2014 CIGRE SESSION
TECHNICAL PROGRAMME

SC A1 ROTATING ELECTRICAL MACHINES

PS1: Developments of Rotating Electrical Machines

A1-101 ***A novel technique for refurbished induction motors' efficiency estimation based on no-load tests***
M. AL-BADRI , P. PILLAY

A1-102 ***Performance of high efficiency induction motors with power quality problems***
P. DONOLO, C. PEZZANI, A. BONELLI, A. AOKI, R. NEHLS, G. BOSSIO, G. GARCIA

A1-103 ***Optimization of the ventilation system of a hydrogenerator through laboratory measurements and CFD simulations***
G. MAS, J. COSTANZA

A1-104 ***Reactive power capability tests in generators in the Colombian power System***
H.M. SÁNCHEZ, N.J. CASTRILLON, J.I. VELÁSQUEZ, O.J. PINILLA

A1-105 ***Models of synchronous generators subject to transient voltage surges***
Á.B. CANÇADO

A1-106 ***CANCELLED - Methodology to analyze the dynamic response of three-phase induction motors subjected to voltage sags***

A1-107 ***The impact on large generators through harmonic currents caused by rapid control***
Q. LIU, F. CHANG, S. JIAO, Y. WANG, T. ZHANG, W. ZHENG, X. LIANG, X. SUN

A1-108 ***Turbo-generator welded rotor***
H. COLOMBIE, M. THIERRY, R. ROTZINGER, C. PELISSOU, C. TABACCO, V. FERNAGUT

A1-109 ***Design improvements in IGBT based variable frequency drive motors***
A.K. GUPTA, D.K. CHATURVEDI

A1-110 ***Trend for static excitation systems in large thermal generators - User's perspective***
D. DEVATE, K. CHATURVEDI, K. NAGESH

A1-111 ***Effects of the modularity in PMSM synchronous machine behaviour***
T. ARLABÁNA, M.P. COMECHB, M.T. VILLÉNB, M.A. COVAB, M.GARCÍA-GRACIAB

A1-112 ***Increased grid performance using synchronous condensers in multi in-feed multi-terminal HVDC system***
A. DI GIULIO, G.M. GIANNUZZI, V. IULIANI, F. PALONE, M. REBOLINI, R. ZAOTTINI, S. ZUNINO

A1-113 ***Design and manufacturing of The world's largest 475MVA/460MW adjustable speed generator-motor for pumped storage hydro electric power plant***
T.KUBO, I. OHNO, O. OSADA, H. TOJO, T. SHIOZAKI, T. SUZUMURA, T. WATANABE

PS2: Life Management of Generators

A1-201 ***Recent endwinding vibration problems in air-cooled turbine generators***
J. KAPLER, J. LETAL, M. SASIC, G.C. STONE

A1-202 ***Development of a hydrogenerator prognosis approach***
N. AMYOT, C. HUDON, M. LÉVESQUE, M. BÉLEC, F. BRABANT, C. ST-LOUIS

A1-203 ***End-winding vibration monitoring for hydro-generators***
S. GIROUX, D. BUSSIÈRES, A. TÉTREAULT

A1-204 ***Improved SVM applied in fault diagnosis on hydropower generating unit***
B. PENG, J. CHENG, J. SHUAI, Y.P. LI, G.Q. CHEN

A1-205 ***Black box for electrical machines***
A. ELEZ, J. POLAK, I. POLJAK, J. STUDIR, M. DUJMOVIC

A1-206 ***CANCELLED - Rotor faults diagnosis in synchronous generators using pattern recognition***
M. BIET, A. BACCHUS

A1-207 ***Innovations in turbogenerator stator rehabilitation at site of installation***

A.L. LIVSHITS, K.A. KOBZAR, V.S. SHPATENKO, V.V. KUZMIN

PS3: Rotating Machines for Dispersed Generation

A1-301 ***Asset modelling challenges in the wind energy sector***

D. MCMILLAN, I. DINWOODIE, G. WILSON, A. MAY, G. HAWKER

SC A2 TRANSFORMERS

PS1: Best practices for asset management

A2-101 ***Use of health index and reliability data for transformer condition assessment and fleet ranking***

P. PICHER, J.-F. BOUDREAU, A. MANGA, C. RAJOTTE, C. TARDIF, G. BIZIER, N. DI GAETANO, D. GARON, B. GIRARD, J.-F. HAMEL, S. PROULX

A2-102 ***Post-mortem analysis of transformer insulating paper and its relationship to the determination of chemical markers***

J. JALBERT, M.-C. LESSARD, B. GIRARD

A2-103 ***Health index as one of the best practice for condition assessment of transformers and substation equipments – Hungarian experience***

B. NÉMETH, C.S. VÖRÖS, G. CSÉPES

A2-104 ***Power transformer management – investment planning considering loss of life of the insulating paper***

M.L. MAMANÍ, R. MEDINA, A.A. ROMERO, E. MOMBELLO, G. RATTÁ

A2-105 ***Pattern recognition techniques for determining the health index of oil-paper insulation of in-service power transformers***

T.K. SAHA, H. MA, C. EKANAYAKE, D. MARTIN, D. ALLAN

A2-106 ***Post-mortem investigation of power transformers – Profiles of moisture and degree of polymerization - Furan concentration in the oil as ageing assessment tool***

T. LIEBFRIED, M. JAYA, M. SCHÄFER, M. STACH, N. MAJER, S. VOSS

A2-107 ***Health Index: the TERNA's practical approach for transformers fleet management***

F. SCATIGGIO, V. IULIANI, A. FRAIOLI, M. POMPILI

A2-108 ***Transformer asset heath review: does it really work?***

R. HEYWOOD, P. JARMAN, S. RYDER

A2-109 ***Learning from power transformer forensic investigation and failure analysis***

H. DING, R. HEYWOOD, S. RYDER, J. LAPWORTH, R. HOOTON, P. JARMAN, E. CROSS, S. HORSLEY

A2-110 ***Addressing Ground-Induced Current (GIC) transformer protection***

A. RAMIREZ ORQUIN, V. RAMIREZ

A2-111 ***Interpretation of data from on-line bushing monitoring systems***

J. WATSON, J. BUCHACZ, V. PRYKHODKO, S. SKINNER

A2-112 ***Experiences of transformer damage and recovery from the Great East Japan Earthquake***

I. OHNO ,T. KOBAYASHI, S. YAMADA, M. KADOWAKI, H. MURAKAMI

A2-113 ***Application of novel algorithms for continuous bushing and OLTC monitoring for increasing network reliability***

N. ABEYWICKRAMA, O. KOUZMINE, S. KORNHUBER, L. CHEIM, P. LORIN, M. GAUVIN, F. LEONARD, P. PICHER

A2-114 ***Managing an ageing transformer fleet. Norwegian situation, research and initiatives***

L E. LUNDGAARD, C. LESAINT, K. B. LILAND, D. LINHJELL, M.H. G. ESE AND AL

A2-115 ***Criterions determining the highest permissible operation temperature of an oil transformer when the humidity of the cellulose insulation increases***

S.J. SŁOWIKOWSKI

A2-116 ***Transformer health and risk indexing, including data quality management***

M. VERMEER, J. WETZER

PS2: Transformers for specialized applications

A2-201 ***Short circuit verification for a 570 MVA, 420 kV single-phase GSU-transformer by SC-withstand tests on a mock-up unit***

G. LEBER, H. PASSATH, M. RYADI, P. HURLET

A2-202 ***Phase shifting transformer on power control - A brazilian experience***

A.L.N. VITA, G.M. BASTOS, J.C. MENDES, F.C. NETO

A2-203 ***Research on the insulation reliability for the lead exit of 1000 kV transformer***

J. LI, J. SUN, S. ZHANG, R. LIU, H. TANG, H. CHENG, Z. ZHAO, F.GAO, R. GUO

A2-204 ***Basic research for fibre optic application in HVDC transformer***

R. WIMMER, J. HOPPE, A. MIKULECKY, F. JENAU, M. FREIBURG

A2-205 ***Design, testing, commissioning and operational experience of first phase shifting transformer in Indian network***

S.V.N. J. SUNDAR, Y. RAJU A, C. RADHAKRISHNA, M. KUMAR, S. SACHDEVA

A2-206 ***Controlled shunt reactor 500kV 180MVA with new design. Field experience at NELYM substation.***

L. MAKAREVICH, L .MASTRYUKOV, V. IVAKIN, V. KOVALEV, N. SULDIN

A2-207 ***New phase shifting transformers in the Italian transmission network. Design, manufacturing, testing and electromagnetic transients modelling***

V. IULIANI, A. DI GIULIO, F. PALONE, M. REBOLINI, S. ZUNINO, M. UBALDINI, S. BADINI, G. CANNAVALE, M. DEL CARRO, L. LOMBINI, G. CAPRIO, A. VITIELLO, P.L. ALBANI, F. FERRARI

A2-208 ***Charge dynamics in oil/pressboard and HVDC converter transformer***

M. HAO, Y. ZHOU, G. CHEN

A2-209 ***Design recommendations arising from experience with offshore transformers***

R. SLAUGHTER, M. BARNETT, A. REISING

A2-210 ***Analysis of 2 core transformer designs***

R. AHUJA, R. DEL VECCHIO

A2-211 ***Variable shunt reactors: applications and system aspects***

C. BENGTSSON, K. RYEN, O.A. RUI, T. OLSSON

PS3: Field experience with the use of non-conventional materials and technologies

A2-301 ***Factory and field experience with monitoring of vegetable oil transformer***

V.G. DAVYDOV, T. ZIELINSKI, L. MCPHERSON

A2-302 ***Ageing phenomena of cellulose/oil insulation in natural ester and mineral oil***

C. PERRIER, M-L. COULIBALY, J. LUKIC, V. MANDIC

A2-303 ***HTSC transformers with localized magnetic field***

E.P. VOLKOV, E.A. DZHAFAROV, L.S. FLEISHMAN

A2-304 ***Dry-type subtransmission transformer: compact and safe indoor substations***

M. CARLEN, M. BERROGAIN, R. CAMERONI, M. SPINARELLI

A2-305 ***CANCELLED - New demands on vacuum interrupters in tap-changer applications***

A2-306 ***Experience with application of natural-ester filled HV transformers in Mexico***

J.G. CASTELLANOS

A2-307 ***Experience with the first 230 kV shell type auto-transformer retro-filled with natural ester on Mexican grid***

R. OCÓN, R. MONTES, R. LIÑÁN, A. GUZMÁN

A2-308 ***CANCELLED - Commissioning testing and operational experience with a network connected 1 MVA superconducting transformer utilising 2G HTS Roebel cable***

SC A3 HIGH VOLTAGE EQUIPMENT

PS1: Equipment to cater for changing network conditions

A3-101 ***High voltage dry-type air-core shunt reactors***

K. PAPP, M. R. SHARP, D. F. PEELO

A3-102 ***Experiment and simulation research on VFTO in UHV GIS***

W. CHEN, Z. LI, W. LIU, L. WANG, C. LI, B. HAN, X. YAN, H. WANG, H. HU

A3-103 ***Capacitive current switching capability of air-insulated high voltage pantograph disconnectors***

B. RUSEK, C. NEUMANN, J. HAUDE, K. KLEINEKORTE, R.P.P. SMEETS

A3-104 ***Assessment of transient recovery voltage for 1200 kV circuit breaker***

S.K. AGRAWAL, B.N. DE BHOWMICK, S.B.R. RAO, B.N.V.R.C. S. KUMAR, U. SEN, R.S. SHIVAKUMARA ARADHYA, MEERA K.S, S. SANTOSH K. PATRO

A3-105 ***Optimal allocation and assessment of superconducting fault current limiter in an urban meshed 110-kV subtransmission network***

B.J.O. SOUSA, A. PIHKALA, M. LEHTONEN

A3-106 ***New references for HVDC metering***

J. HÄLLSTRÖM, A. BERGMAN, S. DEDEOĞLU, A-P. ELG, E. HOUTZAGER, J. KLÜSS, T. LEHTONEN, W. LUCAS, A. MEREV, J. MEISNER, T. NIEMINEN, E-P. SUOMALAINEN, S. SVENSSON, C. WEBER

A3-107 ***Diagnosis of capacitive voltage transformers in service - New method to determine the accuracy of CVTs while in service, without physical references and with a light portable unit***

D. GONZALEZ, A. GALLASTEGI, U. ZATICA, M. L. CORMENZANA

A3-108 ***Overload line controller: new FACTS series compensation application based on switched series reactors***

I. ROMERO, J. MARTIN, R. RIVAS, L. WALL, J.C. SANCHEZ

A3-109 ***Requirements for increasing safety and reliability: new design of current transformers and experience on multiple stress test on composite bushings***

A. DI GIULIO, D. FALORNI, A. FRAIOLI, V. IULIANI, M. SVANBERG, M. GULLO, P. CARDANO, M. DE NIGRIS, G. PIROVANO

A3-110 ***Investigation of LC-resonance driving in disconnector bus-transfer testing***

A. RITTER, U. STRAUMANN, U. RIECHERT, C. M. FRANCK

A3-111 ***Dimensions of influence on RC-dividers on the measurement of power quality parameters in high-voltage transmission networks***

E. SPERLING, P. SCHEGNER

A3-112 ***Protection devices and solutions for evolving distribution smart grid***

L. KOJOVIC, K. ARGIROPOULOS

A3-113 ***Interrupter technology for switching shunt reactors evolves as the frequency of switching reveals weaknesses in traditional designs***

J. ROSTRON, N. MCCORD, T. SPEAS, F. THERBY

A3-114 ***Modelling and experimental verification of DC current interruption phenomena and associated test-circuits***

R.P.P. SMEETS, V. KERTÉSZ, A. YANUSHKEVICH

A3-115 ***Modeling of and recommendations for UHV and EHV switching duties***

A. JANSSEN, D. DUFOURNET, H. ITO, U. RIECHERT, H. KAJINO, Y. YAMAGATA, M. KOSAKADA, S. POIRIER, J. FAN, Z. XIANG, P. FERNANDEZ

PS2: Lifetime management and ageing of T&D equipment

A3-201 ***Measurements of dielectric breakdown delays between series-connected interrupters of a HV circuit breaker***

S. POIRIER, R. DOCHE, R. PATER, J. POIRIER

A3-202 ***Impact of mechanical operations on minimum-oil circuit breaker reliability***

J.-F. BOUDREAU, R. DOCHE

A3-203 ***Long-term reliability of controlled switching systems: observations from two decades of development and experience***

A. MERCIER, S. DE CARUFEL, P. TAILLEFER

A3-204 ***Qualification process of a GIS 400 kV SF6 high voltage circuit breaker controlled switching solution***

M. WALDRON, F. AÏT-ABDELMALEK, J-L. RAYON

A3-205 ***Life extension of well-performing air-blast HV and MV circuit-breakers***

A. JANSSEN, M. VAN RIET, R. SMEETS, H. TE PASKE, M. ILLSLEY

A3-206 ***Romanian experience with lifetime management of high voltage equipment***

I. HATEGAN, C. DIACONU, C. MOLDOVEANU, E. MIHALCEA, V. BREZOIANU, S. ZAHARESCU, B. TOADER, A. VASILE, I. IONITA

PS3: Impact of extreme operating conditions on T&D equipment

A3-301 ***Stresses not covered by standards and overstresses applied to transmission equipment***

A. CAVALHO, P.C. FERNADEZ, A. JANSSEN, S. NKOSI

A3-302 ***Vacuum circuit breaker, switching interactions with transformers and mitigation means***

E. DULLNI, J. MEPPELINK, L. LILJESTRAND

A3-303 ***Comparison of short and long term use of synchronous control versus closing resistor switching methods for capacitor switching***

N. MCCORD, J. ROSTRON, T. SPEAS, F. THERBY

A3-304 ***Study of seismic design and guideline of substation equipment based on the Great East Japan Earthquake***

I. OHNO, T. ITO, T. KOBAYASHI, H. SATO

A3-305 ***Investigation of composite insulators in extreme environments - Heavy snow and severe pollution -***

M. TOYODA, H. MIYAGAWA, H. TAKADA, Y. TAMAKOSHI, J. KIDA, H. KOHYAMA

A3-306 ***Interruption phenomena and testing of very large SF6 generator circuit breakers***

R.P.P. SMEETS, L.H. TE PASKE, S. KUIVENHOVEN, R. THOMAS, V. ROYOT, P. ROBIN-JOUAN, J.M. WILLIEME, F. JACQUIER

SC B1 INSULATED CABLES

PS1: Feedback from newly installed or upgraded underground and submarine AC and DC cable systems

B1-101 ***Application of T-Joints in high voltage underground cables installations***

F.W. SEYBOLD, L.A. MEDAGLIA, I.M. RUIZ

B1-102 ***330kV XLPE cable specific testing protocol requirements***

K. TANG, D. PATON, G. BUCEA, S. MASHIO, Y. MURAMATSU

B1-103 ***Advanced type testing program in order to assure the reliability of new cable systems***

V. BEGHIN, J. BECKER, C. SZCZEPANSKI

B1-104 ***Newly installed underground AC cable systems in Brazil***

C.D. PEIXOTO, J.C.R. LOPES, N.H.G.R. DE LOUREDO, E. KARABOLAD FILHO

B1-105 ***The first HVAC and HVDC grid connection projects for wind power integration in German North Sea: experience, challenge and outlook***

D. ZHANG, V. WERLE, J. JUNG

B1-106 ***Urban 220 kV Cable Transmission: Paradigm Perspective***

K. SHARMA, P. KUMAR, M.S. RAO, V.G. SONAR, T.V. TALANDE, A.K. PHADNIS

B1-107 ***Lessons learnt from permitting and consent relevant to AC UGC lines: the 150 kV " Cagliari Sud – Rumianca " case***

M. FORTELEONI, V.P. LICCIARDI, M. REBOLINI

B1-108 ***Current rating optimisation for offshore wind farm export cables***

J.A. PILGRIM, S. CATMULL, R. CHIPPENDALE, P.L. LEWIN, P. STRATFORD, R. TYREMAN

B1-109 ***138kV transition joint between high-pressure fluid-filled and XLPE cables***

A. MAKOVOZ, J. RUTH

B1-110 ***Practical application of +/-250kV DC-XLPE cable for Hokkaido-Honshu HVDC link***

Y. MURATA, C. WATANABE, Y. ITOU, H. SASAKI,.S. KATAKAI, M. WATANABE

B1-111 ***Lightning impulse test levels for extruded HVDC cable systems***

J. LUNDQUIST, C. ENGELBRECHT, E. THUNBERG, V. DUBICKAS, H. JANSSON, T. WORZYK

B1-112 ***Impact of QA/QC on the succesful commissioning of long 380 kV XLPE cable systems***

S. MEIJER, F.H. DE WILD, G.R. KUIK, J. TER HAAR, R. ROSS, V. WASCHK

B1-113 ***New innovative cable installation methods used for the 500 kV HVDC project, Skagerrak 4 between Denmark and Norway***

B. KLEBO-ESPE, L. BJERKE, U.S. GUDMUNDSDOTTIR, T. KVARTS

B1-114 ***Flexibility of natural/forced ventilated tunnel for EHV cable links across urban environments***

S. AL JALLAF, H. BUSAMRA, K. AL ROKEN, J. GEORGE, L. POPIEL, O. MOREAU, O.J. JARRY

PS2: Best use of existing T&D cable systems

B1-201 ***A deeper insight into fault location on long submarine power cables***

M. BAWART, M. MARZINOTTO, G. MAZZANTI

B1-202 ***Diagnostic testing and on-line condition monitoring of cable systems based on partial discharge measurement***

B.T. PHUNG, Z. LIU, T.R. BLACKBURN, G. BURGESS, P. MCMULLAN, H. ZHANG

B1-203 ***Belgian philosophy and experience with temperature monitoring of cable systems by means of distributed temperature sensing techniques and future PD monitoring techniques***

B. HENNUY, P. LEEMANS, B. MAMPAEY, M. BURCEANU, J. VAN SLYCKEN

B1-204 ***Combination of withstand voltage testing by frequency-tuned resonance and partial discharge testing under damped AC for power cables in field***

Y. XU, B. LIU, J. XUE, H. LI, Y. LA

B1-205 ***Experience of partial discharge with IEC type testing and after installation testing for extruded cables***

A. ELFARASKOURY, O. GOUDA, M. MOKHTAR, M. MEHANNA

B1-206 ***Experiences of PD measurements on installed HV cable systems***

F. GARNACHO, I. TRASMONTE, R. MARTIN, M.A. SANCHEZ-URAN, J. ORTEGO, F. ALVAREZ, D. PRIETO, J. VALLEJO, M.A. JIMENEZ

B1-207 ***REE's experience in predictive maintenance based on monitoring of screen currents in high voltage underground cables***

R. GARCIA FERNANDEZ, M.D. LOPEZ-MENCHERO, G. DONOSO CONEJO

B1-208 ***Pilot project for cable capacity monitoring using optic fibre cables and prognostic software in the city of Zurich***

E. CHIMI, B. HEIMBACH, J. BADER, H. LUTERNAUER

B1-209 ***US DGA (Dissolved Gas Analysis) experience on high voltage extruded and oil-paper terminations, including their differences***

N. SINGH, S. SINGH, R. REYES, B. CHOMA, M. UZELAC, K. ZHOU, T. ZHAO

B1-210 ***Online travelling wave-based fault location on crossbonded AC cables in underground transmission systems***

C.F. JENSEN, C. L. BAK, U.S. GUDMUNDSDOTTIR

B1-211 ***Development and application of compact type on-line PD system at on-site for detecting PD by applying AC withstand voltage in underground power cable***

J.H. BAE, S. AN, J.H. SONG, S.K. LEE, K. JIN, K.J. SEUNG, T. H. KIM, J.S. LEE

PS3: Insulated cables in the Network of the Future

B1-301 ***Innovative insertion of very long AC cable links into the transmission network***

F. LESUR, P. MIREBEAU, M. MAMMERI, J. SANTANA

B1-302 ***Specific submarine cable system challenges for the development of a Mediterranean interconnection grid***

P. ADAM, E. COLOMBO, S. SIM, A. BURNS

B1-303 ***AmpaCity Project – Advanced superconducting 10 kV system replaces conventional 110 kV cable system in city center***

M. STEMMLE, F. MERSCHEL, M. NOE, A. HOBL, N. LALLOUET

B1-304 ***Development and qualification of 150 kV cable produced with highly innovative P-LASER technology***

M. ALBERTINI, A. BAREGGI, L. CAIMI, S. CHINOSI, V. CRISCI, S. FRANCHI BONONI, A. GUALANO, L. GUIZZO, G. PEREGO, G. POZZATI

B1-305 ***Japan's first in-grid operation of a 66 kV - 200 MVA superconducting cable system***

T. MIMURA, S. HONJO, T. MASUDA, A. MACHIDA, T. HARA

B1-306 ***Current depend armour loss in three-core cables; comparison of FEA results and measurements***

M.M. HATLO, J.J. BREMNES

B1-307 ***Water tree ageing of high voltage XLPE cable insulation system under combined dynamic mechanical and AC electrical stress***

E. ILDSTAD, S.M. HELLESØ, S. HVIDSTEN, H. FAREMO, P. EGROT , J-O. BOSTRÖM, S. NILSSON, J.EEK, J. MATALLANA, H.M. WØLNEBERG

B1-308 ***Development status of DC XLPE cable in Korea***

T.H. LEE, S. B. LEE, J.H. NAM, Y.H. KIM, S.K. LEE, I.H. LEE, S.I. JEON, Y.J. WON, J.S. KIM, J.H. LEE

SC B2 OVERHEAD LINES

PS1: Minimizing the Impact of new Overhead Lines

B2-101 ***The impact of transition points on overhead line earthing system performance***

D.J. WOODHOUSE, W.J.V TOCHER

B2-102 ***Risk assessment of a 400 kV overhead line in a heavy industrial environment***

J. HOEFFELMAN, L. BOUCHIKI, K. VAN DAM, J. F. GOFFINET, D. DE BIE, S. BRONCKERS

B2-103 ***Induced voltages on near-by pipelines by AC power lines***

M. ABDEL-SALAM, H. ZIEDAN, A.A. HOSSAM-ELDIN

B2-104 ***Application of new technology solutions for minimizing land use for overhead transmission lines – Indian experience***

CHANDRAKANT, A. ANAND, GOPALJI, G. GUPTA, B.S. PANDEY, I.S. JHA

B2-105 ***Conversion of AC multi-circuit lines to AC-DC hybrid lines with respect to the environmental impact***

B. SANDER, J. LUNDQUIST, I. GUTMAN, C. NEUMANN, B. RUSEK, K.-H. WECK

B2-106 ***Examples of transmission line tower configurations and solutions such as 765 kV insulated cross arms to minimize the impact of new EHV lines***

D. LAKHAPATI, A. FURRER, HR. GASSMANN, F. SCHMUCK

B2-107 ***Development of insulating cross-arms for compact HV lattice tower structures***

S.M. ROWLAND, R. MACLAREN, I. COTTON, D. CHAMBERS, V. PEESAPATI, C. ZACHARIADES

B2-108 ***Minimizing the environmental impact of cew overhead lines in Japan***

T. SHINOZAKI, H. TAKAMURA, K. KAWABATA, S. ROKUTANDA

B2-109 ***Voltage uprate studies of the Irish 220 kV network to 400 kV operation***

J. DOYLE, M. NORTON, S. MURRY, S. TEMTEM, P. MORAN, D. CHAMBERS, I. COTTON

B2-110 ***Improved wind model to verify the stability of Wintrack braced post insulator sets***

A.J.P. VAN DER WEKKEN, A. VAN DER WAL, H.E. HOEKSTRA

B2-111 ***New design pylons as solution to minimize the impact of new overhead lines***

H. STEGEMAN, G. BOUDEWIJN, H. LUGSCHITZ, K. REICH, S. PAULY, M. KOSTNER, E.CHRISTIANEN, P. SINTNICOLAAS

B2-112 ***Corona performance of 400 kV bundle conductors and insulator strings***

M. BECAN, M. BABUDER, S. VIZINTIN, I. KOBAL

B2-113 ***Sharing the transmission grid with storks and other birds***

J. GOMES-MOTA, F. AZEVEDO, L. CAMPOS PINTO, N.P. SILVA, J. CASACA

B2-114 ***Impulse resistance for type "A" grounding systems on transmission towers***

M. VELEDAR, Z. BAJRAMOVIĆ, S. ČARŠIMAMOVIĆ, M. SAVIĆ, O. HADŽIĆ

B2-115 ***Heliborne construction and maintenance of lines***

P. GUILLAUME

PS2: Reliability and Design Optimization

B2-201 ***Optimization and design of the 400 kV double circuit overhead line crossing over the Hoogly River in West-Bengal, India***

E. GHANNOUM, G. SRIVASTAVA, R. KUMAR, S. SUNDAR SINHA

B2-202 ***Derivation and analysis of the relation between conductor sags in inclined and levelled spans based on known data of the latter***

A. HATIBOVIĆ

B2-203 ***Optimization of HSIL non-conventional 500 kV transmission line***

J.F. AMON, C.P.R. GABAGLIA, M.J. IZYCKI, G. TAVARES, R.C.R. MENEZES, A.S. RIGUEIRA, F.C.DART, J.B.G.F. SILVA, L. F. FERREIRA

B2-204 ***Research and engineering application of power grid large-scale ice-disaster prevention and treatment technology***

J-Z. LU, H-X. ZHANG, Z. FANG, B. LI, Z-L. JIANG, W-H. ZHOU, X-J. XU, Y-J. TAN, J. LUO, C. ZHAO, J. GUO

B2-205 ***New conductor types application for overhead transmission lines design optimization and reliability improvement***

L. TIMASHOVA, E. NIKIFOROV, I. NAZAROV, A. MERZLYAKOV, M. ERMOSHINA L. KACHANOVSKAYA, E. KONSTANTINOVA, P. ROMANOV, S. KOLOSOV, V. SHKAPTSOV

B2-206 ***REE's insulator global maintenance policy***

R. GARCIA FERNÁNDEZ, M.A. PEREZ LOUZAO, I. SERRANO

B2-207 ***Dynamic assessment of overhead line capacity for integrating renewable energy into the transmission grid***

S. FERNÁNDEZ DE SEVILLA, G. GONZALEZ, G. JUBERIAS, L. MARTINEZ, M. ESCRIBANDO, J. IGLESIAS, P. ALBI, U. BURDALO, A. MUNIZ, S. KWIK

B2-208 ***Integrating enhanced dynamic line rating into the real-time state estimator analysis and operation of a transmission grid increases reliability, system awareness and line capacity***

T. GOODWIN, S. AIVALIOTIS, R. MOHR, R. STELMAK

B2-209 ***Impact of quality of glass cap-and-pin insulators on life cycle costs and proposals for screening tests***

K. HALSAN, I. GUTMAN, J. LUNDENGÅRD, L. CARLSHEM, J. VELEK, J. LACHMAN, K. VÄLIMAA

B2-210 ***Protection of the 400 kV OHL support foundation structure against a disaster caused by the Dunajec River meandering***

R. CZYŻ, P. WOJCIECHOWSKI

PS3: Conductors: Installation and Long Term Performance

B2-301 ***220-kV field study of different high temperature low sag conductors***

R. PUFFER, T. FREHN, M.V. FONDERN, J. T. KRAPP, M. RIEDL

B2-302 ***Creep behaviour of high temperature low sag conductors***

G. PIROVANO, F. MAZZARELLA, A. POSATI, A. PICCININ, S. SCARIETTO

B2-303 ***Phase displacement as a prospective means for right-of-way upgrading***

L. BARTHOLD, D. WOODFORD, R. ADAPA

B2-304 ***Video based defect detection for ground wire of transmission lines***

R. ISHINO, Y. YAMATO

B2-305 ***Limits of allowed ampacity of EHV/UHV overhead lines with ACSR and ACCC conductors, in the specific climatic conditions of the Slovak Republic***

J. LAGO, L. PAVLOV, M. SAVČÁK, J. BARNIAK

B2-306 ***Creep and fatigue into copper micro alloys for overhead transmission lines***

L. RIERA FONTANA, G. CASTELLANA

SC B3 SUBSTATIONS

PS1: Substation Developments to address future needs

B3-101 ***Software for optimization and time reduction in substation design, using BIM technologies, advanced information systems and knowledge management***

J. CORREA, J. GARCIA

B3-102 ***Christchurch reactive power controller***

P. WANG, M. HODGES, N. MATHESON, J. PHOON, S. BELL

B3-103 ***Self-healing control technology for smart distribution systems and its application***

X. DONG, L. YU, F. WANG, P. LI, X. HUANG, S. HUANG

B3-104 ***A new generation of highly integrated smart substation***

P. SUN, Y. CAI, Z. BO, T. BI

B3-105 ***Development of GIS technologies to meet new requirements at 420 kV level and above***

A. FICHEUX G. GAUDART, N. TOQUET, A. BERTINATO, J .B. JOURJON, N. GARBI, D. DEPRES, M. BERNARD, P. VINSON, V. TROUBAT, T. BERTELOOT

B3-106 ***Design optimisation case study with process bus***

H. JACQUES, C. WOOLLEY, G. TREMOUILLE, R. MIGNÉ, T. BUHAGIAR, T. GLAUTHLIN

B3-107 ***Key parameters for the optimization of a Wind Farm: Impact on the offshore substation***

J. YUAN, P. EGROT, F. MARTIN, P. MONJEAN, G. TREMOUILLE, S. SUN

B3-108 ***POWERGRID experience on operation of 765kV transmission system***

R.P SASMAL, S. SEN, R.K.TYAGI, V. SHRIVASTAVA

B3-109 ***Development and operational experience of substation automation system implementation along with 9-2 LE compliant process BUS with conventional CTs and PTs***

V. SHYAMALA, T. SAI KUMAR, A. AGGARWAL, A. BISWAS, KVH RAO, SVN JITHIN SUNDAR

B3-110 ***First "Digital Substation" 110 kV, using the IEC 61850 (-8-1 and-9-2LE) for measurement, protection and control switching devices in Russia***

Y.I. MORZHIN, S.G. POPOV, Y.V. KORZHETSKIY, M.D. ILIN

B3-111 ***CANCELLED - Improving resource usage, installation time and operation of GIS***

B3-112 ***Limitations, trends and potentials in the design of modern gas-insulated high voltage switchgear***

D. GAUTSCHI, K. POHLINK, R. LUESCHER, Y. KIEFFEL

B3-113 ***Model based, substation-centric distribution automation***

E. HEDGES, F. BECKER, K. GEISLER

B3-114 ***Practical use of monitoring/diagnostic systems to realize more efficient maintenance, stable electric power supply and optimized refurbishment***

Y. MATSUSHITA, H. CHIDA, S. NOGUCHI, K. SASAMORI

B3-115 ***Selection between indoor or outdoor DC yards***

D. WU, U. ÅSTRÖM, L. AREVALO, R. MONTAÑO, B. JACOBSON

B3-116 ***Low cost and fast deployment distribution substations***

N. KENNEDY, S. MULVEY

B3-117 ***Standardisation of MV substation configurations in HV/MV substations***

E.J. COSTER, D. BOENDER

B3-118 ***115 kV GIS Design criteria considering service continuity***

K. ANANTAVANICH, N. PAENSUWAN, S. PRUNGKHWUNMUANG, W. RUNJANG

PS2: Life-cycle management of substations

B3-201 ***Renovation and up-rating of Substations applying new technologies of equipment of High Voltage obtaining greater availability of electric power and compaction of the dimensions of the Substations***

M. KOVALENKO

B3-202 ***Equipotential surfaces and electric fields for substation Corona Effect definition***

E. BETANCUR, M. SUAREZ, L. PABON

B3-203 ***Managing risk in design and installation of substations***

A. KLEPAC, S. JONES, J. HOWLAND

B3-204 ***CANCELLED - Understanding the paradigm shift regarding risk management of earthed assets***

B3-205 ***New solutions ensuring safe maintenance and high system reliability in AIS substations***

M.M. MAAROUF, N.M. OSMAN

B3-206 ***UHF partial discharge monitoring return of experience installed in 400 kV GIS***

P. PRIEUR, S. DUBOSCQ, J-F. PENNING, A. SAAR, A. GIRODET, J-L. RAYON

B3-207 ***Risk assessment of internal fault in compact substations under the aspect of new network topologies***

E. DULLNI, E. HANSEN, A. MÜLLER

B3-208 ***CANCELLED - Integrated substation condition monitoring project for CLP Power Hong Kong***

B3-209 ***Iberdrola emergency plan, design and use experiences***

A. PALLARÉS CASTELLÓ, R. ADOBES GOLFE, J.R. TEJEDO AGUILERA

B3-210 ***PD monitoring system for HV substations***

F. GARNACHO, R. MARTIN, I. TRASMONTE, P. SIMON, M.A. SANCHEZ-URAN, J. ORTEGO, F. ALVAREZ, A. GONZALEZ, D. PRIETO

B3-211 ***From IEC 61850 based substations with sampled values to billing metering***

J. WIDMER

B3-212 ***Fault location in capacitor banks – how to identify faulty units quickly and restore the bank to service***

S. SAMINENI, C. LABUSCHAGNE, S. CHASE, J. HAWAZ

B3-213 ***Optimized replacement strategy of substations equipment considering risk management***

K. KAWAKITA, T. SHIMADA, Y. MATSUSHITA, K. UEHARA, A. OKADA, H. HAMA

B3-214 ***Life-cycle management of HV substation equipment***

D. KOPEJTKOVA, L. KOCIS, J. KONRAD

B3-215 ***Substation renovations & refurbishments: a comparison of full station redevelopment versus partial station upgrades***

B. WALL, P. DUFF

B3-216 ***Reliability of HV/MV substations with air-isolated and gas-insulated switchgear***

D. PERIĆ, M. TANASKOVIĆ, N. PETROVIĆ

B3-217 ***Management experience on ageing high voltage substation equipment in Thailand***

S. KAEWCHAN, K. PETCHSANTHAD, T. SUWANASRI

B3-218 ***Safety design improvement of grounding system by compression ratio and ground rod layout methods : case study of Metropolitan Electricity Authority's power distribution system***

A. PHAYOMHOM, S. SIRISUMRANNUKUL, T. KASIRAWAT, A. PUTTARACH

B3-219 ***Design experience of substation upgrade project in Qatar***

M.S. LEE, Y.W. LEE, I.Y. CHOI, W.B. LEE, M.S. KIM, J.B. KIM

SC B4 HVDC AND POWER ELECTRONICS

PS1: HVDC Systems and Applications

B4-101 ***Optimizing the electrical design of the Colombia-Panamá interconnection***

A. VILLEGAS, J. JARAMILLO, A. CLERICI, F. RIZZO, G. LAGROTTERIA

B4-102 ***New Zealand HVDC Pole 3 Project - Challenges and novel solutions***

M. ZAVAHIR, D. CRAWSHAY, K. MARTIN, P. HOBY, U. KINDLER, C. BARTZSCH

B4-103 ***Final project planning conception for the first 800 kV HVDC link of Belo Monte***

D.S. CARVALHO JR., D.F. SOUZA, T.C. RIZZOTO, J.A. CARDOSO, A. BIANCO, M.J. XIMENES, O.J. ROTHSTEIN, R. RISTOW, G.S. LUZ, R.M. AZEVEDO, R.B. BROETTO

B4-104 ***Operational experience of Madeira River Project in the Brazilian interconnected power system under initial configuration***

A.P. GUARINI, A.R.M. TENÓRIO, P.E.M. QUINTÃO

B4-105 ***Research work of ±1100 kV UHVDC technology***

L. ZEHONG, G. LIYING, Y. JUN, Z. JIN, L. LU

B4-106 ***The operation statistics and analysis of HVDC transmission systems in state grid corporation of China 2006-2012***

Y. JIN, Z. LIANG

B4-107 ***TWENTIES: conclusions of a major R&D and demonstration project on offshore DC grids***

O. DESPOUYS, A.-M. DENIS, D. CIRIO, C.C. LIU, C. MOREIRA, K. BELL, W. GRIESHABER, J.-P. DUPRAZ

B4-108 ***Special requirements regarding VSC converters for operation of hybrid AC/DC overhead lines***

B. RUSEK, K. VENNEMANN, J. VELASQUEZ, K. KLEINEKORTE, C. HEISING, V. STAUDT

B4-109 ***Design challenges for ±800kV, 3000MW HVDC Champa –Kurukshetra transmission link with Dedicated Metallic Return (DMR) – User's perspective***

P. TYAGI, V. BAGADIA, R. KUMAR, A. ANAND, M.M. GOSWAMI, I.S JHA

B4-110 ***Drivers for technology selection in an embedded HVDC link - Case study: France-Spain Eastern Interconnection***

P. LABRA FRANCOS, S. SANZ VERDUGO, C. LONGAS VIEJO, L. CORONADO HERNANDEZ

B4-111 ***Reliability analysis of design options for offshore HVDC networks***

C. MACIVER, K.R.W. BELL

B4-112 ***Designing fault tolerant HVDC networks with a limited need for HVDC circuit breaker operation***
C.D. BARKER, R.S. WHITEHOUSE, A.G. ADAMCYZK, M. BODEN

B4-113 ***The first HVDC project in Indonesia:system study and basic design of Java-Sumatra HVDC link"***
T. SAKAI, B. SISWANTO, R. SJAMSUDDIN, Y. MAKINO

B4-114 ***Celilo Pacific DC Intertie Upgrade presentation***
K. ERIKSSON, O. SAKSVIK, T. HOLMGREN, K.A. MITSCH

B4-115 ***Technology Qualification of Offshore HVDC Transmission Systems***
T. LANGELAND, M. JAFAR, Y. YANG, L.M. HYTTEN, E. HILLBERG, A. DERNFALK

B4-116 ***New synthetic test circuit for the operational test of HVDC thyristor valve***
Y.H. CHUNG, J.B. KWON, T.S. JUNG, Y.W. KIM, W.H SONG, J.H. LEE, S.T. BAEK, B.M. HAN, E.C. NHO

B4-117 ***A survey of the reliability of HVDC systems throughout the world during 2011 - 2012***
M.G. BENNETT, N.S. DHALIWAL, A. LEIRBUKT - ON BEHALF OF STUDY COMMITTEE B4

PS2: FACTS Systems and Applications

B4-201 ***Generic VSC models for project planning studies***
C. KARAWITA, D.H.R. SURIYAARACHCHI, M. MOHADDES, D. KELL, R. OSTASH, T. MAGUIRE

B4-202 ***Smart power line (SPL) experimental research project***
P. COUTURE, J. BROCHU, B. FRANCOEUR, R. MORIN, D.H. NGUYEN, K. SLIMANI, A. TURGEON, P. VAN DYKE

B4-203 ***Dynamic Compensation in Indian Power system – Siting & sizing***
J.I. SHEKHAR, S.Y. KISHORE, G. MANJU

B4-204 ***Factory test and Commissioning test of 450MVA-STATCOM project***
T.MATSUDA, T.SHIMONOSONO, H.HARADA, K.TEMMA, N.MORISHIMA, T.SHIMOMURA

B4-205 ***CANCELLED - Simulation study guideline for performance assessment of HVDC connected WPP_Cigre2014***

B4-206 ***Comparison of field measurements and EMT simulation results on a multi-level STATCOM for grid integration of London Array wind power plant***
J. GLASDAM, L.H. KOCEWIAK, J. HJERRILD, C.L. BAK, L. ZENI

B4-207 ***A novel control method in grid Interconnection of DG based on adaptive pulse voltage source inverter (VSI) and compare with two other control methods for harmonic compensation and power quality improvement***
R. GALANDARY TAZEKANDI, S.M.T. BATHAEE, A.F. DORAFSHAN

PS3: Power Electronic Equipment Developments

B4-301 ***Development and test of a 120 kV direct current circuit breaker***
W. GRIESHABER, J.-P. DUPRAZ, D-L. PENACHE, L. VIOLLEAU

B4-302 ***The Bimode Insulated Gate Transistor (BIGT), an ideal power semiconductor for power electronics based DC breaker applications***
M. RAHIMO, L. STORASTA, F. DUGAL, E. TSYPLAKOV, U. SCHLAPBACH, J. HAFNER, M. CALLAVIK

B4-303 ***A low loss mechanical HVDC breaker for HVDC Grid applications***
T. ERIKSSON, M. BACKMAN, S. HALÉN

B4-304 ***hybrid HVDC breaker – A solution for future HVDC system***
R. DERAKHSHANFAR, T.U. JONSSON, U. STEIGER, M. HABERT

B4-305 ***Effects of STATCOMs on power system in Jeju Island***
E.H. KIM, J.S. PARK, J.S. KIM, S.M. YEO, H.J. JUNG, J.Y. CHOI, H.J. YANG, S.C. MOON

SC B5 PROTECTION AND AUTOMATION

PS1: New protection and automation schemes based on enhanced communication possibilities

B5-101 ***Line current differential protection and the age of Ethernet-based wide-area communications***
B. KASZTENNY, B. LE, K. FODERO, V. SKENDZIC

B5-102 ***A new PMU based power swing detector to enhance reliability of distance relay***
H. BENTARZI, A. OUADI, J-C. MAUN

B5-103 ***CANCELLED - Transmission network wide area out of step protection***

B5-104 ***Automatic voltage control of OLTC power transformers between substations***
G. LECI, I.G. KULIS, J. BENOVIC

B5-105 ***A novel heuristic approach for power system controlled separation wide-area-protection applications***
M. TAGELDIN, W. EL-KHATTAM, A.Y. ABDELAZIZ

B5-106 ***Brand new centralized emergency automation in UPS of East and the experience of its exploitation***
P. KATS, L. KOSHCHEEV, A. LISITSYN, M. EDLIN, A. ZHUKOV, P. LEGKOKONETS, E. SATSUK

B5-107 ***Improving relaying for islanding detection***
R. VÉLEZ, J. TAVALLO, J. M. GARCIA, F. URIONDO ARRUE, E. NAVARRO, F. PAZOS

B5-108 ***The integral maintenance centre as support, coordination and asset management tool***
J. MUÑOZ FLOREZ, D. DEL SOLO, D. ARRIBAS, D. GARCIA, J. FEIJOO, R. RODRIGUEZ, M.D. LOPEZ MENCHERO, M. LOPEZ, R. GARCIA, J.A. GARCIA

B5-109 ***CANCELLED - Adaptive systems for active control of LV networks***

B5-110 ***Feedback on in-service deployment of the fully digital substation***
S. RICHARDS, N. PAVAIYA, M. BOUCHERIT, P. FERRET, J-P. VANDELEENE, P. DIEMER

B5-111 ***Demonstration and analysis of IP/MPLS communications for delivering power system protection solutions using IEEE C37.94, IEC 61850 Sampled Values, and IEC 61850 GOOSE protocols***
S.M. BLAIR, F. COFFELE, C.D. BOOTH, B. DE VALCK, D. VERHULST

B5-112 ***Principles for practical wide-area backup protection with synchrophasor communications***
E. UDREN

B5-113 ***Practical use challenge of WDM & IP communication technologies for protection systems***
K. KUROI, T. FURUKAWA, K. TOMIZAWA, T. KAGAMI, C. KOMATSU, Y. KAWASAKI, H. OSHIDA

B5-114 ***A new approach on protection of networks with large amounts of RES***
F. BALASIU, GH. MORARU

B5-115 ***Real-time monitoring, control and protection by implementation of the PMUS in North- East of Romanian power grid***
A. MIRON, M. DRAGOMIR, GH. MORARU, I. NEDELCU, S. A. GAL, A. RUSU

B5-116 ***Development of intelligent generator special protection system (iG-SPS) to improve transient stability in Dangjin power plants***
S. SEO, S.J. KIM, Y.H. MOON, H.N. KWON, K.S. KOOK

PS2: Expectations from stakeholders about IEC 61850

B5-201 ***Practical approach to the technical specification of IEC 61850 systems***
E. DUFOUR

B5-202 ***IEC 61850 based substation automation systems - Users expectations and stakeholders interactions***
G. HUON, M. JANSSEN, D. MOERS, A. APOSTOLOV, P. LINDBLAD, P. MYRDA, R. DIAS PAULO, R. LIPOSCHAK

B5-203 ***Brazilian utilities experience in acceptance, commissioning and maintenance testing techniques for protection and automation systems based in IEC-61850***
P.H. FLORES, A.T.A. PEREIRA, P.R.A. SOUZA, K. ARRABAL, C.A.M. AVIZ, M.R. BASTOS, L.V.S. PUPPI

B5-204 ***Modernizations of automation systems of hydraulic generating units in Brazil***
M.F. MENDES

B5-205 ***The integrated tool for substation automation system based on IEC61850***
Y. REN, J. DENG, W. WANG, G. HU, F. LI, X. ZHAO, X. SHA, W. QI

B5-206 ***IEC 61850 interoperability at information level - A challenge for all market players***
L. GUISE, G. HUON, P. LHUILLIER, M. HAECKER, C. BRUNNER

B5-207 ***Increasing interoperability by IEC 61850 profiling – requirements and experience from end-user and vendor prospective***
H. ENGLERT, H.-J. HERRMANN, A. LUDWIG, T. BAUER, T. KEIL

B5-208 ***Improving IEC 61850 interoperability and simplifying IED configuration through the standardisation of protection settings***
Q. HONG, V.M. CATTERSON, S.M. BLAIR, C.D. BOOTH, A. DYKO, T. RAHMAN

B5-209 ***Utility perspectives and challenges on implementing IEC 61850***
P. MYRDA, S. STERNFELD, G. CHASON

B5-210 ***Requirements for IEC 61850 in terms of logical node design and engineering tool compatibility***
T. OTANI, K. KUROI, H. ITO, S. KATAYAMA, T. OHMORI, T. OGIYAMA

B5-211 ***Expectations and specifications of IEC 61850 based- Digital substation automation system used by Statnett***
R. LØKEN, M.W. KRISTIANSEN, S. LOSNEDAL

B5-212 ***IEC 61850 and distribution network utilities perspective: trials, tribulations and experiences from New Zealand***
N.-K.C. NAIR, R.VERSTER, Z. POPOVICH, R. FRANCIS

B5-213 ***IEC61850 experiences and expectations from the renovated substations project in MEA's distribution system substation***

P. JINTAGOSONWIT

B5-214 ***Next step for IEC 61850: a unified power utility automation language why and how***

R. PAULO

B5-215 ***A functionally integrated architecture for online monitoring and real-time diagnostics and management of substation assets as a tool for optimized maintenance management***

R. PAULO, F. MATOS

SC C1 SYSTEM DEVELOPMENT AND ECONOMICS

PS1: Improvement in system and asset performance through application of enhanced Asset Management methodologies

C1-101 ***A method of full-scale comprehensive evaluation on operating efficiency of electric power networks***

Y.W. WU, L.L. SONG, J. YANG, Y.Z. SUN, B.W. ZHOU, T. LITTLER

C1-102 ***Introducing the integrated evaluation procedure of T&D utilities' asset management efficiency***

V. KOLIBABA, A. FILATOV

C1-103 ***ALMACENA Project. Electrochemical Electricity Storage for System Operation***

M. ORDIALES, A. SAINZ, C. GOMEZ, R. LIN, B. DONAHUE

C1-104 ***A framework for asset replacement and investment planning in power distribution networks***

A. JOHNSON, S. STRACHAN, A. GRAHAM

C1-105 ***Asset management methodology for optimization of long term replacement plan of age facilities***

Y. OGAMA, A. MATSUDA, N. FUJIOKA

C1-106 ***Circuit impact measurement in the face of a distribution network reconfiguration for asset management***

R. BORRAYO, Z. JIMÉNEZ, A. GUZMÁN, A. AVALOS, J. CERDA.

C1-107 ***Consideration of transmission protection system response in reliability of electricity supply analysis – case study***

V.V. VADLAMUDI, O. GJERDE, G. KJØLLE

C1-108 ***Improving the cross-border transmission capacity of Polish power system by using phase shifting transformers***

W. LUBICKI, H. KOCOT, R. KORAB, M. PRZYGRODZKI, K. ŻMUDA, G. TOMASIK

C1-109 ***Predictive modelling of overhead lines reliability and lifetime***

N. PINHO DA SILVA, J. CASACA, L. CAMPOS PINTO, F. AZEVEDO, J. GOMES-MOTA

PS2: New system solutions and planning techniques

C1-201 ***Flexibility of thermal power generation for RES supply in Germany until 2020***

G. BRAUNER, S. BOFINGER, W. GLAUNSINGER, I. PYC, F. STEINKE, U. SCHWING, W. MAGIN

C1-202 ***FACTS and D-FACTS: The operational flexibility demanded by the transmission expansion planning task with increasing RES***

R.C. PEREZ, G.C. OLIVEIRA, M.V. PEREIRA, D.M. FALCÃO, F. KREIKEBAUM, S.M. RAMSAY

C1-203 ***Smart grid in China: development and practice***

Z. LIU

C1-204 ***A methodology for the development of the Pan-European Electricity Highways System for 2050***

T. ANDERSKI, G. MIGLIAVACCA, E. PEIRANO, G. SANCHIS

C1-205 ***Grid integration of large scale renewable generation – Initiatives in Indian power system***

I.S. JHA, Y. K. SEHGAL, SUBIR SEN, KASHISH BHAMBHANI

C1-206 ***Considerations in design of an offshore network***

K.R.W. BELL, L. XU, T. HOUGHTON

C1-207 ***CANCELLED - Interconnection? Yes, but how?***

C1-208 ***Strategic defense plan for Oman-UAE interconnected power system***

O.H. ABDALLA, A. AL-BUSAIDI, H. AL-HADI, H. AL-RIYAMI, A. AL-NADABI, K. KAROUI, S. WAGEMANS

C1-209 ***CANCELLED - Renewable energy and storage within GCC Electric Power Grid***

C1-210 ***Development of a VAR planning tool for strategic network planning***

A. MANSOLDO, S. CUNI, R. ZUELLI, M. NORTON, A. BERIZZI, C. BOVO

C1-211 ***A strategic network framework for the development of the Southern African power***

K. LEASK, R. MARAIS

C1-212 ***Coordinated power system services from offshore wind power plants connected through HVDC networks***

L. ZENI, J. GLASDAM, T. LUND, P.E. SØRENSEN, A.D. HANSEN, P. KJÆR, B. HESSELBÆK

C1-213 ***The role of innovative grid-impacting technologies towards the development of the future pan-European system: the GridTech project***

A. L'ABBATE, R. CALISTI, A. ZANI, H. AUER, G. KOERBLER, G. LETTNER, P. FRIAS, L. OLMOS, C. FERNANDES, T. MAIDONIS, S. VITIELLO, G. FULLI, G. SCHAUER, S. SULAKOV, A. ANDREEV, M. IVANOV, A. MANSOLDO, C. VERGINE, P. TISTI, O. D'ADDESE, A. SALLATI, K. JANSEN, R. VAN HOUTERT, J. BOS, B. HEYDER, I. RADULOV, J. WOLPERT

PS3: Securing investment in transmission networks with increasing RES

C1-301 ***Justifying transmission investment with large-scale RES***

G. COBLE-NEAL, D. THOMPSON, D PANKHURST, D. BONES

C1-302 ***Hydropower technology roadmap – A pathway for doubling hydroelectricity production worldwide by 2050***

A.C.G. MELO, M.E.P. MACEIRA, M.P. ZIMMERMANN, F.R. WOJCICKI, P. FRANKL, C. PHILIBERT

C1-303 ***Opportunities and solutions for the development of a Mediterranean grid***

H. POULIQUEN, J. KOWAL, P. ADAM, P. LAHIRIGOYEN, M. CHAMMAS

C1-304 ***Energy transition in Germany and its impact on investment costs at the example of AÜW distribution network***

H. MÜLLER, B. MEYER, R. KOEBERLE, M. FIEDELDEY

C1-305 ***Transforming Desertec vision into quantitative scenarios – simulations and optimisation analysis for a decarbonised EUMENA power system***

A. ILICETO, F. ZICKFELD

C1-306 ***Economic assessment of HVDC grids***

J. ZHU, H. LI, M. CALLAVIK, J. PAN, R. NUQUI

C1-307 ***Operation of the electrical system of Crete in interconnection with the mainland grid: a stability study***

M. KARYSTIANOS, Y. KABOURIS, T. KORONIDES

C1-308 ***New methodology of transmission system planning in Poland based on economic and market approach***

W. LUBICKI, M. PRZYGRODZKI, G. TOMASIK

C1-309 ***A spatial framework for strategic investments to enable RE IPP integration***

P.N. GOVENDER, K.P. IJUMBA, C. MUSHWANA

C1-310 ***Transmission investment evaluation in the Chilean electricity market***

J.C. ARANEDA, R. VALPUESTA

C1-311 ***A 100% renewable scenario for Venezuelan Power Generation Sector in 2050 and its costs***

S. BAUTISTA HERMAN

SC C2 SYSTEM OPERATION AND CONTROL

PS1: Managing new challenges in operational planning and real-time operation of Electric Power Systems

C2-101 ***Hierarchical and distributed state estimation for power systems: the Colombia case***

J. ESPINOSA, M. ARBOLEDA, N. DUQUE, J. GOMEZ, W. AMADOR, N. ORTIZ, J. TOBON, E. PEREZ, F. VALENCIA, M. CIFUENTES, M. GIRALDO, S. SALAZAR

C2-102 ***Experience in the application of dynamic transmission line ratings in the Australian and New Zealand power systems***

G. ATHANASIUS, A. PEARD, M. MILLER, C. SCOTT, L. BELL

C2-103 ***Operational experience with dynamic line rating forecast-based solutions to increase usable network transfer capacity***

H.-M. NGUYEN, J.-J. LAMBIN, F. VASSORT, J.-L. LILIEN

C2-104 ***Static and dynamic security assessment of large power systems for online and offline applications***

F.R.M. ALVES, S. GOMES JR., A.A. AVELEDA, R. MOTA HENRIQUES, C.L.T. BORGES, G.N. TARANTO, J.A. PASSOS FILHO, D.M. FALCÃO, T.M.L. ASSIS

C2-105 ***French TSO operational voltage management in a volatile electrical environment***

V. HANNETON, T. MARGOTIN, G. NÉRIN, H. LEFEBVRE

C2-106 ***Intraday studies by regional security coordination initiatives***

F.X. DETRAZ, T. LOXQ

C2-107 ***Voltage stability assessment using advanced models of thermal generation units for the P/V-Analysis***

W.H. WELLSSOW, H. ACKER, S. LOITZ, J. VANZETTA, C. SCHNEIDERS, J. JACOBS, D. CREMER, W. HECKMANN

C2-108 ***Challenges in assessment of transfer capability under a high growth high uncertainty restructured scenario in India***

S.R. NARASIMHAN, PRADEEP REDDY, V.K. AGRAWAL, S.K. SOONEE, P. MUKHOPADHYAY

C2-109 ***Experiences of synchrophasors initiatives in India***

S.K. SOONEE, V.K. AGRAWAL, P.K. AGARWAL, S.R. NARASIMHAN, R.K. PORWA, V. PANDEY

C2-110 ***Stability monitoring and control of generation based on the synchronized measurements in nodes of its connection***

A.G. FISHOV, M.A. SOBOLEVA, A.I. DECHTEREV, V.A. FISHOV, D.V. TUTUNDAEVA

C2-111 ***AGREGA Project***

A. MOLTÓ, M. ORDIALES, A. BLANCO, F. DIAZ-MINGO, E. BARROSO, R. LOPEZ, T. ARZUAGA, L. MARRON, M. DIAZ RODRIGUEZ

C2-112 ***Thermo-mechanical dynamic rating of OHTL: applications to Italian lines***

P. PELACCHI, M. GIUNTOLI, D. POLI, F. BASSI, G.M. GIANNUZZI

C2-113 ***European TSOs' cooperation for enhanced system security, integration of renewables and market support***

C. AUXENFANS, R. BAUMANN, T. KAPETANOVIC, P. DE LEENER, R. PAPROCKI, A. WIRTH, D. KLAAR

C2-114 ***Assessing frequency stability in the GB power system with high wind penetration***

L. WU, D. INFIELD

C2-115 ***Analysis of power systems oscillations in WECC system using synchro-phasor technology***

J. BALLANCE, B. BHARGAVA, H. CHEN, P. PALAYAM, J. HIEBERT

C2-116 ***Simulating the smart electric power grid of the 21st century - bridging the gap between protection and planning***

A. GOPALAKRISHNAN, S. AQUILES-PEREZ, D. MACGREGOR, D. COLEMAN, P. MCGUIRE, K. JONES, J. SENTHIL, J. FELTES, G. PIETROW, A. BOSE

C2-117 ***The total solution to phase angle stability, frequency and voltage problems for operating long-distance bulk power transmission system***

S. YOSHIYAMA, K. TAKAFUJI, H. TAGUCHI, K. HARA, Y. KOWADA

C2-118 ***Online security assessment in Mexican power system***

C. TIRADO, S. ROMO

C2-119 ***Dynamic control of voltage and power flow in Qatar transmission system***

H. ELSAYED, S. ABU EIDA, S. CHAUDHRY, A. AL-MAHMOUD

C2-120 ***Challenges in system operations with renewable generations in ADWEA power network***

E. UDDIN, S. AL HARTHI, H. SIDDIQUI

C2-121 ***Real-time system stability analysis and performance monitoring using synchrophasors***

S. MCGUINNESS

C2-122 ***Integration of coordinated Q–V controller for multi machine power plant into secondary voltage control***

D. ARNAUTOVIC, J. DRAGOSAVAC, Z. JANDA, J. MILANOVIC, L. MIHAILOVIC

C2-123 ***The restoration strategies from neighbouring countries: simulation studies and actual tests experience***

G. GIANNUZZI, R. ZAOTTINI, F. PALONE, W. SATTINGER, R. NOTTER, M. SALVETTI, G. MATLI

C2-124 ***PMU applications in the Korean power system: Wide-Area Monitoring And Control (WAMAC) system***

S. HAN, Y. KWON, J. SONG, B. KO, J. LEE, S. NAM, T. KIM, Y. AHN, J. SHIN, S. KIM, D. WOO, D. KIM, B. LEE, S. OH, B. PARK

PS2: Emerging Operational Issues for Transmission and Distribution Interaction

C2-201 ***Studies on prevention strategy of large wind power outages due to high voltage conditions***

L. YAO, H. ZHAO, Y. CHI, Y. LI, J. WU

C2-202 ***Emergence of demand response mechanisms and integration in operation***

A. DUTOIT, F. GALMICHE

C2-203 ***Next generation distributions system operation taking into account the demands of a transmission system operator***

D. WESTERMANN, S. SCHLEGEL,R. SCHWERDFEGER, S. KOETHE

C2-204 ***Coordination of the settings of phase-shifting transformers to minimize the cost of generation re-dispatch***

M. BELIVANIS, K.R.W. BELL

C2-205 ***An integrated real-time operation system to enable flexible sharing of the management of monitoring-duty and control-execution-permission***

T. KUSANO, T. KOUMI, K. SATO, T. TATEKOJI, M. SHIMADA, H. KUDO

C2-206 ***Coordinated function between transmission and distribution operation systems in the present and its application***

S. KODAMA, T. GOTO, H. TANAKA

C2-207 ***Emerging operational issues for transmission and distribution interaction***

C. BILLINGHAM, R. CANDY, M. KURUP, J. MULLER, T. SMIT

C2-208 ***Implementation of grid forecasting processes at TenneT: from strategic planning to after the fact analyses***

J.B.M. VAN WAES, P.J. VAN DE PLOEG, S.A. DE GRAAFF, S.J.M. BRUIJNS

C2-209 ***Future challenges in the control centre due to distributed generation and renewables***
M. POWER, N. SINGH, M. SANCHEZ, C. ROGGATZ, M. CREMENESCU, R. BESSELINK, F. BASSI

C2-210 ***Probabilistic power system health index model and visualization***
J. CHOI, J. LIM, H. CHOI, J. JOO

C2-211 ***Decision making of bus splitting for reduction fault current level using a novel network reconfiguration algorithm with rerun optimizer***
H.C. SONG, P. N. VOVOS, T.S. KIM, K.W. CHO

C2-212 ***Risk assessment methodology – Running tests at the Portuguese TSO***
N. MACHADO, S. ALMEIDA DE GRAAFF, R. PESTANA

SC C3 SYSTEM ENVIRONMENTAL PERFORMANCE

PS1: Environmental implications of energy storage technologies

C3-101 ***Reservoirs of hydropower plants - The perception of society about the Brazilian Electric Sector storage***
A.L. MUSTAFÁ, A.S. GABRIEL, A.F. SANTOS, L.F.L. VIANNA

C3-102 ***Environmental assessment of Marine Pumped Hydro technology: a case study for Italian Islands***
J. ALTERACH, R. MARAZZI, M. MEGHELLA, A. NEGRI

PS2: Integrated sustainable approaches for T&D development

C3-201 ***Mitigation strategies for magnetic field on substations with passive methods***
G.T. TARSIA, D. DIAZ, J. IORIO, M. HIGHES, E. SPITTLE, R. WULF

C3-202 ***The study on environmental performance indicators system of grid corporate***
Y. JIN, G. ZHANG, F. ZHANG

C3-203 ***Life cycle assessment and end-of-life management of GIS and AIS***
Y. KIEFFEL, A. SPINOSA, E. LARUELLE, K. STUMPF

C3-204 ***How to build a 400 kV overhead line in accordance with the territory***
P. MONTPELLIER

C3-205 ***RTE sustainable substation experience***
E. JAUSSAUD, S. DUMAS, R. MIGNE

C3-206 ***Advanced grid integration of dispersed generation by using Voltage Regulated Distribution Transformers (VRDT) - Experiences from field tests and potentials for minimizing network expansion***
T. SMOLKA, D. DOHNAL, M. SOJER, R. HEILIGER, J. SCHMIESING, T. HUG, F. SUTTER

C3-207 ***Technical and environmental aspects for tunnel design and construction for the electrical interconnexion between France and Spain***
J. ARÉVALO CAMACHO

C3-208 ***Planning new power lines in Spain with GeoDesign***
F-J. MORENO MARIMBALDO, M-A. MANSO CALLEJO

C3-209 ***Life Cycle Assessment to Support Environmentally Conscious Design of Power System and Apparatuses***
R. TAKAHASHI, H. NODA, T. KOBAYASHI, K. OOHASHI

C3-210 ***Wildlife management of a new overhead line in Africa***
E. DRAGAN, G. GHEORGHITA, A. DRAGOMIR, S. BUEHLER, S. KYEGANWA, D. MARGINEAN

C3-211 ***Life cycle assessment of the high voltage OHL transmission system in Iceland***
H.B. HRÓLFSDÓTTIR, G.M. INGÓLFSDÓTTIR, M. PÁLSSON, I.L. VALSDÓTTIR, I. GUÐMUNDSSON, BJARNASON, G.M. GUÐJÓNSDÓTTIR, H.J. BJARNADÓTTIR

C3-212 ***Ferrite filter development and application for prevention of noise influx into protective relays***
G.J. YANG, M.H. LEE, Y.J. WON

PS3: Acceptance of High Voltage transmission assets near urban areas

C3-301 ***Optimal placement and other measures taken to enhance public acceptance of a 380kV grid extension project from the Belgian inland to the coast***
J. MENTENS, V. DU FOUR, J.F. GOFFINET, B. PELSSERS

C3-302 ***The consequences for the system operation due the reduction of the values of magnetic field requirements caused by transmission lines near urban areas - A study case***
D. CORREIA, D. BRASIL, B. BASTOS

C3-303 ***Environmental and social impact assessment for the transmission project assigned to wind power development; the main findings***
M.M. AWAD, A. EL-HANAFY, D. HELMI, S. SHIBL

C3-304 ***88 kV Crowthorne – Lulamisa distribution upgrade: human exposure to electric and magnetic fields: anatomical body dosimetry***
K.R. HUBBARD

C3-305	***Issues in construction project of the 3rd 765 kV transmission line in Korea***	

C3-305 ***Issues in construction project of the 3rd 765 kV transmission line in Korea***

D.I. LEE, S.B. KIM, Y.S. LIM, K.Y. SHIN, Y.H. KIM, B.Y. KIM, B.Y. LEE, S.H. MYUNG

C3-306 ***Landscape and substations: methodological guide for integrating substations into the environment***

S. DELGADO MATEO, L. CABEZÓN LÓPEZ, A. MORILLAS GARCÍA, D. GONZALEZ JOUANNEAU, J. PRIETO MONTERRUBIO

SC C4 SYSTEM TECHNICAL PERFORMANCE

PS1: Power system technical performance in the advent of large deployment of power converter connected generation technologies

C4-101 ***Flicker assessment and mitigation in wind farms connected to distribution grids***

G. JOOS, M. AMMAR, D. MASCARELLA, P. VENNE, C. ABBEY

C4-102 ***Impact of large wind farms on power quality. First experiences gained in the Argentinian power system***

J.L. AGÜERO, P.E. ISSOURIBEHERE, D.A. ESTEBAN, F. ISSOURIBEHERE, G.A. BARBERA, H.G. MAYER

C4-103 ***Considerations on power quality requirements for integration of renewable sources (photovoltaic and wind power) into the transmission grid***

F. OLIVEIRA, P.F. RIBEIRO, P.M. ALMEIDA

C4-104 ***New challenges caused by the new energy sources in the Brazilian power system***

S.J. N. CISNEIROS, M.J. BOTELHO, D.O.C. BRASIL, F.C. MEDEIROS, M. GROETAERS, A.B. FERNANDES, A.D.R. MEDEIROS, S.L.A. SARDINHA, A. BIANCO

C4-105 ***Aspects to arranging the test conditions under challenging electricity market situation and the AC-DC system performance during the site acceptance tests of Fenno-Skan 1 upgrade and Fenno-Skan bipole controls***

T. RAUHALA, M. LAASONEN, H. NURMINEN, A.-J. NIKKILÄ

C4-106 ***Impact of multi-terminal HVDC grids on AC system stability and operation***

E. CIAPESSONI, D. CIRIO, A. GATTI, A. PITTO, A.M. DENIS, L. HE, C-C. LIU, C. MOREIRA, B. SILVA

C4-107 ***Methods for risk assessment of SSCI stability issues between renewable generation and series compensated transmission systems***

K. ANDOV, D. KIDD, B. MEHRABAN, B. ENGLISH, S. DUTTA, M. NEAL

C4-108 ***Frequency response of the US Eastern interconnection under conditions of high wind generation***

N. MILLER, M. SHAO, S. PAJIC, R. D'AQUILA, K. CLARK

C4-109 ***Short-term fluctuations of PV output in Japan - Evaluation method of fluctuations in case of large-scale integration -***

K. YOSHIMOTO, T. NANAHARA, Y. WAZAWA, M. KUBO, Y. KATAOKA, S. IMAI

C4-110 ***Reliability assessment of power generation systems with interconnections of isolated islands incorporating large wind parks and photovoltaic plants***

E.N. DIALYNAS, L.G. DAOUTIS, V. KYRIAKIDES

C4-111 ***Medium-term dynamic studies for a large island power system with high levels of wind***

T. GALLERY, Y. COUGHLAN, C. MCCARTHY, S. GRIMES

C4-112 ***EMC considerations and planning for an offshore HVDC***

F.M. KOERS, H. LANDAU, G.E. TAP, L.E. JUHLIN, O. ANDERSSON, J. SKANSENS

C4-113 ***The impact of wind and solar power generation on Romanian power quality***

C. STANESCU, D. ILISIU, S. GHEORGHE, D. APETREI, P. POSTOLACHE

C4-114 ***Impact of first wind farm in the Kingdom of Thailand on power quality and mitigation solution***

C. MADTHARAD, J. WARMAN

C4-115 ***Guidelines for monitoring power quality in contemporary and future power networks – results from CIGRE/CIRED JWG C4.112***

J.V. MILANOVIC, M.H.J. BOLLEN, N. CUKALEVSKI - ON BEHALF OF CIGRE/CIRED JWG C4.112

PS2: Methods and techniques for the evaluation of lightning performance and insulation coordination

C4-201 ***Evaluation of leader progression model and EGM for analyzing lightning performance of transmission line***

J. HE, X. WANG, R. ZENG

C4-202 ***VFTO simulation and testing for 500 kV and 800 kV GIS disconnectors***

S. SUN, G. TREMOUILLE, G. MARQUEZIN, T. BERTELOOT, P. VINSON, A. GIRAUDET

C4-203 ***High energy line surge arresters to improve reliability and protection against switching surges on a 500 kV transmission line***

P. BUNOV, D. BISWAS, J. HUNT, A.J.F. KERI, R. THALLAM, L. KLINGBEIL

C4-204 ***New technologies of lightning currents registration with high resolution***

A.V. SHURUPOV, A.V. KOZLOV, E.M. BAZELYAN, A.N. CHULKOV

C4-205 ***Protection of power transformers connected to gis against lightning overvoltages***

L. ROUCO, L. SIGRIST, H. GAGO, E. PALAZUELOS, J. BERNAL, M.A. JIMENO

C4-206 ***Principles of insulation coordination and recent activity on reduction of insulation level in Japan***

H. GOSHIMA, K. HIDAKA, J. TAKAMI, T. SAIDA, S. YOSHIIKE, Y. MATSUSHITA

C4-207 ***Effectiveness of line surge arrester application on the 132 kV Kuala Krai – Gua Musang Line***

IRYANI MOHAMED RAWI, MOHD ZAINAL ABIDIN AB KADIR

PS3: Advanced methods, models and tools for the analysis of power system technical performance

C4-301 ***Simulation of voltage collapse caused by GMDs – Problems and solutions***

L. GÉRIN-LAJOIE, J. MAHSEREDJIAN, S. GUILLON, O. SAAD

C4-302 ***Development of advanced GIC analysis tools for the Manitoba Power Grid***

D.A.N. JACOBSON, S. SHELEMY, W. CHANDRASENA, D. BOTELER, R. PIRJOLA

C4-303 ***RTE experiences with the insertion of long EHVAC insulated cables system performance assessment***

Y. VERNAY, S. DESCHANVRES, Y. FILLION

C4-304 ***Involvement of electric utilities in the development of EMT simulation tools***

S. DENNETIÈRE, O. SAAD, A. EL-AKOUM, X. LEGRAND, A. XÉMARD, J. MAHSEREDJIAN, H. MOTOYAMA

C4-305 ***Frequency domain studies for the Malta-Sicily interconnector***

F. PALONE, M. REBOLINI, S. LAURIA, M. SCHEMBARI, J.P. VASSALLO

C4-306 ***Modeling and evaluation of geomagnetic storms in the electric power system***

K. PATIL

C4-307 ***Application of geomagnetic disturbance vulnerability assessments using the eskom main transmission system model***

J. TAYLOR, V. SINGHVI, A. TARDITI, M. VAN HARTE

C4-308 ***Harmonic analysis of wind farm clusters using HV-AC underground cables in the Irish transmission network***

M. VAL ESCUDERO, S. MURRAY, J. GING, B. KELLY, M. NORTON,

C4-309 ***Frequency domain analysis of the influence of compensation wires and earthing resistances in mixed overhead/ underground HV transmission lines***

L. WU, M. ACHTERKAMP, J.P.W. DE JONG, P.A.A.F. WOUTERS, W.L. KLING, M. POPOV, E.F. STEENNIS

C4-310 ***Influence of offshore wind farms layout on electrical resonances***

A. HOLDYK, J. HOLBOELL, E. KOLDBY, A. JENSEN

SC C5 ELECTRICITY MARKETS AND REGULATION

PS1: Electricity Market Governance, Market Models and Market Development Objectives

C5-101 ***Multilateral remedial actions and the proposal for the cost sharing among European system operators(TSOs): Lessons learnt from 2503.2013 (case study)***

M. VUKASOVIC, Z. VUJASINOVIC

C5-102 ***Governance, policy development and implementation within the Australian National Electricity Market (NEM)***

T. BAKER, I. ROSE, P. GALL, B. CLARK, R. KORTE

C5-103 ***Market development and generation expansion: required interaction***

X. VIEIRA, M.V. PEREIRA, M. VIEIRA, A. OLIVEIRA, L.A. BARROSO

C5-104 ***Analysis of the Croatian model for settlement of electricity imbalances and its possible improvements***

I. ŠTRITOF, M. SKOK

C5-105 ***CANCELLED - Regulatory framework for attracting investment in the electric power sector: case study – Egypt***

C5-106 ***Implementation of point of connection tariff in India***

S.K. SOONEE, V. AGRAWAL, S.S. BARPANDA, MOHIT JOSHI, VAISHALLY BHARDWAJ

C5-107 ***Governance of European day-ahead and intra-day market coupling***

M. LEHTONEN, A. CLAXTON, A. LOPEZ NICOLAS, S. KAISER, M. SUPPONEN

C5-108 ***Convergence of prices and efficiency of day-ahead markets***

B. RAJARAMAN, B. VESOVIC

C5-109 ***Japanese market reform with inter-regional operation, complete retail liberalization and unbundling of the transmission and distribution sector***

H. OKAMOTO, H. ASANO, A. YOKOYAMA

C5-110 ***Competition and regulation in the Mexican power market***

E. ARRIOLA

PS2: Interaction between changing demand and energy usage profiles on market design and operation

C5-201 ***Falling demand - a paradigm shift for the Australian national electricity market***

D. BOWKER, A. CRUICKSHANK, R. DUDLEY, J. EGGLESTON, V. FRANCISCO, G. MULHERIN, D.SWIFT

C5-202 ***Demand-side management programs for industrial sector - Case study: energy saving in Petroleum Pipeline Co.***

F. BENDARY, H.M. MAHMOUD, A.S. AHMED

C5-203 ***Development of stock exchange prices – Consequences for innovative electricity tariffs in the German residential market***

A. GERBLINGER, M. FINKEL, R. WITZMANN, C. WIESER

C5-204 ***PERFILA Project***

A. MOLTÓ, M. ORDIALES, B. RODRIGUEZ, M.C. PEREZ, N. RUIZ, A.R. MARTIN, L. CHAVES, V. SANCHEZ, A. PIZONES, N. BUJOSA, J.M. JUBANY

C5-205 ***Facilitating demand side response in the single electricity market***

N. DELANEY, D. STEVENS, S. POWER

C5-206 ***The efficiency of pricing mechanism on tariff structure in Thailand***

R. TEETONG

C5-207 ***Realization of demand response resources using enabling technologies and the improvement of CBL in the Korean electricity market***

K.-W. CHO, L.-H. JEONG, H.-J. YOON

PS3: Integrating renewable resources from the perspective of the electricity market

C5-301 ***Storage as a catalyst for increasing the technical and economic value of electricity generation and networks***

G. THORPE, N. ERTUGRUL

C5-302 ***Challenges and measures to integrate wind generation in both Brazilian power system and electricity market***

S.J.N. CISNEIROS, F.M.C. FERREIRA, D.N. SILVA

C5-303 ***Lessons learned from the auction-based approach to integrate wind generation in the Brazilian electricity market***

G. CUNHA, L.A. BARROSO, B. BEZERRA

C5-304 ***Research on HPWS power control strategies and market mechanism***

R. SUN, G. SHI, S.MA, J. LIANG

C5-305 ***Performance study of deregulated power system networks supported by renewable energy resources***

M.M. ABOUELSAAD, A.F. BENDARY, M.H. ZAKI ABD EL-MAKSOUD

C5-306 ***Market integration and storage resources optimization to mitigate the risks of "over generation" from not programmable RES: the Italian prospective***

E. ELIA, P. PORTOGHESE, G. SOMMANTICO, M. CABANO, B. COVA, A. VENTURINI

C5-307 ***A forward capacity market as a necessary condition for integrating renewable resources***

P. SOTKIEWICZ, G. HELM, M. ABDUR-RAHMAN

C5-308 ***Market evolution for RES integration in the US and Europe***

J. SMITH, M. AHLSTROM, J. DUMAS, P. ERIKSEN, J. O'SULLIVAN, P. SOTKIEWICZ

C5-309 ***Impacts of variable renewable energy source integration into a power system operation and implications to the Japan's future power market***

K. OGIMOTO, Y. UDAGAWA, T. IKEGAMI, K. FURUSAWA, H. ASANO

C5-310 ***Wind power grid integration and cross-border export in Mexico***

M.A. AVILA ROSALES

SC C6 DISTRIBUTION SYSTEMS AND DISPERSED GENERATION

PS1: Design of distribution networks with high penetration of DER and new loads

C6-101 ***Real-time microgrid control validation on the Hydro-Québec distribution test line***

M. ROSS, C. ABBEY, Y. BRISSETTE, G. JOOS

C6-102 ***Maximizing local renewable energy consumption by shifting flexible electrical loads in time and space***

S. ÜBERMASSER, T. LEBER, M. STIFTER, F. LEIMGRUBER, M. MEISEL

C6-103 ***DERri common reference model for distributed energy resources – Modelling schemes, reference implementations and validation of results***

F. ANDRÉN, F. LEHFUSS, P. JONKE, T. STRASSER, E. RIKOS, P. KOTSAMPOPOULOS, P. MOUTIS, F. BELLONI, C. SANDRONI, C. TORNELLI, A. VILLA, A. KRUSTEVA, R. STANEV

C6-104 ***Performance analysis of electric distribution systems with distributed generation resources***

M.M. ABOU EL SAAD, A.H. YOUNES, F. M. BENDARY, A.S. HASSAN ALI

C6-105 ***Impact of node specific load growth and microgrids on distribution network planning***

R. J. MILLAR, E. SAARIJÄRVI, M. LEHTONEN, M. DEGEFA, M. KOIVISTO

C6-106 ***Features of small dispersed CHP integration into the power system***

YU.N. KUCHEROV, D.N. YAROSH, YU.G. FEDOROV, YU.A. ZEYGARNIK, A.Z. ZHUK, S.A. NEKRASOV, P.V. ILYUSHIN, S.P. FILIPPOV, F.V. VESELOV

C6-107 ***LV feeder identification: prior requirement to operate LV grids with high penetration of DER and new loads***

E. NAVARRO, A. SENDIN, A. LLANO, A. ARZUAGA, T. ARZUAGA, X. OSORIO, L. MARRÓN

C6-108 ***Evaluation of PV output fluctuation suppression by cooperative control of distributed CHP and storage battery***

T. HIRAI, K. NAKAO, K. YAKIRE, E .ISONO, Y. NORO

C6-109 ***CANCELLED - EU FP7 project GRID4EU DEMO # 2 – LV network monitoring and control***

C6-110 ***Voltage control in distribution networks with high share of distributed generation***

B. ULJANIĆ, B. BLAŽIČ, I. PAPIČ, C. DIERCKXSENS, B. BLETTERIE, W. DEPREZ

PS2: Operation and control of active distribution networks and dispersed generation

C6-201 ***Economic dispatch of smart distribution grids considering aggregators of plug-in electric vehicles***

P.A. BENALCÁZAR, M.E. SAMPER, A. VARGAS

C6-202 ***Impacts of photovoltaic power variability on power distribution networks based on year-long data of a 1.22 MWp system***

A.G. CAMERON, R. YAN, T. SAHA, A. THOMAS

C6-203 ***Comparative analysis of distributed generation connection requirements in Brazilian utilities***

C.M. LUIZ, E. VINCENTINI, R.D. BARBOSA, P.H.R.P. GAMA, A.R. AOKI, T.V.M. NETO

C6-204 ***Study on the cluster control strategies of distributed energy resources integrated to the local distribution network***

R.CHEN, X. DONG, S. HUANG, L. YU, G. CAI, P. LI

C6-205 ***Integration of electric-cars into an existing virtual power plant – Experiences from a lighthouse project***

B. FENN, A. DOSS, B.M. BUCHHOLZ, V. BUEHNER, P. FRANZ, A. HOFFMANN

C6-206 ***The RiesLing (Germany) and InovGrid (Portugal) projects - Pilot projects for innovative hardware and software solutions for Smart Grid requirements***

S. KÄMPFER, P. G. MATOS, C. KÖRNER, J. BACKES

C6-207 ***Innovation in distribution management systems - PRICE GEN project: energy management and reduction of losses in low voltage networks***

F. SALAZAR SAEZ, M. CASAS DEL POZO, J. COCA, M. GAUDÓ NAVARRO

C6-208 ***Active distribution system management***

D. TREBOLLE, G. LORENZ, P. HALLBERG, P. MANDATOVA, J. TELLO-GUIJARRO

C6-209 ***Decentralised storage systems for applications on electrical distribution networks: tests and field results***

L. COCCHI, M. DI CLERICO, F. CAZZATO, C. D'ADAMO, C. D'ORINZI

C6-210 ***Active MV distribution networks : functional validation of the advanced voltage controller in the Grid4EU Italian demonstrator***

D. MONETA, C. CARLINI, G. VIGANÒ, L. CONSIGLIO, D. STEIN

C6-211 ***Flexible plug and play low carbon networks: an open and scalable active network management solution for a faster and cheaper distributed generation connections***

S. GEORGIOPOULOS, E. CERQUEIRA, R. JOHNSTON, R. CURRIE

C6-212 ***Probabilistic operational envelopes for demand response of new low carbon loads on low voltage networks***

D.F. FRAME, S. HUANG, G.W. AULT

C6-213 ***Performance evaluation of control algorithms for active distribution networks - the potential for algorithm selection***

J.E. KING, P.C. TAYLOR, S.C.E. JUPE

C6-214 ***Leveraging radio communication to enable effective protection of distributed energy resources***

M. MYNAM, D. FINNEY

C6-215 ***Smart distribution application guide – IEEE Project P1854***

S. BAHRAMIRAD, M. BOLLEN, G. CLARK, M. SHAHIDEHPOUR, J. SVACHULA, A. KHODAEI, G. SIMARD

C6-216 ***Evaluation of voltage control system for a distribution network with mediumscale PV systems connection***

K. ABE, Y. MATSUURA, S. KANJA, T.TAKANO, R.TAKAHASHI

C6-217 ***Exploitation of AMR data for DMS functionalities***

D. KOUKOULA, G. SIDERATOS, A. ANASTASIADIS, D. TRAKAS, A. DIMEAS, N. HATZIARGYRIOU, M. KOUVELETSOU, K. ANDREADIS, E. LEONIDAKI, I. VITELLAS

C6-218 ***1MWh BESS demonstration project for energy time-shift in Korea***

J.M. LEE, B.G. JIN, Y.J. CHOI, K.W. SEO

PS3: New roles and services of distribution systems for transmission system operation

C6-301 ***The Nice Grid project: using distributed energy resources to reduce power demand through advanced network management***

J.C. PASSELERGUE, M. MUSCHOLL, G. FOGGIA, C. LEBOSSÉ, K. MERCIER, S. ALBOU, B. CHAZOTTES, A. MICHIORRI, G. KARINIOTAKIS

C6-302 ***Reactive power provision by distribution system operators***

E. KAEMPF, M. BRAUN, A. SCHWEER, W. BECKER, R. HALBAUER, F. BERGER

SC D1 MATERIALS AND EMERGING TEST TECHNIQUES

PS1: Electrical insulation systems under DC voltage

D1-101 ***Behaviour of insulators under hybrid electrical AC/DC field stress***

J. KNAUEL, A. WAGNER, R. PUFFER, J.M. SEIFERT, S. LIU, M. BRÜCKNER, B. RUSEK, S. STEEVENS, A. GRAVELMANN, K. KLEINEKORTE

D1-102 ***Solid/Gaseous insulation systems for compact HVDC solutions***

A. WINTER, J. KINDERSBERGER, M. TENZER, V. HINRICHSEN, L. ZAVATTONI, O. LESAINT, M. MUHR, D. IMAMOVIC

D1-103 ***Solid insulation in DC gas-insulated systems***

B. GREMAUD, F. MOLITOR, C. DOIRON, T. CHRISTEN, U. RIECHERT, U. STRAUMANN, B. KÄLLSTRAND, K. JOHANSSON, O. HJORTSTAM

D1-104 ***Characteristics of candidate material systems for next generation extruded HVDC cables***

V. ENGLUND, J. ANDERSSON, J.-O. BOSTRÖM, V. ERIKSSON, P.-O. HAGSTRAND, J. JUNGQVIST, W. LOYENS, U.H. NILSSON, A. SMEDBERG

PS2: Emerging test techniques and diagnostic tools

D1-201 ***Atmospheric corrections for impulse voltages under high humidity conditions***

R.R. DIAZ, A.A. SEGOVIA

D1-202 ***Application of the UHF technology to detect and locate partial discharges in liquid immersed transformer***

S. HOEK, M. KRÜGER, S. KÖRBER, A. KRAETGE

D1-203 ***Comparison of digital analysis procedures for high-voltage impulses specified in recently revised IEC and IEEE standards on high-voltage test techniques***

Y. LI, W. YAN

D1-204 ***Contact angle measurement as a potential tool for electrical insulating paper condition assessment***

D. VRSALJKO, V. HARAMIJA, V. DURINA, M. POLJAK, B. MUSULIN, M. LESKOVAC

D1-205 ***Moisture estimation in oil filled equipment by capacitive sensors and Karl-Fischer Titration – Is it the same?***

I. ATANASOVA-HOEHLEIN, U. SUNDERMANN, M. KUFFEL, ST. ETTL

D1-206 ***Investigations on application of k-factor method for evaluation of impulse waveforms generated during impulse tests on transformers and reactors***

A. PRADEEP, M.M. BHAWAY, S.V.N. JITHIN SUNDAR

D1-207 ***Cavitation process diagnostics in high-voltage oil-filled electrical equipment***

L. A. DARIAN

D1-208 ***Calibration constant and associated uncertainty of high frequency current transformers for off-line or on-line partial discharge measurement in high voltage insulated cables***

A. RODRIGO, P. LLOVERA, V. FUSTER, A. QUIJANO

D1-209 ***Test procedures for use of wireless partial discharges instrumentation in HV networks***

R. CANDELA, A. DI STEFANO, G. FISCELLI, S. FRANCHI BONOMI, G.C. GIACONIA, A. GUALANO

D1-210 ***Fundamental study on detection method of residual charge from water tree degraded XLPE cables with pulse voltage***

T. KURIHARA, T. OKAMOTO, T. TSUJI, K. UCHIDA, M.H. KIM, N. HOZUMI

D1-211 ***Study of AC insulation tests for UHV substation equipment - Partial discharge and combined impulse voltage tests -***

S. OKABE, T. TSUBOI, G. UETA, T. KOBAYASHI, H. KOYAMA, H. WADA

D1-212 ***Application of weather models for the evaluation of design ESDD for harsh pollution conditions***

I. GUTMAN, C. AHLHOLM, K. HALSAN, R. EIDE, L. CARLSHEM, W.L. VOSLOO, J-F. GOFFINET

D1-213 ***Atmospheric and altitude correction of air gaps, clean and polluted insulators: state-of-the-art within CIGRE and IEC***

I GUTMAN, A PIGINI, J. RICKMANN, J. FAN, D. WU, E. GOCKENBACH

D1-214 ***Critical role of failure investigations in effective asset management***

A. AL-HADABI, A. JOHNSON, K. AL-ROMAIMI, J. WETZER, A. SHARMA

D1-215 ***Estimating moisture content in oil-filled power transformers: in-service experience***

T. GRADNIK, B. ČUČEK, M. KONČAN-GRADNIK

D1-216 ***Dielectric characteristics of winding in oil filled transformer using turn- to-turn and section-to-section insulation model***

Y.J. LEE, J.H. LEE, I.J. SEO, J.Y. KOO, S.J. CHO Y.H. KIM, B.Y. SEOK

D1-217 ***New locating method of partial discharges in power transformers based on electromagnetic wave propagation characteristics***

K.R. HWANG, J.R. JUNG, Y.M. KIM, H.J. YANG

PS3: Properties and potential applications of new materials

D1-301 ***Application of IEC 61788-3 for the determination of the DC critical current of high temperature superconductors of second generation***

A. POLASEK, R. DIAS, O. ORSINO FILHO, F. SASS, P. BARUSCO, F.G.R. MARTINS, A.C. FERREIRA, R. DE ANDRADE JR., F.J.M. DIAS, D.H.N. DIAS, G.G. SOTELO

D1-302 ***Esterification reaction and moisture migration between insulation paper and a corn oil based natural ester***

H.M. WILHELM, A. CABRINO, L.L. SILVA, D. SILVA, H. HOSSRI, C. GALDEANO, M.M. SILVA JR., P.O. FERNANDES, H.P. SILVA

D1-303 ***The effect of semiconductive nanoparticles on the insulating properties of thermal aged transformer oils***

Y.Z. LV, C.R. LI, Q. WANG, W. WANG, Y.F. DU

D1-304 ***Loss and recovery of hydrophobicity of SR insulators under different climatic conditions in Egypt***

B.A. ARAFA, A. NOSSEIR

D1-305 ***SF6 alternative development for high voltage switchgears***

Y. KIEFFEL, A. GIRODET, F. BIQUEZ, PH. PONCHON, J. OWENS, M. COSTELLO, M. BULINSKI, R. VAN SAN, K. WERNER

D1-306 ***Critical electric field strength and effective ionization coefficient measurements of nitrogen-oxygen mixtures with variable mixing ratio***

P. HÄFLIGER, C.M. FRANCK

D1-307 ***Eco-friendly solid insulation for high voltage GIS***

K. POHLINK, F. MEYER, D. GAUTSCHI, Y. KIEFFEL

D1-308 ***CF3I Gas and Its Mixtures: Potential for Electrical Insulation***

M.S. KAMARUDIN, L. CHEN, P. WIDGER, K.H. ELNADDAB, M. ALBANO, H. GRIFFITHS, A. HADDAD

D1-309 ***Electric field grading techniques in power apparatus using functional materials***

N. HAYAKAWA, K. KATO, H. OKUBO, H. HAMA, Y. HOSHINA, T. ROKUNOHE

SC D2 INFORMATION SYSTEMS AND TELECOMMUNICATION

PS1: Information and telecommunication technologies for connecting distributed energy resources

D2-101 ***Study and practice of cybersecurity situation evaluation method for smart grid***

K. GAO, Y. WANG, R. XU

D2-102 ***Study on just-in-time decision of demand respond based on complex event processing***

J.Y. WANG, N. LI, Y.X. XIE, X.Z. LI, D.P. WANG, F.Y. WANG

D2-103 ***Powerline communications for connecting distributed energy resources***

D. GIL, A. LLANO, F. CASTRO, J.A. MORENO, S. MARTINEZ, T. ARZUAGA

D2-104 ***Security of communications in voltage control for Grids connecting DER: impact analysis and anomalous behaviours***

G. DONDOSSOLA, R. TERRUGIA

D2-105 ***Control and measurement system to evaluate solar power grid-tie inverter performance***

R. GUEVARA, C. TELLO, J. RODRÍGUEZ

D2-106 ***DSO's strategic choice for private telecom networks***

G. ROBICHON

D2-107 ***Future smart seters and meter data management***

A.I. BATAINEH

D2-108 ***Utilization of web services for electronic data interchanges on the European energy market for electricity***

A. MARTÍN BARBERO, E. JIMÉNEZ RAYA, J. BEMBIBRE REGUEIRO

D2-109 ***A new experience of Optical Phase Conductor (OPPC) in Red Eléctrica de España***

S. KWIK ALLAN, J.M. DELGADO ALVAREZ

PS2: Maintaining operational IT reliability in an evolving environment

D2-201 ***IT platforms of Japanese electric power companies***

T. YOSHIDA, M. OKAMOTO, N. TAMEHISA, M. KIKEGAWA, C. TSUJI, T. HANAKITA

D2-202 ***Experiences and practices in the implementation of IT governance in Mexican electrical utility***

I. PARRA, G. ARROYO, A. GARCIA

D2-203 ***Security in remote services used by EPUs***

P. SITBON, C. POIRIER, J. ZERBST, D. HOLSTEIN

PS3: Trends in managing utility communication networks

D2-301 ***CANCELLED - Channel estimation for a PLC-OFDM system, using LES in combination with Neural Networks for Smart Grid Applications.***

D2-302 ***Experiences with an IP/MPLS network in utility environment***

T. LEROY

D2-303 ***The telecommunications business expansion at Eletrobras Eletronorte and the needs for changes in operation and maintenance***

M. COSTA DE ARAUJO, M. ALVES RODRIGUES

D2-304 ***Beyond Chesf's telecommunications information security analysis***

A. TEMPORAL, H. BURLE, C.A. BASTOS

D2-305 ***Managing adapted packet network architectures for smart IP-based services***

M. MESBAH, A. MOAINI, V. MENEGUIM

D2-306 ***Challenges in establishment of large OPGW based communication network - Indian experience***

N.S. SODHA, H.H. SHARAN, SHEELA RANI

D2-307 ***Smart grid network through integrated SCADA System-Karnataka Model- A case study***

K.R. ADISHESHAN

D2-308 ***Telecommunication networks for smart grids deployment***

B. PERALTA

D2-309 ***CANCELLED - Benefits of the internet protocols for last mile distribution / field area networks***

D2-310 ***Trends of communication networks in Japanese electric power utilities***

H. TSUCHIYA, K. TAKAHASHI, K. SHIMOOSAKO, N. TAKAHASHI, S. ONO, Y. TADA

D2-311 ***CANCELLED - Field Area Network Implementation for AMI, SCADA and Demand Response Applications***

D2-312 ***Smart Communication System SCS***

J. RAMIREZ, H. CABRERA

http : //www.cigre.org

2014 Paris Session

C6-102

Maximizing Local Renewable Energy Consumption by shifting Flexible Electrical Loads in Time and Space

S. ÜBERMASSER[1], T. LEBER[2], M.STIFTER[1], W. HRIBERNIK[1], F. LEIMGRUBER[1], M. MEISEL[2]

[1]AIT – Austrian Institute of Technology
[2]ICT – Institute for Computer Technology, Vienna University of Technology
Austria
stefan.uebermasser@ait.ac.at

SUMMARY

Worldwide efforts facing global climate change issues and the rise of renewable energy sources are leading to significant changes in the energy sector. G[e]oGreen is a SmartGrids ERA-NET project that aims at bringing another approach to energy balance and overall power system stability. The unpredictable nature of renewable energy sources leads to power peaks in the distribution network which are correlated in time and space and therefore within regions load conditions on the grid will vary. One approach to cope with these fluctuations is the massive deployment of energy storage systems but also the temporal and spatial shifting of energy consumption is possible but not widely used at the moment. Introducing a cell concept of mobile consumers, it considers consumption mobility both in terms of time and space. In particular, electric vehicles and Data Centers' (DC) processing tasks, as typical cases of mobile consumers and their impact on the power grid, improved energy usage efficiency, grid stability and peak shaving are considered.

First simulations of the 18 G[e]oGreen cells and the described use-case were performed. The aim was to simulate electric vehicles in uncontrolled charging mode and to analyse the developed use-case within applicability for the optimization algorithm.

The analysis of uncontrolled charging of EVs show that 67% of all EVs arrive at their charging point with state-of-charges (SOCs) above 80% and another 25% of vehicles have SOCs between 50 and 80%, which leads to a considerable potential for controlled charging and optimization strategies.

The developed use-case features sufficient imbalance in generation and consumption of electrical power as well in time and geographical terms. This is the essential basis for the ongoing development of the optimization algorithm. Along with this and the described simulation environment, which allows full control of simulated consumers, further development and research on optimization algorithms for load shifting in time as well as geographical terms can be done.

KEYWORDS
Smart Grids, Renewable energy, Electric vehicles, Smart charging, Cell concept, Power simulation, Distributed generation

I.INTRODUCTION

Worldwide efforts facing global climate change issues and the rise of renewable energy sources are leading to significant changes in the energy sector. G[e]oGreen [1] is a SmartGrids ERA-NET project [2] that aims at bringing another approach to energy balance and overall power system stability. G[e]oGreen explores technological challenges and potential benefits of utilizing geographical load shifting in addition to time shifting for the purpose of increase the usage of renewable energy, focusing on the cases of electrical vehicles, buildings (with electrical heating systems), and data centers. Introducing a concept of mobile consumers, it considers consumption mobility both in terms of time and space. In particular, electric vehicles and Data Centers' (DC) processing tasks, as typical cases of mobile consumers and their impact on the power grid, improved energy usage efficiency, grid stability and peak shaving are considered. In addition, maximizing the usage of energy from renewable sources through mobile consumption will be addressed and contributes therefore directly to European climate goals. Through structural and functional system modelling, the project explores optimal control strategies and scheduling algorithms for mobile consumers, especially such as electric vehicles.

II. G[E]O GREEN CONCEPT

The proof of concept of G[e]oGreen is based on the theoretical structures and concepts determined during the project and is described in detail in [3]. The basic G[e]oGreen Cell Structure (Figure 1 [3]) contains all main elements of the structure and the relations. In order to make optimization possible, cells should contain at least one infrastructure element (static entity), a flexible entity, and a cell manager performing local optimization. The minimum requirements of a G[e]oGreen cell are shown in Figure 1 and can for example be represented by a single household as well as by a large number of aggregated entities. However, the size of the cell for the proof-of-concept and the corresponding scenario was discussed to cover approximately one medium voltage branch.

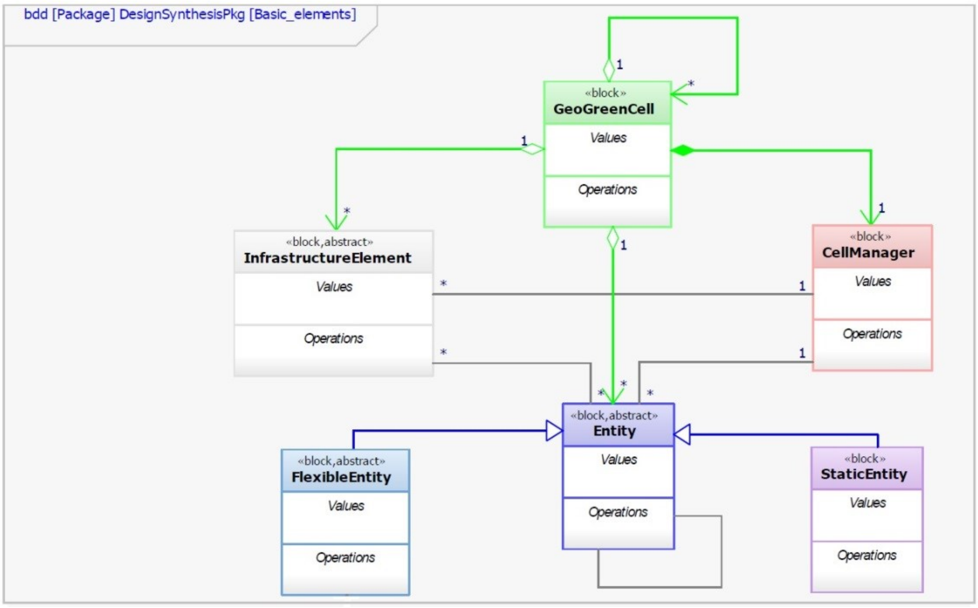


Figure 1 - G[e]oGreen Cell

Flexible and static entities represent either suppliers or consumers of electricity. A flexible entity can either be flexible in time, space or both. Electric vehicles can be considered to be flexible in the consumption of electricity in time as well as in space, if controlled charging is considered. Energy from RES, like PV Systems or wind turbines are, due to their stochastic nature, considered to be static. Flexible entities can be smart grid enabled automated functional buildings or data centers (time flexible), or electric vehicles (time and space flexible).

III. SIMULATION ENVIRONMENT

The simulation environment (as show in the schematics of Figure 2) for the proof of concept consist of several tools and aims for simulating a scenario covering a variety of suppliers and consumers of electricity. The co-simulation environment consist of the power simulation tool PowerFactory [4], the component simulation tool EVSim [5] and the G[e]oGreen optimisation Algorithm. These tools are connected and synchronized via OPC [6] and a round-robin schedule. The traffic and mobility simulation was performed prior the co-simulation with a multi-agent simulation tool (MATSim). The output from the simulation with MATSim [7] is a detailed Agent plan (containing for example: origin, destination, times of arrival and departure, distance driven …) for each mobility agent and this information is further used as input for EVSim to simulate electric vehicles. A detailed description of a similar approach can be found in [8] and [9]. The simulation environment is capable of simulating in different time-steps (e.g. 1-minute, 15-minutes …).

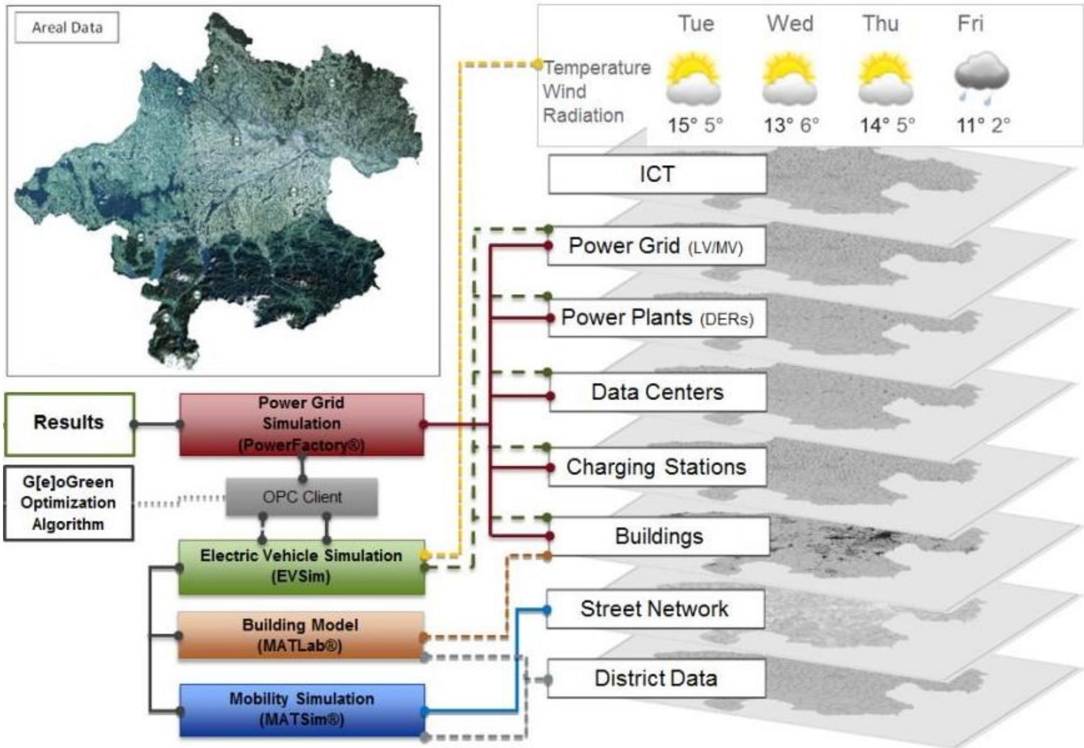


Figure 2 - G[e]oGreen simulation environment and scenario overview

Data from the component simulation is fed and linked via OPC to the specific node in the power grid. Figure 3 shows a power grid node representing a single G[e]oGreen cell with different types of loads (EVs, buildings …) and generators (Power plants, DERs …). During each simulation time step changes of values of every variable get actualized as well as values for the optimization (e.g. set value of max. charging power for EVs).

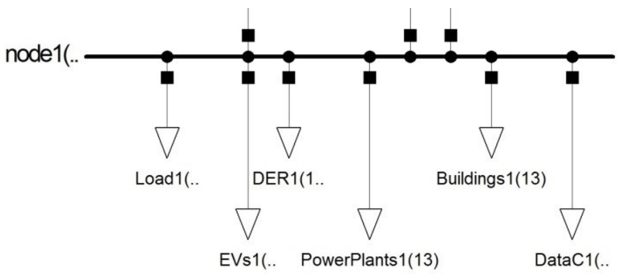


Figure 3 - Example of a power grid node of a single G[e]oGreen cell

IV. USE-CASE DESCRIPTION

For the proof of concept of the G[e]oGreen concept, the area of Upper-Austria was chosen as scenario. The 18 political districts of Upper-Austria were chosen to represent 18 individual G[e]oGreen cells. Based on available statistical data about the population [10], buildings [11] and mobility behaviour [12] a use-case with an assumed number of EVs (based on real vehicle fleet data) and additional power plants of RES was created. Table 1 provides an overview of the main statistical figures of the area Upper-Austria and its districts. It is assumed that population and the car-fleet of Upper-Austria will stay on a constant level. In the use-case, a market-penetration of 100% EVs (more than 800.000 vehicles) is assumed. The maximal charging power in this use-case was set to 22kW[1].

Table 1 - Scenario data

District Nr.:	Population [10]	Power plants [MW_{peak}]				Consumers		
		Thermal [13][14][15]	**Hydro** [13][14][15]	**PV**[2]	**Wind**[3] [17]	**EVs** [18]	**Buildings**[4] [11]	**Data centers**[5]
0	38215	6	0	10	0	20281	364	1
1	56777	0	20	26	2	34381	351	0
2	65131	0	0	27	0	38857	187	0
3	65765	0	379	25	0	39496	336	0
4	81491	0	179	34	20	49258	347	0
5	56565	0	410	25	2	33821	355	0
6	58596	0	81	26	14	36169	624	0
7	98000	223	73	44	16	59173	425	0
8	130520	606	9	56	43	78351	470	0
9	99595	0	30	44	7	58965	604	0
10	55607	0	8	24	53	32955	376	0
11	58751	0	144	25	32	36001	349	0
12	139218	0	1	46	7	83574	377	0
13	62632	0	0	27	0	38826	187	0
14	190802	414	10	33	0	96835	603	3
15	31767	0	324	13	0	19907	125	0
16	58709	13	0	14	0	32967	769	2
17	67961	0	71	28	0	42124	391	0
Total	**1416102**	**1262**	**1739**	**528**	**196**	**831941**	**7240**	**6**

The power generation profile of the RES is based on the historical data from [19] and measured PV profiles, covering an average day (around 20°C). Both time lines were scaled to the particular installed peak power in each G[e]oGreen cell (shown in Table 1, Figure 7, Figure 9 and Figure 11).

A pre-analysis about the shifting potential of EVs (battery capacity: 40kWh), data centres and buildings showed that EVs by far provide the highest potential for load shifting compared to the other two options. By this reason the first simulations and the approaches for optimization of the use-case are focusing on the potential of EVs. The fleet of EVs consist of different types of vehicles with individual parameters (size of battery, max. charging power, number of phases…), which are modelled after vehicles which are currently available on the market.

---

[1] This represents the Mennekes 32A charging standard. EVs always charge with the highest possible power and are either limited by their on-board charger or the maximum charging power allowed by the charging pole.

[2] It is assumed that approximately 30% of the buildings in the districts are equipped with PV system of 5 kW_{peak}

[3] Additionally to the number of current installed wind power per district [16] a certain amount of wind power potential was assumed based on information from [17]

[4] Based on information from [11] buildings with direct electrical heating systems were selected for being controllable within this use-case

[5] Currently no data centres are located in the Upper-Austrian are. However for this proof of concept a number of centres was assumed to be located within the three largest urban areas.

V. G[e]oGreen Optimization

The Optimization itself is divided into three steps:

1. The first step is to determine the actual conditions, like SOC, weather and locations of the cars.
2. Then the actual optimization takes place. First of all, all cars with a SOC smaller than 50 % are loaded immediately. This is to guarantee a minimum amount of energy, so that most of all trips can be realized. Second, cars with a SOC between 50 % and 80 % are loaded during periods of renewable generation. This is to stabilize the grid and therefor to optimize the local consumption. Third, all cars with a SOC of 80 % and 100 % are used for a two way interaction. This means that actually energy is fed back from the cars to the grid. The operations two and three follow the constraint, that if actually an operation is performed, the minimum step size is 5 %. The reason for the step size is to avoid flickering operations of the cars and a resulting shorter lifetime of the devices.
3. In the third Phase the algorithm also includes the possible weather condition of a possible target for the car. Therefore, the route, like from work to home, must be known. If the weather forecast matches better conditions than at the present location, the algorithm tries to shift more consumption to a later time, when the car is connected in an area with better weather conditions.

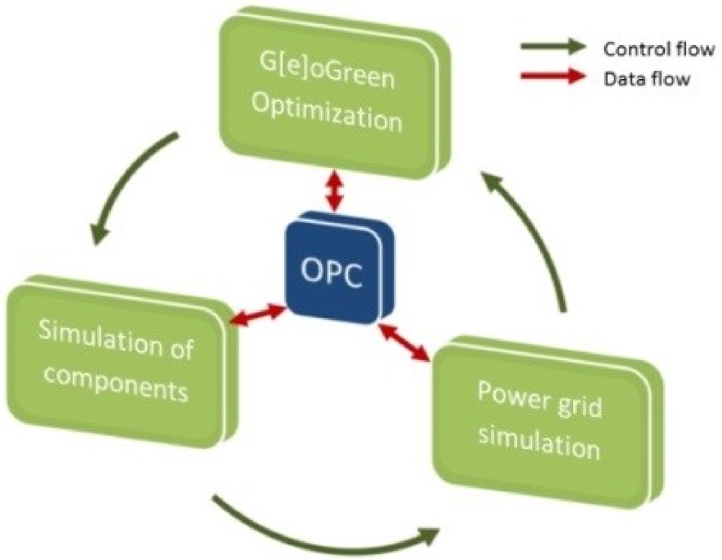


Figure 4 - Round-Robin schematic of simulation environment

Data Center Optimization:

The basic idea behind the data center optimization is that every data center pool has to be redundant, in order to avoid processing outages or to minimize downtime. It may be possible that, centers that run on different locations are capable to run the same task with only a short time of synchronization. In case of a generation gradient that is high enough to justify synchronization, the running task will be shifted. Because of the fact, that one datacenter not only running one task, this may be an interactive process until all tasks are shifted or the amount of energy that is needed equals the generation. This concept is comparable to follow-the-sun strategies, but with a finer granulation.

VI. RESULTS

The use-case of uncontrolled charging of 100% EVs driving in total more than 1,6 mio. trips in 18 G[e]oGreen cell was simulated. An average day in the year was chosen (around T=20°C), where EVs on-board devices (heating or cooling) do not consume more energy.

In order to develop appropriate optimization algorithms for the proof of concept, a pre-analysis of the time lines of supply and consumption of electricity of this specific use-case under uncontrolled (non-optimized) conditions was done. Figure 6 shows the corresponding power curve of generation (PV and Wind) and uncontrolled charging EVs in all of the 18 cells.

Figure 5 shows the SOC of the simulated EVs after arriving at their destination and before starting charging. Around 2% of all EVs are not capable to perform their daily trip without running out of energy. In total, 68% of all EVs arrive at their destination with an SOC above 80%. 25% of all EVs have SOCs between 50 and 80% and the rest of 7% of all EVs ends up with SOCs lower than 50%.

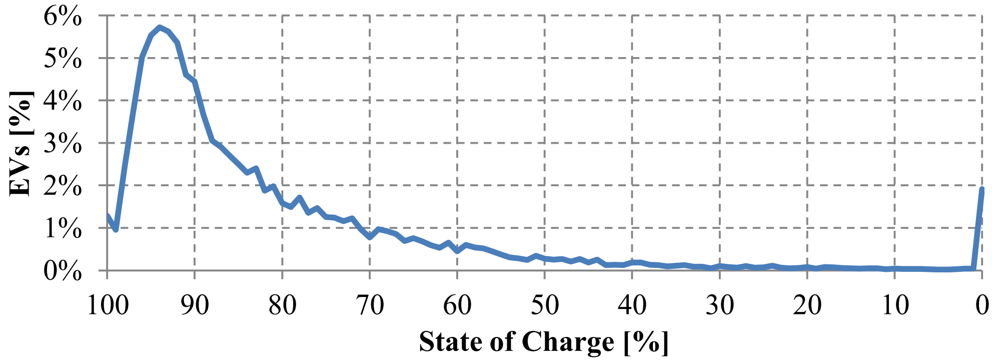


Figure 5 - Minimum SOC of EVs before charging

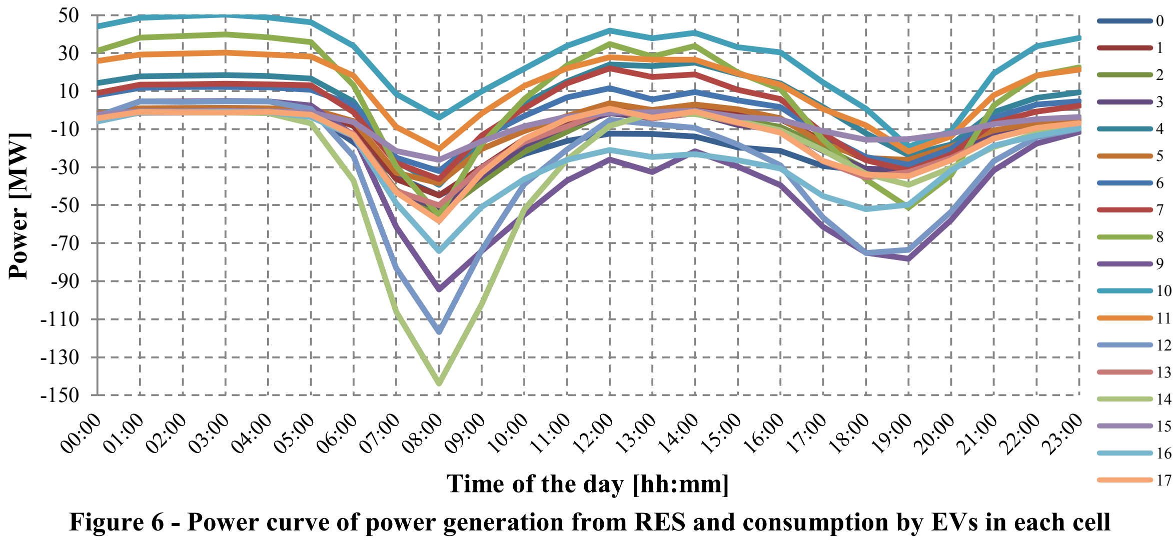


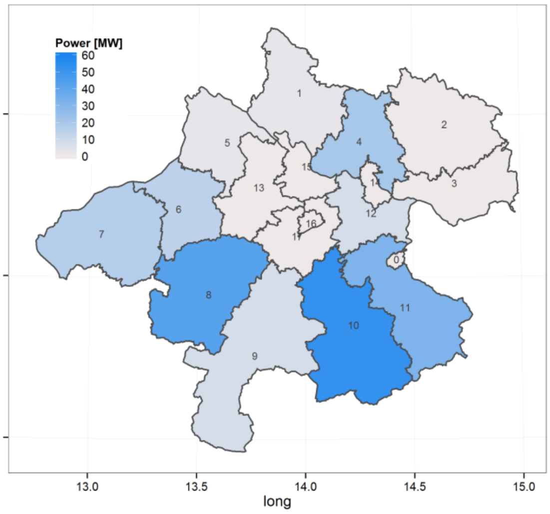
Figure 6 - Power curve of power generation from RES and consumption by EVs in each cell

Between 22:00 and 06:00 of the simulated day, more power from RES would be available in most cells than is consumed by charging EVs. Especially in the hours from 06:00 till 11:00 and 17:00 till 20:00 in most cells the consumption of energy by charging EVs excels the generation from RES. During the noon hours (11:00 till 16:00) in most of the cells the consumption by EVs can be covered the generation from RES (especially from PV systems). In geographical terms (as shown in Figure 8), cell number 14, which represents the largest urban area in this use-case, shows the largest demand in power during the morning hours, whilst more rural cells (e.g. 10 and 11) are less frequented by charging EVs during this time.

Table 2 provides (along with Table 1 from page 4) an overview of the main-specifications of the use-case and shows some geographical snapshots of the power balance within selected points of time.

Table 2 - Results of time-line analysis (at selected points in time)

Location and number of installed RES and EVs per G[e]oGreen cell	Snapshots of power supply (RES) and consumption (EVs) per G[e]oGreen cell
Figure 7 - Installed Wind power (MW)	Figure 8 - Power Snapshot 08:00 (hh:mm)



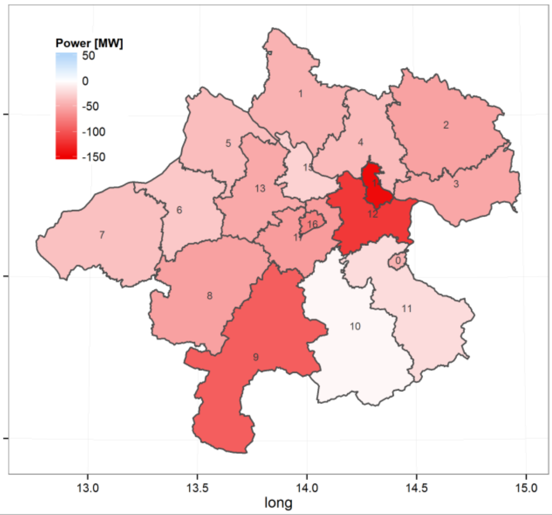
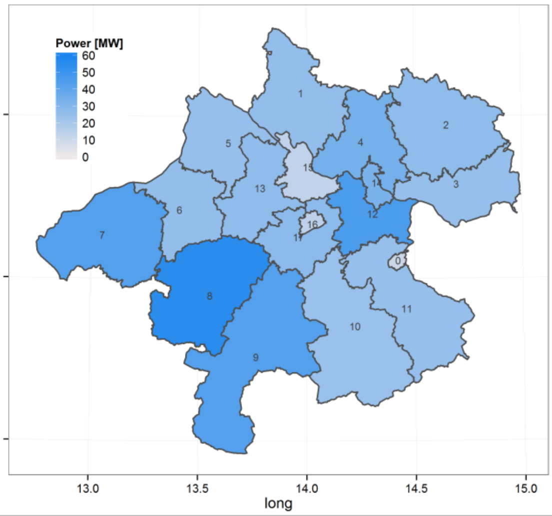


Figure 9 - Installed PV Power (MW)	Figure 10 - Power Snapshot 12:00 (hh:mm)



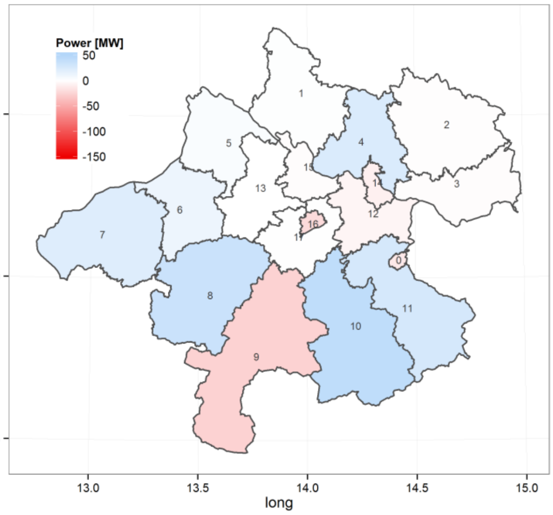
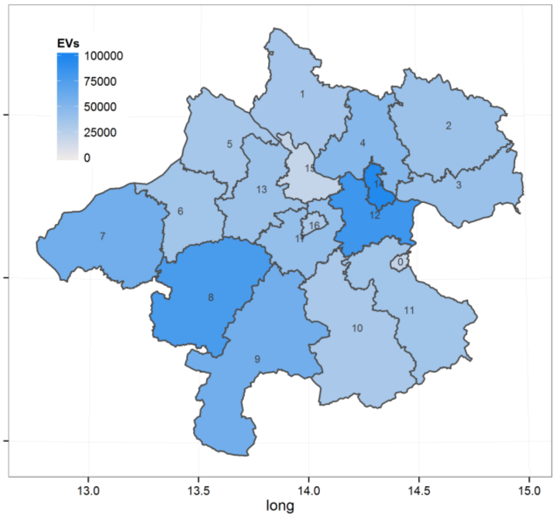
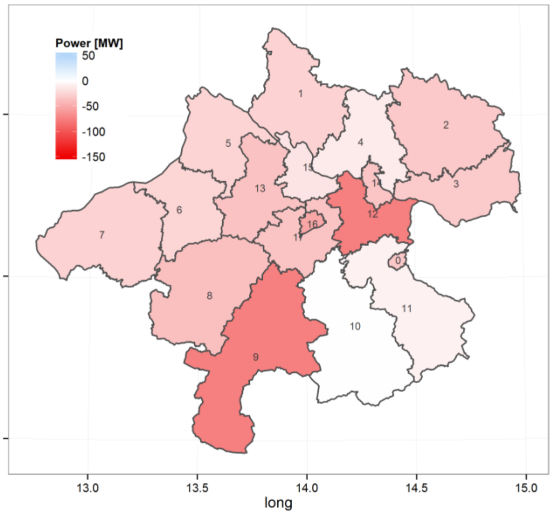


Figure 11 - EVs per G[e]oGreen cell	Figure 12 - Power Snapshot 18:00 (hh:mm)





VII. CONCLUSION, DISCUSSION AND NEXT STEPS

A first simulation of the 18 G[e]oGreen cells and the described use-case was performed. Its aim was to simulate electric vehicles in uncontrolled charging mode and to further on analyse the developed use-case within applicability criteria for the development of the optimization algorithm.

A scenario was defined, which is based on local data and information about population, power, plants, RES potential and the passenger vehicle fleet (including statistical mobility data). The RES potential was based on regional development plans and assumptions. The defined G[e]oGreen cells are related to political districts.

As expected (based on the mobility data), typical mobility behaviour and subsequent charging activities could be identified for the developed scenario. The demand in power for charging cars increases during morning ours especially in urban areas due to commuters from rural areas to work facilities, which are mostly located around urban areas. The analysis of the SOC of EVs at the moment of starting charging shows, that a majority of vehicles arrives at their destination with a SOC above 80%. From this SOC analysis, the potential for load shifting (and controlled charging) can be deflected, as described in section V. This parameter will also be used for validating charging strategies within EV-driver aspects (to verify if certain charging strategies lead to increasing numbers of EVs running out of energy).

The identified potential in load shifting from EVs (at this 100% scenario) outbalances the potentials from buildings and data-centres. Therefor the future focus will be led on the shifting potential of EVs, which are from a G[e]oGreen concept point of view the most promising player in the scenario, as they are considered to be flexible entities (which can shift energy in time and space). Buildings and data-centres will be also considered in the ongoing work but due to limited shifting potential the priority will be on EVs.

In the described scenario, generation of power from RES meets the demand from charging cars only during the hours around noon, if the weather conditions are suitable. This is caused due the regional circumstances, where mainly generation from PV systems is available. This leads to insufficient supply of charging power (from RES) can be identified for the early morning hours, when generation from PV systems is low.

The developed use-case features sufficient imbalance in generation and consumption of electrical power as well in time and geographical terms. This is the essential basis for the ongoing development of the optimization algorithm. Along with this and the described simulation environment, which allows full control of simulated consumers, further development and research on optimization algorithms for load shifting from a time-wise as well as geographical perspectives can be done.

BIBLIOGRAPHY

[1] „Geogreen - Project Website“. [Online]. Access: https://esites.vito.be/sites/geogreen/Pages/home.aspx.
[2] „Welcome to SmartGrids ERA-Net | SmartGrids ERA-Net“. [Online]. Access: http://www.eranet-smartgrids.eu/.
[3] „Geogreen - Geogreen System Concept“. [Online]. Access: https://esites.vito.be/sites/geogreen/systemconcept/Pages/systemconcept.aspx.
[4] „PowerFactory - DIgSILENT Germany“. [Online]. Access: http://www.digsilent.de/index.php/products-powerfactory.html.
[5] M. Stifter und S. Übermasser, „Dynamic simulation of power systems interaction with large electric vehicle fleet activities“. submitted to PowerTech IEEE power & Energy Society, Juni-2013.
[6] „OPC Server from MatrikonOPC – Modbus and 500 OPC Servers and Products“. [Online]. Access: http://www.matrikonopc.com/.
[7] „Agent-Based Transport Simulations | MATSim“. [Online]. Access: http://www.matsim.org/.
[8] S. Übermasser und M. Stifter, „A Multi-agent based Approach for simulating G2V and V2G Charging Strategies for large Electric Vehicle Fleets“. submitted to CIRED 2013 - Electric Distribution Systems for a Sustainable Future, Juni-2013.
[9] D. Burnier de Castro, S. Übermasser, S. Henein, M. Stifter, J. Stöckl, und S. Höglinger, „Dynamic Co-simulation of Agent-based controlled Electric Vehicles and their impacts on Low-Voltage Networks“, 2013.
[10] „STATISTIK AUSTRIA - Volkszählungen, Registerzählung“. [Online]. Access: http://www.statistik.at/web_de/statistiken/bevoelkerung/volkszaehlungen_registerzaehlungen/index.html.
[11] „STATISTIK AUSTRIA - Bestand an Gebäuden und Wohnungen“. [Online]. Access: http://www.statistik.at/web_de/statistiken/wohnen_und_gebaeude/bestand_an_gebaeuden_und_wohnungen/.
[12] „OÖ. Verkehrserhebung 2001 Ergebnisse des Bundeslandes“, Amt der OÖ Landesregierung Abteilung Verkehrstechnik/Verkehrskoordinierung, Linz.
[13] „Energie AG Oberösterreich - Kraftwerke“. [Online]. Access: http://www.energieag.at/eag_at/page/339536979223644121_593479839214310582_593479839214310582,de.html.
[14] „Linz AG - Kraftwerke“. [Online]. Access: https://www.linzag.at/portal/portal/linzag/linzag/linzstrom/kraftwerke/centerWindow;jsessionid=94970AA5C090774EDA24958069409441.node2?plaginit=1&action=1.
[15] „Liste österreichischer Kraftwerke – Wikipedia“. [Online]. Access: http://de.wikipedia.org/wiki/Liste_%C3%B6sterreichischer_Kraftwerke.
[16] „Land Oberösterreich - Windkraft in Oberösterreich hat Tradition“. [Online]. Access: http://www.land-oberoesterreich.gv.at/cps/rde/xchg/ooe/hs.xsl/110638_DEU_HTML.htm.
[17] „Land Oberösterreich - Windkraftmasterplan Oberösterreich“. [Online]. Access: http://www.land-oberoesterreich.gv.at/cps/rde/xchg/ooe/hs.xsl/110625_DEU_HTML.htm.
[18] „STATISTIK AUSTRIA - Kraftfahrzeuge - Bestand“. [Online]. Access: http://www.statistik.at/web_de/statistiken/verkehr/strasse/kraftfahrzeuge_-_bestand/index.html.
[19] „OEMAG - Winderzeugung in den Jahren 2003 bis 2011“. [Online]. Access: http://www.oem-ag.at/de/oekostrom/statistik/winderzeugung.

Study Committee C6

SPECIAL REPORT
(Distribution Systems and Dispersed Generation)

Fabrizio Pilo (Preferential Subject 1)
Tsutomu Oyama (Preferential Subject 2)
Christian D'Adamo (Preferential Subject 3)

Special Reporters

Introduction

The scope of SC C6 is *to assess the technical impacts and requirements which a more widespread adoption of distributed/dispersed generation could impose on the structure and operation of transmission and distribution systems". Rural electrification, demand side management methodologies, including management of the DG and application of storage are within the scope of this SC.*

The SC decided to propose for discussion in the CIGRE 2014 General Session three preferential subjects dealing with:

- PS1. Planning of distribution networks with high penetration of DER and new loads
- PS2. Operation and control of active distribution networks
- PS3. New roles and services of distribution systems for transmission system operation

29 papers were selected for discussion in the General Session. The main issues raised in the reports are summarised hereunder, together with some questions to solicit a lively and profitable discussion.

1. Preferential Subject 1 (Planning of distribution networks with high penetration of DER and new loads)

The theme for Preferential Subject 1 is "Planning of distribution networks with high penetration of DER and new loads".

The areas dealt with are:

- Strategic planning for making distributed generation part of the TSO protection schemes
- Integration of micro generation and storage
- Experiences with demand elasticity trials and smart meter solutions
- Distribution planning with distributed energy resources

The papers submitted

Preferential Subject 1 includes 9 papers addressing various aspects of the planning and operation of active distribution networks. Authors were drawn from 12 countries reflecting the wide and international interest in the topic. The papers were regrouped under 3 subtopics.

pilo@diee.unica.it, t-oyama@ynu.ac.jp, christian.d'adamo@enel.com

The following aspects will be addressed:

- Subtopic 1 – Planning (Papers C6-104, C6-105 and C6-106)
- Subtopic 2 – Load and generation models (Papers C6-102, C6-103)
- Subtopic 3 – Operation of distribution systems (Papers C6-101, C6-107, C6-108 and C6-110)

Subtopic 1 – Planning (Papers C6-104, C6-105 and C6-106)

Papers belonging to Subtopic 1 explicitly deal with planning and highlight at what extent the distributed generation (Papers C6-104 and C6-106) can influence the development of power systems in countries that are extremely diverse for level of development, availability of natural resources and power system structure. In both cases, DG shows interesting potentialities for improving the continuity of service (TSO point of view) and the energy efficiency (DSO point of view). Paper C6-105 illustrates the impact of Micro Grids on distribution expansion plans and proposes an interesting optimization algorithm that does not consider the opportunities from Smart Grid.

Paper C6-104 (Egypt, academia**)** deals with the optimal siting and sizing of Distributed Energy Resources (DER) in Egypt. The authors highlighted that with a proper integration of DER some benefits are to be expected in power systems, and investigated the impact on power losses and voltage profile. Preliminarily they proposed a simple optimization algorithm that can find an optimal position of one, two and three DER. Load flow studies were performed on bus bar by considering the combination of two or three generators and by pruning all combinations that were considered non acceptable from reactive power point of view. The main result is that with a rated DER generation equal to 25% of the slack bus capacity, energy losses can be significantly reduced with a small voltage improvement. The results of the study are in good agreement with those from the booming Literature in field, but further investigations might be necessary if renewable energy resources are used. Furthermore, the impact on voltage and power losses might be completely different with probabilistic models of DER and loads, and with a proper model of smart grid control.

Paper C6-105 (Finland, academia**)** deals with the optimal expansion planning of medium voltage networks. The authors developed a heuristic algorithm that takes into due account the load growth and a more general model of prosumers. The most significant contribution given by the authors in the field of distribution planning is the integration of the Geographic-Dynamic Modeller of the Operational Environment (GDMOE) with a Network Topology Optimiser (NTO). In the proposed paper the expansion plan of a distribution network with and without the exploitation of Micro Grids is studied. The planning alternatives examined also show the impact of specific load growth and innovative fault location, isolation and service restoration systems. All planning calculations are based on worst-case scenarios (i.e., maximum demand/minimum generation and minimum demand/maximum generation) for the design of lines and conductors. In order to assess the reliability for the nodes supplied by micro grids, the probability to have enough generation for load supply is calculated. The planning procedure proposed by the authors is interesting and the inclusion of micro grids in network planning follows the path traced in few papers giving new impetus to this area. Anyway, the planning algorithm can lead to expensive solutions due to the deterministic fit and forget criterion and due to the fact that operation is not considered as a valuable option in planning studies.

Paper 106 (Russia, Utility) deals with the contribution that the increasing DG integration can give to the reliability enhancement in the Russian power systems. The paper offers the TSO point of view that requires DG does not cause reliability issues and do cooperate to solve typical TSO operational problems. In this context, Russian DG, essentially based on gas reciprocating engines or gas turbine generators, may be useful to avoid load shedding and even exclude this remedial action in the set of the admissible system protection actions. In order to achieve these goals, the authors proved that would be reasonable to provide DG with communication systems for fast starting and loading in order to increase the production of reactive power and, if admissible, to move towards synchronous regime. Finally, the authors specify the requirements for new DG so that it might be an active player of modern Smart Grid.

Question 1.1 – DSO and TSO may have different goals and objectives. The definition of requirements for new DG connection is sometimes affected by this situation as well as the definition of DG duties (i.e., voltage and frequency regulation, reserve, etc.). How can such issues be successfully faced in the unbundled and liberalised power system?

Question 1.2 – Modern distribution networks will rely upon enhanced operation. Traditional planning was not considering operation opportunities, because operation systems were not available. Is still reasonable a distribution planning process that follows the traditional path, and tries to solve operation issues at the planning stage? Is this more expensive and enough reliable with RES installed? Can the risk related to innovative planning algorithms that include operation in planning be assessed in advance?

Question 1.3 – Distributed Generation in many countries is mostly based on Renewable Energy Sources and it is completely out of DSO control. Is it still reasonable the use of simple, single value, representation of generation and loads in planning studies? Are probabilistic, time related generation and consumption models necessary? Which is the relationship between the planning horizon and the proper time granularity for load and generation representation?

Question 1.4 – Is the reduction of energy losses still an issue with high shares of renewable energy sources installed? Will the Smart Grid reduce losses or not?

Question 1.5 – The communication infrastructure is essential for Smart Grid. Smart Grid features can be enhanced with the integration of multi-energy networks and storage (e.g., natural gas, heating networks, compressed air, electric vehicles, etc.). Nowadays all those systems are planned independently. Are there any examples of integrated planning? Is integrated planning important for smart cities? How can it be realised in the current fully liberalised framework?

Subtopic 2 – Load and generation models (Papers C6-102, and C6-103)

Two interesting papers belonging to Subtopic 2 deal with models for both load and DG. Paper C6-102 addresses the problem of load demand on large-scale areas in order to identify how and at what extent active demand can influence planning strategies. Paper C6-103 proposes a framework for modelling DG by taking into due account the time granularity and the detail level that are necessary for different analysis. Particularly relevant for planning applications are the models that allow the proper consideration of operation in planning studies as proposed by CIGRE WG C6.19.

Paper C6-102 (Austria, research institution**)** is based on the G[e]oGreen SmartGrids ERA-NET models for describing the potentialities of demand integration. The central model of

G[e]oGreen is the Cell Structure that contains all main elements of the structure and the relations. Cells contain at least one infrastructure element (static entity), a flexible entity, and a cell manager performing local optimization. A cell in the paper coincides with a political district in Austria. Flexible and static entities represent either suppliers or consumers of electricity. A flexible entity can either be flexible in time, space or both. Electric vehicles can be considered to be flexible in the consumption of electricity in time as well as in space, if controlled charging is considered. Energy from RES, like PV Systems or wind turbines are, due to their stochastic nature, considered to be static. Flexible entities can be smart grid enabled automated functional buildings or data centres (time flexible), or electric vehicles (time and space flexible). The paper performs a high level study useful for strategic planning in Austria; since no optimization procedures have been proposed so far, the paper shows the expected demand with uncontrolled EV charge and RES installed. The simulation shows that 68% of vehicles should arrive at destination with 80% SOC, which makes EV very promising for demand side integration. Anyway, there are hours of day where RES generation can feed EV, but there are also some peaks in the morning and early evening with not enough generation for the very coincident EV demand.

Paper C6-103 (Austria, research institution**)** is based on the findings and the models of the European DERri project that developed a standardised modelling scheme and exchanging format for DER modelling. The Common Reference Model (CRM) proposed by the authors for Distributed Energy resources (DER) aims at improving the portability and exchangeability of DER models for different simulation experiments, particularly in the field of real-time and Hardware In the Loop (HIL) studies. A clear categorization of models for *fast transient*, *slow dynamic*, and *quasi-dynamic* simulations as well as the time granularity necessary for each of them is clearly explained. Generally speaking, the smaller the time constant the bigger is the level of details required by CRM. The main goal in definition of CRMs was to obtain dynamic models of DERs that are open and independent from the software environment that will be used to perform simulations. A test case is proposed with an interesting comparison of two popular software packages for the fast transient simulation of grid connected PV that shows a significant difference in the transient behaviour after a voltage dip. The use of CRM with the same input data does not always guarantee the identity of results in different simulation environments because of the solver algorithms adopted. Even in this case, the use of CRM is useful to understand that differences in simulations are for sure caused by different software packages and not by different DER models.

Question 1.6 – Will active demand play a role in distribution planning? Can the distribution system evolution be planned without considering the services that active demand might offer?

Question 1.7 – Are there any good models for modelling EV fast charging station daily load profile?

Question 1.8 – Can traffic and urban planning models be integrated with power distribution planning for the proper modelling of EV load behaviour and for the optimal position and siting of fast recharging stations?

Question 1.9 – Which is the level reached by standardization of models for DER representation? And which is for active demand functions? And for distributed management systems?

Subtopic 3 – Operation of distribution systems (Papers 101, 107, 108, and 110)
The papers belonging to Subtopic 3 are focused on the operation of innovative distribution systems. Paper C6-101 shows the results of experimental studies in a dedicated facility that can simulate a Micro Grid. Paper C6-107 faces the problem of reaching LV customers and controlling LV networks with a system, tested in the field, that does not consume all available communication bandwidth. Paper C6-108 demonstrates the suppression of voltage fluctuations with an optimised coordination of Combined Heat and Power and Battery Energy Systems. Finally, interesting Paper C6-110 gives a clear overview of voltage regulation in LV networks and shows the impact of reactive power. All these papers, mainly focused on operation, offer to researchers models and information that can be included in advanced planning studies.

Paper C6-101 (Canada, utility) deals with real-time studies of Micro Grid operative states and transitions. Researches had been carried out with the distribution test line installed at the Hydro-Quebec research centre (IREQ), a full size representative distribution feeder for testing different types of distributed energy resources, and control and measurement equipment. Islanded, transition to islanded, and transition to grid-connected operation have been investigated. Islanded mode of operation was studied with a droop power sharing control and with an isochronous generator. The authors proved that a Micro Grid can smoothly operate in all modes by maintaining both voltage and frequency. Energy Storage System (ESS) can operate as an isochronous generator with a four-quadrant power electronic interface as the authors experimentally proved. As a consequence, ESS is a viable alternative to synchronous generators for voltage and frequency regulation. The paper confirms with experimental results the simulation studies published in many papers dealing with the islanded operation of Micro Grids and the transient from/to grid–connected states. The worth of the experimental facility is clearly evident, since it allows researchers to investigate or to confirm simulation studies on real utility-scale equipment.

Paper 107 (Spain, Utility**)** deals with the implementation of techniques to operate Low Voltage (LV) networks following the Smart Grid concepts. Correctly, the authors observed that the information available for LV management are often poor and limited to know which meter is connected to a certain Secondary Substation. The information about the feeder to which a meter is connected to is seldom available with enough accuracy. Since Automatic Metering Infrastructures based on Power Line Communication (PLC) are going to be widely deployed through Europe, the paper proses a methodology to allow feeder identification by using the typical messages sent by meters to demonstrate they alive and functioning. The system has been tested on the field (three MV/LV transformers, 13 feeders, 688 smart meters). The combination of direct and indirect detection allows identifying 100 % of smart meters in the correct feeder and phases. With the proposed technique, it was observed that four meters were erroneously assigned to the wrong feeder, confirming that distribution companies know LV with significant inaccuracies often caused by the difficulty to keep databases updated. PLC provided grid topology information (smart meter connectivity to transformer, feeder and phase) just with the information that is naturally generated during the regular operation of meters (control packets). LV grid topology information gathering based only on information naturally generated by the PLC systems ensures an efficient use of the available bandwidth, and the projection of the Smart Metering infrastructure into the Smart Grid applications.

Paper 108 (Japan, industry) deals with application of Battery Energy Storage (BES) to help Combined Heat and Power (CHP) reduce the voltage fluctuations caused by Photo Voltaic

(PV) generation. Indeed, Japan committed itself to 25 % of CO2 emission by 2020 and the resort to nuclear power is no longer considered a viable option after the 2011 Tohoku earthquake and tsunami. For these reasons, demand response is going to be exploited with energy management systems implemented in buildings and dwellings; CHP has been promoted and incentivised with the goal to reach 15% of power generation; PV is growing very fast thanks to very convenient feed-in tariffs. The Smart Energy Network (SEN) project aims at smoothing PV output fluctuation with the control of CHP, hence accelerating PV implementation to the power grid with an optimal integration of both energy resources. In the paper the authors, with the aid of 100 case simulator tests carried out with the Smart Grid Simulator – an analogue simulator which models actual components in 1/1000 scale capacity – proved the feasibility of PV fluctuation suppression by remotely controlled and distributed CHP. The authors conclude that it is possible to regulate 6.7 times the adjustment capacity of PV with a combination of CHP and BES, or with BES alone. The combination of CHP and BES reduces the BES capacity necessary to dispatch low frequency component with CHP, and high frequency component with BES.

Paper 110 (Slovenia, academia) deals with extremely relevant issue of voltage regulation in LV networks with high shares of Photo Voltaic (PV) generation. The authors of the paper are involved in the Meta PV FP7 EU project that aims at demonstrating that PV can actively contribute to system operation, with a transition from '*fit and forget*' approach to the '*fit and rely upon*'. The paper gives a significant contribution based on both simulations and experimental studies, which are very seldom performed at LV level where it is expensive for network operator to measure consumption of individual loads and to track costumers and PV-sources phase connection. First measurement results suggest that voltage control by means of reactive power from PV sources is a viable mean for controlling voltages and preventing the voltage to exceed the maximum defined limits. However, the available data does not allow yet to compare different control strategies and to choose the most suitable one. Moreover, the results indicate that in some points along the grid the number of PV sources having voltage control capabilities is not high enough to prevent overvoltage. The authors conclude that further investigations are necessary to analyse the reactive power flows that might be necessary for voltage regulation and can significantly affect the energy efficiency of power delivery as well as reduce the network power factor. Finally, the authors propose an interesting application of On Load Tap Changer (OLCT) in MV/LV transformers in order to improve voltage regulation with a centralised voltage regulation system that can reduce the need for reactive power from PV generators.

Question 1.10 – Is hardware in the loop simulation a good way to validate models, particularly dynamic models, and programs, which can give completely different results even though the input data are the same as proved by the authors of paper C6-103? Are full real scale data essential for developing good models and produce reliable results? Or do we have to improve the electrical consciousness of young engineers to guide simulation software in the right direction?

Question 1.11 – Can power line communication really work in lines with high shares of photovoltaic generation? Some preliminary Italian studies highlighted the impact of harmonic pollution on the capability to communicate with automatic meters.

Question 1.12 – How to choose the best communication system for Smart Grids and how to involve Communication Companies in the Smart Grid process outside big cities?

Question 1.13 – Are ZEBRA batteries a good solution for voltage fluctuation suppression if coupled with CHP plants?

Question 1.14 – Is Volt/VAR regulation effective in urban LV networks with high shares of underground cables? Are load shifting and load shaping – eventually coupled with storage - more effective or in any case necessary?

Question 1.15 –Which type of control for voltage regulation is better suited for LV systems (decentralised or centralised)? How can LV regulation systems be integrated with MV controls?

2. Preferential Subject 2. (Operation and control of active distribution networks)

The theme for Preferential Subject 2 is “Operation and Control of active distribution networks”.

The areas dealt with are:
• Voltage estimation and supervision using AMIs
• Novel methods for operation and control of distribution networks with high share of Dispersed Generation (DG)
• Energy storage and Electric Vehicles (EV)
• System interconnection requirements/standards for DG
• Wireless communication for protection

The papers submitted
There are 18 papers submitted in preferential subject 2. In view of a wide variety of topics, the papers were grouped into three subtopics.

2.1 Sub Topic 1 – Novel methods for operation and control of distribution networks
Many papers submitted aim to develop novel methods for operation and control of active distribution networks. Some of them feature the large projects utilizing a number of AMIs. The others aim to estimate and control the voltage profile in active distribution networks.

Paper C6-202 (Australia, University and Utility) describes the evaluation results of voltage control methods on a real-world distribution network with a probabilistic type of PV model based on the actual PV measurement data. The evaluation of voltage control methods was performed on different case scenarios which were the combination of tap changer of power distribution transformers and low-voltage supply transformers, STATCOM and batteries.
It is shown that the tap changers had significant effect on voltage control. STATCOM had good effect even with small amount of capacity and even PV inverters might have the same level of performance. Batteries were also effective, however, the large effect might not be expected with batteries only.

Paper C6-204 (China, Research Institute, Utility and University) describes the Cluster Control Strategy, which controls generation schedule of micro gas turbine (MGT) according to PV output curve and the charging and discharging pattern of a storage system for short and rapid adjustment. The effect of this cluster control strategy is confirmed by the simulation for four scenarios which consist of the combination of MGT control and storage control. The cluster control strategy is defined as the combination of MGT output schedule according to the output of PV system and the storage system to smooth the output of PV system. The cluster control strategy is revealed to be able to respond to the randomness of PV output and resolve the voltage fluctuation problem and improve the power quality.

Paper C6-206 (Germany, Portugal, industry) introduces ‘RiesLing’ in Germany and ‘InovGrid’ in Portugal and compares the results of these projects. The project ‘RiesLing’ deals with the development of different solutions for the stepwise automation of secondary substations and advanced grid operation functionalities. The objective of the project ‘InovGrid’ is to seek the answer to several challenges, including: the need for increased energy efficiency; reduced costs and increased operational efficiency; the integration of a large share of dispersed generation; the integration of electric vehicles and the desire to empower customers and support the development of new energy services.

Paper C6-207 (Spain, utility) introduces the PRICE GEN project, a demonstration project in the Henares region around Madrid. The objectives of the project are to implement an advanced distribution automation system, active remote metering, and active energy management functionalities, in order to improve distribution system reliability and minimize energy losses. An important aspect of the project is the analysis and tracking of technical and non technical losses in the low voltage network. In order to carry out this activity, a state estimator algorithm has been designed to calculate the most probable status of the whole network, based on a few real measurements.

Paper C6-208 (Spain, Belgium, Sweden, utility) introduces an Active System Management (ASM), which is a key tool for efficient and secure integration of a high share of distributed energy resources, distributed generation, flexible loads, electric vehicles and storage. In this concept, three steps towards the integration of active distribution system are considered. The first step is passive (Current situation), the second step is re-active, and the third step is active. In the third step, a close coordination between TSOs and DSOs is required.

Paper C6-211 (UK, utility) introduces the Flexible Plug and Play project. The concept of the project is to connect distributed power generations to the constrained parts of the power distribution system cheaply and speedy in UK. The purpose is to construct a platform for connecting and cutting off freely distributed power generations. The IEC61850 is used as the communication protocol in order to maximize capacity for distributed power generation within thermal and voltage limits. As smart devices, the Quadrature-booster and Quadrature-booster Controller System are used to manage loop power flow, and the dynamic Line Rating technology is utilized to calculate the real time thermal rating of power lines. The method of calculating suitable cost is introduced considering cost of curtailment and cost of reinforcement.

Paper C6-213 (United Kingdom, consulting firm and academia) describes the effectiveness of Power Flow Management (PFM) algorithm to alleviate branch overloads by actively controlling the generators' output. Several PFM algorithms, including those based on constraint satisfaction, optimal power flow, power flow sensitivity factors, and linear programming, are evaluated on the actual network model. It is found that no algorithm can always minimize the number of overloads while minimizing the amount of curtailment applied to the generators within the network. It is demonstrated that selecting and using the algorithm that is most effective at removing overloads and minimizing curtailment for each network state has a performance benefit than using the same algorithm for every state.

Paper C6-215 (USA, Sweden, Canada, utility, academia, and industry) describes the IEEE project P1854. The purpose of the project is to give guidance to utilities and network operators in the use of new technology in electric power distribution. The application areas of new technology are: improving the reliability of supply, improving the power quality, improving the efficiency of distribution system operation, increasing hosting capacity for new production or for new consumption, and market functioning and participation.

Paper C6-216 (Japan, Utility) introduces the general outline of distribution automation system of the Kansai Electric Power Company and their demonstration project. This project evaluates the voltage supervision and control methods by applying to the actual power distribution line with 500kW PV system. From the simulation results, it is found that the combination of Step Voltage Regulator (SVR) and Static Var Compensator (SVC) can reduce the voltage fluctuation caused by PV output dramatically. The actual values/parameters of power distribution network are measured and the effectiveness of the combination of SVR, SVC and Thyristor type step Voltage Regulator is evaluated.

Paper C6-217 (Greece, University and Utility) describes the IGREENGrid project, which aims at increasing the hosting capacity of Distributed Renewable Energy Sources (DRES) in power distribution grids without compromising the reliability. In the Greek demo site, advanced functions, such as Congestion and Overvoltage Management, RES Hosting Capacity Estimation and Management, Power Quality Monitoring, etc., are under development. This is the first attempt to utilize the AMR data for the support of the power system operation and planning.

Question 2.1- In C6-207, a state estimator algorithm was developed and successfully implemented in a demonstration project in Spain. Is there any other example of the state estimation especially in the Low Voltage distribution system, which usually are not furnished with a number of measurement and control devices? How do you ensure the reliability of information?

Question 2.2 - What kind of data collection method is used for automatic meter readings? What is the communication bandwidth and how long is the data collection interval?

Question 2.3 - The voltage regulation issues are the major concerns for a power distribution network with a large penetration of renewable energy sources, such as PV system whose power output fluctuates depending on the weather conditions. What is the voltage regulation used for the distribution network operation in your country? Based on this regulation, what are the problems you are facing under current condition of renewable energy penetration level, and how difficult is it to solve such problems?

Question 2.4- The intermittent nature of renewable energy sources brings significant effect on power distribution networks. The prediction technology for the intermittency of renewable energy sources can enhance the performance of the distribution network operation. Do you have any projects to increase the accuracy of the prediction methods for the power output of renewable energy sources? How do you use such prediction methods in the distribution network operation?

Question 2.5- The curtailment of power generation, voltage and reactive power control are used as the countermeasures to manage the power distribution network with a large penetration of renewable energy sources. Are there any other countermeasures you have ever evaluated such as reconfiguration of the distribution network sections with sectionalizing switches or so on?

2.2 Sub Topic 2 - Energy Storage and electric vehicles

There is a wide interest all over the world in applying Low Carbon Technology (LTC) such as integration of renewable energy sources (RES) and electric vehicles (EV) to the distribution networks. The increasing share of LCT may lead to some challenges like how to manage a rapid change in loads and how to sustain the power quality. In these papers, the emphasis is to increase LTC applications to distribution networks, while keeping the voltage within limits.

Paper C6-201 (Argentina, academia) proposes a methodology to solve the short-term economic dispatch (ED) problem of a smart distribution grid (SDG). The advantages of ED are evaluated with regard to the following items, Case1) Plug-in electric vehicles (PEVs) can only charge their batteries without control by aggregators and there are no PVs, Case2) The same as Case 1 plus considering PVs, Case3) PEVs can charge and supply energy, and the SDG integrates PVs and aggregators. As a result, Case3 considering peak demand has advantages in ED, and it is also shown that the development of charge-discharge system for PEVs based on energy price parameter is effective.

Paper C6-205 (Germany, industry) describes the lighthouse project "Well2Wheel(W2W)" which is located in the supply area of the energy supply company (ESCO), HSE, Darmstadt in Germany. The project is based on the existing ICT infrastructure and the virtual power plant (VPP) established within the "Web2Energy" project. The main targets of the W2W consist of gaining experiences regarding the establishment and operation of advanced electric vehicle management (EVM) systems in practice and of investigating the user (drivers) responses on recommendations regarding the dispersion of charging periods. The first hand results of the W2W project demonstrate that the integration of the EVs in the distribution network and the consumption of regional renewable energy beyond the border of energy supply are possible.

Paper C6-209 (Italy, utility) describes the possible uses of Energy Storage System (ESS) on MV and LV distribution networks in Italy. The large increase of Distributed Generation (DG) connected to the Italian distribution network is rapidly changing the load profile curve and dropping the power quality. The ESS is expected to improve the power or voltage quality management and to provide new system services, supporting DSO to improve voltage quality. In 2014, ENEL Distribuzuione is carrying out pilot installations of ESS at primary substations in order to assess the ESS contribution to increase the network utilization factor by means of various functionalities such as peak shaving/time shifting, power balancing, power quality, voltage regulations, etc. The initial results from the field tests of the ESS connected to LV lines are shown to be quite encouraging in reducing the number voltage violations.

Paper C6-210 (Italy, utility) describes a distribution smart-grid demonstration project in Forli-Cesena, Italy. The project involves two primary substations, more than 100 MV/LV substations and at least five MV distributed generation facilities. The main objective is the realization of an advanced control system allowing to increase the Medium Voltage network hosting capacity of Renewable Energy Sources, thus maximizing RES integration. This paper focuses on the control algorithm mathematical models and logics and the validation of the control system.

Paper C6-212 (United Kingdom, academia) presents a framework for probabilistic LV network analysis that has been developed as a planning tool to address the challenges of increased Low Carbon Technology (LCT) load penetration on LV networks. A case study of a real UK network with 50% EV penetration is presented to demonstrate the application of the framework. Results indicate that potential for network limit violations is concentrated during traditional peak hours.

Paper C6-218 (Korea, industry) describes a demonstration project about the applications of Battery Energy Storage System (BESS) for energy time-shift at industrial building in Yongin-Si, Korea. In this project, 1MW/1MWh BESS has been developed based on Lithium Ion Battery technologies, and has been commissioned in 2012. The first demonstration results of BESS for electric energy time-shift application have been successfully completed. The effective operational strategies of BESS with the help of Energy Management System (EMS) can enhance the customer's peak load management and the electricity rate savings effect.

Question 2.6- Paper C6-218 describes the demonstration results of long term saving cost of BESS, which is used for time shift of electric energy. It seems that it is difficult to obtain the return of investment considering the current cost of BESS. What are its basic causes and what are their possible solutions (legislative & technical) to allow for this approach to become more effective?

Question 2.7- A large number of EVs are expected to spread rapidly worldwide. What are the most viable algorithms for EV charging/discharging in order to keep distribution network within its operational limits?

Question 2.8- What are ideal forms of business model to maintain a stable distribution network when a large number of EVs are deployed? Is it necessary to create a societal structure among EV owners, aggregators, and distribution network operators? What should be the relation between them?

3.3 Sub Topic 3 – System interconnection requirements and radio communication for protection

The standardization of system interconnection requirements is very important for active distribution networks with a large share of DGs. Another key issue is the communication between different smart devices and its utilization in operation and control.

Paper C6-203 (Brazil, Utility) describes the guidelines adopted by many Brazilian distribution utilities for connecting distribution generation (DG) to the HV and MV electrical networks. As a result of this study, the guidelines emerged for DG connection and all other related reviews are public and are available on utilities web pages. The main issues and related reviews/findings relating to DG connection have been discussed in detail by categorizing into (1) Connection forms of DG, (2) Access and control Criteria, and (3) Protection systems.

Paper C6-214 (USA, Laboratory) reports the communications based solutions to address the challenges of integrating DERs at the distribution level. It discusses the several teleprotection schemes that use communication to improve protection and anti-islanding performance of a distribution network with DER penetration. Conventional communications channels are usually cost-prohibitive for applications at the distribution level. However, new technologies for wireless communication have become available recently. The wireless technologies provide economical communications options for DER applications.

Question 2.9- At present, it looks that the different procedures are practiced in the setting of the power system protection relays by utilities in Brazil. What are the steps implemented in order to streamline the anomalies in procedures and practices in your country? To standardize system interconnection requirements, how should we think about the relationship between the international standards such as IEEE and the local standards in each country?

Question 2.10- What are the legislative/technical barriers for wide spread acceptance in applying radio communication to tele-protection schemes to the distributed networks with a large penetration of DER?

3. Preferential Subject 3. (New roles and services of distribution systems for transmission system operation)

The theme for Preferential Subject 3 is “new roles and services of distribution systems for transmission system operation”

The areas dealt with are:

- Provisioning of ancillary services from DG and RES
- Reactive power regulation between TSO and DSO
- Data exchanges between TSO and DSO to operate the “active grid”

The papers submitted

Although preferential Subject 3 includes only 2 papers, the quality of the items addressed is very high and the aspects covered are very relevant to the activities of TSOs and DSOs.
Due to the number of the papers, one from France and the other from Germany, the subtopic addressed is:

- Subtopic 1 – Ancillary services of distribution systems for transmission system operation (Papers C6-301, and C6-302)

Subtopic 1 – Ancillary services of distribution systems for transmission system operation (Papers C6-301, and C6-302)

Paper C6.301 (France) deals with the proceedings of an European Project called NICE GRID aimed at testing on field the concept of a smart grid with several interactions between TSO and DSO. The project is located in France in the Nice region.
The main tasks addressed are:

- Power demand reduction and load shifting;
- Management of massive DG and PV generation;
- Islanded mode operation.

The paper focuses on the first task and in particular the management of coordinated power demand or generation reduction, requested by the TSO. The demand/generation reduction is performed in a market scheme (local transaction place) for testing the possibility to establish a market for the ancillary services to the TSO network provided by several actors at DSO level.
In the proposed market scheme, a central role is palyed by the “Aggregator”. This figure acts as service provider in order to match TSO requests and DSO constraints in a competitive scenario. Nonetheless the DSO acts a key role to manage the network and solve local grid constraints making possible the effective provision on “services” from the MV and LV

network to the TSO grid. The paper is really up-to-date and points out a possible way to tackle with a very discussed issue in electric networks with a widespread diffusion of DG.

Paper C6.302 (Germany) is focused on the reactive power provisioning between TSO and DSO assuming a high penetration of renewable sources at DSO level, in HV (110 kV). In this scenario, introducing DSO reactive power flexibility as a system service may be useful to help TSOs in providing the required reactive power resources. The paper focuses on a proposed scheme to indicate how the DSO can use reactive distributed renewable resources to provide services to the TSO in a reverse power flow condition. As a result, network hosting capacity could be enhanced and also economic operation could be competitive when compared to traditional methods, as for example Static Var Compensators. In the solution envisaged, the implementation scheme could be: direct access from TSO to relevant HV DER; measurement of key network parameters in "reactive zones" and optimize power flows calculations to send set points to DER units by mean of DSO or using tap changers of HV/MV transformers.

Question 3.1 – DSO and TSO may have different goals and objectives in providing ancillary services. How to match these targets? In your opinion is this mainly a market model or a technical rule?

Question 3.2 – What is the optimal way to deal with flexibility services from grid users (consumers, DER, storage) in order to operate the system in the most secure and economical way?