu (Tampere University of Technology, Finland), Sami Repo (Tampere University of Technology, Finland), **Davide Della Giustina Esercizio** (A2A Reti Elettriche SpA, Italy)

2014ISGTEU0289
IEC 61850-based Functional Specifications Common to Multiple Utilities
Tetsuo Otani (CRIEPI, Japan), **Makoto Kaminaga** (Tokyo Electric Power Company, Japan), **Fumitoshi Hagiwara** (Chubu Electric Power Company, Japan), **Masahiro Kameda** (Kansai Electric Power Company, Japan), **Shogo Miura** (Toshiba Corporation, Japan), **Yoshihiro Seto** (Mitsubishi Electric Corporation, Japan)

2014ISGTEU0094
Performance and Reliability Assessment of Protection System in IEC 61850 ¨CBased Smart Substation
He Ruiwen (Guangdong University of Technology, China), **He Xiaowang** (Guangdong University of Technology, China), **Lv Mengli** (Guangdong University of Technology, China), **Cai Zexiang** (South China University of Technology, China), **Li Xiaohua** (South China University of Technology, China), **Zhu Lin** (South China University of Technology, China)

2014ISGTEU0184
Challenges to the Implementation of a Real-Time Process Bus According to IEC 61850-9
Gilberto Igarashi (University of São Paulo, Brazil), **Josemir Santos** (University of São Paulo, Brazil)

2014ISGTEU0188
Effects of Loss of Time Synchronization in Differential Protection of Transformers Using Process Bus According to IEC 61850-9-2
Gilberto Igarashi (University of São Paulo, Brazil), **Josemir Santos** (University of São Paulo, Brazil)

2014ISGTEU0517

Paper Session 21: Smart Grid Protection

Date Wednesday, 11:30 – 13:00
Chair **Desire Dauphin Rasolomampionona**

2014ISGTEU0538
A Novel Anti-Islanding Protection Method Based on the Combination of a Q-f Droop and RPV
Ontrei Raipala (Tampere University of Technology, Finland), **Anssi Mäkinen** (Tampere University of Technology, Finland), **Sami Repo** (Tampere University of Technology, Finland), **Pertti Järventausta** (Tampere University of Technology, Finland)

2014ISGTEU0008
Adaptive Distance Relay Setting for Hybrid power Transmission Networks
OD Naidu (ABB, India), **A. K. Pradhan**, (Indian Institute of Technology, India)

2014ISGTEU0480
Insight into Microgrid Protection
Sukumar Brahma (New Mexico State University, USA), **Jonathan Trejo** (El Paso Electric Company, USA), **Jason Stamp** (Sandia National Laboratories, USA)

2014ISGTEU0565
Using Distance Protection in Smart Grid Environment
Sampo Voima (University of Vaasa, Finland), **Kimmo Kauhaniemi** (University of Vaasa, Finland)

2014ISGTEU0108
Evaluating Performance of Classifiers for Supervisory Protection using Disturbance Data from Phasor Measurement Units
Om Prasad Dahal (New Mexico State University, USA), **Sukumar Brahma** (New Mexico State University, USA), **Huiping Cao** (New Mexico State University, USA), **Rajesh Kavasseri** (North Dakota State University, USA)

2014ISGTEU0509
Coordinating Overcurrent Protection Relays in Cascaded Parallel-Series Distribution Feeders
Mahmoud Essad (Minoufiya University, Egypt), **Abdel-maksoud Taalab** (Minoufiya University, Egypt), **Nagy Elkalashy** (Minoufiya University, Egypt), **Tamer Kawady** (Minoufiya University, Egypt)

Paper Session 22: Voltage Control 2

Date Wednesday, 11:30 – 13:00
Chair **Matti Lehtonen**

2014ISGTEU0332
Variable Voltage Set Point Control of Tap Changers in Distribution Grids
Eva-Maria Baerthlein (GE Global Research, Germany), **Marianne Hartung** (GE Global Research, Germany), **Ara Panosyan** (GE Global Research, Germany)

2014ISGTEU0378
Reactive Power Provision by Distribution System Operators - Optimizing Use of Available Flexibility
Erika Kaempf (Fraunhofer IWES, Germany), **Hans Abele** (Transnet BW, Germany), Sebastian (Stepanescu Netze BW, Germany), **Martin Braun** (Fraunhofer IWES, Germany)

2014ISGTEU0524
Distribution Network Supports for Reactive Power Management in Transmission Systems
Linwei Chen (University of Manchester, UK), **Haiyu Li** (University of Manchester, UK), **Victoria Turnham** (Electricity North West Limited, UK), **Simon Brooke** (North West Limited, UK)

2014ISGTEU0266
Applying Full MILP Model to Volt-Var Optimization Problem for MV Distribution Networks
Saeed Rahimi (University of Genova, Italy), **Yaser Tohidi** (KTH Stockholm, Sweden), **Stefano Massucco** (University of Genova, Italy), **Federico Silvestro** (University of Genova, Italy), **Mohammad Reza Hesamzadeh** (KTH Stockholm, Sweden)

2014ISGTEU0336
Consensus-based Distributed Cooperative Control for Microgrid Voltage Regulation and Reactive Power Sharing
Dawei He (Georgia Institute of Technology, USA), **Di Shi** (NEC Laboratories America, USA), Ratnesh **Sharma** (NEC Laboratories America, USA)

2014ISGTEU0318
A Comparison between Synergetic Control and Feedback Linearization for stabilizing MVDC Microgrids with Constant Power Load
Marco Cupelli (RWTH Aachen, Germany), **Mojtaba Moghimi** (RWTH Aachen,

Paper Session 23: Demand Side Management 2

Date Wednesday, 11:30 – 13:00
Chair **Canbolat Uçak**

2014ISGTEU0259
Optimal Assignment of Off-Peak Hours to Lower Curtailments in the Distribution Network
Luca Merciadri (University of Liège, Belgium), **Sébastien Mathieu** (University of Liège, Belgium), **Damien Ernst** (University of Liège, Belgium), **Quentin Louveaux** (University of Liège, Belgium)

2014ISGTEU0424
Real-Time Simulation of Real-Time Pricing Demand Response to Meet Wind Variations
Luis Gomes (Polytechnic Institute of Porto, Portugal), **Filipe Fernandes** (Polytechnic Institute of Porto, Portugal), **Pedro Faria** (Polytechnic Institute of Porto, Portugal), **Marco Silva** (Polytechnic Institute of Porto, Portugal), **Zita Vale** (Polytechnic Institute of Porto, Portugal), **Carlos Ramos** (Polytechnic Institute of Porto, Portugal)

2014ISGTEU0207
Wide Area Cyclic Blackout Mitigation by Supply-Demand Matching of HVAC Counterpart Loads
Kasim Al-Salim (University of Strathclyde, Scotland)

2014ISGTEU0267
Impact Analysis of Load Control for Frequency Regulation: the case of Sardinia in 2020
Stefano Massucco (University of Genova, Italy), **Francesco Baccino** (University of Genova, Italy), **Francesco Conte** (University of Genova, Italy), **Federico Silvestro** (University of Genova, Italy), **Emanuele Ciapessoni** (RSE, Italy), Diego Cirio (RSE, Italy)

2014ISGTEU0614
Peak Shaving with Photovoltaic-Battery Systems
Felix Braam (Fraunhofer ISE, Germany), **Raphael Hollinger** (Fraunhofer ISE, Germany), **Martin Llerena Engesser** (Fraunhofer ISE, Germany), **Stine Mueller** (Fraunhofer ISE, Germany), **Robert Kohrs** (Fraunhofer ISE, Germany), **Christof Wittwer** (Fraunhofer ISE, Germany)

2014ISGTEU0521

Panel 8

Wednesday, 14:00 – 15:30
Conference Main Hall

Transactive Energy: Market-based Approaches to Smart Grid The University Perspective: Concepts, Advanced Modelling and Application Area

Chair: Koen Kok, TNO

Koen Kok is Senior Scientist Intelligent Electricity Systems at TNO, the largest applied research institute in The Netherlands, and part-time Visiting Researcher at the Center for Electric Power and Energy (CEE) of the Danish Technical University DTU. He is strongly involved in the European smart grids research field, working on numerous EU and NL-national projects developing and field deploying smart grid technology. He is the thought-leading scientist behind the PowerMatcher, an award winning smart grid technology based on Transactive Energy principles. PowerMatcher matches demand and distributed generation on one hand with available renewable power and network capacity on the other.

Co-chair: Henrik Bindner, DTU

Henrik Bindner is Senior Scientist and Head of the Energy Systems Operation and Management (ESOM) group at the DTU Center for Electric Power and Energy (CEE). He is an expert in intelligent systems for a sustainable power infrastructure, developing technologies and control schemes enabling DER units to participate in the control of the power system.

Transactive Energy: A Field-proven Approach to Integration of Demand Response and Distributed Generation
Koen Kok, TNO, The Netherlands and DTU, Denmark.

Market Based Control for Electric Vehicles Integrations Considering Network Operational Constraints
Junjie Hu, DTU CEE, Denmark.

Market-based Ancillary Service Provision by Distributed Energy Resources
Mazher Syed, University of Strathclyde, Scotland.

Business Agents for Optimized Operation of Clusters of Demand Response Units and/or Distributed generators
Davy Geysen, VITO, Belgium.

Paper Session 24: Smart Metering Applications

Date Wednesday, 14:00 – 15:30
Chair **Serhat İkizoğlu**

2014ISGTEU0542
Adaptive Scheduling Algorithm for Link Recovery in Smart Metering Mesh Networks
Siva Subramani (Toshiba Research Europe Ltd, UK), **Yichao Jin** (Toshiba Research Europe Ltd, UK)

2014ISGTEU0436
Online and Scalable Data Validation in Advanced Metering Infrastructures
Vincenzo Gulisano (Chalmers University of Technology, Sweden), **Magnus Almgren** (Chalmers University of Technology, Sweden), **Marina Papatriantafilou** (Chalmers University of Technology, Sweden)

2014ISGTEU0642
Identifying Consumer Requirements as an Antidote to Resistance to Smart Meters
Rani Yesudas (The Australian National University, Australia), **Roger Clarke** (The Australian National University, Australia)

2014ISGTEU0514
Coarse-Grained Cycle-Accurate Electricity Metering
Mikhail Simonov (ISMB, Italy)

2014ISGTEU0497
Voltage Analytics to Infer Customer Phase
Vijay Arya (IBM Research, India), **Rajendu Mitra** (IBM Research, India), **Richard Mueller** (DTE Energy, USA), **Heather Storey** (DTE Energy, USA), **Gerard Labut** (DTE Energy, USA), **Janet Esser** (DTE Energy, USA), **Brian Sullivan** (DTE Energy, USA)

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Date Wednesday, 14:00 – 15:30
Chair **Ömer Usta/Belgin Turkay**

2014ISGTEU0287
Unsupervised Energy Disaggregation Using Conditional Random Fields
Panikos Heracleous (Nagoya University, Japan), **Pongtep Angkititrakul** (Nagoya University, Japan), **Norihide Kitaoka** (Nagoya University, Japan), **Kazuya Takeda** (Nagoya University, Japan)

2014ISGTEU0300
Voltage-Dependent Models of Power Generation Units: A Detailed Analysis for Control Center Application
Soenke Loitz (University of Kaiserslautern, Germany), **Hendrik Acker** (University of Kaiserslautern, Germany), **Wolfram H. Wellssow** (University of Kaiserslautern, Germany), **Dirk Cremer** (FGH GmbH, Germany), **Willi Heckmann** (FGH GmbH, Germany)

2014ISGTEU0486
A Modelica-Based Execution and Simulation Engine for Automated Power System Model Validation
Francisco Gómez (KTH Stockholm, Sweden), **Luigi Vanfretti** (KTH Stockholm, Sweden), **Svein Harald Olsen** (Statnett SF, Sweden)

2014ISGTEU0627
A New VBR Modeling of Squirrel-cage Induction Machine for Power System Analysis with XTAP
Orie Sakamoto (Sophia University, Bulgaria)

2014ISGTEU0421
A Quantitative Method for the Assessment of VSC-HVdc Controller Simulations in EMT Tools
Robert Rogersten (KTH Stockholm, Sweden), **Luigi Vanfretti** (KTH Stockholm, Sweden), Wei Li (KTH Stockholm, Sweden), **Lidong Zhang** (ABB Power Systems, Sweden), **Pinaki Mitra** (ABB Power Systems, Sweden)

2014ISGTEU0448
A Novel Hybrid Dynamic Simulation Algorithm Based on Iterative Coordination
Shaowei Huang (Tsinghua University, China), **Ying Chen** (Tsinghua University, China),

Paper Session 26: Residential Demand Response 2

Date Wednesday, 14:00 – 15:30
Chair **Anastasios Bakirtzis**

2014ISGTEU0014
A Virtual Power Plant for the Aggregation of Domestic Heating Load Flexibility
Antti Alahäivälä (Aalto University, Finland), **Olli Kilkki** (Aalto University, Finland), **Merkebu Degefa** (Aalto University, Finland), **Ilkka Seilonen** (Aalto University, Finland), **Matti Lehtonen** (Aalto University, Finland)

2014ISGTEU0532
Demand Side Focused Simulation Platform for the Evaluation of Demand Side Management Approaches
Kornschnok Dittawit (Norwegian University of Science and Technology, Norway), **Finn Arve Aagesen** (Norwegian University of Science and Technology, Norway)

2014ISGTEU0533
EnergyTest: A Tool for Assessing Building Energy Sustainability
Emilio Ancillotti (CNR, Italy), **Raffaele Bruno** (CNR, Italy), **Emanuele Crisostomi** (University of Pisa, Italy), **Mauro Tucci** (University of Pisa, Italy), **Marco Conti** (CNR, Italy)

2014ISGTEU0414
Regulating Power from Supermarket Refrigeration
Niamh O'Connell (DTU, Denmark), **Henrik Madsen** (DTU, Denmark), **Pierre Pinson** (DTU, Denmark), **Mark O'Malley** (University College Dublin, Ireland), **Torben Green** (Danfoss, Denmark)

2014ISGTEU0307
Demand Response Potential of Residential HVAC loads Considering Users Preferences
Mubbashir Ali (Aalto University, Finland), **Amir Safdarian** (Aalto University, Finland), **Matti Lehtonen** (Aalto University, Finland)

2014ISGTEU0406
Performance Assessment of Aggregation Control Services for Demand Response
Daniel Esteban Bondy (DTU, Denmark), **Giuseppe Tommaso Costanzo** (DTU, Denmark), **Kai Heussen** (DTU, Denmark), **Henrik W. Bindner** (DTU, Denmark)

Panel 9

Wednesday, 16:00 – 17:30
Conference Main Hall

Transactive Energy: Market-based Approaches to Smart Grid The Industrial Perspective: Field Deployments, New Markets and Standardization

Chair: Koen Kok, TNO

Koen Kok is Senior Scientist Intelligent Electricity Systems at TNO, the largest applied research institute in The Netherlands, and part-time Visiting Researcher at the Center for Electric Power and Energy (CEE) of the Danish Technical University DTU. He is strongly involved in the European smart grids research field, working on numerous EU and NL-national projects developing and field deploying smart grid technology. He is the thought-leading scientist behind the PowerMatcher, an award winning smart grid technology based on Transactive Energy principles. PowerMatcher matches demand and distributed generation on one hand with available renewable power and network capacity on the other.

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Presentations

Couperus Smart Grid: Experiences with Market-based Coordination of Residential Heat Pumps for Wind Power Integration and Distribution-level Grid Management
Arnoud Rijneveld, Stedin, the Netherlands

Real-Time Energy Exchange (REX): An on-line Flexibility Aggregating Platform
Harry van Breen, Alliander & Energy Exchange Enablers (EXE), The Netherlands.

FLECH Flexibility Clearing House: Creating a Flexibility Marketplace for the Smart Grid
Olle Sundström, IBM Research, Switzerland.

PowerMatching City 2: Experiences with Multi-Objective Optimization in a Transactive Energy System
Jan Pieter Wijbenga, TNO, The Netherlands.

Paper Session 27: Smart Grid Automation

Date Wednesday, 16:00 – 17:30
Chair **Mehmet Bayrak**

2014ISGTEU0530
ICT based Performance Evaluation of Control Reserve Provision Using Electric Vehicles
Stefan Böcker (TU Dortmund, Germany), **Christian Lewandowski** (TU Dortmund, Germany), **Thorsten Schlüter** (TU Dortmund, Germany), **Christian Rehtanz** (TU Dortmund, Germany), **Christian Wietfeld** (TU Dortmund, Germany)

2014ISGTEU0312
Considering Correlations for Reliable Distributed Ancillary Service Provision
Marita Blank (University of Oldenburg, Germany), **Sebastian Lehnhoff** (OFFIS, Germany)

2014ISGTEU0444
Holistic View of Active Distribution Network and Evolution of Distribution Automation
Sami Repo (Tampere University of Technology, Finland), **Ferdinanda Ponci** (RWTH Aachen, Germany), **Davide Della Giustina** (A2A Reti Elettriche SpA, Italy)

2014ISGTEU0589
Towards Consistent Smart Grid Architecture Tool Support: From Use Cases to Visualization
Christian Neureiter (Salzburg University of Applied Sciences, Austria), **Dominik Engel** (Salzburg University of Applied Sciences, Austria), **Jörn Trefke** (OFFIS, Germany), **Rafael Santodomingo** (OFFIS, Germany), **Sebastian Rohjans** (OFFIS, Germany), **Mathias Uslar** (OFFIS, Germany)

2014ISGTEU0584
Multi-Agent Distributed Method for Dynamic Power System Rebalancing
Georgios Georgiadis (Chalmers University of Technology, Sweden), **Christopher Saunders** (Chalmers University of Technology, Sweden), **Marina Papatriantafilou** (Chalmers University of Technology, Sweden)

Paper Session 28: Wind Power

Date Wednesday, 16:00 – 17:30
Chair **Deniz Yıldırım**

2014ISGTEU0625
Scenario Selection of Wind Forecast Errors for Stochastic Unit Commitment: A UK Case Study
Jonathan Gomez (The University of Manchester, UK), **Miguel Ortega-Vazquez** (The University of Washington, USA), **Luis F. Ochoa** (The University of Manchester, UK)

2014ISGTEU0598
Mathematical Morphology-based Short-term Wind Speed Prediction Using Support Vector Regression
Lei Zhu (The University of Liverpool, UK), **Q.H. Wu** (South China University of Technology, China), **Lin Jiang** (The University of Liverpool, UK)

2014ISGTEU0553
Dynamic Economic Dispatch with Wind Power Penetration Using Group Search Optimizer with Adaptive Strategies
J.J. Chen (South China University of Technology, China), **J.H. Zheng** (South China University of Technology, China), **Y. Liu** (South China University of Technology, China), **Q.H. Wu** (South China University of Technology, China)

2014ISGTEU0447
Assessment of Wind Power Impact on Power System Transmission Losses
Sanna Uski (VTT, Finland), **Inna Kim** (Kazakh Research Institute of Power Engineering, Kazakhstan)

2014ISGTEU0546
Full Converter Wind Turbine
Daniel Mueller (Frankfurt University of Applied Sciences, Germany), **Walter Kuehn** (Frankfurt University of Applied Sciences, Germany)

Paper Session 29: Load Forecasting

Date Wednesday, 16:00 – 17:30
Chair **Serhat Şeker**

2014ISGTEU0635
From Forecasting to Scheduling in Short Term Power Procurement using Stochastic Optimization
Manish Punjabi (Tata Consultancy Services, India), **Prakash Awate** (Indian Institute of Technology Bombay, India), **Rajeev Gajbhiye** (Indian Institute of Technology Bombay, India), **Shreevardhan Soman** (Indian Institute of Technology Bombay, India), **Krishna Prasad** (Tata Consultancy Services, India)

2014ISGTEU0357
Use of Day-ahead Load Forecasting for Predicted Cable Rating
Rui Huang (University of Southampton, UK), **Jame Pilgrim** (University of Southampton, UK), **Paul Lewin** (University of Southampton, UK), **David Scott** (National Grid, UK), **Daniel Morrice** (National Grid, UK)

2014ISGTEU0393
On Accuracy of Demand Forecasting And Its Extension to Demand Composition Forecasting Using Artificial Intelligence Based Methods
Yizheng Xu (University of Manchester, UK), **Jovica Milanovic** (University of Manchester, UK), **Jingyi Cai** (University of Manchester, UK)

2014ISGTEU0011
A Simplified Short Term Load Forecasting Method Based on Sequential Patterns
Konstantinos Kouzelis (Aalborg University, Denmark), **Birgitte Bak-Jensen** (Aalborg University, Denmark), **Pukar Mahat Energy** (Aalborg University, Denmark), **Jayakrishnan R. Pillai** (Aalborg University, Denmark)

2014ISGTEU0547
Assessment of Some Methods for Short-Term Load Forecasting
Pekka Koponen (VTT Technical Research Centre of Finland, Finland), **Antti Mutanen** (Tampere University of Technology, Finland), **Harri Niska** (University Of Eastern Finland, Finland)

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Controller Hardware in the Loop Approaches Supporting Rapid Prototyping of Smart Low Voltage Grid Control

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***Abstract*—Intelligent control approaches for smart low voltage (LV) grids have to meet the future requirements caused by increasing penetration of distributed generation (DG) from renewable sources and new network participators like electric vehicles. To meet these technical requirements complex solutions have to be developed. Due to the fact that these solutions should be implemented in one of the most critical infrastructures, a detailed test, evaluation, and deployment process is necessary. One highly relevant part of this process is controller hardware in the loop (C-HIL) testing. This paper will therefore present and discuss different C-HIL approaches as part of a rapid prototyping process to support the development of active control solutions. The approaches were investigated within the research project "DG DemoNet – Smart LV Grid".**

***Index Terms*--Automatic voltage control, Distributed power generation, Power system analysis computing, Power system control, Smart grid**

I. Introduction

In the future, new requirements on the medium and low voltage distribution networks have to be fulfilled due to increased penetration of the power grids with decentralized generation from renewable sources, but also due to new network participators like electric vehicles. This comes along with a paradigm shift. While distribution grid operation in the past got along without monitoring of real-time information due to adequate dimensioning, trends aim for more and more online monitoring and higher utilization of the available resources. Consequently, active interventions during grid operation will be used in the future to guarantee quality parameters such as voltage bands and line load conditions. This will be possible due to emerging technologies, such as Smart Metering related communication systems that improve the affordability of low voltage automation infrastructures. Following this paradigm shift, the project "DG DemoNet – Smart LV Grid" searches for solutions for active network operation at the low voltage level [1]. To allow a cost effective development of these solutions, a rapid prototyping process [2] was introduced. A major part of this rapid prototyping process builds a controller hardware in the loop (C-HIL) simulation environment. Hardware in the loop (HIL) simulation is a common technique to support complex development and test of embedded systems. Therefore, the HIL simulation provides an effective framework by considering a model of the environment together with the selected system platform. Hard- and software can be tested with the real set-up of parameters. The C-HIL simulation is a special form of HIL focusing on the development of control systems interacting with a simulated model of the controlled environment.

HIL is used for a wide field of applications, such as wind turbine control [3] or engine control [4], to test developed hardware with simulated models of their target environment. Isermann et al. [4] discuss, that the boarder from the simulated to the real component is not strict, but can rather be shifted during the development phase. Thus, hybrid structures of HIL exist, which we are investigating in this work in the scope of LV grid control development.

Based on the experiences of previous projects in the medium voltage grid [5] and also in the low voltage grid [6] [7] [8], a set of suitable control approaches has been developed. These were designed to allow a step-by-step extension from simple to more and more complex control strategies. The result of this work is described in the following section of this paper.

II. Context for the C-HIL Approaches

The context for the C-HIL approaches presented in this work is the control of the active grid components of the rural low voltage grids in the course of the project "DG DemoNet – Smart LV Grid". The structure of the control system as well as the available infrastructure and grid components form the framework to fit the C-HIL approaches to, and lead to the requirements for the C-HIL evaluation system.

A. *Rapid agile control development process*

For the development of the low voltage grid control system, a seamless development process has been elaborated by Faschang et al. [2]. The five consecutive steps of this process are depicted in Figure 1.

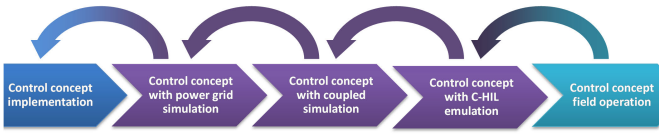

Figure 1: Rapid agile control development process

The process begins from the first draft of the control concept, which contains the source code of the first basic control approach. Then, it leads to power grid simulation, where the behavior and the performance of the control approach is being evaluated with a simulated power grid. The third step goes even closer to real world conditions, by also taking the field communication system into account by co-simulation of the power and communication system.

Finally, before the control concept can be deployed in the field, C-HIL evaluation is carried out. This fourth step of the process approaches real world conditions by operating the control concept on the destined field hardware – coupled to a simulation environment, which simulates real world conditions by means of electric power grid simulation combined with a model of the communication channel.

B. *Overall control system*

Figure 2 shows the five stages of the control concept that were implemented in a smart low voltage grid controller (SLVGC), built of standard automation components and a robust industrial PC [9].

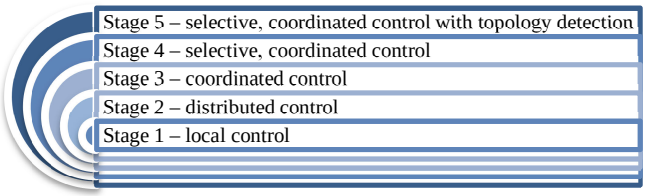

Figure 2: Stages of investigated smart grid controller

This structure represents the increasing complexity during the control development process. Each control stage builds up on the previous one. The findings that were made during realization of each stage are used to enhance the next control stage.

After verification of the functionality of each stage by co-simulation based on models of LV grids and communication channel behaviour, the stages of the concept can be implemented in a controller test environment. The development process is finished after a successful hardware-in-the-loop (HIL) test under real test conditions. With this procedure, the concept can be demonstrated step by step in real LV grids.

After evaluation in co-simulation, different approaches of C-HIL are necessary to test the hard- and software of the target system. Otherwise it is not possible to implement a controller prototype in such a critical infrastructure. The description and discussion of these C-HIL tests is the focus of the following section.

Finally, real tests of the control solution were implemented in selected LV networks in Austrian federal provinces of Salzburg and Upper Austria. The validation in the demonstration networks is in progress. In the preparation phase, voltage problems in these selected low voltage segments were created by integrating a high share of photovoltaics (PV) and electro mobility (PV installation on every second roof; in the demonstration region in Salzburg also electric vehicles in every second household). In order not to exceed the limits for power quality given by EN 50160 [10], in the pilot regions, stricter voltage limits are set than necessary. The developed control concepts solve the generated voltage problems and keep voltages within the stricter limits.

III. SLVG Controller Field Architecture

The architecture of SLVGC supporting rapid prototyping is shown in Figure 3 and described in detail in [9]. It is important for the understanding of the control concepts that the different stages of control are working continuously in hot standby. If respective data quality is sufficient, always the "highest", more complex and therefore more efficient stage is allowed to interoperate with the available actors (e.g., solar inverters, electric vehicles charging stations).

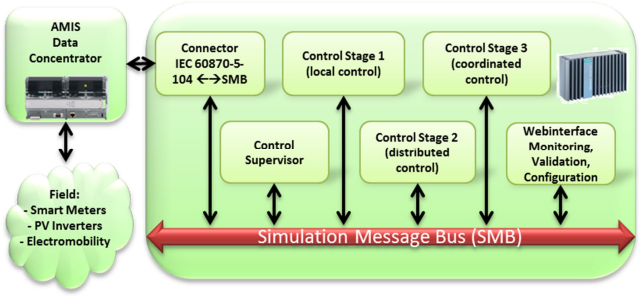

Figure 3: SLVGC architecture

So, for instance, if the running Stage 2 is suddenly lacking information about the grid status through measurements, the previous Stage 1 is activated. The local control of Stage 1 builds the fall back, because its operation does not depend on grid status measurements (i.e., three-phase voltage measurements). The control entity "Supervisor" is responsible for managing the different stages and defines the stage that is currently allowed to interoperate with actors in the field.

IV. Comparison of Different HIL Approaches

To evaluate the SLVG controller's behaviour, various hardware in the loop (HIL) evaluation set-ups with increasing integration of field control hardware are presented within this section. The basis and common platform for all of these set-

ups is given by the co-simulation set-up, which has been presented by Faschang et al. in [2] and is described in the following subsection.

A. Co-Simulation

After the initial implementation of the designed control concept (cf. first step of the rapid agile control development process depicted in Figure 1), the control strategies will be evaluated in simulations. In order to gain precise results, a co-simulation environment was developed that can simulate both the electrical grid as well as the communication system that connects controller, remote sensors, and actuators. The electrical grid models for selected test networks were validated using the ISOLVES-PSSA method [7].

This co-simulation set-up is used to enhance the development and evaluation methods for SLVG control. Conventional power grid simulation enables the development and the evaluation of the basic functionality of control algorithms. Furthermore, an extension of this simple simulation by a model of the communication channel is an inevitable step to also take the dynamics of the communication system (PLC) into account.

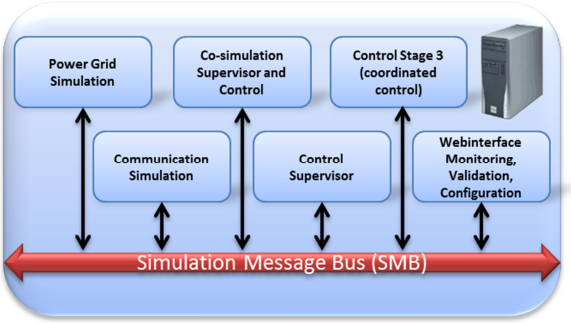

Figure 4: Co-simulation set-up

Figure 4 shows the basic co-simulation set-up that has been implemented and successfully utilized for control algorithm development, improvement, and evaluation in power- and communication grid co-simulation. It consists of six subsequently described simulation and control entities, which are all interlinked via a central message exchanging middleware, the Simulation Message Bus (SMB).

Power Grid Simulation: This simulator is one of the two major simulation components of the co-simulation. As there are several highly sophisticated power grid simulators on the market, one of them is chosen, which offers a suitable API for simulation control and data exchange. For this work, DIgSILENT PowerFactory was used to simulate several models of the rural low voltage grids that are supposed to be controlled by the SLVG-C.

Communication Simulation: The communication channel simulation forms the second major part of the co-simulation. Due to the fact, that all communication of the power grid under evaluation is done via the SIEMENS AMIS – PLC system, a model of this has been implemented. This statistical model relies on a data basis of approx. $2.5 \cdot 10^6$ recorded message transmission logs for each of the power grids. From this model the two channel parameters propagation delay time and loss probability of a single packet can be obtained.

Co-Simulation Supervisor: The composition of the two previously mentioned simulators leads to the need of a co-simulation controlling unit. This co-simulation supervisor maintains the synchronicity of the simulators. Furthermore, it controls the flow of co-simulation and forwards simulation scenarios.

Control Supervisor: The SLVG control system is a multi-stage control system with several control stages, each one relying on the one with lower priority as hot fallback redundancy. The Control Supervisor maintains this hierarchical structure of the control stages, supervises their internal states, and forwards their control commands and set points to the actuators.

Control Stage: The Control Stage is the device under test, which means, its performance is evaluated by co-simulation and improvements are done in an agile way [2]. In Figure 4, only one of the previously mentioned control stages is connected. There may be several of them simultaneously running with varying complexity and scope of the power grid. They are all coordinated by the Control Supervisor.

Dashboard: The Dashboard plays a key role both in the co-simulation set-up, as well as in the field. It provides a convenient overview for the developer, allows for remote control and manipulation of the simulation, and thus simplifies the evaluation of the designed control algorithm.

B. C-HIL basic approach

The previously described co-simulation environment runs on a common Microsoft Windows system (blue). In this environment the first versions of the control algorithm were developed using C++. The target system will run an Ubuntu Linux distribution (green) hosting the rapid prototyping platform as shown in Figure 5.

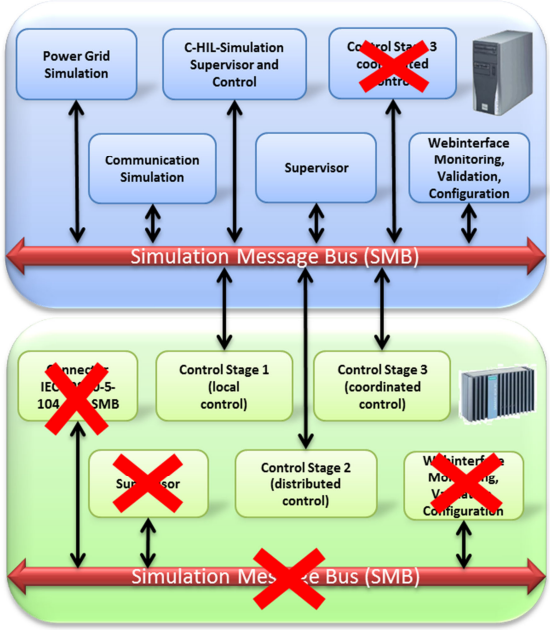

Figure 5: Set-up of C-HIL basic approach

Taking the different operation systems of co-simulation hosting system (blue in Figure 5) and field target system (green in Figure 5) into consideration, the C-HIL basic approach is used to face cross compiling and target hardware performance issues. As shown in Figure 5, the control algorithms investigated in co-simulation are compiled for the target system. To test the success of cross compiling methods within the C-HIL basic approach, the algorithms are running on the SLVGC target system. The flexible simulation message bus (SMB) architecture allows using the same TCP socket connectors to the SMB as of the co-simulation environment.

C. C-HIL advanced approach

After co-simulation and C-HIL basic approach, the fundamental functionality of the control algorithms and the stable operation within the operating system of the target system is approved. The next step is to investigate the coordinated operation of the underlying modules SMB and Supervisor of SLVGC architecture with the compiled control stages. Therefore, the basic co-simulation modules Grid Simulation, Communication Simulation and C-HIL Supervisor and Control are connected to the SMB of the target system (cf. Figure 6).

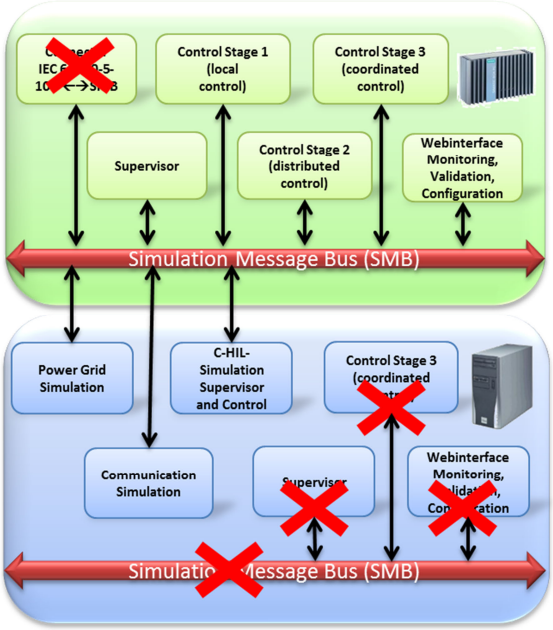

Figure 6: Set-up of C-HIL advanced approach

Now, also the interfaces between the modules of the target system can be tested as a whole. But there is a major disadvantage in this variant of C-HIL. The real environment is simulated through the corresponding modules of co-simulation. Therefore information packets between Power Grid Simulation and Communication Simulation cause additional loading of the SMB on the target system. The target system is not that powerful in comparison to the original hosting system of co-simulation so that only selected scenarios (e.g., limited number of nodes / simulation speed) are possible.

D. C-HIL final approach

The final variant of C-HIL combines the advantages of both systems. As shown in Figure 7, the target system with its interfaces is running completely like under field test conditions without the additional loading of SMB through packet handling for co-simulation modules.

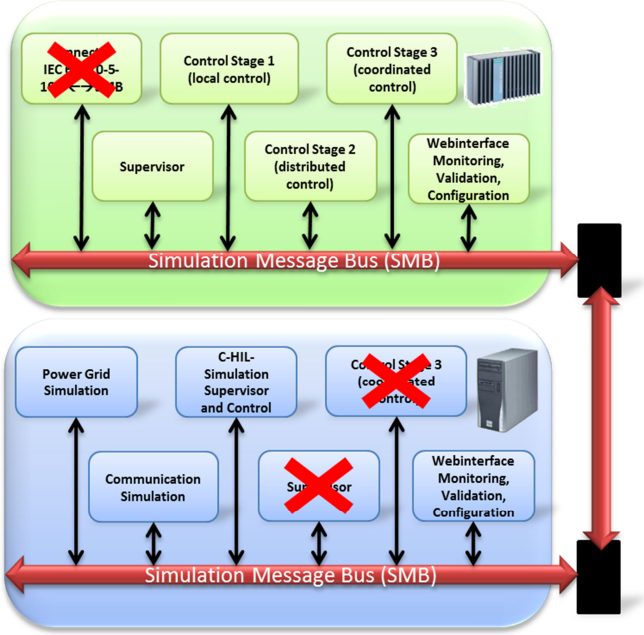

Figure 7: Set-up of C-HIL final approach

The flexible rapid prototyping architecture allows a coupling of co-simulation and target system SMBs by a simple packet forwarding entity. So the co-simulation runs on the powerful Windows PC and the SLVGC framework can be evaluated close to reality.

V. C-HIL Simulation Results

A necessary condition for a successful C-HIL co-simulation environment is that it must not make any difference whether the simulations are performed on one single computer or if some components run on a simulation computer and others on the deployment hardware. Therefore, performance requirements for the hardware have to be chosen in a way that timing characteristics do not differ significantly within the different C-HIL set-ups. In practice the controller as well as the overall software architecture needs to be very flexible concerning timing characteristics, delays and losses. Therefore, the variations in TCP packet transmission delay between loopback and gigabit-Ethernet communication as they occur in the different C-HIL set-ups do not influence the control process and can be neglected.

As a result of this, each of the presented C-HIL set-ups produces very similar simulation results that do not show distinguishable differences when visualized as diagram. Thus, only a common simulation result is exemplarily shown in Figure 8 that is representative for all three C-HIL set-ups. In the presented example 20 three-phase meter voltage measurements are periodically polled from the Power Grid Simulation and routed via the Communication Simulation to the controller. Furthermore, three-phase transformer voltage measurements, the tap position and the active and reactive power measurements are also polled from the Power Grid Simulation. These

values are directly transmitted to the controller due to the fact that communication delay within the substation that hosts the transformer and the controller is negligible. This leads to 66 data points that are periodically transmitted over the SMB with a negligible routing delay compared to packet delay caused by the PLC meter communication, which is simulated by Communication Simulation. Thus, it is possible to run the simulation with a factor 4 faster than real time without losing synchronization of the co-simulation's entities described in Subsection IV.A.

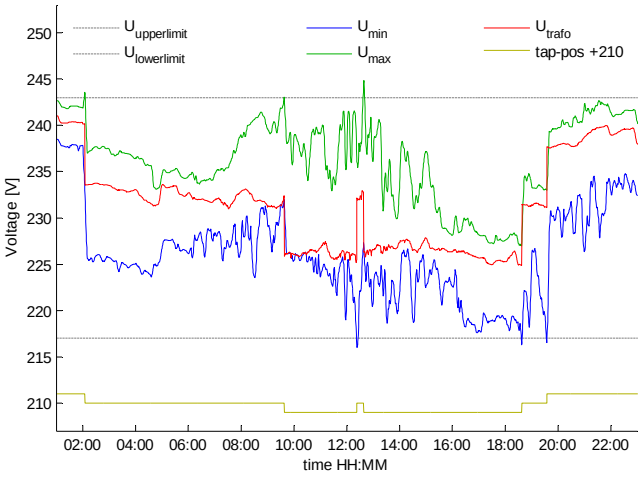

Figure 8: Exemplarily C-HIL simulation result of SLVG Control Stage 2 [9] operated on target hardware: The transformer's tap position is controlled according to voltage measurements from the grid

Figure 8 shows C-HIL simulation results of one day, indicating the highest and lowest grid voltage of the 20 meters as well as the transformer busbar voltage. For the underlying voltage profiles, a mixed sunny/cloudy PV-profile was combined with the load profiles of a summer working day. The voltage limits were chosen narrow to test the performance of the voltage controller. Short voltage variations are reasoned firstly in the averaging time frame of the meters and secondly in an inverse time characteristic of the tap position control process.

VI. Summary and Outlook

In order to minimize risks continuously during the control development process for low voltage grid control development, a crucial task is the evaluation of the designed control system in C-HIL simulation.

In this work we have presented three different approaches for C-HIL integration in the control development process, which have been elaborated in the course of control development for the research project "DG DemoNet – Smart LV Grid". As a common basis, the presented co-simulation set-up has been used and extended by real field control hardware. This step is inevitable in the development process, because by co-simulation itself, it is possible to take also the communication channel parameters into account, but not the manifold aspects of real control hardware. By discussing and analyzing the various approaches, we have found a suitable way for C-HIL simulation to support rapid prototyping of smart LV grid control and gained experience for a close coupling of field and lab environment. Even though the C-HIL simulation step in the development process is the one closest to field conditions, not all circumstances of the real target hardware, and especially the power grid that is to be controlled, can be taken into account. This remaining risk could be even more reduced by an extension of the final C-HIL approach that has been presented in Section IV.D. The idea is currently researched and bases on a horizontal coupling of the field automation hardware with the lab co-simulation and control development system. This would interlink the real low voltage grid even closer to the simulation and would thus allow the control development engineer to evaluate the control approaches under very realistic conditions.

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