

CIGRE Paris Session 2024

Technical Programme

See the list of Accepted Paper based on synopses AND Full Papers final review.

Authors have been duly notified about acceptance or non-acceptance.

The selection process is now over.

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A1 - POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION

PS1 - ROTATING ELECTRICAL MACHINES AND THE ENERGY TRANSITION

ID: 10306

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS1 - Rotating Electrical Machines and the Energy Transition

Keywords: Nuclear turbogenerators, Grid, PV production, Power capability, technical features

The benefits of nuclear turbogenerators for grids of the future

Herve BIELLMANN, Florent CHARVET, Jacques MARCHAND, Martin TOULEMONDE, Vincent DUBS, Baptiste GUIDOUX, Vincent FERNAGUT, Thierry VINAS

EDF, France

ID: 10692

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS1 - Rotating Electrical Machines and the Energy Transition

Keywords: International Standard; Hydro-Generators; Motor-Generators; IEC 60034-33; Pumped storage

Insights to the new IEC 60034-33 – The Standard for Hydro-Generators and Motor-Generators for Pumped Storage

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ID: 10904

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS1 - Rotating Electrical Machines and the Energy Transition

Moneypoint Synchronous Condenser and Flywheel - A Zero Carbon Solution to Increasing Renewables and Improving Resilience on the Irish Electricity Grid

Katie WALL, Ruairí COSTELLO

Electricity Supply Board (Ireland)

ID: 11031

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS1 - Rotating Electrical Machines and the Energy Transition

Practical Experience with the Thermal Evaluation and Classification of Type II Machine Insulation Systems according to IEC 60034-18-31

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ID: 11065

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS1 - Rotating Electrical Machines and the Energy Transition

Incorporating Fibre Optic Arc Flash Detection into a Conventional Generator Protection Scheme

James DASH, Len GUNN

Origin Energy, Australia

ID: 11102

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS1 - Rotating Electrical Machines and the Energy Transition

Synchronous Condenser to Ensure Stable, Reliable And Quality Power in Renewable Energy Rich Regions – India Perspective

D.K. CHATURVEDI

NTPC

ID: 11271

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS1 - Rotating Electrical Machines and the Energy Transition

Challenges in Core Flux test of Large Hydro Generators with natural frequency near to Power Frequency

Vipin GUPTA, Ashwatthama TIWARY*, Randhir KUMAR*, Sanjeeb BAG

NHPC Limited, India

ID: 11394

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS1 - Rotating Electrical Machines and the Energy Transition

Design individualization of an air-cooled synchronous condenser with directly water-cooled stator winding due to varying market requirements for grid stabilization services

Monja EVENKAMP, Hendrik STEINS, Uwe EICKELBECK, Moritz ACKERMANN

Siemens Energy Global GmbH & Co. KG, Germany

ID: 11744

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS1 - Rotating Electrical Machines and the Energy Transition

Measurement and Practical Applications of Magnetic Flux Sensors by Radial and Tangential Axis in Synchronous Generator-Motors

Oleg AGAMALOV

Tashlyk Pump-Storage Power Plant (TPSPP)

PS2 - EVOLUTION AND DEVELOPMENT

ID: 10123

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS2 - Evolution and Development

Keywords: Rotating diode rectifier, machine, diode failure, frequency, digital signal processor

Rotating diode rectifier, machine, diode failure, frequency, digital signal processor

Marc FLORES, Luc TEMPLIER, Léo PERDRIEL

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ID: 10542

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS2 - Evolution and Development

Damping local and inter-area oscillations with synchronous compensators: a fundamental study

Luis ROUCO, Jorge SUÁREZ, Fidel FERNÁNDEZ-BERNAL, Lukas SIGRIST

ETS ICAI-IIT Universidad Pontificia Comillas, Spain

ID: 10693

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS2 - Evolution and Development

Keywords: Salient pole synchronous machine - Synchronous condenser - Synchronous condenser nameplate - Reactive power management - Capability chart - Power diagram

On the Design of Salient Pole Synchronous Machine to Operate Strictly as Synchronous Condensers

Jorge Johnny ROCHA ECHEVERRIA, Mauro UEMORI

Brazilian NC of CIGRE, Brazil; Trassínio Consultoria Ltda.

ID: 10864

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS2 - Evolution and Development

Keywords: Doubly-Fed Asynchronous Machine, Load Commutated-Cyclo-converter, Low Voltage Ride Through

Retrofit to 2 x 303MW Doubly-Fed Asynchronous Machine (DFAM) System at Oku-Tataragi Pumped Hydro Power Plant of Kansai Electric Power Co.

Akira BANDO¹, Toshinari FUJII², Shinji ONO², Osamu NAGURA¹, Masayuki OKADA¹, Tomohiro YANO³

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ID: 11020

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS2 - Evolution and Development

Development and design of an air-cooled 944.5 MVA hydro-generator

Thomas HILDINGER, Gunar KLAUS, Babette SCHWARZ, Georges MORONIS, Stefan ALLGEYER

Voith Hydro, Germany

ID: 11022

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS2 - Evolution and Development

Qualification of a HV-Insulation System according IEC 60034-18-42 for a Hydro-generator Operating with Inverter Technology

Thomas HILDINGER¹, Christian STAUBACH²

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ID: 11171

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS2 - Evolution and Development

Design Aspects of Synchronous Condensers

Gerfried MAIER, Serdar KADAM

Andritz Hydro

ID: 11362

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS2 - Evolution and Development

Development of Engine Mounted Generators for Eco-Friendly Onboard Power Generation in Marine Applications

Sándor Rajmund HORVÁTH

HD Hyundai Electric Hungary Ltd.

PS3 - KEEPING THE LIGHTS ON

ID: 10125

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS3 - Keeping the Lights on

Keywords: HV motors, detection device, fatigue breaking mechanism, coil connections

Fatigue breaking mechanism study at the coils connections of a stator winding and at the magnetic core fasteners

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ID: 10350

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS3 - Keeping the Lights on

Use of Non-Destructive Tests (NDT) for synchronous condensers flywheel inspection

Gianluigi GEMELLI¹, Alessandro DEL GRACCO¹, Mauro GAMBASSI¹, Roberto SPEZIE¹, Andrea VALANT¹, Enrico VELLUCCI¹, Giuseppe NARDONI², Pietro NARDONI², Marco FEROLDI²

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ID: 10658

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS3 - Keeping the Lights on

Detection of Generator Earth-brush Fault Types from Shaft Voltage and Currents Measurements to monitor the performance of Earthing Brushes

Oupa MAILULA

Eskom Research, Testing & Development

ID: 10700

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS3 - Keeping the Lights on

Keywords: Deep Learning; Vibration; Wind Turbines; Rolling Bearings; Predictive Maintenance

Deep learning applied to bearing anomaly detection using advanced signal processing techniques

Marcos NISHIOKA, Gustavo G. de SOUZA, Tiago MATSUO, Emerson LIMA DO NASCIMENTO, Vitor POHLENZ

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ID: 10701

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS3 - Keeping the Lights on

Keywords: Corona Effect; Corona Discharges; Corona glove; Partial Discharges; Relief Interface

Reconfiguration of the Corona Prevention System and Application to a Practical Case

Paulo VILHENA¹, Renan DUARTE¹, Fernando BRASIL¹, Jorge Johnny ROCHA ECHEVERRIA², Mauro UEMORI²

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ID: 10702

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS3 - Keeping the Lights on

Keywords: Synchronous Compensator, Short Circuit, Stator, Maintenance

The painful (and expensive) experience of having to remedy an avoidable stator failure

Rafael FERREIRA, André GARGHETTI

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ID: 10865

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS3 - Keeping the Lights on

Keywords: Hydro generator, Non-contact sensor, Condition monitoring and diagnosis, Partial discharge

Application of Non-contact On-line Partial Discharge Monitoring System to Hydro Generator

Tomoaki TAKAHASHI, Makoto TAKANEZAWA, Takashi HAKAWA, Akira FUJIMOTO, Hirotaka TSUBAKIHARA, Hideyuki NAKAMURA

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ID: 11047

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS3 - Keeping the Lights on

Keywords: EL CID, low flux core test, electromagnetic core test, high flux core test, high frequency, hot spot, interlaminar insulation, core fault, stator core

Low Flux Core Testing of Rotating Electrical Machines at Elevated Excitation Frequencies

Nick STRANGES¹, Mladen SASIC¹, David R BERTENSHAW²

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ID: 11661

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS3 - Keeping the Lights on

Keywords: diagnostics, hydrogenerator, stator to rotor eccentricity, vibration and air-gap measurements

Mechanical Diagnostic Campaign of a 415 MW Vertical Francis Hydro-Unit

Ozren ORESKOVIC¹, Ozren HUZNJAK¹, Damijan CERINSKI², Andrija KOSTELAC³, Lucas Eduardo GUNE⁴

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ID: 11712

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS3 - Keeping the Lights on

Evaluation and Assessment of Operational Data for Condition Based Service Interventions on Synchronous Machines

Sven MUSIELAK, Hendrik STEINS, Jan HOFFMANN, Moritz ACKERMANN

Siemens Energy Global, Germany

ID: 11813

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS3 - Keeping the Lights on

Keywords: Burn-out test, Generator stator, Ground fault generator, Locate phase-to-ground fault

Locate Generator Stator Phase-to-ground Fault Point by Burn-out Test

Aticha WONGKHAMLA, Passapong PORNPACHARAPUN, Yodsanon WITITTHUMAKUN, Apichart PALATORNPAPIRUK

Electricity Generating Authority of Thailand (EGAT), Thailand

ID: 11853

A1 POWER GENERATION AND ELECTROMECHANICAL ENERGY CONVERSION - Full Papers

Topics: A1 PS3 - Keeping the Lights on

Keywords: Wind Turbine Maintenance; Automated Diagnostics; Pitch Imbalance; Vibration Analysis

Case Study: How Pitch Imbalance May Affect Vibration and Performance in a Wind Turbine

Marcos H. N. NISHIOKA, Emerson L. do NASCIMENTO, Vitor POHLENZ, Tiago K. MATSUO

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A2 - POWER TRANSFORMERS AND REACTORS

PS1 - DESIGN OF RESILIENT TRANSFORMERS

ID: 10122

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Power Transformers, Dielectric Test, Front of Wave Impulse Test, RSO Test, Impulse Voltage Distribution

Impact of Front of Wave Impulse Testing on Dielectric Design of Transformer

Dharam VIR, Pradeep RAMASWAMY, Tim ROCQUE, Ajith VARGHESE

Prolec-GE Waukesha, United States of America

ID: 10148

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Comparison of Structural Strength of UHV AC Transformers with Different Outgoing Modes under Arc Fault in Oil

Yikun ZHAO¹, Ke WANG¹, Jinzhong LI², Shuqi ZHANG¹, Jiaxi LI¹

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ID: 10149

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Research on the Static Stress Distribution of Winding Transposition Structure under External Short-circuit Fault

Yi ZHAO¹, Tao WEN¹, Weijiang CHEN², Guangjin ZHANG³, Ke WANG⁴, Jinzhong LI²

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ID: 10150

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Transformer Winding Deformation Monitoring Technology Based on Distributed Fiber Optic

Peng LI, Zhengyu XU, Zuoxian WANG, Shuqi ZHANG, Huanchao CHENG

CEPRI, China

ID: 10157

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Research on Analysis for Fire and Explosion Prevention Capability of Large Transformers and its Improvement Measures

Jun DENG, Zhicheng XIE, Zhicheng PAN, Haibin ZHOU

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ID: 10256

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Insulating liquid, requirements, dielectric properties, ageing stability, LCA

Insulating liquid requirements for power transformers

Christophe PERRIER, Marielle MARUGAN, Sébastien LOUISE, Juliette SULPICE

GE Grid Solutions, France

ID: 10259

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Powers transformers, floating offshore, applications, technology, potential failure

Stresses on Power Transformers in Floating Offshore Applications

Triomphant NGNEGUEU¹, Max GILLET¹, Vivekkumar CHAUBEY², Rupesh DARIPA², Oguzkan SENTURK³, Tobias STIRL⁴, Jian ZHANG⁵, Hongbiao SONG⁶

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ID: 10351

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Natural Ester in Arc-Furnace Transformers for Steel Production

Fabio SCATIGGIO¹, Rainer FROTSCHER², Cristian CHITTARO³, Fabrizio FERRARI⁴, Giorgio CAMPI⁵, Daniele GIRO³, Luca LOMBINI⁴

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ID: 10402

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Dissolved Gas Analysis, Data Analytics, Power Transformer, Asset Management, Trend Detection, Rate of Change, Anomaly Detection.

Thermal and Electrical Designs of Transformers by Considering Different Insulating Liquids

Qiang LIU¹, Sicheng ZHAO¹, Haichuan YU¹, Zhongdong WANG¹, Mark WILKINSON², Massimo NEGRO³, Christoph KRAUSE³, Andree HILKER⁴, Ed Van SCHAIK⁵, Muhammad DAGHRAH⁶, Attila GYORE⁶

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ID: 10489

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Challenges regarding Factory acceptance Test of large offshore Shunt Reactors

Daniel WIKBERG

Hitachi Energy Sweden AB, Sweden

ID: 10517

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Geomagnetic Induced Currents (GIC) - Geomagnetic Disturbance (GMD) - Harmonics- Reactive Power - Temperature - Sound - Transformer

GIC Field Test on 500 kV Single-Phase Transformers

Bart SIMONS¹, Luc DORPMANNS¹, Roland BRANDIS², Adedasola A. ADEMOLA², Andy SCHUETZINGER², Robert ORNDORFF², Marlu DEVERICK², Francisco VELEZ-CEDENO², Katelynn VANCE², Micah J. TILL², Mike LAMB², Matthew GARDNER², Emanuel BERNABEU³

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ID: 10543

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Dynamic model analysis of shell power transformers under short circuit vibration and the influence in the tank design

Miguel AGUIRRE¹, Daniel GARCÍA-VALLEJO², Jesús VÁZQUEZ², Carlos NAVARRO², Jaime DOMÍNGUEZ-ABASCAL²

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ID: 10545

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Design of transformers suitable for different insulating liquids

Andres AGUADO, Izaskun ARICETA, Diego LUMBRERAS, Miguel MARTINEZ

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ID: 10546

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Life Extension, Sustainability, Transformer

Transformer Sustainable Refurbishment for Ultra Long-Life

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ID: 10611

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: High Temperature Insulation System, Nomex®, Aramid Paper, Aramid Board, Ester Liquid, Plug & Play Transformer, Grid Resilience, Mobile Transformer, Rapid Response, Interchangeability, Reconnectable Transformer, Overload Capability

Resilient Transformers – holistic Approach considering Aspects in Operation, Maintenance and Design

Radoslaw SZEWCZYK¹, Jean-Claude DUART², Anastasia O'MALLEY³, Robert MAYER⁴, Ewald SCHWEIGER⁵

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ID: 10659

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Optimized design methodology of a resilient power transformer

Mphumuzi KHOZA

ACTOM HIGH VOLTAGE EQUIPMENT

ID: 10660

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Multidisciplinary approach to achieving resilient transformers – an end user perspective

Sidwell MTETWA

Eskom Holdings SOC Limited

ID: 10712

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Distribution Transformer, Short Circuit, Dynamic Short Circuit, Impedance, Windings

Swiss Experience in IEC Short Circuit Testing of Distribution Transformers

Marcel STOECKLI¹, Bruno BOSNJAK^{*2}, Rolf FLURI³, Davide BOTTA²

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ID: 10714

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: resilient transformer, overload capability, compactness, weight reduction, ONAN cooling, ester liquid, thermally upgraded paper and pressboard, aramid paper and pressboard, advanced insulation system

Design evaluations with advanced insulation systems for resilient transformers

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ID: 10733

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

GIC Test with Mock-up Transformer for Verification of Temperature Rise Calculation

Heesung YOON, Myung Gong SOHN, Tae Sung PARK, Cheul Hyeok CHANG, Woo Heng HEO

Hyosung Heavy Industries, Korea, Republic of (South Korea)

ID: 10784

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Power Transformer Protection against Geomagnetic Induced Currents: Thyristor Neutral Earthing

Aleksandr KHRENNIKOV¹, Alexey KUVSHINOV², Vera VAKHNINA²

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Identification of Switching Operations Leading to Harmful Fast Transient Overvoltages in Power Transformers Windings

Vasily LARIN¹, Anton ZHUYKOV², Daniil MATVEEV³, Mikhail FROLOV³, Andrey SELIKHANOVICH⁴, Alexander SMIRNOV⁵

¹VEI – branch of RFNC-VNIITF, Russian Federation; ²FACTS Plus, LLC, Russian Federation; ³National Research University «MPEI», Russian Federation; ⁴BO-Energ, LLC, Russian Federation; ⁵SMTT High-Voltage Solutions, LLC, Russian Federation

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Transformer, Arc, Tank, Pressure, Rupture, Finite-element, Specification

Specifications for a Calculation Procedure to Achieve an Adequate Arc-Resistant Design for Power Transformers and Reactors

Jean-Bernard DASTOUS

Hydro-Québec, Canada

ID: 10886

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Geomagnetic Induced Currents (GIC), Site testing, Windings, Structural parts, temperatures

On-site GIC withstand experiment on a 1000 MVA 3-limb autotransformer and a 300 MVA 5-limb transformer Part 1: Design, Modelling, Instrumentation, DAQ and Testing

Roald KLEIVI¹, Dietrich BONMANN², Claes CARRANDER³, Geir Morten BJØRKVIK¹, Dejan SUSA¹

¹Statnett; ²Hitachi Energy Germany; ³Hitachi Energy Sweden

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Transformers, Resilient, Power, Systems

Flexible Transformers for Resilient and Adaptable Power Systems

Enrique BETANCOURT-RAMIREZ¹, Juan Gonzalo CASTELLANOS-GONZALEZ¹, Omar MENDEZ-ZAMORA¹, Ibrahima NDIAYE²

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Topics: A2 PS1 - Design of Resilient Transformers

On-site GIC withstand experiment on a 1000 MVA autotransformer and a 300 MVA 5-limb transformer Part 2: Measurements and Evaluation

Dietrich BONMANN¹, Roald KLEIVI², Claes CARRANDER³

¹Hitachi Energy Germany AG, Germany; ²Statnett Norway; ³Hitachi Energy Germany AG, SVEDEN

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Synthetic ester, transformers, in-service assessment, DGA, 2-FAL

Summary of In-Service Assessment of Synthetic Ester Filled Transformers

Muhammad DAGHRAH¹, Rafat AL JARRAH², Ayham BAKHEER³

¹M&I Materials Ltd UK; ²Princess Sumaya University for Technology Jordan; ³Jordan Electric Power Company Ltd Jordan

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Design of rupture-proof transformers equipped with on-load tap-changer in the event of internal arc failures

Moritz BENGLER¹, Michael STEPLINGER¹, Marc FOATA¹, Sebastian REHKOPF¹, Ewald TASCHLER², Martin STOESSL², Monther SARI²

¹Maschinenfabrik Reinhausen GmbH; ²Siemens Energy Austria GmbH

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Earthquake, Seismic design, Transformer, Diagnosis, Coil slide

Seismic strengthening of large-capacity transformers and methods of diagnosis in the event of a huge earthquake

Atsushi ETO, Keisuke YOKOHATA, Yuki ISHIKAWA

TEPCO Power Grid, Inc., Japan

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Short Circuit Tested Power Transformer FAT Healthiness check

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Indian Experience of Reactive Power Compensation at 220kV Grid using Variable Shunt Reactor (VSR) for Voltage Stability

Ayyaj MANER*, Manali SARVANKAR*, Raiju HASSAN, Vini VAZHAPPULLY, Sonu KAREKAR, Mahesh AMBARDEKAR
Adani Electricity, India

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Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Extreme weather, Hydro power, Optical fibre, Specification, Transformer

EDF specifications for hydro power transformers

Olivier VACHERON¹, Mohamed RYADI², Dominique SOURIE¹, Jean SANCHEZ³

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: High-frequency model, Non-standard impulse waveforms, Power transformer, Overvoltages, White-box model

Calculation of Internal Transformer Overvoltages for Non-Standard Impulse Waveforms

Zvonimir JURKOVIC¹, Bruno JURISIC¹, Mladen MARKOVIC², Tomislav ZUPAN¹

¹Končar – Electrical Engineering Institute Ltd, Zagreb, Croatia; ²Končar – Distribution and Special Transformers Inc. Zagreb, Croatia

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Topics: A2 PS1 - Design of Resilient Transformers

Calculation and visualization of forces on leads during short circuit of a large offshore power transformer with axially split dual MV windings

Igor TELALOVIĆ

Končar Power Transformers Ltd. – A Joint Venture of Siemens Energy and Končar Croatia

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Topics: A2 PS1 - Design of Resilient Transformers

DC Injection Testing on In-Service Power Transformers for Replicating GIC

Soren SUBRITZKY¹, Andrew LAPHORN¹, Stewart HARDIE¹, Michael DALZELL²

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: Phase shifting transformers, ATP-EMTP modelling, Saturation, Overexcitation, Overfluxing

Modelling of Dual-Core Phase Shifting Transformer in ATP-EMTP environment

Gabriele TRESSO, Luca BUONO, Pierluigi VACANTE, Lorenzo PAPI, Gaia LEONE, Franco DI BONA, Daniele DIFINO, Francesco PALONE

Terna S.p.A. Italy

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS1 - Design of Resilient Transformers

Keywords: HVDC, Ageing, Converter transformer, DC conductivity, Degree of polymerization, Electric field distortion, Oil-paper insulation, Polarization/Depolarization Current, Pulsed Electro-Acoustic

Impact of Cellulose Degradation on Space Charge Dynamics and Conductivity of Synthetic Ester Liquid-Impregnated Kraft Paper Insulation

Abdelrahman ALSHEHAWY

University of Exeter, United Kingdom

PS2 - ADVANCES IN TRANSFORMER ANALYTICS

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Powers transformers, maintenance, critical outage, technical policies, strategy

RTE's Large Power Transformers: new fleet management strategy

Abasse TIMERA¹, Rudy BLANC¹, Benoît IZAC², Philippe CLAUDE³

¹RTE France Substation Expertise Dpt., France; ²RTE France Asset Management Dpt., France; ³RTE France R&D Dpt., France

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Vibration Characteristics and Typical Mechanical Failure Analysis of Converter Transformer

Zhicheng PAN, Jun DENG, Zhicheng XIE, Haibin ZHOU

China Southern Power Grid, Co., Ltd. , China

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Degree of Polymerization, Dielectric Frequency Response, Insulation Transformers, Mineral Oil, Moisture

Analysis of Non-accelerated Thermal Aging of Model Windings Immersed in Mineral Oil and Natural Ester

Diego ROBALINO¹, Matias MEIRA², Raul ALVAREZ³, Fabio SCATIGGIO⁴

¹MEGGER, United States of America; ²INTELYMEC (UNCPBA), Argentina; ³IITREE-FI-UNLP, Argentina; ⁴A&A Fratelli Parodi SpA, Italy

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Transformer Aging, Life Assessment, Digital Twin, Numerical Simulation

Power Transformer Digital Twin: Incorporating Thermodynamic and Water Diffusion Discrete Elements Model for Enhanced Aging Calculation

Alan SBRAVATI, Luiz V. CHEIM, Mauricio SOTO

Hitachi Energy, United States of America

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Dissolved Gas Analysis, Data Analytics, Power Transformer, Asset Management, Trend Detection, Rate of Change, Anomaly Detection.

Data Analytics for Transformer Dissolved Gas Analysis to Aid Asset Management

Zhongdong WANG¹, Thathsara HERATH¹, Qiang LIU¹, Gordon WILSON², Ruth HOOTON², David WALKER³, Timothy RAYMOND⁴, Luke van der ZEL⁴

¹The University of Manchester UK; ²National Grid Electricity Transmission UK; ³SP Energy Network UK; ⁴Electric Power Research Institute USA

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Statistical Model – Data Mining – Polychlorinated Biphenyls –Asset Management – Pole Mounted Transformers

Data Mining for Targeted PCBs Management of Pole Mounted Transformers

ShengJi TEE, David NEILSON, Matthew JONES, Malcolm BEBBINGTON

SP Energy Networks UK

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Power Transformer, CFD, Windings, Natural Ester

Analysis of Simplifications and Accuracy of a Thermal-hydraulic Model of Core-type Power Transformer Winding

Sandra COUTO, João SILVA, Beatriz OLIVEIRA, Catarina SOUSA, Ricardo CASTRO LOPES

Power Transformers R&D, Efacec Energia S.A., Portugal

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Hot-Spot Temperature, Hot-Spot Location, HST, Natural Ester

Evaluation of the Hot-Spots' Location during Dynamic Loading of a Natural Ester Cooled Power Transformer

Beatriz OLIVEIRA, Catarina CORTE-REAL, João SILVA, Sandra COUTO, Ricardo CASTRO LOPES

EFACEC Energia, S.A., Portugal

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Topics: A2 PS2 - Advances in Transformer Analytics

Artificial Intelligence in Transformer Manufacturing

Robin AXELSSON

Hitachi Energy Sweden AB, Sweden

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: online bushing monitoring, network unbalance, measuring uncertainty of isolation coefficients, cyber security

Application of Online Bushing Monitoring With Low Measurement Uncertainty

Marek ANDRZEJEWSKI¹, Wiesław GIL¹, Maciej LECHMAN², Wiktor MASŁOWSKI¹, Piotr RYTKA²

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Topics: A2 PS2 - Advances in Transformer Analytics

The evolution of power transformer appraisal methodology towards an effective and efficient risk assessment for the South African power utility

Sidwell MTETWA

Eskom Holdings SOC Limited

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Topics: A2 PS2 - Advances in Transformer Analytics

The usefulness of capacitive moisture sensors in online gas analysers

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Topics: A2 PS2 - Advances in Transformer Analytics

Non-uniform winding Temperature Distribution in directed cooling Mode

Tor LANERYD

Hitachi Energy Sweden AB, Sweden

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Power Transformer, Renewables, Thermo-Chemical Evaluation, Aging, Dynamic rating

Dynamic Loading of Transformers in Renewable Energy Generation: A Comparison of Traditional Methods and a Novel Thermo-Chemical Evaluation of Transformers Ageing

Wilson CALIL, Alan SBRAVATI, Luiz V. CHEIM

Brazilian NC of CIGRE, Brazil; HITACHI ENERGY

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Transformers, Thermal hydraulic network model, Dynamic thermal modelling

Advancements in Dynamic Thermal Modelling of Power Transformers: Integrating Detailed Thermal Hydraulic Network Models

Patrick PICHER¹, Federico TORRIANO¹, Zoran RADAKOVIC², Marko NOVKOVIC²

¹Hydro-Québec, Canada; ²University of Belgrade, Serbia

ID: 10842

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Thermal modeling of power transformer, inverse problem, Physics-Informed Neural Networks, indirect validation of predictive models

Thermal Modeling of Power Transformer and Shunt Reactor Using Physics-Informed Neural Networks

Jhelum CHAKRAVORTY¹, Michele LUVISOTTO², Nicolo RIPAMONTI³, Tor LANERYD², Annamalai LAKSHMANAN³

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Condition assessment, Diagnosis, DFR, FDS, Bushings

Detecting degraded bushings with DFR – A case study

Lars Andreas ERIKSSON¹, Evgenii ERMAKOV², Lars JONSSON², Erik NICOLAISEN³

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Clamping pressure; condition monitoring; power transformer; short circuit performance

Monitoring Clamping Pressure in 40 MVA Power Transformer: A Study of Short and Long-Term Trends

Inge MADSHAVEN¹, Henrik ENOKSEN¹, Stefan JAUFER², Christoph KRAUSE², Borut PRASNIKAR³, Asgeir MJELVE⁴, Alexander REITBAUER⁵, Mohamed RYADI⁶

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: transformer, cooling, thermal model, benchmarking, metrics, accuracy

Improvement and Validation of IEC dynamic Transformer thermal Model

Tim GRADNIK¹, Xiang ZHANG², Irina LUPANDINA³, Remi DESQUIENS⁴, Alvaro PORTILLO⁵, Federico PORTILLO⁶, Patrick PICHER⁷

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: DGA, Transformer Failures, Condition Monitoring, Data Analytics, Diagnostics

The Good and Bad about Online Transformer DGA Monitoring

Varun GOYAL

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Transformation, Solid-Insulation

Digital Transformation of Power-Transformer Solid-Insulation Drying Process

Gerardo TAMEZ-TORRES, Enrique BETANCOURT-RAMIREZ

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Partial Discharge (PD), PD Source Localization, PD Signal Propagation, Power Transformer, Ultra-high frequency (UHF) sensor

Modeling and Simulation to Analyze the Propagation of the Partial Discharge UHF Signals and Localization of Their Source in the Power Transformer

Djordje DUKANAC

Joint Stock Company "Elektromreza Srbije", Belgrade, Serbia

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Steady State and Dynamic Thermal Performance of Liquid-Filled Distribution Transformers

Ali AL-ABADI
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Topics: A2 PS2 - Advances in Transformer Analytics

Results of Long-Term Monitoring for the Proof of Stability in the Switching Process of On-Load Tap-Changers based on Vibroacoustic Measurements

Karsten VIERECK¹, Anatoli SAVELIEV¹, Julia MASSMANN², Johannes VEIT²

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Transformer, Partial Discharge, Defect Location, Ultra-High Frequency

Study on Estimation System of Partial Discharge Position in Oil/Gas Transformer

Byoung-Woon MIN, Danbi LEE, Jeong-Bok LEE, Kwang-Don BAE

HD Hyundai Electric, Korea, Republic of (South Korea)

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Topics: A2 PS2 - Advances in Transformer Analytics

Australian and New Zealand transformer reliability analytics within the context of the international failure surveys

Daniel MARTIN¹, Stefan TENBOHLEN², Zeenat HANIF², Chris BECKETT³

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Topics: A2 PS2 - Advances in Transformer Analytics

Advancing Electrical Fault Diagnosis in Power Transformers with AI

David ALVAREZ¹, Oswaldo ARENAS¹, Jhonatan ANAYA¹, Isabella ARANGO²

¹ISA Intercolombia; ²Universidad Nacional

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Voltage harmonics and dc detection on power transformers via vibration measurement analysis

Dennis ALBERT^{1,2}, Andre WÜRDE³, Christoph ENGELEN¹

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Topics: A2 PS2 - Advances in Transformer Analytics

Transformer Electromagnetic Modelling based on DC Hysteresis Measurements

Dennis ALBERT^{1,2}, Alexander FRÖHLICH¹, Sergey ZIRKA⁴, Johannes RAITH³

¹Graz University of Technology; ²OMICRON electronics; ³Siemens Energy; ⁴Dnipro National University Ukraine

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Topics: A2 PS2 - Advances in Transformer Analytics

A Reliable Future in Power Transformers and Reactors Through Proactive Bushing Management

Elkin CANTOR

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Shunt reactor, Deterioration, Aging, Criteria of Replacement

Detailed Study of Aging Shunt Reactors to Determine Suitable Maintenance and Replacement Strategies

Takashi YAMAMOTO, Ryo SAEKI, Atsushi ETO, Shunsuke TAMURA, Harukazu AKIYAMA, Yasuhiko HANAMAKI

TEPCO Power Grid, Inc., Japan

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Transformer Diagnostics, Continuous Monitoring, Active Parts Deformation, Load Condition, Acceleration Sensor, Magnetic Sensor

Power Transformer Diagnostics using Magnetic and Acceleration Sensors

Kohei YAMAGUCHI, Mizuki OGI, Satoshi ICHIMURA, Yusuke TAKENAKA, Kota DOI

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Dissolved-gas-analysis, Fault-detection, Machine-learning, Oil-immersed-transformer

Incipient fault detection method for oil-immersed transformer using time series data of dissolved gas analysis

Shunichi HATTORI, Kosuke MIKUNI, Hiroshi MURATA, Taisei HOMMA, Satoru MIYAZAKI, Yoshinobu MIZUTANI

Central Research Institute of Electric Power Industry, Japan

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Aging, Diagnosis, Degree of polymerization, Power transformer, Thermally upgraded paper

Diagnostic method for thermal deterioration of insulating paper used in power transformers based on winding temperature calculation

Satoru MIYAZAKI, Yoshinobu MIZUTANI

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Determination of Short-Circuit Reactance of Transformers from Sweep Frequency Response Analysis Measurements

Sreeram V*, Rajkumar M, Rajaramamohanarao CHENNU, T GURUDEV, S Sudhakara REDDY

Central Power Research Institute, India

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Development of AI-ML based Reliability Centred Maintenance Framework for Power Transformers and Reactors in Powergrid

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Powergrid, India

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Topics: A2 PS2 - Advances in Transformer Analytics

A novel approach in Development of Furan and Methanol-Based Accelerated Ageing Model for Power Transformers and Shunt Reactors

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POWERGRID, India

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

AI-Driven Intelligent Objective Analysis of SFRA Signatures for EHV Transformers and Reactors

Deo Nath JHA*, Maganti SIDDHARDHA, Akash TRIVEDI, Aakash KHANDELWAL, Keshav GUPTA

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Practical Implementation of Two-Dimensional Transformer Fleet Management Approach based on an example of a German Utility.

Alexei BABIZKI¹, Philipp BIRGMEIER¹, Martin GUTH¹, Rolf FUNK², Martin KNAPP²

¹Maschinenfabrik Reinhausen GmbH, Germany; ²Rheinische NETZGesellschaft mbH, Germany

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Shared digital twins as approach for the data-sovereign collaboration between TSO and 3rd Party in the condition assessment of a transformer fleet

Bastian FISCHER¹, Christian HOFMEISTER¹, Jochen JUNG², Michael GRATZA²

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Advancing Transformer Condition Assessment through Fuzzy Logic

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Cast resin transformer, FEM analysis, Load loss, Winding temperature rise

Characteristic Evaluation and Performance Analysis for Cast Resin Transformer of Large Capacity

Hongwoo JIN, Youngbae CHOI, Byungjun HWANG, Woonghee LEE, Jonggun LEE

HD Hyundai electric, Korea, Republic of (South Korea)

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Advances in Transformer Data Management and Analytics in Malaysian Grid Utility (TNB)'s Perspective

Gobi Kannan SUPRAMANIAM, So'adiah NANYAN, Roslina YASSIN

Tenaga Nasional Berhad, Malaysia

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Requirement for reliable transformer diagnostics using Frequency Response Analysis (FRA)

Evgenii ERMAKOV

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Predicting oil quality to support asset management decisions using Markov chains

Niklas SCHMIDT¹, Markus ZDRALLEK¹, Alexei BABIZKI², Karlheinz LINDL²

¹University of Wuppertal, Germany; ²Maschinenfabrik Reinhausen GmbH, Germany

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: EMTP simulations, field measurements, high frequency model, lightning location system, overvoltages, power transformer

Simulations and Measurements of Lightning Overvoltages Transferred Through Power Transformers

Bruno JURIC¹, Bozidar FILIPOVIC-GRIC², Tihomir JAKOVIC¹, Tomislav ZUPAN¹

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

A new method for health index calculation using power transformers as an example

Mahmoud MOH'D, Henning SCHNITTKER, Peter WERLE

University of Hannover, Germany

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Dielectric Condition Assessment Index of Power Transformer a Case Study at UIT-JBM Population

Fermi TRAFIANTO, Indra KURNIAWAN, Didik Fauzi DAKHLAN, Ika SUDARMAJA

PT. PLN (PERSERO), Indonesia

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Enhancing Power Transformer Transmission Reliability Evaluating and Strategizing Online Monitoring Implementation for Power Transformer in PLN

Harry GUMILANG, Rahmat BETA, Andhy Dharma SETYAWAN, Tejo WIHARDIYONO

PT.PLN (Persero), Indonesia

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Analysis of AC Transformer Reliability

Stefan TENBOHLEN², Dan MARTIN¹

¹Essential Energy; ²University of Stuttgart

ID: 11865

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS2 - Advances in Transformer Analytics

Keywords: Digital twins; Distribution transformers; Dynamic loading; Reliability

Estimating the Dynamic Rating of Distribution Transformers using Digital Twins

Saravanan BALAMURUGAN

Minaatral Power Systems Private Limited, India

PS3 - RELIABILITY OF TRANSFORMERS FOR RENEWABLE ENERGY

ID: 10117

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

Keywords: Electric vehicles (EVs), peak load shaving, voltage regulation, type of insulation system

1 How Charging Electric Vehicles Affects the Lifespan of Power Transformers : A Study from Aswan City

Mohamed ORABI¹, Al-Attar ALI¹, Omar ABDEL RAHIM², Mostafa ALI ELDAWY³

¹Faculty of Engineering, Aswan University; ²Egypt-Japan University of Science and Technology; ³Upper Egypt Electricity Distribution Company

ID: 10413

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

Keywords: Distribution Transformer, Dynamic Voltage Regulator, Condition Monitoring, Amorphous Magnetic Circuit, Distribution Grid Power Quality, Sustainability, Lifecycle Assessment, Predictive Maintenance, Digital Asset Management, Online Monitoring, IANOS

Transforming the Future: The Innovative Design of Distribution Transformers

Andrea SOTO¹, Luís Filipe AZEVEDO², Valter PIMENTA³, Ricardo CASTRO LOPES¹, Fernando XAVIER², Ricardo RIBEIRO³, Pedro Miguel SILVA¹, Simão ALMEIDA², Luís Almeno FERNANDES³

¹Power Transformers R&D, Efacec Energia S.A., Portugal; ²Smart Power R&D, Efacec Energia, S.A., Portugal; ³Service R&D, Efacec Energia, S.A., Portugal

ID: 10498

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

Keywords: ReCiPe, Circular Economy, Circularity, Life Cycle Assessment, LCA Software, Power Transformer

Comparative analysis of Life Cycle Assessment methodology for a power transformer manufacturer's transition to Circular Economy

Filipa FARIA¹, Beatriz TEIXEIRA², Viviana PINTO¹, Luís Almeno FERNANDES², Ricardo RIBEIRO²

¹INEGI, Portugal; ²Efacec Power Solutions, SGPS, S.A., Portugal

ID: 10544

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

Experimental analysis of transient overvoltage protections in distribution transformers

Víctor Manuel GARCÍA-CHOCANO, Antonio NOGUÉS

Hitachi Energy, Spain

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Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

Wind Farm Transformers. Relevance of FAT Tests for Safe and Reliable Operation

Raúl ALVAREZ¹, Leonardo CATALANO¹, Hernán MAYORA², Pablo MORCELLE¹, Tomas SCHMIDT¹

¹IITREE-FI-UNLP; ²FI-UNLP

ID: 10707

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

Keywords: Dry-type, Liquid-Cooled, Low-Carbon, Reduced Footprint, Renewable, Solar, Sustainability, Transformer, Wind

The sustainability benefits of liquid cooled dry-type transformers in renewable energy and vent-closed applications

Luiz OLIVEIRA, Müge ÖZERTEN, Ghazi KABLOUTI, Antonio NOGUÉS

Brazilian NC of CIGRE, Brazil; HITACHI

ID: 11063

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Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

Effects of Rooftop Photovoltaics on the Load Profile and Ageing of Distribution Transformers

Xin ZHONG¹, Chandima EKANAYAKE¹, Hui MA¹, Tapan SAHA¹, David FINK², Greg CALDWELL²

¹The University of Queensland; ²Energy Queensland Limited

ID: 11091

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

Development of multi-windings power transformer in frequency regulation system

Jaeyong PARK, Hyeon Gu JEONG, Seo Hyun LEE, Min Gyu KIM, Jae Seop RYU, Chae Yoon BAE, Jang Cheol SEO

LS ELECTRIC, Republic of Korea

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A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

Investigation of the transformer winding shield design parameters on electrical performance

Serenay CURUKOVA KALE¹, Oluş SONMEZ¹, Yunus Berat DEMIROL², Bora ALBOYACI³

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Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

Important Aspects of HV Dry Type Shunt Reactors in Comparison with Oil Immersed Shunt Reactors

Peter DOPPLMAIR¹, Naveen BHARDWAJ¹, Simon EL-KHOURY²

¹Trench Group; ²RTE

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Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

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Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

Integration of Photovoltaic considering Dynamic Transformer Rating in the Distribution Grid Planning Process

Moritz FRANZ¹, Martin BRAUN², Jan WIEMER², Denis MENDE¹

¹University of Kassel, Germany; ²Fraunhofer Institut für Energiewirtschaft und Energiesystemtechnik IEE & Universität Kassel, Germany

ID: 11713

A2 POWER TRANSFORMERS AND REACTORS - Full Papers

Topics: A2 PS3 - Reliability of Transformers for Renewable Energy

Enhancing Variable Shunt Reactors with a Power Electronic Fast-Switching Module

Ilya BURLAKIN¹, Sebastian REHKOPF², Elisabeth SCHEINER¹, Gert MEHLMANN¹, Matthias LUTHER¹, Martin WOLFRAM², Christian HURM²

¹Friedrich-Alexander-University Erlangen-Nueremberg, Germany; ²Maschinenfabrik Reinhausen GmbH, Germany

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT

PS1 - ENERGY TRANSITION INVOLVING T&D EQUIPMENT

ID: 10161

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS1 - Energy Transition Involving T&D Equipment

Development of High Voltage Intelligent Fast Circuit Breaker

Zhibing LI¹, Yu TIAN¹, Jianwei WEI², Bo LIU³, Sheng YIN⁴, Yang TIAN¹, Jinghua JIANG², Zhihua MA³, Qingchao SUN², Kejia XIE³, Liyan ZHANG⁴, Enyuan DONG⁴

¹China Electric Power Research Institute, China; ²Pinggao Group Co.,Ltd. , China; ³Shandong Taikai high voltage switchgear CO., LTD. , China; ⁴Dalian University of Technology, China

ID: 10162

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS1 - Energy Transition Involving T&D Equipment

Enhancing the Supporting Insulation Reliability in HVDC Gas Insulated Power Transmission Equipment based on Novel Ceramic Dielectrics

Bo QI¹, Xiao YANG¹, Mingcheng HUA¹, Yi ZHANG¹, Licheng LU², Faqiang YAN³, Hao TANG⁴, Chengrong LI¹

¹North China Electric Power University, China; ²State Grid Smart Grid Research Institute Co. Ltd. , China; ³Sinoma Jiangxi Electric Porcelain Electrical Co., Ltd. , China; ⁴China Electric Power Research Institute , China

ID: 10163

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS1 - Energy Transition Involving T&D Equipment

Key Technology Research, Prototype Development, and Engineering Application of Self-trigger/Self-discharge Gap for Fast Control of UHV DC/AC Controllable Arresters

Zhibing LI¹, Ran ZHANG¹, Xiaolang LI², Xiaodong XU¹, Huangguo ZHOU¹, Jinyang LIN¹, Ningbo ZHANG², Wen WANG¹

¹China Electric Power Research Institute,China; ²Xi'an Jiaotong University,China

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS1 - Energy Transition Involving T&D Equipment

Research And Prospect Of High-speed Switch Fault Current Limiter

Rui CAO, Pei YUAN, Yishi YUE, Yun LIU

State Grid Hunan Electric Power Company Limited Research Institute, China

ID: 10319

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS1 - Energy Transition Involving T&D Equipment

Keywords: Solid Insulated Busbar, Pluggable Connectors, Plug-in Bushing, Superconductor Cable, Gas Insulated Switchgear

Solidly Insulated Buses and Pluggable Connectors and Bushings for the Substations Modernization

Boris GUREVICH¹, Can TAKAN², Christian SPAETH³

¹Exelon/ComEd, United States of America; ²Moser-Glaser Ltd., Switzerland; ³PFISTERER Kontaktsysteme GmbH, Germany

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS1 - Energy Transition Involving T&D Equipment

Frequency Response Modelling of Instrument Transformers: Validation of Simulation Results with Industrially Viable Tests

Urko ZATIKA LARRINAGA, Alvaro ZARANDONA ARRUE

Arteche Group, Spain

ID: 11259

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS1 - Energy Transition Involving T&D Equipment

Keywords: DCCB, Residual current switch, Synthetic air, VARC

Development of an HVDC circuit-breaker and study of the requirements -Residual current interruption in multi-terminal HVDC system-

Takashi INAGAKI¹, Motohiro SATO¹, Frederick PAGE¹, Simon NEE², Tomas MODEER², Staffan NORRGA²

¹Mitsubishi Electric Corporation, Japan; ²Scibreak AB, Sweden

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS1 - Energy Transition Involving T&D Equipment

Selection Criteria of NGR Value Based on Measurements and Simulation of Actual Fault Events

Dr Subir SEN, B.B MUKHERJEE, Pradeep Tanaji PATIL*, Ashish SONI

Power Grid, India

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Optimization of controlled Switching for Transmission Lines

Urmil PARIKH

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Point on Wave (Controlled Switching) - for a wider range of Applications

Gustav STEYNBERG, Klaus BOEHME

Siemens AG, Germany

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS1 - Energy Transition Involving T&D Equipment

Keywords: Superconductor, Fault Current, Short-Circuit Current, Fault Current Limiter, Grid Splitting

An Approach for Economic Evaluation of Superconducting Fault Current Limiters in City Grids with Relay Protection Considerations

Mikhail MOYZYKH, Daria KOLOMENTSEVA, Kirill BABURIN, Eldar MAGOMMEDOV

SJSC SuperOx, Russian Federation

ID: 11851

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS1 - Energy Transition Involving T&D Equipment

Keywords: Composite insulators, Substations, UHV AC/DC applications, Life-cycle costing

Experience in UHV AC / DC projects in India & China with fully composite external insulation of substation equipment

Eric MOAL¹, Madhu SUDAN², Shuchen ZHOU³, Sida ZHANG³

¹JACKSON AND FRANK, France; ²GE India Industrial Pvt LTD., India; ³Jiangsu Shemar Electric CO., LTD, China

ID: 11900

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS1 - Energy Transition Involving T&D Equipment

Keywords: DC circuit breaker, fusion devices, quench protection circuits, DC fault, nuclear fusion plant.

A Soft-switched Hybrid DC Circuit Breaker for the Protection of Fusion Power Plant Electrical Systems

Hanwen ZHANG¹, Ferro ALBERTO², Thomas FRANKE³, Mattia DAN², Cristina TERLIZZI⁴, Yanbo WANG¹, Zhe CHEN¹

¹Aalborg University; ²Consorzio RFX; ³Max-Planck-Institute for Plasma Physics; ⁴University of Rome Tor Vergata

PS2 - LOWERING THE CARBON FOOTPRINT OF T&D EQUIPMENT

ID: 10127

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Gas Insulated switchgear, Metal enclosed, SF6-free, Circuit- breaker, GIS Bay

SF6-free metal enclosed switchgear at 245kV and above

Cyril GREGOIRE, Antoine PERRET, Jean-Baptiste JOURJON, Samuel SOUCHAL

GE Vernova, France

ID: 10165

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Diagnostic Study of Two-dimensional Distribution Spectroscopy of Vacuum Circuit Breaker Arc

Yilong LI¹, Zhao YUAN¹, Lixue CHEN¹, Shan LIU¹, Liming LIU¹, Penglong YA¹, Chuanqi WU², Yuan PAN¹

¹Huazhong University of Science and Technology, China; ²State Grid Hubei Electric Power Research Institute Measurement

ID: 10321

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: HV Substation Products, HV Dry Type Insulation Technologies, Non-conventional Instrument Transformers

Safety, Eco-Friendly and Durability Delivered by Advanced Dry Type Insulation Technologies

Robert MIDDLETON, Eric EUVRARD

RHM International, United States of America

ID: 10323

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: C4-FN, Expected Lifetime, Gas Components, Aging, Thermal Cycling

Component Gas Losses Over Simulated Lifetime in a CO₂/C₄-FN Gas Blend

Jeff MOORE, Rahul JAIN

S&C Electric Company, United States of America

ID: 10352

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

New Approach to Life Cycle Assessment for Digital Solutions & Components

Marco RIVA, Luca MARCOLONGO, Simone CARNÌ, Alessia SIRONI, Claudio CENCI

ELDS Technology Center – ABB SpA, Italy

ID: 10549

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: C₄-FN, effect of humidity, PD-measurement, fluoronitrile, green gas

The effect of humidity on the AC breakdown behaviour of C₄-FN/CO₂ (5%/95%) with different humidities and operating pressures, including its corona behaviour

Ewout VAN VELDHUIZEN, André LATHOUWERS, Christian MIER, Mohamad GHAFARIAN NIASAR

Delft Technical University

ID: 10569

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Alternative gas, Condition monitoring, GIS, Partial discharge

Partial Discharge Measurement in SF₆-Alternative Electrical Insulation Systems

Alistair REID¹, Rahmat ULLAH¹, Fatima ELENEZI¹, Manu HADDAD¹, Peter TADDEI², Mini NAMBIAR², Matthew BARNETT²

¹Cardiff University UK; ²SEN Transmission UK

ID: 10580**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

How working with customers on specifications leads to a reduced carbon footprint impact

Ixone URRUELA, Asier ZORROZUA, Sonia GONZALEZ, Eneko MADARIAGA

Arteche Group, Spain

ID: 10709**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Additive Manufacturing (AM), Laser Directed Energy Deposition (L-DED), Inconel, Circuit Breaker

Advancing Circuit Breaker Maintenance and Repair through Metal Additive Manufacturing Technology

Alexandre PINHEL¹, Rodrigo MAIA¹, Gabriel Ângelo VIEIRA¹, Anselmo THIESEN²

¹Brazilian NC of CIGRE, Brazil; Eletrobras Furnas; ²Brazilian NC of CIGRE, Brazil; SENAI-SC

ID: 10715**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Current Transformers, Non-invasive Monitoring, Partial Discharges; HFCT; Extra High Voltage Substation

An Advanced Intelligent Online Monitoring System for Current Transformers

George LIRA¹, Ana MAROTTI², Edson COSTA¹, Antonio LEITE NETO¹, João MELO¹, André COSTA², João Paulo DE SOUZA³, Fabiana FERNANDES², Allan David SILVA¹, João Paulo SOUZA³

¹Brazilian NC of CIGRE, Brazil; Federal University of Campina Grande; ²Brazilian NC of CIGRE, Brazil; Eletrobras Furnas; ³Brazilian NC of CIGRE, Brazil; Concert Technologies S.A

ID: 10717**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: SF6-alternative, High Voltage Circuit Breaker, CO₂-O₂-C₄FN Gas Mixture, Current Interruption, Post-arc Current, Computational Fluid Dynamics

SF6-alternative 145 kV metal enclosed circuit breaker

Marcel STOECKLI¹, Patrick STOLLER^{*2}, Mahesh DHOTRE², Brooke SPREEN², Jakub KORBEL²

¹ELECTROSUISSE / CIGRE Switzerland NC Secretary; ²Hitachi Energy Switzerland Ltd, Switzerland

ID: 10718**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: High voltage circuit breakers, dielectrics, rise of dielectric withstand, controlled switching, SF6 alternatives

RDDS and RRDS characterization for 420 kV 63 kA SF6-free High Voltage Circuit Breaker

Marcel STOECKLI¹, Reto KARRER^{*2}, Valeria TEPPATI², Mahesh DHOTRE², Sami KOTILAINEN², Peter FREI²

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²Hitachi Energy, Switzerland

ID: 10719**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: High voltage circuit breakers, SF6 alternatives, C₄-FN mixtures, computational fluid dynamic simulations, short line faults, terminal faults

Development and type testing of a 420 kV 63 kA 50 Hz and 60 Hz SF6-free High Voltage Circuit Breaker

Marcel STOECKLI¹, Valeria TEPPATI^{*2}, Reto KARRER², Mahesh DHOTRE², Peter FREI², Patrick STOLLER², Markus BUJOTZEK²

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²Hitachi Energy, Switzerland

ID: 10720**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: SF6-free, C₄-FN, dual-gas, GIS, CB, short-circuit, switching

72.5 kV C₄-FN/O₂/CO₂ GIS and CB performance and comparison with its SF6-equivalent

Marcel STOECKLI¹, Maxime PERRET^{*2}, Robert LUESCHER², Clement COCCHI², Bernhard SPICHIGER², Alexis COMBAZ³

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²GE Vernova, Switzerland; ³GE Vernova, France

ID: 10721**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Decarbonisation, Environmental impact indicator, Gas insulated switchgear, High voltage circuit breaker, Life cycle assessment, fluoronitriles, Vacuum, PFAS, F-Gas

Evaluation of Environmental Impact of SF6-based, CO2+C4F7N-based GREENTRICTM and Dry air Insulation/Vacuum Interruption-based GREENTRICTM High Voltage Gas Insulated Switchgears through Life Cycle Assessment'

Marcel STOECKLI¹, Kedar PANDYA^{*2}, Manuel GOTTI², Nicole SONG³, Javier MANTILLA², Hyoungjin JOO³

¹ELECTROSUISSE / CIGRE Switzerland NC Secretary; ²HD Hyundai Electric Switzerland Ltd, Switzerland; ³HD Hyundai Electric Ltd, South Korea

ID: 10722**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: HVCB, CO2 footprint, decarbonization, C4F7N, GWP, F-gas regulations, x-ray emissions-free, CFD, MOO, terminal faults, recovery voltage, carbon-neutral, digital twin, condition monitoring

Experience in the development of a Fluoronitriles-based 145 kV / 40 kA / 50-60Hz HVCB with an extremely low CO2 footprint

Marcel STOECKLI¹, Manuel GOTTI^{*2}, Kilsoo HAN³, Jeong Cheol KIM³, Sihyeong KIM³, Xiangyang YE², Javier MANTILLA², Kedar PANDYA²

¹ELECTROSUISSE / CIGRE Switzerland NC Secretary; ²HD Hyundai Electric Switzerland Ltd, Switzerland; ³HD Hyundai Electric Ltd, South Korea

ID: 10725**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Dielectric Design, Insulation, Type Test, SF6-alternatives, Gas-Insulated Switchgear, GIS, Dead-Tank Breaker, DTB

High Voltage type testing of a 420 kV SF6-free High Voltage Circuit Breaker for Gas Insulated Switchgear and Dead Tank Breaker Applications

Marcel STOECKLI¹, Peter FREI^{*2}, Reto KARRER², Wilhelm THUNBERG², Valeria TEPPATI², Brian CHRISTOPHER³, Matt CUPPETT³, Carl R. KURINKO³

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²Hitachi Energy, Switzerland; ³Hitachi Energy, United States

ID: 10917**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Future Needs and Common Approach of the Implementation of SF6 Free Equipment in the Grid of Six European TSOs

Frank RICHTER¹, Lisa SCHAEFER¹, Aurelien TAUREAU², Jonas BAUMANN³, Thomas WIJNHOFEN⁴, Maria Isabel MARTIN DIAZ-TOLEDO⁵, Patrick SCHOERNBOECK⁶, Pierre MEYER²

¹50Hertz Transmission GmbH, Germany; ²RTE, France; ³Swissgrid AG, Switzerland; ⁴Elia Transmission, Belgium; ⁵REDEIA, Spain; ⁶APG, Austria

ID: 10967**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: SF6 Free, GIS, Alternative

SF6 Free 170kV 50kA GIS verification test considering substation energization

Sooik LEE, Dongwook MOON, Kwangjoong LEE, Seungwan SON

Hyosung Heavy Industries Corporation, Republic of (South Korea)

ID: 11042**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

F-gas-free, zero-emission clean air switchgear for 420 kV

Paul Gregor NIKOLIC, S. WILKE, A. GRIEGER

Siemens Energy, Germany

ID: 11251**A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers**

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Ground fault, Micro-gap, SF6 alternative gas, Temperature measurement

Hot Gas Temperature Measurement in High Voltage Circuit Breakers Using Micro-gaps in SF6-free circuit breakers

Man-Jun HA, Jung-Ho PARK, Dong-Hoon JEONG

Hyosung Corporation

ID: 11261

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Life cycle assessment, Global warming, Switchgears, SF6 gas, Alternative technologies, Standardization

A Common LCA Format for High-Voltage Switchgears

Toshiyuki UCHII¹, Satoshi TAKAHASHI², Haruhiko KOYAMA²

¹Toshiba Energy Systems & Solutions Corporation, Japan; ²JEMA (The Japan Electrical Manufacturers' Association), Japan

ID: 11263

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Gas - insulated - switchgear (GIS), Global - warming, SF6 - emission, SF6 - alternative - gas, Synthetic - air, Natural - origin - gas, O - ring, Grease, Silver - plating

Lifetime Aspects and Experiences through Commercial Operations of 72 kV SF6-free Gas-Insulated Switchgear using Natural Origin Gas

Tomoya ONISHI¹, Toru KOIKE¹, Akihisa MUKAIDA¹, Hideaki SHIRAI¹, Shigeyuki TSUKAO², Syuichi TAMURA²

¹Toshiba Energy Systems & Solutions Corporation, Japan; ²TEPCO Power Grid, Inc., Japan

ID: 11265

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Synthetic air, Gas-Insulated Switchgear (GIS), Vacuum Circuit-Breaker (VCB), Vacuum Interrupter (VI)

Application of SF6 alternative switchgears – circuit-breakers and GIS using vacuum interrupter in synthetic air-insulated systems –

Naoya AIHARA¹, Ryosuke ITOTANI², Koki SADAHIRO², Shinichiro NAKAUCHI¹, Kenji SASAMORI¹

¹Mitsubishi Electric Corporation, Japan; ²Kansai Transmission and Distribution, Inc., Japan

ID: 11266

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Carbon neutral, Compactness, SF6-free, Solid-insulated switchgear(SIS), Solid insulation

Long operational experiences of medium-voltage solid-insulated switchgears

Satoru MAENO¹, Yuk ISHIKAWA², Ryosuke ITOTANI³, Yoshimitsu NIWA⁴, Hiroyuki SHIRAI⁵

¹Mitsubishi Electric Corporation, Japan; ²TEPCO Power Grid, Inc., Japan; ³Kansai Transmission and Distribution, Inc., Japan; ⁴Toshiba Infrastructure Systems & Solutions Corporation, Japan; ⁵Hitachi Industrial Equipment Systems Co., Ltd., Japan

ID: 11336

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

SF6 alternatives in GIS/AIS Switchgear and challenges faced in its execution and project management

Ravi Sushant CHAUDHARY*, Anshul SHARMA, R. P. S. RANA, M. THIRUMALA

POWERGRID, India

ID: 11337

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Subject - Life cycle management and life extension of AIS/GIS Switchgear, FACTS equipment by application of RCM

Ravi CHAUDHARY*, Amit KUMAR, R. P. S. RANA, Kuleshwar SAHU, M. Thirumala REDDY

POWERGRID, India

ID: 11369

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Low power instrument transformers; Sustainability; Energy losses; Rogowski coils; Voltage sensors; Medium Voltage Switchgear

Utilization of smart measurement technologies to improve medium voltage switchgear sustainability

Roman PERNICA, Karol MAJER, Pavel VANO

ABB Czech Republic

ID: 11638

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Digital model and supply chain of a MV GIS, to manage a low carbon energy system

Thomas DUERR, Achim KALTER, Florian WOLFRUM, Patrick SCHNEIDER

ID: 11682

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Biodegradable Liquids, Dielectric Performance, Instrument Transformers, Partial Discharge, Simulated Aging

Implementation of Various Biodegradable Insulation Liquids in Instrument Transformers Rated at 420 kV

Kresimir KOPRIVEC¹, Igor ZIGER¹, Darko IVANOVIC¹, Tomislav ZUPAN²

¹Končar – Instrument Transformers Zagreb, Croatia; ²Končar – Electrical Engineering Institute Zagreb, Croatia

ID: 11757

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: Gas Insulated Switchgear, GIS, Global Warming Potential, GWP, Voltage Transformer, Sulphur Hexafluoride, SF6, Fluoronitrile, Synthetic Air, Coating, Partial Discharge, Gas Permeation, Compatibility

Design Aspects for the use of Alternative Gases in GIS Voltage Transformers

Marcel STOECKLI¹, Mostafa REFAEY^{*2}, Martin BOSS³

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²alumni Pfiffner Instrument Transformers, Switzerland; ³Pfiffner Instrument Transformers, Switzerland

ID: 11858

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS2 - Lowering the Carbon Footprint of T&D Equipment

Keywords: SF6 Replacement; Vacuum Circuit Breaker; Contact erosion; Molecular Dynamics

Molecular Dynamics Simulation of Cathode Spots Formation and Contact Erosion in Vacuum Circuit breakers

Haonan YANG

University of Manchester, UK

PS3 - MAINTAINING AND MANAGEMENT T&D ASSETS

ID: 10132

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: Low power instrument transformers, electrical networks, TSO Experience, High voltage applications, evolutions

Status of the utilisation of Low Power Instrument Transformers in electrical networks

Laurent ROUX

RTE, France

ID: 10195

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Research on Magnetic-controlled Vacuum Arc Technology and Circuit Breaker Development

Jianying ZHONG, Xiaoming ZHAO, Hang ZHANG, Wenkui LIU, Yaopeng LU, Linying CHENG

Pinggao Group Co., LTD , China

ID: 10257

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: SF6-alternatives, Health Index, Asset Performance Management, Partial Discharges, UHF measurement

Health Index computation in Switchgear Monitoring Systems: providing Asset Performance Management crucial data straight from the primary equipment

Nicolas GADACZ, Jean-Luc RAYON, Eros STELLA, Samuel FIFI, Raphaël LEBRETON

GE Vernova, France

ID: 10258

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: SF6 Alternatives, Smart Live Tank Circuit Breaker, Asset Performance Management, Monitoring, Control

Return on Experience of Smart Live Tank Circuit Breaker with SF6-Alternative

Nicolas GADACZ¹, Henrik Roland HANSEN²

¹GE Vernova, France; ²Energinet, Denmark

ID: 10280

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: fault detection and classification, power transmission systems, two-stage detection systems, and optimal and secure power transmission systems

Enhancing Fault Detection and Classification in Power Transmission Systems Using Two-stage Detection System

Hassan MAHMOUD¹, Haitham H MAHMOUD²

¹Egyptian Electricity Holding Company; ²Birmingham City University

ID: 10324

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: Condition, Monitoring, Save, Asset Management

Condition Monitoring Analyses: from Straightforward to Surprising

Tony MCGRAIL¹, Philip BOREHAM¹, Jamie BEARDSALL², Mark ROWBOTTOM², Carl JOHNSTONE³, Rachael SUH⁴

¹Doble Engineering, United States of America; ²Drax Power, United Kingdom; ³i4 Asset Management, United Kingdom; ⁴Energy Harbor, United States of America

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: Active Monitoring, Asset Performance Management, Condition Assessment, Investment Planning, Maintenance Optimization

Utilizing Asset Performance to Guide Asset Replacement and Maintenance Optimization Decisions at TVA

Jeffrey H. NELSON¹, Jay JAYARAMAN², Siri VARADAN³

¹Tennessee Valley Authority, United States of America; ²Hitachi Energy, United States of America; ³Quanta Technology, United States of America

ID: 10552

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: Condition monitoring, historical failures, current transformers, tangent delta, partial discharges, laboratory research

Towards online condition assessment of oil-paper insulated current transformers: experiences from laboratory experiments

Daniël WOLDENDORP, Sjoerd NAUTA, Reinder PETERSE

Alliander N.V.

ID: 10578

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Smart Sensor with Embedded AI Model for Automatic Detection of PD Defects in Distribution Networks

Javier ORTEGO¹, Elvis JORGE¹, J. David BIELVA², Antonio GONZALEZ²

¹Ampacimon, Spain; ²EDP Redes Spain, Spain

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Monitoring 245 kV instrument transformers using AI for condition assessment and operation optimization

Amaia RECALDE¹, Jone JUIZ¹, Iñigo HUERTA¹, Jesús SAEZ¹, Mikel FERNANDEZ², Jose Antonio EGUREN³

¹Arteche Group, Spain; ²Tecnalia, Spain; ³i-DE (Iberdrola), Spain

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

A Wireless Self-Powered and Edge Computing Sensor for Power Quality and Grid Analysis

Antonio-Miguel MUÑOZ-GÓMEZ¹, Alfonso MARECA-MIRALLES¹, Javier BALLESTÍN-FUERTE¹, José-Francisco SANZ-OSORIO²

¹Circe, Spain; ²University of Zaragoza, Spain

ID: 10599

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: Frequency response measurement, white noise, instrument transformers, test voltage level, frequency bandwidth, power quality

Test voltage level analysis for frequency response measurements on instrument voltage transformers

Mathieu NADEAU¹, Erik SPERLING², Roberto SCHULZE³

ID: 10711

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: IEC 61850, Optical Current Transformer, Low-Power Instrument Transformer, Substation Instrumentation, Faraday Effect, Process Bus Integration, Comparative Analysis, Laboratory Testing, TECO, Substation Technology

Assessment of Critical Aspects Related to Optical Current Transformer Measurements

Carlos DUTRA¹, Luan TOMINAGA¹, Vitor WOYAKEWICZ², Tiago MATSUO²

¹Brazilian NC of CIGRE, Brazil; PowerOpticks; ²Brazilian NC of CIGRE, Brazil; AQTech

ID: 10726

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: Electric Stray Field, CR Divider, Voltage Divider, Accuracy, Frequency Response Behaviour, Power Quality

Investigation of the impact of external stray fields on voltage divider accuracy for 36 kV and 123 kV system voltage levels

Marcel STOECKLI¹, Erik SPERLING^{*2}, Roberto SCHULZE³, Thomas HEID⁴

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²OMICRON energy, Switzerland; ³OMICRON energy, Germany; ⁴CONDIS SA, Switzerland

ID: 10727

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: power quality monitoring, transient monitoring, CR-divider, RC-divider, low-power voltage transformer

High bandwidth low-power voltage transformers for power quality measurement and fast transient monitoring in MV and HV substations - technological overview and experience from field installations

Marcel STOECKLI¹, Thomas HEID^{*2}, Werner SCHOEFFER³, Dominique ROLLE⁴

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²CONDIS SA, Switzerland; ³Artemes GmbH, Austria; ⁴HEIA Fribourg University of Applied Sciences, Switzerland

ID: 11015

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: Asset Performance Management System (APMS), Condition Based Maintenance Strategy, Assets Health Index (AHI), Risk Indices, AHI methodology, APMS roadmap, Online Monitoring Systems, Real-time DataHub, IT solution architecture, Data management

Asset Performance Management System Design for a Modern TSO

Ales HVALA¹, Andrej F. GUBINA², Despoina MAKRIDOU³, Anastasios PATSIOTIS³

¹Blueprint Energy Solutions, Austria; ²IRI UL, Slovenia; ³TSO Greece

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Service experience with the POW control switching on power transformers

David PITA¹, Haren MUTUKUMARANA^{1,2}

¹Powerlink QLD Australia; ²The University of Queensland, Australia

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Digitization Techniques for Smart Asset Management in the Energy Sector

Darío Alberto MEYER, Gino Leonel FURLANO, Fabián Edgardo LÓPEZ, Gabriel Franriq BONILLA
DISTROCUYO SA

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Multi-Country and Multi-Company Concatenating Failure Catalogue

Diego VARGAS¹, Euro ALMEIDA², Irwin LOPEZ³, Nc CIGRE⁴

¹ENLAZA; ²ARGO; ³CONECTA; ⁴NC CIGRE

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers
Topics: A3 PS3 - Maintaining and Management T&D Assets
Risk Management Through the Implementation of Digital Twins for the Analysis of Safe Ground Clearance and Solution of Non-Compliance in High-Voltage Transmission Lines
Yasert PEREZ, Alexander BEDOYA
 ISA Intercolombia

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers
Topics: A3 PS3 - Maintaining and Management T&D Assets
Current Transformer Hysteresis Modelling for Condition Assessment under standard and non-standard Operation
Dennis ALBERT¹, Nicolai SCHWARTZE¹, Lukas DOMENIG²
¹OMICRON electronics; ²Graz University of Technology

ID: 11269
A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers
Topics: A3 PS3 - Maintaining and Management T&D Assets
Keywords: Maintenance, Reliability Centered Maintenance, Aged Asset, Condition Monitoring, Asset Performance Management
Reliability-Centered Maintenance for Optimized IoT-based Maintenance and Life Extension of Aging Substation Equipment
Toshiaki KONO, Ryoichi SHINOHARA, Hiroaki HASHIMOTO, Li LU
 Hitachi Ltd., Japan

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers
Topics: A3 PS3 - Maintaining and Management T&D Assets
Robotic isolation of MV breakers and condition monitoring using AI and AR
Ravi SAHU, Amit PATEL, Ashish MHATRE, Kapil UMAK
 Tata Power Co. Ltd, India

ID: 11323
A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers
Topics: A3 PS3 - Maintaining and Management T&D Assets
Keywords: Partial Discharge
A Study on the Location Estimation of the Partial Discharge Signal using Current Transformer Sensors with Ultra-high Frequency Bandwidth in C-GIS
Sang Hyuk IM, Seung Hun OK, Jung Soo LEE, Doo Ki LEE
 HD Hyundai-Electric, Korea, Republic of (South Korea)

ID: 11331
A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers
Topics: A3 PS3 - Maintaining and Management T&D Assets
IoT based Solution – Smart LT Distribution System Smart MCCB (Protection, Remote Control, and Auto-Reclosing)
Gagandeep KAUR*, Brajanath DEY, Amit BANSAL
 TATA Power DDL, India

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers
Topics: A3 PS3 - Maintaining and Management T&D Assets
Fiber Optic Current Transformers (FOCT) - High Voltage Design Considerations and Challenges
Mritunjay KUMAR*, Aditya N YADAV, S Nagesh KUMAR, M Mohana RAO, Shyamala VENKATARAMAN
 BHEL R&D , India

ID: 11338
A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers
Topics: A3 PS3 - Maintaining and Management T&D Assets
Online Partial Discharge Monitoring System for Gas Insulated Substation - Utility Experience
Rashmi* CHAUDHARY, B. P. SONI, Dr. A. J. CHAVDA
 Gujarat Energy Transmission Corporation Ltd, India

ID: 11494

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: GIS(Gas Insulated Switchgear), PD(Partial Discharge), UHF(Ultra High Frequency) Sensor, Signal Attenuation, 3D Modeling, FEM(Finite Element Method), Simulation

Research on UHF Sensor Signal Attenuation Simulation Method for Improvement of GIS Partial Discharge Diagnosis

Danbi LEE, Byoung-woon MIN

HD Hyundai Electric, Korea, Republic of (South Korea)

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Failure Investigation of Series Capacitors on Transmission Lines and Novel Technique to Mitigate the Damage During Fire on the Platform.

Randhir SINGH*, M.S. HADA, Pankaj Kumar JHA

POWERGRID, India

ID: 11637

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: High Voltage, Circuit Breaker, Switching, Re-ignition, Vibration, Overvoltage, Grading Capacitor, Partial Discharge, Radio Frequency, Diagnostic.

In-service circuit breaker condition assessment

Phil MOORE¹, Keith WILLIAMS², Mark WALDRON²

¹Elimpus Ltd UK; ²National Grid UK

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Benefits of Smart Generator Circuit Breaker Solutions from a Manufacturer-Utility Collaboration Perspective

Vitsanu PHONPHAI¹, Nicolas GADACZ², Charcris KUHAARN¹, Panupan THAKONG¹

¹Electricity Generating Authority of Thailand (EGAT), Thailand; ²GE VERNOVA, France

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A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Applying a Deep-Learning Method to Diagnose the Capacitor Voltage Transformers with Excessive Measurement Errors

Hamid Reza MANSOURI¹, Mohammad Majid JALALI¹, Hojjat DEZFULI²

¹Nirou Trans Co.; ²Monenco Iran Consultant Engineering Co., Iran, Islamic Republic of

ID: 11855

A3 TRANSMISSION AND DISTRIBUTION EQUIPMENT - Full Papers

Topics: A3 PS3 - Maintaining and Management T&D Assets

Keywords: Post insulators, Disconnectors, Pollution, Online Real Time Monitoring, Diagnostics, Leakage Current, Preventive Maintenance

Real-time pollution monitoring and diagnostics of Air Insulated Switchgear oriented to predictive maintenance

Rodolfo SARACENI¹, Alberto PIGINI², Marco NOSILATI¹, Eros STELLA¹

¹GE Vernova Italy; ²Independent Consultant Italy

B1 - INSULATED CABLES

PS1 - LEARNING FROM EXPERIENCES

ID: 10168

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

220kV three-core submarine cable armouring loss test

Yuantao ZHAO^{1,2}, Kanghong LIU¹, Mingyue LIU², Guojun YU², Fan YANG², Feng XIA², Fei LI¹, Lisheng ZHONG¹

¹Xi'an Jiaotong University, China; ²Ningbo Orient Wires&Cables Co., Ltd., China

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

A Location Method of Local Defects in Power Cables Based on Reflection Coefficient Spectrum

Kai ZHOU, Yao FU

Sichuan University, China

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Design, manufacturing, and installation of world's first 500kV three-core XLPE insulated AC submarine cable

Muhammad AWAIS, Yuantao ZHAO, Yongming ZHANG, Guojun YU, Feng XIA, Jianjun YANG, Ziwei ZHAO

Ningbo Orient Wires & Cables Co., Ltd., China

ID: 10303

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: HVDC cable, bending stiffness, FEM, testing, mechanical

Comparison of bending stiffness modelling and measurements on HVDC cables

Raquel MARCHENA¹, Annalisa VERRILLO², Nicolas BOUVIER¹

¹Prysmian Group, France; ²Prysmian Group, Italy

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Analysis of the screen currents on the HV and EHV cable systems through on-line measurement: study of the main issues and case-studies investigation

Luca GUIZZO

TERNA, Italy

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Topics: B1 PS1 - Learning from Experiences

Design and testing of the dynamic export cable of Gruissan offshore floating wind farm

Luigi COLLA

Prysmian Group, Italy

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Topics: B1 PS1 - Learning from Experiences

New 132 kV intertie between Elba Island and Italian Mainland designed for security of supply, safety and environmental conservation

Lucia DE MERICH

PRYSMIAN GROUP, Italy

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Tyrrhenian Link - Sea Trials for ultra-high-depth cable system

Federico CORDO'

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

On-spot PD Measurements on Singapore 22 kV XLPE Circuits: Experiences and Challenges

Kai Xian LAI, Chun Sern YIONG, Javan Chun Fong LEE, Hongyan CAO, Vincent Kum Kong WONG, Ranjan THIRUCHELVAM

SP Group Singapore

ID: 10519

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: DALY (disability adjusted life years) method, Installation cost reduction, Proportional risk assessments, Subsea power cable installation, Unexploded Ordnance (UXO)

A proportional approach of subsea UnExploded Ordnance (UXO)

Marijn HELSLOOT³, Wino SNIP¹, Ira HELSLOOT², Anja DREWS¹

¹TenneT; ²Crisislab; ³Radboud Universiteit

ID: 10530

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Dynamic Cable Load – Cable Ampacity – Thermal-Measurements – Finite Differences – Thermal Modelling – XLPE – PILC – WG-B1.91

Using continuous in situ measurements to probe the diverse thermal dynamics of MVAC & HVAC power cables

Pjotr MUIS, Colin VAN WIJK, Ramon CREYGHTON, Anna VAN VELSEN, Joan RESSING, Sjoerd NAUTA

Alliander N.V.

ID: 10540

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Power cables, combined testing, insulation, electrical tree, dynamic, mechanical strain

Development of an Electromechanical Test Technique to Grow Electrical Trees in Dynamic Power Cables

Christopher EMERSIC¹, Frances HU¹, Lujia CHEN¹, Simon ROWLAND¹, Aidan EBRAHIM²

¹The University of Manchester UK; ²ORE Catapult UK

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Analysis of Ground Penetrating Radar (GPR) technologies used in areas with high density of underground utilities for insulated cable projects

Pedro LLOVERA-SEGOVIA^{1,3}, Luis ARIAS FERNÁNDEZ², Pablo RODRÍGUEZ HERRERÍAS², Gregorio DENCHE CASTEJÓN², Guillem GIL PRIETO¹, Marcos DOMÍNGUEZ-LAGUNILLA¹

¹Instituto Tecnológico de la Energía (ITE), Spain; ²Red Eléctrica, Spain; ³Universitat Politècnica de València, Spain

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Fault location on the Spain Morocco HV Submarine Cable – Improving Fault Distance Measuring Accuracy

Ricardo GOMEZ RIVERA¹, Manfred BAWART², Daniel BLANCO SACEDO¹, Jose Luis FERRERES NOS³, Ricardo REINOSO DELGADO¹, Gonzalo DONOSO CONEJO¹, Elena NOGUEROLES LAGUIA¹

¹Red Eléctrica, Spain; ²BAUR GmbH, Austria; ³MARTIN BAUR S.A, Spain

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

New measurement technique and use cases in the inspection of partial discharges of circuits with insulated cable in the Spanish TSO

Ricardo GÓMEZ, Ricardo REINOSO, Gonzalo DONOSO, Elena NOGUEROLES

Red Eléctrica, Spain

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Construction methods civil works power link Tenerife-La Gomera

Alberto MARTÍN VILLALTA, Álvaro FRANCÉS PÉREZ, Virginia MORENO FERNÁNDEZ

Red Eléctrica, Spain

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Construction challenges in terms of permitting, consents, and safety issues in highly touristic places in Spain

Alexandra GAVILANES, Berta DÍAZ DE FIGUEROA, Carlos GARCÍA

Red Eléctrica, Spain

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Distributed Temperature Sensing Real Time Thermal Rating Soil Dehydration Backfill Hot Spot

Distributed temperature sensing: detection and mitigation of observed hot spots due to soil dehydration

Daniël VREE, Vincent GEVERS, Wouter VAN DOELAND, Richard KONING

Energy Solutions

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Environmental and Technical Lessons learnt during the cable repair of a legacy cable in a watercourse

Shamaine THULASAIE

Eskom Distribution

ID: 10695

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: submarine, 400kv, pq, type test, accessories

Results of PQ Test and Various Type Tests for AC 400kV Submarine Cable System

Hunjin LEE

LS Cable&System, Korea, Republic of (South Korea)

ID: 10759

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Floating Wind, Dynamic Power cables, Bend stiffness, Axial tension

Bend Stiffness Test For Cable Considering Tension During Installation Or Operation

Chulmin KIM¹, Jaebok LEE¹, Kwangsu CHAE¹, Yuho RHO¹, Chunsik SHIM²

¹LS Cable & System Ltd; ²Mokpo National University

ID: 10760

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: High Voltage - Underground Cable – Transmission System – Distribution System - Energy Utility - Failure Statistic

Failure Statistics of High Voltage Underground Cables in Urban Areas – Experience of the Southeastern Brazilian Large City Centers

Carla DAMASCENO¹, Adilson MENEZES², Paulo DEUS³, Daniel Lucas SILVA⁴

¹Brazilian NC of CIGRE, Brazil; Consultor; ²Light SESA; ³Enel SP; ⁴ISA-CTEEP

ID: 10761

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Extra High Voltage – Underground Transmission Line – Interferences – Magnetic Field – Crossings – Electromagnetic compatibility – Building Information Modelling

Challenges and solutions to implement an underground transmission line in the biggest city of Brazil

Jody FUJIHARA¹, Rogerio LAVANDOSCKI¹, Gabriela RODRIGUES¹, Julio LOPES²

¹Brazilian NC of CIGRE, Brazil; ISA CTEEP; ²INOVATEC

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Underground Transmission Line – Fault location – Preventive maintenance – Corrective maintenance

Learnings from a third party accident in a 220 kV underground transmission line in Colombia

Julio LOPES¹, Antonio PEDRAZA²

¹Brazilian NC of CIGRE, Brazil; INOVATEC; ²ISA

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: High voltage, Underground Lines, Cable insulated, Two Cables per Fase

The Construction of High Voltage Underground Lines Using Two Cables Per Phase in Large Cities - Their Motivations, and Installation and Maintenance Complexities

Paulo DEUS, Eduardo LEANDRO, Artur CONFORTI

Brazilian NC of CIGRE, Brazil; ENEL

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: cable line, insulation, partial discharges, insulation aging, reliability, residual life, overvoltage, insulating materials

Limitation of Switching Overvoltage as a Way to Provide the Reliability of Power Cable Lines

Ian KOROSTELEV¹, Rasim BABAEV², Anton KORZHOV², Mikhail DZIUBA², Valery SAFONOV²

¹Energy+21 JSC / South Ural State University, Russian Federation; ²South Ural State University, Russian Federation

ID: 10879

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: EPDM PMJ, HVDC PMJ, PMJ

Development of EPDM Insulation Material for 500kV-class HVDC PMJ

Yeonwoo JO, Jaecheol JUNG, Dongseok HONG, Hyunjoo KIM

TAIHAN Cable&Solution, Korea, Republic of (South Korea)

ID: 10892

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Thermal assessment, Semi-conductive PE Sheath, HVDC, Fault Simulation

Thermal assessment of the transition joint between insulating and semiconductive inner PE sheath

Abbas LOTFI, Martin HOVDE, Allen TUNHEIM

Nexans Norway AS

ID: 10950

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Siphon underground XLPE cable system - cross-bonding - earth continuity conductor - insulation coordination

420 kV underground cable system in environment with high electrical resistivity of soil. Use of an earth continuity conductor in combination with cross bonding and consequences on insulation coordination

Jerome MATAALLANA¹, Kostas VELITSIKAKIS², Thinus DU PLESSIS²

¹Statnett, Norway; ²TENNET The Netherlands

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Dynamic Analysis on HVDC Land Cable and Prefabricated Joint under Salt-mine Blasts

Yang ZHOU¹, Christian ANDERSSON¹, Markus SALTZER², Daniel PESTANA², Martin SPLETTSTÖSSER³, Herbert LOBÜSCHER³, Marc JEROENSE⁴, Giampaolo MARTUFI¹

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Development of an extended commissioning program for temporary 220 kV cable connections

Alexander PIRKER¹, Anita MACHL²

¹Verfahren Umwelt Management GmbH; ²Austrian Power Grid AG

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

The role of quality assurance in a high voltage cable market shaped by the energy transition from a grid operators' perspective

Florian AINHORN, Andreas BOLZER

Wiener Netze

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Derivation and Application of a Sustainability Assessment System for the Installation of High and Extra-High Voltage Cables in the City of Vienna

Florian AINHORN¹, Michael KLEIN¹, Alicia OGRYSEK², Lea ORTH²

¹Wiener Netze; ²Technical University Vienna

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

New approaches in performing commissioning tests in HVAC on long land and inter array cable projects using Resonant Test Systems

Peter MOHAUPT¹, Marco BRAMBILLA², Emilio DEL RIO RUIBAL²

¹Mohaupt HV; ²Prysmian Powerlink

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Experiences and Perspectives in the Application of the BIM Methodology to the Design and Construction Phases of Underground Transmission Lines for the "El Río" 220 kV Project

Hernan RESTREPO, Antonio PEDRAZA, Luis SARMIENTO

ISA Intercolombia

ID: 11193

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Cable Condition Monitoring, HV Cable, Cable Termination, Cable Joint, Passive Sensing, Distributed Electrical Sensing, Sheath Current, IEC 61850-9-2, Sampled Values

Installing passive sensing for condition monitoring of a 400 kV cable

Steven BLAIR, Neil GORDON, Iain MCKEEMAN, Philip ORR, Marcus PERRY

Synaptec UK

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Insulated Cables Statistics 2012 to 2021

Russell WHEATLAND¹, Soren MIKKELSEN², Francis WAITE³, Kim ove ASKLUND⁴, Peter van der WIELEN⁵, Andrew WOOLLES⁶

¹Ausnet Services, Australia; ²Energinet, Denmark; ³Balfour Beatty, United Kingdom; ⁴Hafslund Nett, Norway; ⁵DNV, Netherlands; ⁶TE Connectivity, New Zealand

ID: 11275

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Natural Degradation, Pre-breakdown, Discharge Detection, Water Tree, Wet Design, XLPE, Asset Management

Assessment and asset management of aged 66 kV – 77 kV wet design XLPE cable

Shojii MASHIO¹, Kimihiro IWASAKI², Takeshi KAYA³, Toshihiro TAKAHASHI⁴

¹Sumitomo Electric Industries, Ltd., Japan; ²TEPCO Power Grid, Incorporated, Japan; ³Kansai Transmission and Distribution, Inc., Japan; ⁴Central Research Institute of Electric Power Industry, Japan

ID: 11279

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Optimization, Rationalization, Replacement, Y-branch joint

Challenges and Initiatives for replacement of aged SCFF or HPFF cables to XLPE cables

Hiroki YOKOTA¹, Masahiro NARITA¹, Kimihiro IWASAKI², Hidenori SATOU², Takeshi KAYA³, Tatsuhiko SAKAMOTO³

¹Furukawa Electric Co., Ltd., Japan; ²TEPCO Power Grid, Incorporated, Japan; ³Kansai Transmission and Distribution, Inc., Japan

ID: 11307

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Ampacity, Cable, Harmonic, Triplen

Cable Current rating in the presence of Harmonics

Andreas CHRYSOCHOS, Konstantina BITSİ, Iordanis CHALEPLIDIS, Dimitrios CHATZIPETROS, Varvara RIZOU, Vasileios KANAS
Hellenic Cables, Greece

ID: 11308

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Cable System, Direct Cross Bonding, Insulation Coordination, Lightning, Overvoltage

Evaluation of Cable Bonding Scheme under Lightning Overvoltages in HVAC Modern Siphon Systems

Christos TRAIANOS¹, Iordanis CHALEPLIDIS², Andreas CHRYSOCHOS², Dimitrios CHATZIPETROS²

¹Electrical Engineer, Greece; ²Hellenic Cables, Greece

ID: 11311

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: FEM, Modeling, Rigid Joint, Submarine Cable.

Modeling of the Thermoelectric Performance of Offshore Power Cable Joints

Konstantina BITSİ, Dimitrios CHATZIPETROS, Andreas CHRYSOCHOS, Vasileios KANAS

Hellenic Cables, Greece

ID: 11354

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Electric field, finite element method, heat-shrink cable terminal, structural defect

Electric field analyzes in heat-shrink cable terminals depending on the assembly and defects parameters with FEM

Yunus Berat DEMIROL¹, Elif SAKALLIOGLU¹, Bora ALBOYACI², Mehmet Aytaç CINAR²

¹Genetek Güç&Enerji, Türkiye; ²Kocaeli University, Türkiye

ID: 11356

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

A Machine Learning-Induced Cable Health Indexing Model for Utilities

Akshat KULKARNI*, Sanjeev KUMAR, Pratik BAJARIA, Yash KULKARNI

OrxaGrid Pvt Ltd, India

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Improvisation in Laying & Installation of HV/EHV Power cables in extreme challenging conditions

Puneet CHAWLA, Jai KUMAR, Dileep K. SHUKLA, Vivek KAPIL, Aruna GULATI

BHEL, India

ID: 11468

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Single Sheath Bonding-Induced Voltage-Sheath Circulating Current-Earth Continuity Conductor-Ground potential Rise

Single Sheath Bonding Method To Eliminate Earth Continuity Cable

Mohamed KHAN

Electricite De France, UAE

ID: 11568

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Challenge of TDR Fingerprint on Viking Link

Henrik Roland HANSEN¹, Manfred BAWART², Marco BRAMBILLA³, Emilio DEL RIO RUIBAL³

¹Energinet; ²BAUR GmbH; ³Prysmian Powerlink

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Calculation of Magnetic Fields around Stranded 3 core cables

Thomas KVARTS, Anna Candela GAROLERA

Ørsted Wind Power a/s

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Data-Driven Laying Condition Assessment of High Voltage Cables using Distribute Temperature Sensing - DTS

Soumya THAKUR¹, Joachim HOLBØLL¹, Joachim NIEMANN-LARSEN²

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ID: 11755

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: after installation test, cable breakdown, cable discharging, HVDC cable system, onsite, test system protection, wind resistance

Requirements for onsite test systems for the after-installation test of HVDC cable systems

Marcel STOECKLI¹, Michael GAMLIN^{*2}, Carl-Hendrik STUCKENHOLZ², Tobias MUELLER², Manuel ECKERT²

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ID: 11802

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Cable monitoring, Distributed Fiber Optic Sensing, Floating offshore technologie, Operation, Maintenance

Complete power cable monitoring for floating marine energy technologies

Pierre CLEMENT¹, Gaetan CALBRIS¹, Caroline LOURIE², John EMEC²

¹FEBUS Optics, France; ²EMEC Ltd, UK

ID: 11827

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Failure investigation – Failure Analysis - Power Cable - Quality Assurance - Quality Control

Approach, experiences and lessons learned from failures investigations on power cable systems

Peter VAN DER WIELEN¹, Anurag KUMAR², Jacco SMIT²

¹DNV & TU Eindhoven; ²TenneT TSO

ID: 11849

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Earth continuity conductor, gallery, HV cable, theft prevention

Solutions to prevent theft of earth continuity conductor in galleries and tunnels

Alicia JANDIN, Matthieu CABAU, Mathieu GROULT

RTE, France

ID: 11885

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: Failure cause analysis, backfill, cable failures, power cable, thermal resistivity.

Root Cause Analysis in Onshore Wind Farm MV Cable: A Study Based on IEEE 1511.1 Guide

Phelipe SILVA

BAUR do Brasil

ID: 11892

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: High-voltage XLPE cable, buffer layer defect, detection method, partial discharge, distributed optical fiber.

Comparative Study on Detection Methods for Buffer Layer Defects in High-voltage XLPE Cable with Corrugated Aluminum Sheath

Yanpeng HAO¹, Yanting CHENG¹, Wanxing TIAN¹, Qishun LI¹, Haotian TAN¹, Peng ZHAO², Baojun HUI³, Licheng LI¹

¹School of Electric Power Engineering, South China University of Technology; ²Jiaxing Power Supply Company of State Grid Zhejiang Electric Power Co., Ltd.; ³Electric Power Research Institute, China Southern Power Grid

ID: 11897

B1 INSULATED CABLES - Full Papers

Topics: B1 PS1 - Learning from Experiences

Keywords: High-Pressure Fluid Filled (HPFF), Cross-linked Polyethylene (XLPE), Self-Contained Fluid Filled (SCFF), Gas Insulated Substation (GIS), Cable.

Design, Qualification Testing and First Installation of a 138 kV High-Pressure Fluid Filled (HPFF) to Cross-Linked Polyethylene (XLPE) Transition Joint

Jake GELHARD

EHV Power Inc., a USi Company

PS2 - FUTURE FUNCTIONALITIES AND APPLICATIONS

ID: 10134

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Keywords: MVDC cables system, electrical field stabilization, proposition, qualification procedure, electrothermal stresses

Proposition of qualification procedure for MVDC cables

Amjad MOUHAIKALI¹, Raphaël GUFFOND², Ludovic BOYER¹, Lina RUIZ²

¹SuperGrid Institute, France; ²Nexans, France

ID: 10172

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Development and Experiment of Two-section Three-phase Coaxial 10 kV/1 kA HTS Cable with Three-phase Balance Design

Panpan CHEN, Jiahui ZHU, Qifan YANG, Yanfang YANG, Hongjie ZHANG

China Electric Power Research Institute, China

ID: 10328

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Keywords: Routing, Superconductor, Transmission, Underground

High-Temperature Superconducting Cable Systems as a Solution to Underground Transmission Line Routing in Congested Project Areas

Collin EDWARDS, Darin LAWTON

Burns & McDonnell, United States of America

ID: 10331

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Keywords: Underground Transmission, Submarine, Finite Element Modeling (FEM), Cable Ampacity

Developing an FEM Model of the TB880 3-Core Cable Case Study

Brian RUTHERFORD

Burns & McDonnell, United States of America

ID: 10405

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Keywords: Temperature, Crosslinked-polyethylene (XLPE), Qualification Testing

Thermal limit of XLPE insulation: Is 90 still the magic number?

James PILGRIM¹, Thomas ANDRITSCH², Paul LEWIN², George CALLENDER²

¹Ørsted Wind Power UK; ²University of Southampton UK

ID: 10520

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Keywords: HVDC, GIS, cable connection assemblies, dielectric testing, type test

Recommendations for dielectric testing of HVDC gas insulated cable connection assemblies

C.A. PLET¹, M. KOSSE², S. ALAPATHI³, N. LALLOUET⁴, F. JACQUIER⁵, U. RIECHERT⁶, T. KARMOKAR⁷, F. MICHON⁸, H. HE¹, H. HE⁷, C. BEVERWIJK⁹, D. BOA¹⁰, M. YAGI¹¹, L. HOEFER¹², J. STRIDE³, K. ZHOU¹³, Marco ALBERTINI⁸, Diego CISILINO¹⁴, Guoyan SUN¹⁵

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ID: 10577

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Keywords: Temporary Cable Connections, Substation Renovation, Bay Replacement, Pre-fab cable ends, GIS Metal Enclosed Cable Terminations, Cable Core Locking, plug-in/-out system, thermo-mechanical test

Testing Experience on Temporary High Voltage Cable Connection Solutions

Panos TSAKONAS¹, Corné VAN EEDEN¹, Riccardo BODEGA¹, Roy ZUIJDERDUIN², Jacco SMIT²

¹Prysmian Group; ²TenneT

ID: 10775

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Keywords: Ampacity, J-tube, Solar radiation intensity, Wind velocity

Analysis of Parameters Affecting Current Rating of Cables Installed in J-tube for Offshore Wind Farms

Ruhi RUHI¹, Tapabrata MUKHERJEE¹, Camilo APRAEZ¹, George J. ANDERS²

¹Eaton Energy Automation Solutions, Canada; ²Lodz University of Technology, Poland

ID: 10786

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Feasibility Assessment of Solutions for the Introduction of High-Temperature Superconducting AC Cable Lines in Megacities

Andrey KASHCHEEV, Mikhail DUBININ, Victor SYTNIKOV, Elena FILIPEVA, Dmitriy SOROKIN

ROSSETI R&D Center, Russian Federation

ID: 10817

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Motion Characterization of dynamic Cables with distributed acoustic Sensing obtained from Field Measurements

Simon DE RIJCKE¹, Carlos ARBOLEDA¹, Koen DE BAUW², Antoine VERGAERDE², Andr  s MCKAY³

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ID: 10951

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Keywords: Ampacity Rating Calculation, Distributed Temperature Sensing, Finite Element Analysis, Thermal Network Model

Evaluation of Thermal Network Modelling and Finite Element Analysis for Ampacity Rating Calculation of Wind Farm Export Cable

Camilla ESPEDAL, Henrik STRAND, Espen EBERG, Henrik STRAND, Espen EBERG, Svein Magne HELLES  , Nina Marie THOMSEN

SINTEF Energiforskning

ID: 11050

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Keywords: Cable Ampacity, Cable Dimensioning, Dynamic Load Curve, HVDC Export Cable, Meshed Grid

Cable Dimensioning based on Wind Predictions in an Offshore Meshed Network

Tom EGAN¹, Vasileios L. KANAS², Andreas I. CHRYSOCHOS², Nikolaos Ion BATISTATOS², Maryam ZADFALLAH¹, Henry ABRAMS¹, Casey FONTANA¹

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Qualification of Submarine AC Cables for 1500 m Water Depth

Lisa JOHANSSON

NKT AB, Sweden

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Development and Validation of a Third-Party Intrusion Detection Software Based on DAS Measurement Data

Florian AINHORN¹, Andreas BOLZER¹, Werner LIENHART², Lisa STRASSER²

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ID: 11329

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Keywords: Power cables - Ampacity calculations - Soil dryout - External thermal resistance - Dynamic cable rating

Dynamic cable rating with partial drying of the soil

Robert SPICE¹, Martin HIRD¹, Justin DIX²

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Superconducting Power Cable For 500 MVA at 110 kV in Munich - First Insights in the Test Run

Robert BACH¹, Robert PRINZ², Werner PRUSSEIT⁴, Dag WILLÉN², Patrick MANSHEIM¹, Alexander ALEXSEEV⁵, Wescley Tiago BATISTA DE SOUSA⁶

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Concept and development of a digital twin of a 110-kV-cable line

Robert BACH¹, Michael HOISCHEN¹, Rouven BERKEMEIER¹, Judith SCHRAMM², Carsten WOLFF³

¹South Westphalia University of Applied Sciences Soest, Germany; ²Rheinische NETZGesellschaft mbH, Germany; ³NKT GmbH & Co. KG, Germany

ID: 11454

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Keywords: Reliability Failures Underwater Transmission

High Reliability Zero Failures in Underground and Underwater Transmission Systems

Pablo Enrique REALPOZO DEL CASTILLO¹, Rafael Antonio RAMIREZ RIOS¹, Jose Luis GARCIA-URRESTI¹, Victor SIERRA-MADRIGAL²

¹CIGRE México; ²ECSA Energía Cables y Sistemas SA de CV México

ID: 11634

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

New HVDC Insulation System Electrical Evaluation on Small Scale Samples and Model Cables

Marc BAILLEUL¹, Ramona HUUVA², Johan ANDERSSON², Anette JOHANSSON²

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ID: 11886

B1 INSULATED CABLES - Full Papers

Topics: B1 PS2 - Future Functionalities and Applications

Keywords: Complementarity, Offshore Wind, Offshore Floating Photovoltaics, Cable Pooling, Submarine Cable.

Harnessing solar-wind complementarity to unlock the full potential of submarine high voltage cables: a case study for the Belgian North Sea

Oscar DELBEKE, Johan DRIESEN

KU Leuven

PS3 - TOWARDS SUSTAINABILITY

ID: 10332

B1 INSULATED CABLES - Full Papers

Topics: B1 PS3 - Towards Sustainability

Keywords: Circular Economy, Crosslinked, Thermoset, Cable Materials, Sustainability

Sustainable Circular Solutions for Cables with XLPE Insulation System

Paul BRIGANDI¹, Maria MOUBARAK², Edit BERCZI³, Saurav SENGUPTA¹, Alison SHAPIRO⁴

¹Dow, United States of America; ²Dow Deutschland, Germany; ³Dow Europe GmbH, Switzerland; ⁴University of Delaware, United States of America

ID: 10333

B1 INSULATED CABLES - Full Papers

Topics: B1 PS3 - Towards Sustainability

Keywords: Chemistry, Cure-Scorch, Sustainability, XLPE

Positive Impact of Novel XLPE on both Performance and Sustainability

Timothy PERSON¹, Roshan AARONS², Edit BERCZI³, Saurav SENGUPTA¹

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS3 - Towards Sustainability

Design for sustainability (D4S)

Alberto BAREGGI

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Topics: B1 PS3 - Towards Sustainability

Development of GIS Cable Termination with improved Compactness and Compatibility towards SF6 alternative Gases

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B1 INSULATED CABLES - Full Papers

Topics: B1 PS3 - Towards Sustainability

Keywords: gas insulated lines, pressurized air cables, GIL, GIB, high voltage, medium voltage, SF6-free, operational experience, HV testing

On-site testing and 1-year operational experience for 145 kV, 2500 A pressurized air insulated cables

Marcel STOECKLI¹, Walter HOLLAUS^{*2}, Zeljko TANASIC², Raphael LUETHI², Jasmin SMAJIC³

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ID: 10952

B1 INSULATED CABLES - Full Papers

Topics: B1 PS3 - Towards Sustainability

Keywords: HVDC, accessories, alternative gases, dry, termination

Towards innovative solutions to connect HVDC cables with less potential environmental impact

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ID: 11002

B1 INSULATED CABLES - Full Papers

Topics: B1 PS3 - Towards Sustainability

Keywords: High-voltage Cable Systems, HV Intelligent Solutions, Impulse Voltages, Partial Discharge Alarming, Shield Induced Voltages, Shield Currents

Enhanced HV Cable Connection Alarm System: Introducing i-LinkBox™

Sadettin ERDENİZ, Yusuf HIZAL

EM Elektrik-EMELEC Türkiye

ID: 11285

B1 INSULATED CABLES - Full Papers

Topics: B1 PS3 - Towards Sustainability

Keywords: HPFF cable, Pipe coating, Reaction force, Reduced insulation thickness, Replacement

Development of replacing method from HPFF cable to XLPE cable system sustaining old steel pipe

Yusuke MURAKAMI¹, Fumihiko TAKI¹, Kimihiro IWASAKI¹, Takuto KOBAYASHI², Makoto SUIZU³, Ryu MATSUO⁴

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ID: 11896

B1 INSULATED CABLES - Full Papers

Topics: B1 PS3 - Towards Sustainability

Keywords: Renewable energy sources, underground cable, multiple cables per phase, cable ampacity.

Design process for the assessment of currents distribution and ampacity on high loaded 36 kV links with multiple cables per phase

Enrico DI VITO, Paolo FALESSI, Lorenzo GARZELLI, Luca GUIZZO

B2 - OVERHEAD LINES

PS1 - CHALLENGES FROM RENEWABLES INTEGRATION AND INFLUENCES OF ENERGY TRANSITION ON OHL

ID: 10173

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Application of Phase-to-phase Spacers in Prevention and Control of Ice-Shedding on Compact Transmission Lines

Zenghao HUANG¹, Hao LI¹, Lingmeng FAN¹, Linjie ZHAO¹, Qi YANG², Hao PAN²

¹China Southern Power Grid Research Institute Co., Ltd ,China; ²Electric Power Science Research Institute of Yunnan Power Grid Co., Ltd China

ID: 10313

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: HVDC, hydrophobic surfaces, polluted insulators, IEC 60815, DC insulators

HVDC overhead line insulators: basics and performance

Jean-Marie GEORGE, Damien LEPLEY

Sediver, France

ID: 10359

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Double circuits overhead lines DC + AC: focus on EMF of the pilot project 500kV DC + 132kV AC

Andrea PIGNATA

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

The new 500 kV HVDC Italian Overhead Lines

Gabriele TRESSO

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: Overhead lines, induced currents, temporary earthing, portable earthing device, arcing

Considerations for temporary earthing in compact and heavy loaded OHL

Ebbo DE MEULEMEESTER¹, Ranjan BHUYAN², Dhruvi SHUKLA¹, Pragati KIDAMBI¹, Chris ENGELBRECHT³

¹DNV; ²TenneT TSO; ³DNV / Technical University of Delft

ID: 10574

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: Overhead Lines, Uprating, HTLS conductor, Tower Reinforcement, Conductor Selection

Design Challenges and Recommendations in Uprating the Existing 380 kV Overhead Lines, The Netherlands

Tom BÖRGER¹, E. PLATENKAMP², Jeff BROWN², Renata GHENO¹

¹DNV; ²TenneT TSO

ID: 10620

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Nodes-based connection system for the cost-effective assembly of tubular lattice towers

José Ramón LÓPEZ-BLANCO¹, Pablo RODRÍGUEZ-HERRERÍAS², Norberto IBÁN-LORENZANA³, Antolín LORENZANA-IBÁN⁴, Álvaro MAGDALENO-GONZALEZ⁴, Carlos GARCÍA-BARRIOS²

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ID: 10766

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: Energy transition, regional interconnections, transmission line optimization, compacting, bundle expansion, Surge Impedance Level (SIL)

500 kV Paranaíba OHL - A HSIL line with high transmission capacity: Design, construction and performance report

Luiza Lemos Nogueira MARTINS, João Batista Guimarães Ferreira DA SILVA, Ricardo ANDRADE, Ronaldo COELHO

Brazilian NC of CIGRE, Brazil; Paranaíba

ID: 10790

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: remote monitoring, power transmission capacity of OHLs, wire state

Real-time Continuous Remote Wire Condition Monitoring System for Evaluation of Overhead Line Capacity

Mikhail PANARIN, Viktor TOKAREV

ServiceEnergy Ltd, Russian Federation

ID: 10900

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Maximizing power transfer and RES integration using Dynamic Line Rating (DLR) - Ireland TSO experience

Kingsuk SAHA¹, Derek CARROLL¹, Andrew MCGRATH², Aidan GEOGHEGAN¹, Dag DREJER³, Vemund LOSNEDAL³, Aran STOKES¹

¹EirGrid; ²ESB Networks; ³Heimdall Power

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

A Data-Driven Machine Learning Framework for Day-ahead Estimation of Dynamic Line Rating in Power Systems

Rohit TRIVEDI, Chittesh CHANDRAN

EirGrid

ID: 10928

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: Braced line posts, Compact lines, Composite insulators, Insulated cross-arm

Evolution, State of the Art and Future Development Trends in Composite Insulated Cross-arm Technology

Usama AHMED¹, Eric MOAL³, Xinlong WANG², Yanlin LI², Jie YU², Liu CHAO²

¹SHEMAR, Canada; ²SHEMAR, China; ³SHEMAR, France

ID: 10954

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: Dynamic line rating - Increased capacity of existing OHL – LIDAR - Sensor application - Weather data

Predicting Capacity Gains from Dynamic Line Rating prior to Sensor Deployment

Tobias AASPRONG, Gunnhild SVANDAL PRESTHUS

Statnett Norway

ID: 10957

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: Ampacity, Conductor, High temperature low sag, Transmission, Test

High temperature low sag conductors in high ice load regions

Vivendhra NAIDOO¹, Bjarni Helgi THORSTEINSSON², Kjell Åge HALSAN²

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ID: 10977

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: Overhead line, Ampacity, DLR, Realtime, Forecast, Conductor temperature, Wind speed

Efficacy of introducing a DLR system for the operation of an overhead line connected with high power photovoltaic facilities

Tomoki KITASHIMA¹, Yves BRUSTEN², Daisuke SAITO¹, Brian BERRY², Jonathan MCGINNIS², Laurent GERLACHE²

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ID: 11044

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: EHV AC, Radio, Interference

Audible Noise and Radio Interference Constraints for Hybrid Conversion of Existing EHV AC Overhead Lines: Mexican and Italian Case Studies

Francesco PALONE¹, Carlos TEJADA-MARTINEZ²

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Noise-reducing conductors for reconductoring projects

Jeremy UNTERFINGER, Stefan STEEVENS, Saskia MÖLLENBECK, Benjamin SCHRÖDER, Steffen RIEBLING

Amprion GmbH, Germany

ID: 11141

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: Insulated cross-arms, Overhead lines, Retrofitting, Voltage uprating.

Voltage Uprating of 275 kV Overhead Transmission Lines to 400 kV with Retrofit Insulated Cross-arms (RICA)

James DEAS¹, Usama AHMED², Xinlong WANG³, Yanlin LI³, Tango Teh PT⁴, Alfredo FERNANDEZ⁵, Bahare HASSANPOUR⁶

¹National Grid UK; ²SHEMAR Canada; ³SHEMAR China; ⁴SHEMAR UK; ⁵SHEMAR Spain; ⁶Wood plc UK

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Improved Model for Overhead Line Audible Noise Prediction

Oliver PISCHLER¹, Uwe SCHICHLER¹, Isobel GREEN², Azeez AJIBOLA²

¹TU Graz; ²SSEN Transmission

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Sustainable Transmission Innovation with Poles, Cables, and Insulators -TRIPI-Study Case in Urabá, Colombia

Jhoinner OSORIO, Diego TAUTA

EPM

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Optimization Algorithm for Transmission Line Routing with Multicriteria Constraints

Anderson VELANDIA¹, Cristian MENDOZA¹, Fernando DINIZ², Judy VALVERDE¹, Wallace HONORATO²

¹Enlaza Grupo Energía Bogotá; ²Argo

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Wind speed measurement at the conductor for exact ampacity calculation for overhead power lines

Wolfgang FRÖB¹, Carsten BROCKMANN², Andreas HORETH¹, Alexandra KRAEMER³

¹LTB Leitungsbau GmbH, Germany; ²Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration IZM, Germany; ³BKW ES, Germany

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

First HV DC links in KSA OHL networks, conductor design, DC loss studies, manufacturing and testing

Mohamad EL CHMOURI

RIYADH CABLES GROUP, KSA

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Turning Cold Deserts of India into Solar Energy Powerhouse by Developing a Transmission system Through Snow Cladded Mountains

Karanvir Singh PUNDIR, Nitesh KUMAR, Dr. Subir SEN, Rajesh GUPTA, Abhay CHOUDHARY

Power Grid Corporation of India Limited , India

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Innovative Solution & Construction Technique For Cable Termination Arrangement for Transmission Line Towers

Rahul PURI*, Nitesh Kumar SINHA, Rajesh GUPTA, Dr. Subir SEN, Abhay CHOUDHARY

Power Grid Corporation of India Limited , India

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Rock bolting raft foundation of a Long span Narrow based terminal tower for Lower Subansiri Hydropower project – POWERGRID Experience

Pradeep PALANISAMY*, Neeraj Singh GAUTAM, Nitesh Kumar SINHA, Rajesh Gupta GUPTA, Dr Subir SEN, Abhay CHOUDHARY

Power Grid Corporation of India Limited India

ID: 11527

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

DESIGN CONSIDERATIONS & ROUTE SELECTION FOR WORLD'S HIGHEST ALTITUDE +/-350 kV MULTIPOLE HVDC TRANSMISSION LINE

Ashish SINGH, Nikhil JHA, Chandra KANT, Anil SHARMA, Rajesh KUMAR

POWERGRID CORPORATION OF INDIA LIMITED , India

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

A Study on the New Adjustment Device to Adjusting a Sagging of Wires for Overhead Lines

Heejeong YU, Kyunghun LEE, KiHyun CHO, Jongchae KIM

KEPCO, Korea, Republic of (South Korea)

ID: 11615

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Passive asset activation through a measuring system based on fiber optics in context of asset management, strategies, technologies and methods for OHL

Franziska GEBHARDT, Roman SIMKIN, Dirk KUNZE, Dennes MENTZ

50 Hertz Transmission GmbH, Germany

ID: 11667

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Development of Design Rules for the Use of New High-Strength Steels for Lattice Towers

Jan MAESSCHALCK¹, Sofia ANTONODIMITRAKI², Marios-Zois BEZAS², Jean-François DEMONCEAU², Muhammad Omer ANWAAR³

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ID: 11687

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Key challenges of Design & Construction in Creek Area of 765 kV D/C Hexa Conductor Based Lakadia Vadodara Transmission Project

Chandan KALRA*, Harish KUMAR*, Prem KUMAR, Rajesh SURI

Sterlite Power Transmission Limited, India

ID: 11717

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: power system, overhead line, dynamic line rating, dynamic modeling

Dynamic modeling and analysis of a DLR System towards increasing overhead transmission Lines ampacity

Jemma MAKRYGIORGOU, Christos – Spyridon KARAVAS, Ioannis MORAITIS, Efthimia CHASSIOTI, Jun RONG

Department of Research Technology & Development, Independent Power Transmission Operator (IPTO) S.A., Athens, Greece

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Emission-free Electric Drum Winch eST 140

Michael ERSPAMER², Gisela GRUBER¹, Ulrich OTTERMANN³

¹Zeck GmbH, Germany; ²Omexom Hochspannung GmbH Zeck GmbH, Germany; ³TenneT TSO GmbH

ID: 11759

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: bundling effect, connection to grid, corridor usage, stakeholder engagement, routing, renewables, geographic information systems

Optimal routing of corridors and paths of OHL for grid connectivity and substation siting with improved stakeholder engagement

Marcel STOECKLI¹, Stefano GRASSI²

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ID: 11776

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: Artificial intelligence (AI), AC corona, Electric field intensity, Overhead power lines

Advanced Overhead Power Lines Electric Field and Stationary AC Corona Analysis Utilizing Artificial Intelligence

Adnan MUJEZINOVIC, Ajdin ALIHODŽIĆ, Emir TURAJLIĆ, Maja MUFTIĆ DEDOVIĆ, Zijad BAJRAMOVIĆ

University of Sarajevo - Faculty of Electrical Engineering, Bosnia and Herzegovina

ID: 11899

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS1 - Challenges from Renewables Integration and Influences of Energy Transition on OHL

Keywords: Direct Line Monitoring, Dynamic Line Rating, Error Propagation, Maximum Operating Temperature.

Navigating Uncertainties in Dynamic Line Rating Estimation

Brian LEIST, Kristine ENGEL, Josef SPALENKA, Clay WATERS, Rachael GRUDT, Nathan PINNEY, Jon MARMILLO

LineVision Inc.

PS2 - ASSET MANAGEMENT, STRATEGIES, TECHNOLOGIES AND METHODS FOR OHL

ID: 10137

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Assets management tools, OHL, modelling, wind-induced aeolian vibrations, damages

Damage in overhead lines – A tool for lifespan prediction

Julien SAID¹, Emmanuel CIEREN², John REFORD², Maxime GUEGUIN², Rémi CAPILLON², Matthieu ANCELLIN²

¹RTE, France; ²Eurobios, France

ID: 10175

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

A Forest Fire Target Detection Method Based on YOLOV8

Yuanjun ZUO, Zhihong HUANG, Yunlong SUN, Jian XIAO, Sheng WU

State Grid Hunan Electric Power Company Limited Research Institute, China

ID: 10176

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Analysis of lightning strike distribution of typical 500 kV transmission lines based on lightning data and distributed transient traveling wave

Shanqiang GU, Yingpu XIE, Jian LI, Min WU, Mengfei LEI, Xiaoqin ZHANG

State Grid Electric Power Research Institute, China

ID: 10178

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Experimental Study on the Characteristics of Grounding Devices for Towers of Overhead Transmission Line

Bo ZHANG¹, Sen WANG², Shanqiang GU³, Zhizhong LI², Yingpu XIE³

¹Tsinghua University, China; ²Shaanxi Electric Power Research Institute, China; ³State Grid Electric Power Research Institute, China

ID: 10179

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Lightning Risk Assessment Method for Transmission Channel Based on EGM and Numerical Solution

Shanqiang GU, Mengfei LEI, Jian LI, Min WU, Hua REN, Yingpu XIE

Wuhan NARI Limited Company, State Grid Electric Power Research Institute, China

ID: 10314

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: overhead line cable, asset management, non-destructive testing, ACSR

Test bench and database for ACSR cable non-destructive testing

Pascale PRIEUR¹, Stéphane HEURTAULT¹, Louise EYMARDAUPHIN¹, Julien SAID¹, Jean-Philippe SAUT², Kieu-Diem HO²

¹RTE, France; ²EUROBIOS, France

ID: 10336

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Artificial Intelligence, Asset Management, Object Detection, Transmission Line Inspection

AI-Enabled Transmission Line Inspections

Zefan TANG, Jing YANG, Junhui ZHAO, Elizabeth HALL, Asim FAZLAGIC

Eversource Energy, United States of America

ID: 10490

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Risk-based after-service Inspections and Testing of overhead Line Composite and Porcelain Insulators for residual Life Assessment

Igor GUTMAN¹, Johan LUNDENGÅRD¹, Matthew HEATH², Charles KURNIAWAN²

¹Independent Insulation Group Sweden AB; ²Transgrid Australia

ID: 10500

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Resilience, Decision Support, Wildfires, Natural Risks, Infrastructure, Protection, Simulation

Decision Support Center with Multi-sensory Data for Infrastructure Protection

João GASPARI¹, Luís Mário RIBEIRO², José MOREIRA¹, Carlos VIEGAS², Pedro MARQUES¹, David ALMEIDA²

¹REN - Redes Energéticas Nacionais, SGPS, S.A.; ²Univ Coimbra, ADAI, Department of Mechanical Engineering

ID: 10501

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Polymeric insulators, Condition assessment

Defect Analysis of Polymeric High Voltage Insulators: Condition Assessment and Inspection Techniques

André COELHO¹, Gonçalo PINTADO², Pedro NUNES¹, Rui MARTINS¹

¹EDP Labelec, Portugal; ²REN, Portugal

ID: 10502

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Electromagnetic interference, gas pipelines, transmission line

On the assessment of electromagnetic interference of overhead lines and underground cables on gas pipelines

Andreia LEIRIA, João TARQUÍNIO, António ESTEVES

EDP Labelec, Portugal

ID: 10618

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Use of insulating towers in high voltage transmission lines: effect of grounding elimination on lightning performance

Iván HIGUERO-TORRES¹, Carlos GARCÍA-BARRIOS², Alexandra BURGOS-MELGUIZO², Paulino APARICIO-CILLÁN², Pedro LLOVERA-SEGOVIA^{1,3}, Vicente FUSTER-ROIG^{1,3}

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ID: 10621

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Integrated system for work at height safety management

Pablo RODRÍGUEZ¹, Carlos RODRÍGUEZ², Guillermo GONZÁLEZ³, Javier VALDÉS⁴, Abel SANCHO⁴, Jesús MARTÍN⁵, Alejandro SICILIA⁵

¹Red Eléctrica, Spain; ²Elewit, Spain; ³Redeia, Spain; ⁴AOS, Spain; ⁵Amplia, Spain

ID: 10705

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Experience with Satellite Imagery for Maintenance of OHL Lines

Emanuel DE BOE¹, Görg Philip MAXIMILIAN², William VAN DEN BROECK¹, Irid BUI²

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ID: 10735

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Composite Insulator, Acid Resistance of Silicone Rubber, Hydrophobic Retention, Hydrophobicity Recovery, Hydrophobicity Transfer, Contact Angle

Influence of Acid Attack on the Hydrophobicity of HTV Silicone Rubber on Composite Insulators

Marcel STOECKLI¹, Jaka STRUMBELJ^{*2}, Yannick INDERBITZIN², Urs GASSER², Christine BAER³

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ID: 10736

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Audible Noise Mitigation, Corona Discharges, Enlargement of Conductor Diameter, Surface Treatment, Calculation of Audible Noise Emission

Combined Effects of Audible Noise Mitigation Measures for OHLs by Surface Treatments and Enlargement of Conductor Diameter

Marcel STOECKLI¹, Hannah KIRCHNER^{*2}, Christian FRANCK², Benjamin SCHROEDER³

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²ETH Zurich, Switzerland; ³Amprion GmbH, Germany

ID: 10768

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Nanosatellites, Monitoring, Overhead Lines, Wildfire, Artificial Intelligence, NDVI and Images

Monitoring Overhead Lines through images from nanosatellites

Carlos NASCIMENTO¹, Thiago MUNIZ², Demetrio AGUIAR², Valter SILVA¹, Guilherme BRANGIONI¹, Lucas SOUZA¹

¹Brazilian NC of CIGRE, Brazil; Cemig GT; ²Cemig D

ID: 10778

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Corrosion, Atmospheric pollution, Transmission lines, Galvanized carbon steel, Atmospheric corrosion, Artificial Salt Spray, Electrochemical tests

Atmospheric weathering and corrosion, in a tropical country such as Brazil, in the maintenance costs of metallic materials in power transmission lines

Fernando DINIZ¹, Euro PINTO DE ALMEIDA², Thiago Luiz FERREIRA¹, Alberto RODRIGUES DE SOUSA¹, Camila PACHER³, Julia Stefany ALBRECHT³, Mariana BRAGANÇA³, Kleber PORTELLA³, Juliano DE ANDRADE³, Bruno KOWALCZUK³, Mauricio MAZUR³

¹Brazilian NC of CIGRE, Brazil; ARG0; ²Consultor; ³LACTEC

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Hyperspectral Imaging for the Corrosion Detection on Metallic Lattice Towers

Frédéric MANGIALETTO¹, Irid BUFI², Mohring WENCKE², Eveline VRANKEN¹, Roeland VANDEBRIEL³, Michiel VLAMINCK³, Zakaria BNOULKACEM³, Mina ZAHIRI³, Gonzalo LUZARD³, Hiep LUONG³

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ID: 10973

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Full-scale test, Slim type tower, Tower in Tower, Wind tunnel experiments

Development of the design and construction method for newly constructing a slim tower inside an existing 275 kV tower

Hayato SANO, Motoyuki YAMAZAKI, Yoshiyuki SAITO, Tomoaki OSONO, Keito MURAKAMI, Tomonori SHIRAISHI

TEPCO Power Grid, Japan

ID: 10979

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: CFRP, maintenance technology, reliability, existing tower, flat bar

Development of steel tower reinforcement method using flat bar and steel tower repair method using carbon fiber

Hiromitsu IJICHI, Keito MURAKAMI, Keigo TANAKA, Tomoaki OSONO, Motoyuki YAMAZAKI, Tomonori SHIRAISHI

TEPCO Power Grid, Inc., Japan

ID: 10980

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Anomaly detection, Automated inspection, Drones, Machine learning

Development of automated inspection technology for overhead transmission lines using drones

Fumihiko KONDO¹, Yuki MARUME¹, Takaya MASUDA², Masahiro OGAWA², Kentaro FUKAMI², Erika TANAKA²

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ID: 10981

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Audible noise, Inspection robot, Partial discharge

Field Experience and Maintenance Assessment of RTV Coated Cap and Pin Insulators in Japan

Ryo YUZAWA¹, Asuka TOKURIKI¹, Motohiro MAEDA², Toshiyuki NAKACHI²

¹Chubu Electric Power Grid Co., Inc., Japan; ²NGK Insulators, Ltd., Japan

ID: 10986

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Composite insulator, Spacer, Polymer, Electrical breakdown, Aging

Mechanism Clarification of Insulating Performance Decreasing by Aging of Polymer Insulators for Overhead Transmission Lines

Teruhisa TATSUOKA¹, Toshihiro TSUBOI¹, Hiromitsu IJICHI², Tatsuya ISHIKAWA², Sakae TANIGUCHI², Tomonori SHIRAISHI²

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: asset health index, mechanical stresses, temperature influence, tower, vibration

Asset Health Index for Towers and Conductors in the Framework of EU Project FARCROSS

Viktor LOVRENCIC¹, Nenad GUBELJAK², Bálint NÉMETH³, Matej KOVAČ⁴, Levente RACZ⁵, Ana LOVRENCIC⁶

¹C&G Ljubljana, Slovenia; ²Faculty of Mechanical Engineering, Maribor, Slovenia; ³BME Budapest, Hungary; ⁴GRIDPULSE Ljubljana, Slovenia; ⁵BME Budapest, Hungary; ⁶C&G Ljubljana, Slovenia

ID: 11082

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Case study for refurbishment of 33kV line with surge arresters on the earth wire

Anne WILLIAMS

Aurecon, Australia

ID: 11108

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Impact of Bushfire on Conductor Performance - Prioritising Rectification Works

Matthew HEATH¹, Charles KURNIAWAN¹, Brendan SHANAHAN¹, Tim MACPHERSON², Denis DOWLING²

¹Transgrid, Australia; ²Raedyne Systems, Australia

ID: 11160

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Wind induced acoustic emissions on glass insulators

Carina LINTNER¹, Oskar OBERZAUCHER¹, Michael LEONHARDSBERGER¹, Fabien VIRLOGEUX²

¹Austrian Power Grid AG; ²Sediver S.A.S.

ID: 11194

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Incorporation of New Technologies (drones) in the Maintenance and Monitoring of the Condition of High-Voltage Transmission Lines in ISA-INTERCOLOMBIA

Natalia RESTREPO, Carlos PUELLO, Juan PEÑA

ISA Intercolombia

ID: 11230

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Drones, innovative methods, asset reliability, technological advances

The use of drones for preventive maintenance of high voltage transmission lines: business case and field experiences

Samuel A. ASTO¹, Daiana A. DA SILVA², Alejandra M. LUNA¹

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ID: 11314

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Risk Management – Storm - Resilience - High Voltage – Overhead Line – Protection Zone – Dynamic Model – Network Performance - Optimisation

Towards a Digital Twin for Management of OHL Risk

Ailidh MEEK¹, Matthew JONES¹, Alexandra CAMPBELL¹, Iain DIVERS¹, Taco ENGELAR², Mark LEEMAN²

¹SP Energy Networks UK; ²Neara UK

ID: 11353

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: DLR, overhead line, sensor, neural network, distributed monitoring

Power System Management based on Distributed Line Monitoring

Levente RÁCZ, Dávid SZABÓ, Gábor GÖCSEI, Bálint NÉMETH

Budapest University of Technology and Economics

ID: 11357

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Live-line maintenance, accident analysis, work safety, overhead line, personal protective equipment

Analysis of Live Work Accidents in Transmission Lines and Recommendations to Improve Working Safety

Dávid SZABÓ¹, Dániel BALOGH¹, Bálint NÉMETH¹, Eduardo RAMIREZ-BETTONI²

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ID: 11471

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Assessment of Operating Life of Silicone Rubber HV Insulator Coatings in Harsh Desert Environment

Raouf ZNAIDI¹, Ahmad ALTHAGAFI²

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ID: 11504

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Use Of Convolutional Neural Network For Defect Identification From Tower Images And Unsupervised Machine Learning Algorithms For Transmission Line Vulnerability Estimation

Neeraj JOSHI*, Sukdev MONDAL, Neelanjana JAIN, B.C. JHA, Virendra KUMAR, Harsh PAREEK, Sandeep Ramesh BANKAR, VMS Prakash YERUBANDI*, Vinay K CHOWDHARY, Alok RAJ, Vijay Prakash PURI, M S HEJIB, Dharambir KUMAR, Vibhay KUMAR, R K I TYAG

POWERGRID CORPORATION OF INDIA LIMITED, India

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Comprehensive Rectification Methodology for Submerged Pile Foundation of Overhead Transmission Line Towers

Pankaj Kumar DWIVEDI, Nitesh Kumar SINHA, Rajesh GUPTA, Dr. Subir SEN, Abhay CHOUDHARY

Power Grid Corporation of India Limited, India

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Transforming Transmission Line Surveys: An Innovative AI-Based Optimization Approach

Neeraj Singh GAUTAM*, Priti NAHAR, Rajesh GUPTA, Dr. Subir SEN, Abhay Chaudhary CHAUDHARY

Power Grid Corporation of India Limited, India

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Residual Life Estimation of Overhead Transmission Lines based on Asset Health Indexing

Devaprasad PAUL*, Joseph George JOSE, Deo Nath JHA, Kuleshwar SAHU

POWERGRID, India

ID: 11630

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Implementation of AHL for risk-based asset management approach on overhead lines and the strategic value towards transmission grid

Franziska GEBHARDT, Roman SIMKIN, Andre DECKWERTH, Dirk KUNZE

50 Hertz Transmission GmbH, Germany

ID: 11672

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Use of Gantries as Medium-Term Support to Ensure Continuity of Service for OHL After Severe Structural Damage in an Impact Incident

Jan MAESSCHALCK¹, Kris NUYTS²

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ID: 11710

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: UAVs, OHL Inspection, Fault Detection, Machine Learning, Drones, Artificial Intelligence

The Innovative Project “ALTITUDE” - Automatic aerial Network inspection using Drones and Machine Learning

Georgios CHATZARGYROS¹, Vasiliki KOTOULA¹, Evangelia RIGATI¹, Dimitrios STIMONIARIS², Dimitrios TSIAMITROS², Apostolos PAPA-KONSTANTINOU³, Argyrios MOUSTAKAS³, Dimitrios SIMOS³, Georgios LOUKOS⁴, Sotirios CHRISTOPOULOS⁴, Georgios DOUKAKIS⁴, Konstantinos MARIOLIS⁴, Konstantinos KAOUSIAS⁴

¹Renel I.K.E, Greece; ²INNORA, Greece; ³SciDrones, Greece; ⁴Hellenic Electricity Distribution Network Operator (HEDNO), Greece

ID: 11898

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: Overhead lines, Aeolian vibration, Wind estimation, Amplitude profile, Fretting fatigue.

Probabilistic Assessment of the Residual Life of Overhead Conductors Under Aeolian Vibrations

Shaoqi YANG¹, Luc CHOUNARD¹, Sébastien LANGLOIS², Pierre VAN DYKE³, Josée PARADIS³

¹McGill University; ²Université de Sherbrooke; ³Institut de recherche d'Hydro-Québec

ID: 11906

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: HTLS conductor, Overhead transmission lines, Composite core, Monitoring, Non-Destructive Testing (NDT).

Dielectric testing for integrity assessment of overhead composite core conductors

Léo RICHARD

Epsilon Composite Cable

ID: 11908

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS2 - Asset Management, Strategies, Technologies and Methods for OHL

Keywords: corona discharge, audible noise emission, water droplet, overhead line, negative halfwave.

Investigation of audible noise emissions from corona discharges of single water droplets on different surfaces under AC stress

Yang LU, Christian FRANCK

ETH Zurich

PS3 - IMPACTS FROM CLIMATE CHANGE ON OHL

ID: 10183

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Analysis of ice shedding induced faults of multiple voltage levels overhead lines and its mitigation strategies

Kunpeng JI, Bin LIU, Jialun YANG

China Electric Power Research Institute, China

ID: 10184

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Design and experimental analysis of arrester for ± 800 kV UHVDC OHL

Wei CAO^{1,2}, Shanqiang GU^{1,2}, Jian LI^{1,2}, Shuai WAN^{1,2}, Jian WANG³

¹Wuhan NARI Limited Company, China; ²State Grid Electric Power Research Institute, China; ³State Grid Corporation of China, China

ID: 10185

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Development of Galloping Distribution Maps for Overhead Transmission Lines with Specific Return Period in China

Jialun YANG, Bin LIU, Bin ZHAO, Yi LIU, Zhiyuan LU

China Electric Power Research Institute, China

ID: 10186

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Potential Wildfire-induced Tripping Section Assessment of Transmission Line Based on Tree Identification and Flame Combustion

Linmeng FAN^{1,2}, You ZHOU³, Enze ZHOU^{1,4}, Lei WANG^{1,4}

¹Electric Power Research Institute, China; ²Southern Power Grid Co., Ltd., China; ³Changsha University of Science and Technology, China; ⁴Guangdong Power Grid Co., Ltd., China

ID: 10307

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Keywords: IRMA, Numerical model, Hurricane integration, methodology, OHL design rules

Hurricane IRMA feedback in the French West Indies

Pierrick PRIGENT, Jean MARTINON

EDF, France

ID: 10327

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Keywords: Covered Conductor, Overhead Line, Wildfire, Distribution, Insulator

Testing the Effectiveness of Covered Conductors for Wildfire Mitigation

Ben GEORGIN¹, Matt BOWERS¹, Alex HUDGINS¹, Hunly CHY², Arianne LUY²

¹Exponent, Inc., United States of America; ²SCE Company, United States of America

ID: 10608

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Keywords: Solar absorptivity, Ampacity, Energy transit, Non-contact probe, Live-line measurement, ACSR conductor, Robotic, Non-planar surface

A Novel Probe for Non-Contact, In-Situ Assessment of Solar Absorptivity: The Special Case of ACSR Conductors

Jonathan BELLEMARE, Ghislain LAMBERT, Sébastien LEPROHON, Marion NOURRY, Vincent Q. GUAY, Pierre-Luc RICHARD, Nicolas POULIOT

Hydro-Québec, Canada

ID: 10884

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Keywords: meteorological calculations and ice and wind load modeling, dynamic modeling of mechanical loads on OHL towers

Multiphysics OHL modeling

Aleksandar TERZIĆ, Nebojša PETROVIĆ

Elektromreža Srbije JSC, Serbia

ID: 10982

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Keywords: Atmospheric Corrosion Monitor, Artificial snow accretion test, Field monitoring, Insulator, Snow accretion

Packed Snow Accretion on Overhead Transmission Line Insulators - Field Monitoring and Snow Conductivity Measurement using Atmospheric Corrosion Monitor -

Manabu SAKATA¹, Yusaku SATO¹, Hiroki MIZOE², Masayoshi MASUDA², Ryota ICHIKAWA³

¹Nippon Katan Ltd., Japan; ²Tohoku Electric Power Co., Inc., Japan; ³Tohoku Electric Power Network Co., Inc., Japan

ID: 10983

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Keywords: Auxiliary Member, Semi-Diamond Structure, Snow Accumulation

Design and verification of countermeasure against snow accumulation on transmission towers

Kento FUJII¹, Katsuyuki ENDO¹, Akihiro WATANABE¹, Koichi MINAGAWA², Isamu HIROTA²

¹Tohoku Electric Power Network Co., Inc., Japan; ²TOMOE Corporation, Japan

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B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

GIS database for overhead lines resilience to extreme ice events

Anne WILLIAMS¹, Matthew HEATH², Charles KURNIAWAN²

¹Aurecon, Australia; ²Transgrid, Australia

ID: 11155

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Data analysis and technical description of the ice monitoring system at Austrian Power Grid

Oskar OBERZAUCHER¹, Carina LINTNER¹, Conner GARCIA¹, Tommy MYRVIK²

¹Austrian Power Grid AG; ²Heimdall Power

ID: 11158

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Investigation of the future development of temperature and low wind velocity in climate change for the Austrian power grid

Kerstin WEINDL¹, Klemens REICH¹, Hans RESSL², Theresa SCHELLANDER-GORGAS², Max NUTZ²

¹Austrian Power Grid; ²Geosphere Austria

ID: 11196

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Satellite Images as a Tool for Risk Management in Transmission Lines: Results of a Pilot with Emphasis on Landslides

Alexander BEDOYA, Mallory SUAREZ

ISA Intercolombia

ID: 11223

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Keywords: transmission tower, grounding, impedance, design, improvement

Influence of transient impedance due to atmospheric discharges in the design of grounding of transmission towers

Hugo Eduardo BARREDA SÁNCHEZ

Redinter - Redeia

ID: 11507

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Measures to mitigate effect of cyclone on the transmission line structures

Karanvir Singh PUNDIR*, Nitesh Kumar SINHA, Rajesh GUPTA, Dr. Subir SEN, Abhay Choudhary CHOUDHARY

Power Grid Corporation of India Limited, India

ID: 11635

B2 OVERHEAD LINES - Full Papers

Topics: B2 PS3 - Impacts from Climate Change on OHL

Climate change and its associated materials requirements

Franziska GEBHARDT¹, Wencke MOHRING¹, Jan KNACKMUS¹, Dirk KUNZE¹, Milad MEHDIANPOUR², Jan MAESSCHALCK³

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B3 - SUBSTATIONS AND ELECTRICAL INSTALLATIONS

PS1 - CHALLENGES AND NEW SOLUTIONS IN T&D SUBSTATION DESIGN AND CONSTRUCTION FOR ENERGY TRANSITION

ID: 10322

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Keywords: Distribution of Electricity, Environmentally Conscious Design, Electrical Enclosure, Technology, Substation

Next Generation Distribution Center in a Box (DCIAB)

Kushal SINGH, Jose MITRA, Sean FITZGERALD

Exelon/ComEd, United States of America

ID: 10337

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Keywords: Small Modular Reactor, Electrolyzer, Hydrogen, Nuclear, Substation

Small Modular Reactor and Hydrogen Production: "Impacts on Substation Design"

George W. BECKER

POWER Engineers, Inc., United States of America

ID: 10338

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Keywords: USA West Coast, Offshore Substation (OSS), Floating Offshore Substation (FOSS), Finite Element Analysis (FEA), Wave Basin Model Test

Conceptual Design of Semi-submersible Floating Offshore HVAC Substation Solution

Hongbiao SONG¹, Zhaoxiang TANG⁵, Yang OUYANG³, Robert LUESCHER³, Tobias STIRL⁴, Hana ASSEFA²

¹GE Vernova Grid Solutions, United States of America; ²GE Vernova Grid Solutions, Norway; ³GE Vernova Grid Solutions, Switzerland; ⁴GE Vernova Grid Solutions, Germany; ⁵Genesis Technip Energies, United States of America

ID: 10362

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

The 36 kV voltage level – a new standard solution for grid integration of renewable energy sources

Andrea VALANT

TERNA, Italy

ID: 10737

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Keywords: Floating Offshore Substation, FOSS, GIS, Simulation, Vibrations, Experimental Correlation

GIS for offshore and floating applications

Marcel STOECKLI¹, Yang OUYANG², Lukas TREIER², Bernhard SPICHIGER², Robert LUESCHER², Hongbiao SONG³

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ID: 10738

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Keywords: High voltage switchgear, SF6 alternatives, disconnector, earthing switch, C4-FN, LCA

420 kV SF6-free High Voltage Gas Insulated Switchgear Design, Type Tests and Product Footprint

Marcel STOECKLI¹, Vincent TILLIETTE², Navid MAHDIZADEH², Ueli STRAUMANN², Patrick STOLLER², Denis TEHLAR², Kalpesh CHAUHAN³

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ID: 10781

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Keywords: Energy Transition, BESS, Grid Code Compliance, Grid Impact

First Step toward Carbon Neutrality using BESS Project in South Africa

Jung Bae KIM, Minsoo LEE

Hyosung Heavy Industries

ID: 10903

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

The role of increased standardisation in the delivery of substation infrastructure to enable a low carbon future in Ireland

Hugh CUNNINGHAM, Ivan CODD, Enda HARRINGTON, Brendan LINEHAN, Bernard O'SULLIVAN, Colm TWOMEY
Electricity Supply Board (Ireland)

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Experience with HVDC GIS application during commissioning and early operation phase

Maria KOSSE¹, Christoph KLEIN¹, Maximilian TUCZEK², Frank Rene RICHTER³, Thomas GÖTZ¹

¹Siemens Energy Global GmbH & CO. KG, Germany; ²TenneT TSO GmbH, Germany; ³50Hertz Transmission GmbH, Germany

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

New test and commissioning tools and concepts for Low Power Instrument Transformers

Franz GATZE², Peter MENKE¹, Patrick MORITZ¹, Federico CANAS², Max BUROW¹, Joerg BLUMSCHEIN², Antoni Furlani ROSA³, Lucas VARELA³, Thomas NEUMEIER²

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Keywords: Floating, HVAC, HVDC, Offshore Wind, Primary Equipment, Substations

Offshore floating HVAC and HVDC substations – Experiences in design of selected primary equipment

Douglas RAMSAY¹, Mark GEARY¹, Thomas HAMMER², Thorsten STEINHOFF², Matthias STEUER², Stephan VOSS², Joerg HAFERMAAS², Yana SHATEROVA²

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Optimization of overall HV cable length in hybrid transmission technologies used for evacuation of power from off-shore wind parks/Solar parks by implementation of compact transition station.

BB MUKHERJEE, Sasikiran KANDALAM*, PNV Murali PRAKASH

Power Grid Corp. of India Ltd., India

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

EV Changing Infrastructure Design Challenges And Solutions – Case Study

Nilesh KANE, Ravindra BHANAGE*, Ajay POTDAR

TATA POWER, India

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Challenges And Precautions During Design And Engineering Of Gas Insulated Switchgear (GIS) Substation Of Hydro Projects

Gorav VIG *, Sudhir KUMAR, Dileep SHUKLA, Vivek KAPIL, Aruna GULATI

BHEL, India

ID: 11604

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Novel Solution for Converting Existing 400kV I-Type One & a Half Breaker Scheme to D-Type for Evacuating Double Circuit Lines in Same Direction Using 3D Modelling

Nishant SINGH*, Vinay Anand ANAND, Sanjeev SHRIVASTAVA, Aruna GULATI

BHEL, India

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Optimization Approach for the Layout design of 400/220kV Gas insulated Switchgear (GIS) Substations

Akhilesh KUMAR*, Aruna GULATI, Vivek KAPIL, Dileep K SHUKLA, Puneet CHAWLA

BHEL, India

ID: 11646

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Development of DC 320kV, 525kV GIS Cable terminations

Eui-hwan JUNG, Jin-ho NAM, Sung-yun KIM, Si-ho SON, Jung-nyun KIM

LS Cable&system, Republic of (South Korea)

ID: 11816

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS1 - Challenges and New Solutions in T&D Substation Design and Construction for Energy Transition

Keywords: Substation, Station Service Voltage Transformer, SSVT, Auxiliary Power Supply, Electrical Installation

Design and Considerations for Station Service Voltage Transformer (SSVT) to Provide Low-Voltage Supply in EGAT's Substation

Koranee PHONGKHUMPHAI, Nabhat CHAIYAPHAN, Thanyathep NANTACHAI, Korrakot WONGNIYOM, Pornpimon SAWADDEEMONGKON

Electricity Generating Authority of Thailand (EGAT), Thailand

PS2 - RETURN ON OPERATIONAL EXPERIENCES FOR SUBSTATION MANAGEMENT

ID: 10139

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Capacitive Voltage Transformers, power plant substation, diagnosis

In situ monitoring of the precision shift of capacitive voltage transformers

Bernard PAYA¹, Alain JEANMAIRE¹, Benoît BRUCHON²

¹EDF R&D, France; ²EDF CIST-INGEUM, France

ID: 10141

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Asset management, load capacity, temperature monitoring, wireless sensors

Solutions for temporarily increasing the Reliable Installation Capacity

François GEGOT¹, Lars EBBERS², Robert VOSSE³

¹Wika, France; ²Qirion, Netherlands; ³Alliander, Netherlands

ID: 10309

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: SF6 Alternatives, AIS circuit breakers, AC transmission network, HV main technologies, Operation and maintenance

Integration, Operation and Maintenance of AIS Circuit Breakers using SF6 alternatives - experience with the 3 HV main technologies

Emmanuel LOPES¹, Minh NGUYEN², Benoît BRUCHON¹, Fabrice MARETTE¹

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ID: 10339

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Flexible Conductor Dynamics, Transformer Bushing, Parametric Resonance, Damping, Mode Shapes

Seismic Resilience of Interconnected Substation Equipment: Lessons Learned from a Comprehensive Test and Modelling Program

Leon KEMPNER. JR.¹, M.V. SIVASELVAN²

¹Bonneville Power Administration, United States of America; ²University at Buffalo, United States of America

ID: 10340

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Risk, Condition, Assessment, Plans

Condition & Risk Assessment: Plans and Reality

Tony MCGRAIL¹, Philip BOREHAM¹, Jamie BEARDSALL⁴, Mark ROWBOTTOM⁴, Reena DHIR², Carl JOHNSTONE³

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ID: 10341

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Automation, Inspection, Robots, Specifications, Substation

System Approach to Evaluation and Deployment of Substation Robotics

Poorvi PATEL¹, Dean GORDON², Sergo SAGARELI³, Dexter LEWIS¹, Sunny BELLARY¹

¹Electric Power Research Institute (EPRI), United States of America; ²Con Edison, United States of America; ³Black & Veatch, United States of America

ID: 10342

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Substation Security, Substation Manmade Threats, Substation Environmental Threats, Substation Threat Mitigation Tactics

Evaluating and Comparing Substation Threat Mitigation Tactics: Substation Improvements for a More Resilient Power Grid

Paul SOMBOONYANON¹, Connor BOWEN²

¹AEC Lionstech, United States of America; ²Burns & McDonnell, United States of America

ID: 10343

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Substation Digital Transformation, Substation Digitalization, Substation Advanced Technologies

Overcoming Challenges and Progressing Electrical Substations toward Digital Transformation

Paul SOMBOONYANON¹, Brian PALMER²

¹AEC Lionstech, United States of America; ²Burns & McDonnell, United Kingdom

ID: 10582

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Monitoring System of Earth Loop Impedance to Verify Step and Touch Voltages

José R. VIDAL², Abderrahim KHAMLI^{2,1}, Antonio GONZALEZ³, José L. NAVARRO⁴, Pascual SIMÓN², Fernando GARNACHO¹

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ID: 10684

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Asset management, asset reliability, risk management, portfolio management, decision making, power transformer, substation

European Experience of Developing from Asset Reliability Information to Risk Method for Optimal Investment on Substation Assets

Jos SLANGEN¹, Qikai ZHUANG², Branislav PILAT³, Despoina MAKRIDOU⁴, Ilic VLADIMIR⁵, Jan CERNOHORSKY⁶, Phillipe CLAUDE⁷, Mehdi OTHMANI⁷, Uros KERIN⁸

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ID: 10716

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Spare Parts; Mean Time To Repair; Inventory; Optimization; Stock-out; Critical Spares; Critical Assets

A system risk approach for management and optimization of critical spare parts

Marcel STOECKLI¹, Enrico CONTE², Sourav ADHYA³, Sakthivel DURAIAPPAN⁴

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²Hitachi Energy, Switzerland; ³Hitachi Energy, Poland; ⁴Hitachi Energy, India

ID: 10739

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Operational Availability, HV GIS, MRE Code, Service Continuity Guide, Service Continuity, Maintenance, Repair, Extension

New Standards and Solutions for Service Continuity of HV GIS

Marcel STOECKLI¹, Jens HETTLER^{*2}, Mark KUSCHEL³, Samuel PACHLATKO⁴

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²Swissgrid AG, Switzerland; ³Siemens Energy AG, Germany; ⁴Hitachi Energy AG, Switzerland

ID: 10740

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: SF6 Alternatives, Gas-Insulated Switchgear, GIS, Gas-Insulated Line, GIL transmission, C4-FN fluoronitrile, gas handling, health and safety, retrofill, sealing material, installed base

Retrofill for 420 kV Gas-Insulated Lines: Technical Concept and Return of Experience

Marcel STOECKLI¹, Samuel PACHLATKO^{*2}, Michael GATZSCHE², Freddy VON ARX², Manuel NAEF², Francesco AGOSTINI², Mark WALDRON³

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ID: 10741

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Service Continuity Concept (SCC), Maintenance, Repair and Extension (MRE), gas-insulated switchgear (GIS), buffer gas compartments, work on partitions, Asset Life Cycle (ALC)

Implementation of the new IEC and CIGRE requirements on service continuity to high voltage gas insulated switchgears

Marcel STOECKLI¹, Samuel PACHLATKO^{*2}, Denis TEHLAR², Josef HANSON³, Jennifer-RuiQiong PAN⁴, Benoit GODEAU⁵, Thomas WIJNHOFEN⁵, Nicolas DEMARTHE⁵

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ID: 10769

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Substation; Power Generation; GEOBIM; Reality Capture; GIS; Point Cloud; Digital Twin; BIM

Case Studies - GEOBIM Substation and Power Generation Reality Capture for Digital Twin purposes

Ana MAROTTI¹, Gerson LIMA², Daniel FERNANDES³, Rodrigo AGUIAR⁴, Lucas HOLANDA⁵, Juliano Calazans MARQUES⁶, Sergio SILVEIRA⁷

¹Brazilian NC of CIGRE, Brazil; Eletrobras FURNAS; ²Computer Graphics Works; ³Eletrobras ELETRONORTE; ⁴Energia BIM; ⁵Eletrobras CHESF; ⁶Eletrobras CGT ELETROSUL; ⁷Imagem

ID: 10771

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Electric power substation; circuit breaker; online monitoring; integrated to the Asset Registry, Operating System and Geographic Information System (GIS); intelligent analysis; Artificial Intelligence; Digital Twins; BIM

Digital twins applied for intelligent analysis and real-time monitoring of circuit breakers in electrical power substations

Ana MAROTTI¹, Giovanni BERNARDES², Sergio SILVEIRA³, Clayton DUARTE PESSOA¹, Gerson F. M. LIMA⁴, Clodualdo SOUSA², Fabiano VILLANI³

¹Brazilian NC of CIGRE, Brazil; Eletrobras FURNAS; ²UNIFEI; ³Imagem Geosistemas; ⁴Computer Graphics Works

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

New Competencies and diagnostic Methods needed for the Application of Composite Insulators in Substations

Peter SIDENVALL

Independent Insulation Group Sweden AB, Sweden

ID: 10796

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

The Impact of Digital Transformation on the Asset Management System

Dmitry VODENNIKOV¹, Yulia ZHILKINA¹, Svetlana ZAKIROVA²

¹PJSC ROSSETI, Russian Federation; ²S&T Centre of Rosseti FGC UES, Russian Federation

ID: 10960

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: SF6-free GIS, fluoro-nitrile, IEC 61850, LPIT, interoperability, condition monitoring, partial discharge

Experiences with commissioning of a 132 kV GIS SF6-free digital substation

Karl POLLESTAD¹, Jean-Luc RAYON², Christopher GEBS⁴, Hans Kristian MEYER³, Asgeir MJELVE⁴, Alban LUCIOL², Jean-François MIRONNEAU², Assan SARR²

¹Bane NOR Norway; ²GE Renewable Energy France; ³SINTEF Energy Research Norway; ⁴Elvia Norway

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Commissioning and operational experience with the first switchgear of its kind to integrate digital and greenhouse gas-free components for power transmission

Marcel ENGEL², Peter MENKE¹, Mark KUSCHEL¹, Fred OECHSLE², Julian SPRINGER², Grzegorz POLICHT², Tim FRITSCH³, Jakob SIEMAYR⁴

¹Siemens Energy, Germany; ²Netze BW GmbH, Germany; ³Siemens AG, Germany; ⁴OMICRON electronics GmbH

ID: 11087

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Outdoor, GIS, Environment, Long-term, Reliability, Lifecycle, Design, O&M, Economic, Extension

Impact on Engineering and Lifetime Management of High Voltage Outdoor GIS

Toshiyuki SAIDA¹, Keisuke NAKAMURA², Tobias ZIESEMER³, Jens KALLWEIT⁴, Manuel NAEF⁵, George BECKER⁶

¹Toshiba Energy Systems & Solutions Co., Japan; ²TEPCO Power Grid, Inc., Japan; ³Siemens Energy Global GmbH & Co. KG, Germany; ⁴GE Grid Solutions, Germany; ⁵Hitachi Energy, Switzerland; ⁶POWER Engineers, Inc., USA

ID: 11088

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Automatic diagnosis, Control and operating current, Hydraulic pump current, Monitoring system

Management experience of condition-monitoring system and development of new IoT devices

Yuki YATABE, Shinya AICH, Takayuki KANAMORI, Tetsuya IKEDA, Yusuke TAKENAKA

Chubu Electric Power Grid Co., Inc., Japan

ID: 11089

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: SF6 gas, Leakage, Management, Repair

Management of SF6 gas leakage and repair technology in gas insulated equipment

Keisuke NAKAMURA, Keisuke MURAKITA, Shigeyuki TSUKAO, Wataru ISHIKAWA, Harukazu AKIYAMA, Syuichi TAMURA

TEPCO Power Grid, Inc., Japan

ID: 11090

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Advanced Maintenance, Aging Equipment, Asset Management, Diagnosis of Deterioration

Study on Advanced Maintenance Strategies and Asset Management for Substation Equipment in Japan

Kiyohiro TSUBOI¹, Shinya AICHI¹, Satoshi ICHIHARA², Kosho KAMATANI², Ryosuke ITOTANI³, Koki SADAHIRO³

¹Chubu Electric Power Grid Co., Inc., Japan; ²TEPCO Power Grid, Inc., Japan; ³Kansai Transmission & Distribution, Inc., Japan

ID: 11092

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: SF6 alternative equipment, Synthetic air insulation, Natural ester oil transformer, Deregulation, Fire extinguishing equipment, Remote maintenance, Sensor, Monitoring camera

Sustainable improvement on substation resilience and reliability by using eco-friendly equipment and remote maintenance systems

Ryosuke ITOTANI¹, Koki SADAHIRO¹, Masashi TOKAI³, Hiroyuki HAMA², Kazuki SUGINO², Manabu TAKEDA³

¹Kansai Transmission and Distribution, Inc., Japan; ²Mitsubishi Electric Corporation, Japan; ³DAIHEN Corporation, Japan

ID: 11093

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Condition monitoring, IEC61850, IED

Verification of Substation Condition Monitoring by Linking IEDs with Existing Substation Equipment

Hiroko ISAJI, Yousuke OGURA, Masanobu YOSHIDA

Chubu Electric Power Co., Inc., Japan

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Retrofit GIS Service Solution for extended Lifetime Maintenance

Philip BENGTTSSON

Hitachi Energy Sweden AB, Sweden

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Operational experience with dynamic current rating of busbar systems in 220-kV-substations

Ralf PUFFER¹, Richard WEISSNAR², Klemens REICH², Anita MACHL²

¹RWTH Aachen University; ²Austrian Power Grid AG

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

SF6 Insulated Substations: Challenges and Lessons Learned for Improving ISA Group Operational Reliability and Sustainability.

Marcelo MEZA, Johan SÁNCHEZ

ISA Interconexión Eléctrica

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Sustainable Urban Electrical Substations: an Integral View for a Sustainable Transformation of the Energy Sector

Andrés LONDOÑO, Diego TAUTA, Juan SIERRA

EPM

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Methodology for the Condition Analysis of High Voltage Capacitor Banks (Proposal and application case)

Gerardo GUERRA¹, Fabian ROJAS¹, Edgar TORRES¹, Carlos VARGAS², José MORATAYA²

¹Enlaza Grupo Energía Bogotá; ²Conecta

ID: 11306

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: C4-FN, Gas handling, gas quality, SF6 alternative, asset management, service life, gas analysis

Return of experience on gas handling with C4-FN mixtures for high-voltage equipment

Matthew BARNETT¹, Ewan SCOTT¹, Manuel NAEF², Michael GATZSCHE², Maxime PERRET³, Fabrice MORAND⁴, Peter PILZECKER⁵, Martin GOPPEL⁵, Frederic LORAY⁶, Chrystelle BASSET⁶, Roland KURTE⁷, Lars BLANZ⁷, Neil GWINNUTT⁸

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ID: 11334

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Heptafluoro-iso-butyronitrile (C3F7CN; C4F7N; (CF3)2-CF-CN), sulfur hexafluoride (SF6), gas-insulated switchgear (GIS), partial discharge (PD)

Sensitivity Study and Operational PD Monitoring Experiences of SF6-free GIS

Constantinos ONOUFRIOU¹, Lujia CHEN¹, Malcolm SELTZER-GRANT²

¹The University of Manchester UK; ²Monitra, Manchester UK

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Autonomous Inspection Robots for use in HVDC Converter Halls

Georg FRÜBING¹, David INGRAM³, Jörg HAFERMAAS⁴, Mark VAES²

¹50Hertz Transmission GmbH, Germany; ²Elia System Operator S.A., Belgium; ³Ross Robotics Ltd, United Kingdom, Great Britain; ⁴Siemens Energy Global GmbH & Co. KG, Germany

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Compact photoacoustic sensor system for the continuous monitoring of SO₂ and SF₆ percentage in gas-insulated switchgears

Roland KURTE¹, Christian WEBER², Daniel STAIGER¹, Johannes KAPP², Michael MANN³, Carlo LEIDECKER³, Daniel FUCHS¹

¹WIKA Alexander Wiegand SE & Co. KG, Germany; ²Fraunhofer IPM, Germany; ³TH Aschaffenburg, Germany

ID: 11475

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Assessment, Key Performance Indicator (KPI), Operation & Maintenance (O&M), Personal Protective Equipment (PPE), Remote Racking Device (RRD), Safety Management System (SMS), Safe electrical arc flash standard (SEAFS)

Continuous Improvement of Arc Flash Assessment for Work Place Safety

Md Abid KHAN, Rashid ALMISFER

Saudi Aramco, KSA

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Development of Asset Risk Mapping to Support Asset Management Decision Making in an Integrated Electricity Utility

Andreas Putro PURNOMOADI, Heri Setyo PURNOMO, Indera ARIFIANTO, Erny ANUGRAHANY, Ova KURNIAWAN, Anita PHARMATRISANTI, Herry NUGRAHA

PT. PLN (PERSERO), Indonesia

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Challenges And Lessons Learnt Through Failure Experience And Initiatives To Strengthen Resilience Of The Gas Insulated Switchgear

Mayank RANA*, Pankaj Kumar JHA, M.S. HADA, Sandeep YADAV

POWER GRID CORPORATION OF INDIA LIMITED, India

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Controlled Switching Of Coupled Power Transformers Based On Residual Flux Estimation Including State Of Art Digital Monitoring Technique – Field Experiences

Snigdha TALE*, Chintan PATEL, Umamahesh P, Mehulbhai SONAGRA

Hitachi Energy India Limited, India

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Design Philosophy of Extension bays for EHV Gas Insulated Switchgear

M. Mohana RAO*, Neelam TIWARI, Sonali Abhinav ROY, Mritunjay KUMAR, Arun KUMAR, Krishna PRASAD, HR PATEL, SanJai Kumar RAI, K Venkateswar REDDY, B. Jagadeesh Chandra PRASAD

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Challenges Of Managing Assets: Initiatives To Strengthen Resilience, Reliability And Security, Best Practice And End-Of-Life Management Considering Sustainability Aspects.

Anoop Kumar SINGH, M A Naveen NAVEEN, Anirban Bhattacharyya BHATTACHARYYA

POWERGRID, India

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Service Continuity Criteria for Gas Insulated Switchgear (GIS) - Utility Experience in Green Field and Brown Field GIS Substations

Rashmi CHAUDHARY *, B P SONI

Gujarat Energy Transmission Corporation Ltd, India

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Gas Insulated Substation (GIS) Overhaul Prioritizing Index Calculation a Case Study East Java and Bali Population

Wisnu F PRADITAMA, Nur Fajar FARDIANSYAH, Muftakhul EFENDI, Fermi TRAFIANTO

PT. PLN (Persero), Indonesia

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Digital Technology Breakthrough Experience in Increasing Grid Operational Efficiency and Productivity

Abdul Halim BAHARUDIN, Sugumar SHUNMUGAM, Zainizam MOHAMED

Tenaga Nasional Berhad, Malaysia

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B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Spearheading Asean Utility Role in Sustaining Green Environment by Intensifying Effort to Reduce SF6 Leakage in GIS Equipment – User Experience Sharing

Abdul Halim BAHARUDIN¹, Suthep SINGHARERG²

¹Tenaga Nasional Berhad, Malaysia; ²Electricity Generation of Thailand

ID: 11824

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Substation, Power Transformer, Distribution, Hazard

Amesbury #5 Substation Emergency Power Transformer Relocation

Carli GAVIN

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ID: 11893

B3 SUBSTATIONS AND ELECTRICAL INSTALLATIONS - Full Papers

Topics: B3 PS2 - Return on Operational Experiences for Substation Management

Keywords: Substation equipment fault, Lightning protection design, Resilience, Investigation for inter-pole flashover, Multiple direct lightning strikes.

Substation Design Improvement Considering Actual Accident Due to Direct Multiple Lightnings

Keisuke MURAKITA

TEPCO Power Grid, Inc.

B4 - DC SYSTEMS AND POWER ELECTRONICS

PS1 - DC EQUIPMENT AND SYSTEMS

ID: 10142

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: HVDC transmission topologies, large offshore wind power connection, solutions, technology, renewable energy

Technical-economic analysis of different HVDC transmission topologies for large offshore wind power connection

Tanh VU-CONG, Marco SCHUDEL, William BELE, Guillaume MEYER

RTE, France

ID: 10143

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: DC/DC converter, DC voltage control, Modular multilevel converter, Multi-terminal DC grid

EMT simulation of an MTDC system integrating Modular Multilevel DC/DC converter with DC voltage control

Ghazala SHAFIQUE^{1,2}, Frédéric COLAS^{1,2}, François GRUSON^{1,2}, Xavier GUILLAUD^{1,3}

¹L2EP, France; ²Arts et Metiers, France; ³Centrale Lille Institute, France

ID: 10144

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: DC harmonics, EMT study, HVDC-LCC

Study and mitigation of DC harmonics on Corsica's SACOI HVDC-LCC station causing long unavailability, a case study.

Yannick VERNAY¹, Jordann BRIONNE², Julien MICHEL¹

¹RTE, France; ²EDF, France

ID: 10145

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: DC breakers, HVDC protection, interoperability, protection components sizing

A contribution to HVDC protection interoperability through components sizing

Myriam RATAJCZYK^{1,2,3,4,5}, Bertrand RAISON^{2,3,4,5}, Alberto BERTINATO¹, Pascal TORWELLE¹

¹SuperGrid Institute, France; ²University Grenoble Alpes, France; ³CNRS, France; ⁴Grenoble INP, France; ⁵G2Elab, France

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Advancement in HVDC Technology: Exploring Controllable Current Source Converters Utilizing Reverse Blocking IGBTs

Guangfu TANG¹, Xiaoguang WEI¹, Longlong CHEN², Taosha JIANG¹, Anyou DONG¹

¹Beijing Huairou Laboratory, China; ²State Grid Smart Grid Research Institute Co., Ltd., China

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Development and Engineering Application of Controllable-Line-Commutated Converter

Zhiyuan HE¹, Chong GAO¹, Kunpeng ZHA², Jun YANG¹, Guangfu TANG³, Dongshan HE¹

¹State Grid Smart Grid Research Institute, China; ²C-EPRI Electric Power Engineering Co., Ltd., China; ³Beijing Huairou Laboratory, China

ID: 10192

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Key Techniques and Engineering Applications of ± 500 kV High Voltage and Large Capacity DC grid Based on Voltage Source Converter with 100% New Energy connected

Jin ZHANG¹, Ming LI², Jie LIU¹, Zheng ZHAO², Tan LI², Qichen CHEN²

¹State Grid Corporation of China, China; ²State grid economic and technological research Institute Co., Ltd., China

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Key Technology of Baihetan-Jiangsu ± 800 kV Hybrid Cascaded UHVDC Transmission Project

Jing ZHOU, Jiawei ZHOU, Dong LIU

State Grid Smart Grid Research Institute Co., Ltd, Beijing, China

ID: 10194

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Research and application of new technology and equipment for Baihetan-Jiangsu ± 800 kV UHVDC project

Kunpeng ZHA, Fan ZHANG, Yuefeng YANG, Fuyue WEN, Xiaolin ZHANG, Ting ZHAN

C-EPRI Electric Power Engineering Co., Ltd., China

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

The world's first series-connected multi-terminal LCC UHVDC transmission -- System studies for the Jinshang-Hubei ±800 kV project

Ying XU¹, Ying PU¹, Zijian GAO¹, Ling WANG¹, Yajun LU¹, Weiran CAO², Andersson MATS², Ying YE², Xun WANG²

¹State Grid Economic and Technological Research Institute Co.,Ltd. (SPERI),China; ²Hitachi Energy,China

ID: 10347

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: HVDC Upgrade, Refurbishment/Replacement, VSC Converter Technology, Expandable Symmetric Monopole, Project Staging

A Staged Approach for Upgrade of the Square Butte HVDC System

Christian WINTER¹, Peter SCHOMMER¹, Joanne HU², Bruno BISEWSKI²

¹Minnesota Power, United States of America; ²RBJ Engineering, Canada

ID: 10363

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Innovative Design of a Reduced Scale Prototype for the New Multiterminal Italian HVDC Network with SiC-based HVDC Hybrid Circuit Breaker

Pierluigi VACANTE

TERNA, Italy

ID: 10406

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: SIL, Simulation, HVDC, Control, Protection, Black-Box

Software-In-the-Loop Real-Time Simulation of a HVDC Terminal

Carl BARKER¹, Emmanuel AMANKWAH¹, Omar JASIM¹, Samek ELIMBAN², Stella ZHANG², Hui DING², Yuan CHEN², Paul FORSYTH²

¹GE Vernova UK; ²RTDS Technologies Inc.Canada

ID: 10407

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: HVDC, harmonics performance, harmonic stability, frequency domain simulations

Application of Harmonic Loci-Based Control Design in Frequency and Time Domain for a Consistent Design of VSC HVDC Harmonic Active Solutions

Omar JASIM, Jose A R MONTEIRO, Nagasesha REDDY

GE Vernova UK

ID: 10492

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Successful Test Method for primary Faults on a VSC-HVDC overhead Line

Martin PETTERSSON

Svenska kraftnät, Sweden

ID: 10493

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Verification of Performance for VSC-HVDC with a DC primary Fault Test

Martin PETTERSSON

Svenska kraftnät, Sweden

ID: 10521

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: HVDC, offshore, planning, modularity, hubs

Modular offshore HVDC transmission planning principles

Cornelis PLET¹, Maksym SEMENYUK¹, Hans CLEIJNE¹, Michel DUBBELBOER²

¹DNV; ²TenneT

ID: 10523

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: Bipole, Power Electronics Module, Offshore Interconnections, VSC-HVDC, Wind Farms, MultiTerminal Direct Current (MTDC)

±525 kV 2 GW Bipole VSC-HVDC Offshore Transmission (TenneT Projects) - Key Design Aspects

Ashish BANGAR¹, Amit KUMAR², Francisco CHACON², Nadew Adisu BELDA¹, Yogesh GUPTA², Olivier RUITON²

¹TenneT; ²GE Vernova

ID: 10538

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

LCC UHVDC System Improvements, with a novel Converter Transformer Configuration

Mats ANDERSSON

Hitachi Energy Sweden AB, Sweden

ID: 10600

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: HVDC, IT, System, Replacement, Cybersecurity, Extension, HMI

Two Approaches to HVDC IT System Replacement

Colin MADSEN¹, Michael PARADIS¹, Tong SHU¹, Lee HARROP², Lydia SMITH²

¹ATCO Electric, Canada; ²Transpower, New Zealand

ID: 10601

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: Overload, Cable, Design, Maintenance

Labrador Island Link Overload Design Considerations

James NUGENT, Tyler THOMPSON

Newfoundland and Labrador Hydro, Canada

ID: 10602

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: Back-to-back, black-start, HVDC, islanded operation, operational flexibility, reactive power, substation design, system resiliency, transmission assets end-of-life, transmission system planning, voltage source converter (VSC), voltage stability, water m

Hydro-Québec's Chateauguay Back-to-Back HVDC Converter Replacement Project: Integration of New Operating Modes for System Resiliency Improvement and Water Management Effectiveness using VSC Technology

Amr ABDELLAOUI, Vito DE LUCA, Marie-Jacinthe HEMSAS

Hydro-Québec, Canada

ID: 10609

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: Survey, Reliability, HVDC Systems, LCC, VSC

Survey of the Reliability of HVDC Systems Throughout the World During 2021-2022

P.V.I. TAIAROL

Advisory Group AG-04, Study Committee B4, Canada

ID: 10729

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: HVDC, Analysis System, Operational Reliability, Proactive Diagnostics

Development and Application of HVDC Analysis System for Improving Operational Reliability

Woojin CHO¹, Insoo PARK¹, Seonho LEE², Olivier CLEMENCON¹

¹KAPES, Korea, Republic of (South Korea); ²KEPCO, Korea, Republic of (South Korea)

ID: 10731

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: Power Oscillation Damping Control, Hybrid Simulation

The experience of the Power Oscillation Damping Study based on the hybrid simulation method for the Bukdangjin 2nd project in South Korea

Hyunjae YOO¹, Kumar MANOJ², Panyoung SUNG¹, Hyunkeun KU³, Olivier CLEMENCON¹

¹KAPES, Korea, Republic of (South Korea); ²GE Grid Solution, UK; ³KEPCO, Korea, Republic of (South Korea)

ID: 10772

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: 800 kV - DC Link - Multi-infeed - VRG – Regional - Interconnection – EMT - Modelling

A HVDC 800 kV link, enlarging regional interconnection, to increase the utilization of variable renewable generation

Dourival CARVALHO, Rodrigo CABRAL, Tiago RIZZOTTO, Fabiano SCHMIDT, Thais TEIXEIRA

Brazilian NC of CIGRE, Brazil; EPE

ID: 10773

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: Crustal Conductance – Geology – Geophysics – Grounding - HVDC Ground Electrodes

Crustal Conductance - an Index for the Estimate of the Minimum Electrode Size and Electrode - Converter Substation Distance

Paulo Edmundo da Fonseca FREIRE

Brazilian NC of CIGRE, Brazil; PAIOL Engenharia

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Analysis of Power Oscillation Damping Performance in Grid-forming VSC HVDC System

Jae-hyuk KIM¹, Hyung-seung KIM¹, Hyun-jun KIM², Jun-chol LEE¹, Hong-ju JUNG¹

¹Hyosung, Korea, Republic of (South Korea); ²Hyosung Heavy Industries, Korea, Republic of (South Korea)

ID: 10883

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: DC TOV SCC, EMT study, HVDC-VSC.

Generic EMT study circuit and TOV for the design of a DC link.

EI-Mehdi KARMANI, Julien POUGET, Pierre RAULT, Marco SCHUDEL

RTE, France

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Topics: B4 PS1 - DC Equipment and Systems

The Greenlink Interconnector - A new 504 MW HVDC Interconnector

Jonathan RUDDY¹, Katrin RASCHKE², Ernest NKUSI², Vincent FOO³, Katherine HAROLD⁴

¹Greenlink; ²Siemens Energy; ³Sumitomo Electric Industries; ⁴WSP

ID: 10961

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: HVDC – LCC - MIND cable degradation/failures - cable polarity reversals

Measures to secure long lifetime of an LCC based HVDC link with a potentially aged cable

Magne MEISINGSET¹, Jon Ivar JUVIK², Kees KOREMAN³, Thinus DU PLESSIS⁴

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ID: 10964

B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: Aging, Asset management, C&P (Control and protection) system, Multivendor, Thyristor module, Update

Refurbishment of the control and protection system devices and thyristor valve modules in the 300 MW Shin-Shinano No.2 Frequency Converter

Masanori TAKECHI¹, Masahito KANEKO¹, Shigenori KAKUNO¹, Taihei SATO², Takahiko KIKUI³

¹TEPCO Power Grid, Inc., Japan; ²Toshiba Energy Systems & Solutions Corporation, Japan; ³Hitachi, Ltd, Japan

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: Vyborg HVDC Back-to-Back Link, Control and Protection System, System Test, Reconstruction, Valve Equipment

Refurbishment and System Test of High Voltage Converter Unit 3 (HVCU3) at Vyborg Back-to-Back HVDC Link

Natalya LOZINOVA¹, Sergey KATANTSEV², Olga SUSLOVA¹, Evgeniy ZMAZNOV¹

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

A classification framework for HVDC-based transmission grid architectures

Sarah ANHAUS¹, Patrick DÜLLMANN¹, Lars OSTERKAMP¹, Robert DIMITROVSKI², Paul MCNAMARA³, Juan-Carlos GONZALEZ⁴

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Topics: B4 PS1 - DC Equipment and Systems

Switching Voltage Capability of Air-Core Dry-Type VSC Converter Reactors

Klaus POINTNER, Wolfgang BIERBAUMER, Taneli MONNI

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Advanced Maintenance Recommendation for HVDC and FACTS Air-core Drytype Reactors

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Coil Innovation GmbH

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Topics: B4 PS1 - DC Equipment and Systems

Overvoltages experienced by Metallic Return Cables in Bipolar HVDC Configuration

Max GOERTZ¹, Simon WENIG¹, Daniel BARTH¹, Simon BECKLER²

¹Mosaic Grid Solutions GmbH, Germany; ²TransnetBW, Germany

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Topics: B4 PS1 - DC Equipment and Systems

Sunrise Wind: USA's first HVDC connected offshore wind farm

Lorenzo ZENI¹, Gustavo F. GONTIJO¹, Peter MCGARLEY¹, Lennart SCHUETZE², Alejandro B. SALAS², Stefan HANSEN³, Ahmed SOLIMAN³

¹Ørsted; ²Siemens Energy; ³Siemens Gamesa Renewable Energy

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Topics: B4 PS1 - DC Equipment and Systems

DC/DC Conversation and Distributed Grid based Solution of HVDC Tapping

Qi ZHANG¹, Filipe Faria SILVA¹, Roni IRNAWAN², Rian FATAH²

¹Aalborg University; ²Gadjah Mada University

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: Capacitor, Fire, LCC, VESDA, Valve Hall

HVDC Valve Hall Fire Incident: A Case Study at GCCIA Al Fadhili HVDC

Abdullah ALGHAMDI¹, Jayakumar MUTHUSAMY², Ranjith PANIGRAHI³

¹GCCIA, KSA; ²GCCIA, KSA; ³GCCIA, KSA

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Dynamic Performance of Dual HVDC Terminals (± 800 KV LCC and ± 320 KV VSC) at the same busbar- Operational Experience

Narendra KUMAR*, Puneet TYAGI, S. BHATTACHARYA, V. DIWAKAR, P. RAVI
POWERGRID, India

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Challenges, Design Considerations & Field Studies for Relocation of Earth Electrode Station- User's Perspective

Narendra KUMAR*, Aditya B. CHANDRAN¹, Dr. Puneet TYAGI¹, S. BHATTACHARYA¹, Dr. Subir SEN¹, Rohidas MASKE², Sandeep KALANTRI², Abhay CHOUDHARY¹

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Topics: B4 PS1 - DC Equipment and Systems

Operational Experience on the Black-Start Exercise of VSC Based HVDC Systems in Southern Regional Grid of India

Arthi Sahaya Rones V*, Nikhitha C J, T Muthu KUMAR, T SRINIVAS, S P KUMAR
Grid-India, India

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Addressing Operational Contingencies Faced in Parallel Operation of ± 800 kV 6000 MW Champa Kurukshetra HVDC Link.

Anoop KUMAR*, Keshav GUPTA, Gopesh Kumar JHAJHARIA, Vishnu Parkash SRIVASTAVA
POWERGRID, India

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Topics: B4 PS1 - DC Equipment and Systems

Evolving of protection strategies for DMR Faults in the ± 800 kV 6000 MW Champa Kurukshetra HVDC Link.

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POWERGRID, India

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: Derisk, HVDC, Stability analysis, MIIF

A Novel Methodology to Derisk HVDC and Offshore Wind Connections to A Network

Xiao-Ping ZHANG¹, Shuailong DAI¹, Chengyi WU¹, David LI¹, Dechao KONG², Xiaoyao ZHOU²

¹University of Birmingham UK; ²NG ESO

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: HVDC circuit breakers, VSC, type tests, fully assembled, multi-terminal grids.

Test procedures for ± 500 kV HVDC circuit breakers: how to assess their performances based on current world laboratory facilities

Sino PATTI¹, Massimo MARZINOTTO¹, Giuseppe PELLICCIONE¹, Roy NIJMAN², Shankar SUBRAMANY², Roberta ALUNNI³

¹Terna S.p.A; ²KEMA Labs; ³CESI S.p.A

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: Grid-forming, Virtual Synchronous Machine, MMC, STATCOM, VSC.

Optimal Control Selection for Grid-Forming MMC-Based Assets: An analysis of interplay between GFM and internal MMC controls

Eros AVDIAJ, Jef BEERTEN

KU Leuven ESAT/ELECTA & EnergyVille

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS1 - DC Equipment and Systems

Keywords: Large-scale, New energy, LCC-HVDC, VSC-HVDC, Ultra-long-distance.

Integrated Design Scheme of VSC-HVDC System for 10GW Large-Scale New Energy Ultra-long-distance Transmission

Qingming XIN, Junjie FENG, Zhiyong YUAN, Xiaobin ZHAO, Chuang FU, Ting HOU, Biyue HUANG, Yuebin ZHOU, Changyue ZOU

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C-EPRI Electric Power Engineering Co., Ltd, China

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Design of Hybrid Active AC filter Scheme in MinYue back-to-back DC Project

Weimin MA¹, Yiming YANG¹, Fangjie WU¹, Ling WANG¹, Yiming JI¹, Yiran CHANG², Xiujuan ZHANG³

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Stability enhancement of weak Grids with high penetration of Renewables with grid-Forming STATCOM/Enhanced-STATCOM

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Hitachi Energy Sweden AB, Sweden

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Topics: B4 PS2 - FACTS and Power Electronics

Keywords: Large STATCOM units, SSO detection and mitigation, common control and coordination of STATCOM units, series compensation

Application of Large STATCOMs for Dynamic Reactive Power Support in California 500kV Series Compensated Transmission System

Joanne HU¹, Eric STAUFFER², Stefan SCHILLING³, Bruno BISEWSKI¹, John RANDOLPH², Felix NABEIN³

¹RBJ Engineering, Canada; ²LS Power, USA; ³Siemens Energy, Germany

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Transformer-coupled Static Synchronous Series Compensators for transmission and distribution operators, based on industrial-class converters

Markel ZUBIAGA¹, Javier CHIVITE², Pedro IZURZA¹, David SANTOS², Javier CAÑAS¹

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Topics: B4 PS2 - FACTS and Power Electronics

Keywords: Control, Efficiency, Loss reduction, Power-electronic converter

Experimental validation of the General Power Theory using Power Hardware-in-the-Loop - Opportunities for New Converter Controls

Pitambar JANKEE¹, Trevor GAUNT¹, Zhiwang FENG², Graeme BURT²

¹University of Cape Town South Africa; ²University of Strathclyde United Kingdom

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The Analysis of the SSR between TCSC and Synchronous Generator using RTDS and TCSC Replica

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Korea Electric Power Corporation, Korea, Republic of (South Korea)

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS2 - FACTS and Power Electronics

Keywords: Static Var Compensator – Hunting – Control Interaction – FACTS

Hunting Issues in the Brazilian Interconnected Power System – A Case Study of Multiple SVCs

Antonio Ricardo TENÓRIO¹, Saulo SILVA FILHO⁴, Rodrigo PRAXEDES², Felipe SOBRINHO³

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The Vectorized Approach: An Efficient Method to Model VSC Converters and its Verification Against Tests

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Improved dynamic Voltage Control based on Network Sensitivity Characteristics

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Subsynchronous Resonance Analysis for an M-SSSC FACTS Installation in the Atlantico Region of the Colombian Transmission System

Juan BOTERO¹, Carlos BORDA¹, Mohammad HAMMAD²

¹Smart Wires Inc; ²Siemens Energy

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Operation of Static Series Synchronous Compensators integrated into the Colombian Power System: Challenges, Experiences and Lessons Learned

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Reflection on applicable standards and learnings from actual failures of power inverters

Muhannad ALSUHAILY¹, Robert HEUCKELBACH², Ashutosh SHARMA³, Sukant BHATTACHARYA⁴

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Control Strategies For Parallel Operation Of Statcoms – Securing For Bulk Renewable Energy Transmission

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PS3 - NEW TECHNOLOGIES AND CONCEPTS OF DC AND FACTS ENABLING ENERGY TRANSITION

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Application of Multi-ports Energy Router to Coordinated Control of Renewable Energy, Network, Load and Storage at County-level Power Grid

Chong ZHANG¹, Zhiyuan HE¹, Xiaotong JI², Huafeng WANG¹, Xueguang WU¹, Junda QIN¹

¹State Grid Smart Grid Research Institute Co., Ltd. , China; ²State Grid Hubei Electric Power Co., Ltd. , China

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Analysis of Oscillation Mechanism of Renewable Energy Generation Integrated into MMC-HVDC Under Islanded and Grid-connected Modes

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China Electric Power Research Institute, China

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Grid-Forming Control for VSC-HVDC System with Large-scale New Energy Integration

Xiuda MA, Yu LU, Jie TIAN, Changjiang ZHAN, Nannan WANG, Qiang ZOU, Gang LI

NR Electric Co., Ltd. , China

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Keywords: Direct current system, medium voltage, power electronics.

Linear PV power plant based on MVDC collection network

Piotr DWORAKOWSKI¹, Silvain MARACHE¹, Eric LAMARD², Caroline RAMONDOU²

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Keywords: DC Microgrid, HES, RES, Renewable Energy Storage, H2 Integration

Modeling, Analysis, and Control of an Islanded Grid-Connected RES-Hydrogen DC Microgrid with Floating Solar Integration

Libin VARGHESE, Peng ZHANG

Stony Brook University, United States of America

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The innovative Damping Resistor System adopted in the Italian Transmission Grid

Gianluigi GEMELLI

TERNA, Italy

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A new STATCOM topology equipped with short-time energy storage and Grid Forming control for HV network voltage and frequency regulation

Gianluca POSTIGLIONE

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Keywords: HVDC, Grid-forming, Synchronous-Grid-forming, Demand, Demand-ramp, Fault-recovery, Inertia

Dynamic demand control applied to synchronous grid forming controlled HVDC

Carl BARKER¹, Si DANG¹, Omar JASIM¹, Syed Aaqib HASSAN², Girish G², Kerry EVANS³, Taoufik QORIA⁴

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On the Role of Energy Storage in the Future HVDC Systems

Frans DIJKHUIZEN

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Keywords: Multi infeed interaction factor (MIIF), Modular multilevel converter (MMC), HVDC, Point of Interaction (POI), Faults, Load rejection

Analysis of Converter Interactions in HVDC systems

Pragati KIDAMBI MURALI, Jiayang WU, Theo BOSMA, Yontao YANG, Cornelis PLET

DNV

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Keywords: DC Transmission, EMT, Grid forming, HVDC, STATCOM

Application of Synchronous Grid Forming Back-to-Back HVDC System for System Frequency Support

Arash FAZEL DARBANDI¹, Phaedra TAIAROL¹, Sharmen ANDREW², Ani CHOPRA²

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Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

New VSC-HVDC interconnection between the Iberian Peninsula and Balearic Archipelago to enable energy transition

Javier RENEDO, Silvia SANZ VERDUGO, Antonio CORDÓN, Belén SEGURA, David CASTAÑEDA, Rosalia RIVAS, Patricia LABRA

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

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Development of an EMT model of the Balearic power system

Javier RENEDO¹, Yousef PIPELZADEH², Dharshana MUTHUMUNI³, Farid MOSALLAT⁴, Silvia SANZ VERDUGO¹, Antonio CORDÓN¹, Edgar NUÑO¹, Macarena MARTÍN¹

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Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Performance of Generic grid forming RMS models under standardized test contingencies

Benjamin PAZ¹, Hazem KARBOUJ², Shivraman MUDALIYAR², Deepak RAMASUBRAMANIAN³, Xiaoyao ZHOU²

¹EPRI Europe, Spain; ²National Grid ESO, UK; ³EPRI, USA

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Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Battery storage with power oscillation damper for improved stability performance

Manfred MANCHEN

NamPower

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Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

DC Circuit Breaker feasibility study - protection system design

Domagoj HART¹, Amjad MOUHAI DALI¹, Alberto BERTINATO¹, Colin FOOTE², Suresh RANGASAMY², Benjamin MARSHALL²

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Keywords: Energy Storage, Grid-Forming Control, Pumped-Storage Hydropower, Static Frequency Converter, Modular Multilevel Converter

Grid-Forming Variable-Speed Full Converter Pumped-Storage Hydropower

Marcel STOECKLI¹, Alexandre CHRISTE^{*2}, Mats LARSSON², Christoph HAEDERLI², Michail VASILADIOTIS², Tobias THURNHERR²

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Keywords: VSC HVDC, HVDC Light, STATCOM, IGBT, Diode, BIGT

Bi-mode Insulated Gate Transistor BIGT - An Outstanding Key Component in Present and Future HVDC Systems

Marcel STOECKLI¹, Evgeny TSYPLAKOV^{*2}, Boni BOKSTEEN², Luca DE MICHIELIS², Ying Jiang HAFNER³, Gontran PAQUES², Jurgen HAFNER³

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Keywords: Offshore Wind, Grid Connection, Grid Forming, Small-signal Stability, Large-signal Stability

Grid Connection of Offshore Wind with Grid Forming Turbines

Marcel STOECKLI¹, Mats LARSSON^{*2}, Jiuping PAN³, Alberto BOLZONI², Ying-Jiang HAFNER⁴, Per HOLMBERG⁴, Pankaj ROY⁴

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Expandability of offshore HVDC grids during (in) development planning considering protection system design

Merijn VAN DEYCK¹, Geraint CHAFFEY¹, Mudar ABEDRABBO¹, Hakan ERGUN¹, Dirk VAN HERTEM¹, Ervin SPAHIC², Dennis DE DECKER²

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Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Functional Modelling for HVDC grids – State-of-the-art and future Outlook

Geraint CHAFFEY¹, Ilka JAHN², Melanie HOFFMANN³, Rodrigo ALVAREZ VALENZUELA⁴, Eduardo PRIETO ARAUJO⁵, Staffan NORRGA⁶

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Keywords: DC, DER, Power quality, Simulation, Stability

DC System power quality and stability assessment and management: method, simulation, and on-site validation

Xavier YANG¹, Xingyan NIU¹, Xialin LI², Yifeng WANG², Wei LI², Pengfei LI³

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Application of VSC-HVDC Dynamic Capacity: Technical, commercial and legal opportunities and challenges

Kevin SCHOENLEBER¹, Rickard EKSTROM², Peter LUNDBERG², Nils ENGLUND², Jens REIFSCHNEIDER³, Andreas WASSERRAB³, Mark THIELE³, Robert FELLER³

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Keywords: HVDC, DCCB, Interoperability, Multi-terminal

DC Switching Stations with High-speed DC Breakers: Enabling Multi-vendor DC Grids

Frederick PAGE¹, Yu ARAI¹, Takashi INAGAKI¹, Tomas MODEER², Staffan NORRGA², Simon NEE²

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Keywords: Multi-terminal HVDC Transmission Network, Multi-purpose Interconnector (MPI), Windfarms, Real-time Studies

Assessment of Operational Challenges of HVDC Multi-Purpose Interconnectors with Low Short Circuit Levels

Asif KHAN¹, Wasim AHMAD¹, Nikhil SHARMA¹, Ben GOMERSALL¹, Benjamin MARSHALL¹, Richard POOLE²

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Grid Forming Solution for Offshore Wind Park with HVDC Connection

Mian WANG¹, Blazej STRONG¹, André SCHÖN¹, Mohammad SUWAN¹, Roberto ROSSO¹, Nicholas CHEROUVIM¹, Tobias NEUMANN², Philipp RUFFING², Eduard Wiebe WIEBE², Tobias BARTH¹, Thyge KNÜPPEL³

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

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Modular Static Synchronous Series Compensator (M-SSSC): EMT Modeling for Real Time and Offline Applications

Camilo ORDONEZ

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Topics: B4 PS3 - New Technologies and Concepts of DC and FACTS enabling Energy Transition

Keywords: Hybrid STATCOM, STATCOM, Synchronous condenser

A study on the mitigation effect of hybrid STATCOM system on low inertia and voltage regulation issue

JooYong JUNG^{1,2}, WooSeok SEO¹, NamKyu KIM¹, Young-Jin KWON¹

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Insulation Coordination Criteria of VSC-HVDC Overhead Power Lines in Colombia Considering Climatic and Environmental Conditions

Hernan RESTREPO¹, Cristian C. ACOSTA², Alejandro PALACIO³, Eros ESCOBAR³, Antonio PEDRAZA¹, Jorge GONZALEZ³, Ernesto PÉREZ²

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Alban DUVIVIER¹, Nicolaos CUTULULIS¹, Oscar SABORÍO-ROMANO¹, Peter Jan RANDEWIJK², Li YANG³

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ENOWA, NEOM, KSA

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

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Keywords: Parallel HVDC converters, Grid-forming converter, Offshore energy hubs, Virtual impedance, Stability analysis.

Stability Analysis and Mitigation of Power Oscillations Between Parallel MMC-HVDC Connections Operating in Grid-Forming Mode in Offshore Energy Hubs

Benjamin VILMANN¹, Daniel MÜLLER¹, Gustavo Figueiredo GONTIJO², Hjörtur JOHANNSSON¹

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B4 DC SYSTEMS AND POWER ELECTRONICS - Full Papers

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Keywords: Multiterminal DC (MTDC), DC Grid, DC Circuit Breakers (DCCB), DC Switching Station (DCSS), DC Protection.

Phased Approach to MTDC: Proposed integration of DC Circuit Breakers in a DC Switching Station facilitating a partially selective protection scheme

David DEVOY, Ian COWAN, Perry HOFBAUER

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B5 - PROTECTION AND AUTOMATION

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Centralised protection, IEC 61850, Process bus, Testing, Virtualisation, Functional tests, System tests

Functional Testing of virtualized and centralized Protection Systems

Janne STARCK¹, Juanita DOMINGUEZ², Rob COGGAN³, Jani VALTARI¹

¹ABB Oy; ²OMICRON Electronics; ³Energy Queensland

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Centralised protection, IEC 61850, Virtualisation, Wide-area protection

Demonstration of enhanced and virtualised Protection of the Distribution Network

Anna KULMALA¹, Ontrei RAIPALA¹, Petri HOVILA¹, Boris-Emanuel YAZADZHIYAN², Colin SCOBLE², Ibrahim ABDULHADI³

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Integration and Application of merging unit and intelligent terminal in smart substation based on IEC 61850

Chen FAN¹, Zhiqiang YAO¹, Naichao CHANG², Yu LIU², Zhihuai SHU², Zhongqing LI¹, Renhui DOU¹, Jiangwen MENG¹

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Process Interface Unit, Requirements, interface, interoperability framework, configuration chain

Process Interface Unit requirements related to industrial deployment

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RTE, France

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Digital Substation, Hydraulic Power Plant, Intelligent Electronic Device (IED), Merging Unit (MU), Nuclear Power Plants

IEC 61850 digital substations technologies applied to power plants

Valentin BOUVIGNIES, Damien JOUAN, Edouard THEZELAIS

EDF, France

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Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Process bus implementation

Review by WG B5.69 of published Experience Feedback on Process Bus Implementation

Volker LEITLOFF¹, Alex APOSTOLOV², Thomas CHARTON³, Rannveig LØKEN⁴, Julien SAUNIER⁵, Dieter BINON⁶, Takaya SHONO⁷, René TROOST⁸, Sakis MELIOPOULOS⁹

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ID: 10304

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Digital Substation, Intelligent Electronic Device (IED), Merging Unit (MU), Process Bus, Protection Automation and Control Systems (PACS)

Digital substation with process bus: grid operator and PACS manufacturer feedback 2 years after the commissioning

Gérard CHAROT¹, Valentin BOUVIGNIES², Julien TISSERAND³, Samir EL HADI³, Apolline MAZAS¹, Sylvain AUPETIT²

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ID: 10349

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: IEC 61850, Object Modelling, Process Interface IED

Object Modeling of Process-near Interface Intelligent Electronic Devices in Digital Substations

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ID: 10367

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Interoperability of protection devices among a multi-vendor IEC 61850 process bus system

Emiliano CASALE

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Virtualization, IEC 61850, Digital Substations, Test Philosophy

Unified Grid Control Platform Requirements of Process Bus

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ID: 10421

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Low-Power Instrument Transformers, Digital Secondary Systems, Rogowski Coils, Capacitive Dividers, IEC 61869 Series

Quiet Revolution: How Low-Power Instrument Transformers and Digital Secondary Systems are Changing What is Possible

Veselin SKENDZIC¹, Peter MENKE², Normann FISCHER¹

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ID: 10427

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: IEC61850, Active Distribution System, Estimation Based Protection (EBP), Coordination Free Protection, Estimation Based Calibration

Protection and Control of Active Distribution Systems

Sakis MELIOPOULOS¹, George COKKINIDES¹, Glenn WILSON², Kenneth WILHELM³, Rebecca RYE⁴

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ID: 10503

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Centralized Protection and Control, Process Bus, Virtualization, Line Protection

Assessment of Time-Critical IEC 61850 Process Bus Communications in a Virtualized Protection and Control System

Ana Cristina ALEIXO, Fernando GOMES, Carlos ARANTES, José VENTURA, João PERES, Rui JORGE

EFACEC, Portugal

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Digital Substation, Redundancy, Resilience, Synchronism, Top-Down Engineering

DSAS Rollout Experience - Picking the Ripe Fruits

João PERES, Sara COSTA, Rui JORGE, Diogo CORREIA

EFACEC, Portugal

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Current Channel - Distance Protection - Modular Merging Unit solution - Process Bus - Proof of Concept - PTP clock - Remerging application - Sensor - Voltage Channel

Distance Protection Performance Evaluation with Process Bus by using Modular Merging Units

Marieke HEERZE¹, Nicolas BRANCHE²

¹Grid to great; ²RTE

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Impact on Busbar Protection by mixed analogue Input Chains in digital Substations

Jianping WANG

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System Architectures for Virtualisation and Hardware Consolidation

David MACDONALD¹, Mital KANABAR², Camilo DE ARRIBA¹, Thomas CHARTON³, Ibukunolu OLADUNJOYE³

¹GE Grid Automation, Spain; ²GE Grid Automation, Canada; ³National Grid, UK

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Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Implementation of an IEC 61850 MMS interface for Centralized Protection and Control (CPC) virtualized platforms

Carlos ALBERO CASTILLÓN¹, Miguel Ángel OLIVÁN MONGE¹, Yasmina GALVE PASTOR¹, Carlos RODRÍGUEZ DEL CASTILLO²

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Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Practical implementation of full Digital PACS in a Multi-vendor Environment

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ELIA GROUP, Belgium

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: IEC 61850 process bus, digital substation, retrofit

Experiences with process bus technology for substation retrofit

Marcel STOECKLI¹, Stefan MEIER^{*2}, Rajesh K. YADAV², Yuji KIMURA³

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: IEC 61850-9-2 process bus, transformer protection

Practical experiences with process bus based transformer protection system

Marcel STOECKLI¹, Stefan MEIER^{*2}, Ruben MARTINI³, Markus HELWIG²

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: digital substation (DS), merging unit (MU), PTP, time synchronization system, protection, automation and control (PAC), IEC 61850-9-2, digital exchange

SV-stream Processing in the Event of Synchronization Loss by Publishers

Mikhail BEZDENEZHNYKH, Nikolai DONI, Ivan KOSHELOV, Nataliya DONI

EKRA Research and Production Enterprise Ltd., Russian Federation

ID: 10807

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: transmission line differential protection, IEC 61850-9-2(SV), process bus, cybersecurity, relay protection prototype

Pilot Operation of Transmission Lines Differential Protection with Information Exchange According to IEC-61850-9-2 (SV)

Aleksandr KULIKOV¹, Anton LOSKUTOV¹, Vladimir ZININ², Anton PETROV³

¹NNSTU n.a. R. E. Alekseev, Russian Federation; ²LLC NPP "ALIMP", Russian Federation; ³JSC "NIPOM", Russian Federation

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: protection and automation, digital substation, process bus, virtual IEDs, migration of functions, pilot operation

Development and Pilot Operation of the Intelligent PAC System Using the Concept of Virtual IEDs and Migration of Functions

Andrey LEBEDEV¹, Alexander VOLOSHIN¹, Andrey ZHUKOV², Vitaly AKULICHEV³

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Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Developments and Practical Experiences of Merging Unit

Dmitry ULYANOV¹, Andrey MARTYNOV¹, Alexey MOKEEV², Sergei PISKUNOV²

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Digital Substation, IEC 61850, Process Bus, Sample Value, Station Bus

Experience and Challenges in the Practical Implementation of Four Digital Substations in Brazil

Denys LELLYS¹, Pablo HUMERES², Júlio Cesar LIMA³

¹Brazilian NC of CIGRE, Brazil; ²GE Vernova; ³Eletrobras CGT ELETROSUL; ³PUC Minas University

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Process Bus, Merging Unit, GOOSE, Sample Values

Digital Substation: Lessons Learned by CPFL in Process Bus Application

Wagner HOKAMA¹, Julia Beatriz CONCEICAO¹, Douglas FERREIRA², Daniel BERNARDON³

¹Brazilian NC of CIGRE, Brazil; ²CPFL Energia; ³Automalógica; ³UFSM University

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: LPIT, Optical Current Transformer (OCT), Digital Substation, Process Bus, IEC 61850

LPIT operational experiences and challenges in a Norwegian digital substation

Karl POLLESTAD¹, Thomas JUDENDORFER², Christopher GEBS³

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: IEC 61850-9-2LE, IEC 61869-9, Process Bus, Sampled Values

Advantages and Challenges in Implementing the IEC 61869-9 Standard versus IEC 61850-9-2-LE in the Digitization of the Right Bank Substation

Gustavo MERELES¹, João JORGE², Jose CHIARADIA¹, Marcos MENDES¹

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Virtualisation – Wide Area Protection – IEC 61850 – Digital Substation – 5G – Validation

Experience from integration, functional and performance testing of virtualised wide area protection

Ibrahim ABDULHADI¹, Boris Emanuel YAZADZHIYAN², Colin SCOBLE², Ontrei RAIPALA³, Anna KULMALA³

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Using process bus over substation boundaries with multi-vendor line differential protection

Philipp STACHEL¹, Yann GOSTELI², Adolf FREI³, Stefan FLEMMING¹

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Experiences from a substation pilot project implementing process bus based partly centralized protection and control

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Full digital substation, IEC 61850, Process bus, Reliability, Standardisation, Return of Experience

The Full Digital Substation Success in Vietnam

Chee-Pinp TEOH¹, Van Ha NGO², Than Tuan BUI³, Hung HOANG⁴, Dang-Thoang VO⁴, Chin-Fei CHOW⁵, Simon RICHARDS¹

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Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Assessment of Distributed and Centralized Protection: Comparison of Response Times for Protective Dynamic System on Process Bus

Johan CASTRO¹, Germán RUEDA¹, Rodolfo GARCÍA², César HERNÁNDEZ¹, Germán ZAPATA¹, Oscar TOBAR¹

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: IEC 61850, Process bus, MU, IED, Protection Relay, Ethernet, Processing time, PTP

Merging Unit Performance Evaluation and Issues for Multi-Vendor Configuration in Process Bus

Hiroki DOI¹, Noriyuki UEDA¹, Akihiro TANAKA¹, Kenji KONDOU², Makoto MIZUNO², Yusaku SANO²

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Keywords: Process bus based protection systems, Process bus in one and half circuit breaker bus station, IEC 61850 sample value applications, IEC 61850 GOOSE message application, process bus implementing in diameter substation

Case Study: IEC 61850 Process Bus-Based Protection System Applications For One and Half Breaker Bus System in NEPCO 400 Kv stations

Hussien ALMOMANI, Mohammad DAWOOD

National Electric Power Company, Jordan, Hashemite Kingdom of

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B5 PROTECTION AND AUTOMATION - Full Papers

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Transition from device management to application management for Protection & Control through virtualization and centralization

Matthias REIS, Marcus STOLLFUSS, Saurabh TALWAR

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

How a well-designed, optimized time synchronization concept can increase the reliability and availability of a digital switchgear's protection system

Stefan FLEMMING¹, Andrej GOERBING¹, Joerg WEILBIER¹, Igor KOGAN¹, Ji CHEN², Lu WANG²

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Interoperability Challenges in Multi-Vendor Digital Substations: PTP Time Synchronization and Profile Compatibility

César HERNÁNDEZ¹, Johan CASTRO¹, Oscar TOBAR¹, German RUEDA¹, Germán ZAPATA¹, Rodolfo GARCÍA²

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Utility Experience of FEED for IEC 61850 Process Bus based Protection and Automation system for 765/400/220KV Greenfield Substation

Subir Sen SEN, Rajil SRIVASTAVA, Abhay KUMAR, S.J. LAHIRI, Mr ANURAG, M.S. HADA, C.P AWASTHI, Suresh BADERIA*

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Impact of IEC 61869-9 Based Sampled Values on Network Optimization and Protection System Performance in a Process Bus Based Digital Substation

Dr Subir SEN, B.B MUKHERJEE, Abhay KUMAR, Mr ABHISHEK, C.P. AWASTHI, Yashwant K, Suresh BADERIA, Pradeep PATIL, Ritesh KUMAR*

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Commissioning & Operational Experiences of Brownfield & Greenfield Process Bus Substations in POWERGRID

Jeetesh KUMAR*, Gopinath S S, Joydip GHOSH, B. B. SINGH, M.K. JHA

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

A comprehensive approach towards implementing the Process Bus based Substation Automation system in Substations and its benefits.

Vikram GANDOTRA¹, Laurent TOGNAZZI², Hamza EHTISHAM², Nimish RASTOGI³

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Reliable Time Synchronization for IEC 61850 Substations by Distributed Time Sources and Visibility

Raymond SHIEH, King WU, Sever SUDAKOV

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS1 - Practical Experiences and new Developments of Process Bus

Experience and Challenge in Deploying the IEC 61850 Driven Digital Substation within Indonesia Utility Context

Eko PRASETYO, Fermi TRAFIANTO, Amiruddin AMIRUDDIN, Andhy D SETYAWAN

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PS2 - ACCEPTANCE, COMMISSIONING, AND FIELD TESTING FOR PROTECTION, AUTOMATION AND CONTROL SYSTEMS

ID: 10103

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Field Testing, MPLS-TP, Teleprotection, Line Differential, Inter-substation Communications

Field testing, Experiences and Results with Line Differential and Teleprotection Applications in TDM/MPLS-TP Hybrid Networks

Sebastian SJÖGREN, Teemu VIINIKAINEN, Mikko HOLMGREN

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ID: 10104

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Distance Protection, Zone settings, IBR, PQ-diagram, Reactive Power Capacity

Coordinating Zone Settings of Distance Protection with Reactive Power Capabilities and Voltage Support of Inverter-based Resources

Mikko HOLMGREN, Minna LUOJUS, Lasse LINNAMAA

Fingrid Oyj

ID: 10105

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Distance relay, harmonics, converter-connected generation, relay testing

Performance of Distance Relays in the Finnish Power System under High Penetration of Converter-Connected Generation

Valteri HYTTI, Pauli PARTINEN

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Distance Protection, Total Harmonic Distortion, Power System, Secondary Injection

Experiences, Secondary Injection testing and Grid Studies on Distance Protection and Current and Voltage Harmonics during Power System Faults

Mikko HOLMGREN, Juho TUOMINEN, Paavo OJAVALLI

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ID: 10263

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: R#SPACE, Protection Automation, Control system

Testing approach for Rte's R#SPACE Protection Automation and Control System

Maud MERLEY*, Jean-Etienne LEMAIRE, Yann LELOUP, Alexandre AZEVEDO, Xavier MICHAUT, Volker LEITLOFF

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

SAS2021 Project: benefits of standardization on acceptance, commissioning, and field testing during the whole PACS lifecycle

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ID: 10419

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Low Power Instrument Transformer (LPIT), Secondary Injection Test Kit, Low Power Relay Test Set, Low Power Voltage Transformer, Merging Units

LPITs in High Voltage Switchgear and Field-testing of Relay Protection with LPIT Inputs

Dhanabal MANI¹, Niclas WETTERSTRAND², Peter MENKE³, Thomas NEUMEIER⁴, Franz GATZEN⁴

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ID: 10422

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: IEC 61850, Acceptance, Commissioning and Maintenance Testing, Efficiency

Improving the Efficiency of Acceptance, Commissioning, and Maintenance Testing of IEC 61850 Based Digital Substations

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ID: 10423

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Digital Substation, IEC 61850, UCAlug, Interoperability Tests, System Configuration Language

Experience in the UCA International Users Group Interoperability Tests

Keith GRAY¹, Sina KARIMI², Chris DYER¹

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ID: 10424

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Hardware-in-the-loop, Inverter-based Resource, Modelling, Relay Misoperation, Relay Testing

Use of Detailed Real-Time System Models to Evaluate Relay Performance Impacted by High Penetration of Inverter-Based Resources

Yi HU¹, Henry CHAO¹, Zheyuan CHENG¹, Juergen HOLBACH¹, Thai Thanh NGUYEN², Edward L. SEITER³, Michael RAZANOUSKY⁴, Damir NOVOSEL¹

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ID: 10425

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Synchrophasor, Testing, Protection, Control, Monitoring, Standards

Life-cycle Testing of Synchrophasor Systems

Mladen KEZUNOVIC

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ID: 10428

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Testing, Commissioning, 3-D Printer, IEC61850, GOOSE

Evolution of Testing Practices: A Utility's Experience

Steven WALKER, Matt DUBOIS, Pat SCANNELL. JR., Bill HORN

Commonwealth Edison, United States of America

ID: 10429

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Fault Location, Isolation, and Service Restoration; Protection; FLISR; Distribution Automation

Design and Testing of Distributed Fault Location, Isolation and Service Restoration Scheme for Open-loop Electric Distribution Systems using IEC61850 GOOSE

Palberz KHALEDIAN¹, Yujie YIN², Amin ZAMANI², Farid KATIRAEI², John WILTSHIRE³, Roy LUO⁴, Ben ROSENFELD⁴, Shawn DEANGELO⁴, Drazena BROCILO⁴, Selver CORHODZIC⁴, Alan DUONG⁴

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Distribution Grid, Real-Time Digital Simulation, Digital Substation, MV Advanced Applications, Protection and Control Centralization, Virtualization, IEC 61850

Testing of Centralized Protection, Control and Advanced Automation for MV networks with DER

Clara GOUVEIA¹, Everton ALVES¹, André MELIM¹, Jorge PEREIRA¹, António CARRAPATOSO¹, Nuno FONSECA¹, José ANDRADE¹, Tiago HEKKERT¹, Ana Cristina ALEIXO², Carlos ARANTES²

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Implementation of the line differential protection in the 30 kV distribution network of i-DE

Iñaki OJANGUREN¹, Ziorta LLONA², Oscar HERNANDEZ¹, Isabel LOUREIRO¹, Juan Mari GARCIA²

¹i-DE, Spain; ²Ingeteam, Spain

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Development and Implementation of a WAMPAC Algorithm for Detecting Real-Time Voltage Instability Phenomena in Electric Power Systems

Anibal Antonio PRADA HURTADO¹, Eduardo MARTINEZ CARRASCO¹, Jose SALDANA¹, Carlos ALBERO CASTILLÓN¹, Konstantinos F. KROMMYDAS², Christos-Spyridon G. KARAVAS², Konstantinos A. PLAKAS², Efthimia CHASSIOTI², Ioannis MORAITIS²

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Challenges and perspectives for a new era of protection, automation and control systems through IEC 61850

Victor LLAMAS SANJUAN

CIRCE Centro Tecnológico, Spain

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

IEC61850 Engineering of a Digital Substation: Common User Vision on Top-down Engineering

Thomas STERCKX¹, Florian SOYEZ¹, Maud MERLEY²

¹ELIA, Belgium; ²RTE, France

ID: 10747

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Distribution Network, Phasor Measurement, Fault Location, FLISR

PMU-based fault distance calculation in long radial feeders using an enhanced reactance-based approach

Marcel STOECKLI¹, Mayank NAGENDRAN^{*2}, Lorenzo ZANNI², Paolo ROMANO², Farnoosh RAHMATIAN³, Ali ALVI⁴, Sihikhar PANDEY⁵

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: process bus, relay protection, testing

The Experience of Commissioning and Initial Maintenance of Relay Protection on Operational Digital Substations with the IEC 61850 Process Bus

Nikolay ALEKSANDROV, Yuriy SMIRNOV, Alexander SHALIMOV

LLC «NPP «Dinamika», Russian Federation

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

A New Technological Approach for Commissioning and Operation of Relay Protection and Automation Systems

Alexey ANOSHIN, Aleksandr GOLOVIN, Natalya MARARAKINA

Tekvel, Russian Federation

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Experience of the Field Testing of Power Units Control Systems

Andrei GERASIMOV, Ruslan IZMAILOV, Evgeniy SATSUK, Andrei SMIRNOV, Dmitriy KABANOV, Oleg GURIKOV

JSC STC UPS, Russian Federation

ID: 10806

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: fault location technology, cable line, overhead line, electrical network topology, single phase-to-earth fault, short circuit

Experimental Verification of Fault Location Technology in Power Distribution Networks with Complex Topology

Andrey KUCHERIAVENKOV, Pavel GOROZHANKIN, Ekaterina KARTASHEVA

ANTRAKS Research&Development& Manufacturing Co, Russian Federation

ID: 10815

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: PACS, PMU, PDC, synchrophasor, WAMS

Development and Commissioning of PACS for Operating Modes of the Power System Based on PMU Data

Andrey ZHUKOV¹, Evgeniy SATSUK¹, Dmitrii DUBININ¹, Maksim POROZKOV², Jury IVANOV², **Anna DMITRIEVA**²

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Methods for Configuring, Testing and Inspecting Automatic Excitation Regulators for Synchronous Generators during Commissioning

Andrey ZHUKOV¹, Evgeniy SATSUK¹, Tatiana KLIMOVA², Andrei GERASIMOV¹

¹JSC SO UPS, Russian Federation; ²National Research University «MPEI», Russian Federation

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Device Management, Remote Access, Commissioning Assistance, Testing Traceability

Automating commissioning tests, accepting remote maintenance, and guaranteeing inventory integrity using a Device Management System

Adriano PIRES, David MACDONALD, Mital KANABAR, Shobhit MEHTA

Brazilian NC of CIGRE, Brazil; GE Grid Automation

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Commissioning tests, electromagnetic transients, inverter-based resources, phasor-based protection, time-domain protection, transmission lines

Commissioning Perspectives for the New Era of Transmission Line Protection Schemes: Historical Evolution and Future Expectations

Felipe LOPES¹, Moisés DAVI², Giovanni FABRIS³, Mário OLESKOVICZ², Raphael REIS¹

¹Brazilian NC of CIGRE, Brazil; UFPB University; ²USP University; ³Eletrobras ELETROSUL

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: PTP - Time Synchronization - Interoperability - Process Bus — PACS Testing

Time Synchronization Interoperability and Testing Challenges for Process Bus

Guilhermme LISBOA, Guilherme NORMANTON

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Auditor, Digital Substation, Process Bus, Stand-Alone Merging Unit

Practical approaches for improving reliability and availability of digital multivendor substations

José Eduardo DA ROCHA ALVES JUNIOR, Tiago MORAES, Marco Antonio MACCIOLA RODRIGUES

Brazilian NC of CIGRE, Brazil; Eletrobras CEPEL

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: IEC 61850, Process Bus, PAC System Tests

A Practical Approach to The Requirements and Strategies for Monitoring the IEC 61850 Process Bus in a Multivendor Test Platform

Pablo HUMERES FLORES¹, Mateus ALEXANDRINO¹, Júlio Cesar MARQUES DE LIMA², Denise BORGES DE OLIVEIRA³, Jorge DAMASCENO⁴, Denys LELLYS⁵, José Eduardo DA ROCHA ALVES JUNIOR⁶, João JORGE⁷, Paulo Sergio PEREIRA JUNIOR⁸

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: vPACS, IEC 61850, software-defined smart grid, virtual IED, virtual Test Set

How to Test Virtual Protection, Automation and Control Systems (vPACS)

Paulo Sergio PEREIRA JUNIOR, Rodolfo Cabral BERNARDINO, Gustavo Silva SALGE, Cristiano Moreira MARTINS, Paulo Sergio PEREIRA, Gustavo Espeinha LOURENÇO

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: FAT, SAT, Inspection and Test Plan, Electrical Commissioning, Technical Training

FAT and SAT Procedures from the Perspective of the Brazilian TSO

Rafael de Oliveira FERNANDES¹, Ricardo DUTRA²

¹Brazilian NC of CIGRE, Brazil; UNICAMP University; ²State Grid

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Lab Environment for fully digital Substation Solution Validation - technical Solution and testing Solution

Yiming WU

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

A consistency validation Tool for IEC 61850 Substation System Integration Configuration

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

A Study on the Development of Interoperability Test Automation System for Digital Substation

Yu-Yeong PARK, Nam-Ho LEE, Chang-Seob LEE, Woo-Joong KIM, Nam-Dae KIM, Seok-Kon KIM, Byung-Tae JANG

KEPCO Research Institute

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: LPIT, PACS, on-site calibration procedure, a certification process

Certification and On-site Calibration of Metering System Based on LPIT

Peter MENKE¹, Vladan LAPČEVIĆ², Michael FREIBURG³, Vladimir RAJOVIĆ⁴, Mikhail VASSILYEV²

¹Siemens Energy, Germany; ²Meter&Control, Serbia; ³TH Köln – University of applied sciences, Germany; ⁴University of Belgrade, School of Electrical Engineering, Serbia

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Joint-Development and Demonstration of an Adaptive Protection System at a German DSO – Practical Experiences and Lessons Learned

Jasper LAMMERING¹, Jessica STEPHAN⁴, Jan Peter KEMPER¹, Stefan DALHUES¹, Tobias LORZ², Wesley DRECHSEL¹, Andreas KUBIS¹, Tobias PLETZER¹, Gerrit ERICHSEN³

¹PSI Software AG, Germany; ²FAU Nürnberg, Germany; ³Schleswig-Holstein Netz AG, Germany; ⁴In

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Acceptance and Commissioning of a Wide-Area Broken Conductor Detection System for Distribution Networks

Michael STANBURY

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Testing of Travelling Wave Fault Locators

Jörg BLUMSCHEIN¹, Bruno Alencar ARRAES¹, Tiago Fernandes BARBOSA²

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Collaborative Engineering and Testing of Smart Grid Automation Applications

Christof BRANDAUER¹, Filip PRÖSTL ANDRÉN², Catalin GAVRILUTA², Thomas STRASSER², Armin VEICHTLBAUER³, Gerald STEINMAURER³, Jürgen RESCH⁴, Sebastian SCHÖNDORFER⁴

¹Salzburg Research; ²AIT Austrian Institute of Technology; ³FH Oberösterreich; ⁴COPA-DATA

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Retrofit, electromechanical, overcurrent, relays

A modern retrofit solution for induction disc overcurrent relays

Graeme LLOYD¹, Richard DUFFY¹, John WRIGHT¹, Majid HASHEEM², Peng SHEN³, Dickson LAU⁴, K M TSANG⁴, Carol FISHER⁵

¹GE Grid Solutions UK; ²GE Grid Solutions India; ³GE Grid Solutions Hong Kong; ⁴CLP Hong Kong; ⁵GE Grid Solutions USA

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Efficiency Improvement in Testing: Maximizing Resources and Reducing Time with Digital Twins

Jhonatan ANAYA, Santiago YEPES

ISA Intercolombia

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Distance Protection, Directional Overcurrent Protection, Wind Farm Protection, Collector Systems, Polarization Techniques, HVDC Protection.

Performance of Distance and Directional Overcurrent protections in a HVDC connected Offshore Windfarm

Chris SMITH¹, Jose JARAMILLO², Mauricio CORREA³, Camilo GARCIA², Andres GARCIA²

¹RWE UK; ²IEB Colombia; ³GE Vernova France

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

User-centric tools for engineering, commissioning and operation of protection and automation devices

Cedric HARISPURO, Francois SIMON

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Protection instrument transformers characterization and modelling for travelling wave applications

Federico CANAS¹, Johannes BLESER¹, Cezary DZIENIS³, Thomas JUDENDORFER², Joerg BLUMSCHEIN¹

¹Siemens AG, Germany; ²Trench Germany GmbH, Germany; ³University of Applied Sciences Zittau / Görlitz, Germany

ID: 11423

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Digital substation, Engineering process, IEC 61850, SCL (System Configuration Language), OCL (Object Constraint Language), XML, XSD (XML Schema Definition)

Introduction to IEC 61850-6-3 OCL: Machine-processable rules for validation of IEC 61850 XML-based files

Aurélien DEHOUC¹, Sina KARIMI², Christophe DYER³, Keith GRAY³

¹EDF R&D, France; ²POWER Engineers, Inc., Canada; ³POWER Engineers, Inc., USA

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Performance of the Overcurrent Function in the Event of Loss of Information in the Process Bus Using a Merging Unit Developed in ATP-EMTP

Ernesto PEREZ, Oscar TOBAR, Johan CASTRO, César HERNÁNDEZ

Universidad Nacional

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

EMT Based Protection Coordination Study Considering M-SSSC FACTS Technology in the Atlántico Region of the Colombian Transmission System

Alejandro DUQUE¹, Dilan CARO¹, David URBAEZ¹, German GUTIERREZ², Jhon CALDERON³, Carlos BORDA¹

¹Smart Wires Inc; ²ISA Intercolombia; ³ISA Interconexión Eléctrica

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Enhancing Protection Schemes for Inverter-Based Renewable Generation in Transmission Networks

Oswaldo ARENAS¹, Sebastián MANRIQUE²

¹ISA Intercolombia; ²FEDERAL UNIVERSITY OF TECHNOLOGY - PARANÁ

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Blackout, Black Start, Grid Protection Relay, Grid Restoration

Performance Test of Grid Protection Relay for Black Start

Tomoya ISHII¹, Atsushi OKAHISA¹, Iori NAKAYAMA¹, Mai ARAKI²

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Autonomous, Decentralization, Post fault calculation, Special Protection Scheme (SPS)

Development and testing of response-based wide area SPS without telecommunication

Tomohiro KURUSHIMA¹, Yoshihiro MATSUBARA², Jun YASUE², Tadaaki YASUDA², Koji SAKAGUCHI¹, Toru MAEDA¹

¹Mitsubishi Electric Corp., Japan; ²TEPCO Power Grid, Inc., Japan

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: IEC 61850, MMS, Japanese Connect And Manage, N-1 Inter-trip Scheme

IEC 61850 Compliant N-1 Inter Trip Scheme Suitable for Japanese Connect and Manage

Ryuichi KAWAZOE¹, Shotaro SAKAI¹, Kazuhiro KOJIMA¹, Hironori IMAEDA², Yutaka ANDO²

¹Chubu Electric Power Grid Co., Inc., Japan; ²C-tech Corp., Japan

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Protection verification for HVDC connected wind farms

Adnan COKIC¹, Alexander TSYLIN¹, Michael PARADIS², Deepak H. NAIR¹

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Plug & Play of Protection ,Automation & Communication system with Portable SCADA for EHV Substations

Vivekanandan S*, Tushar KULKARNI, Ganesh Jagtap JAGTAP, Dayanand Konduskar KONDUSKAR, Vishal KULKARNI, Akhilesh Chandrakar CHANDRAKAR

TATA Power Company, India

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Protection coordination, protection relay, transmission network, wide area assessment

A wide Area protection coordination assessment for the Albanian transmission System

Aristotelis TSIMTSIOS¹, Vassilis PAPASPILIOTOPOULOS¹, Vassilis KLEFTAKIS¹, Mohammad DJAMALI², Ralf KYNAST³, Elgi HAXHIRAJ⁴

¹PROTASIS SA, Greece; ²Fichtner GmbH & Co. KG, Germany; ³KfW Development Bank, Germany; ⁴OST sh.a., Albania

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Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Real-Time Simulations to Validate the Impact of m-sssc Devices on Protection Coordination in Power Systems

Sebastian HINCAPIE¹, Jhon CALDERON², Carlos BORDA¹, Alejandro DUQUE¹, Pablo MACEDO¹, Juan GALLEGOS³

¹Smart Wires Inc; ²ISA Interconexión Eléctrica; ³Transelca

ID: 11807

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Digital transformation, Smart test solutions, Power grid, Maintenance, Commissioning, Artificial Intelligence, Data analysis

Digital Transformation of the Power Grid and Smart Testing Solution for Commissioning and Maintenance

Anas ABDULKHADER

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B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: Commissioning, Digital substation, FAT, Protection Systems, SAT

Experience in Protection System Commissioning for Digital Substation Pilot Project in Thailand

Wanlert TANAYUWANNA, Banthoeng KONGKAE, Sunphad CHAIPUNHA

Electricity Generating Authority of Thailand (EGAT), Thailand

ID: 11901

B5 PROTECTION AND AUTOMATION - Full Papers

Topics: B5 PS2 - Acceptance, Commissioning, and Field Testing for Protection, Automation and Control Systems

Keywords: FAT, SAT, Routine Field Test, Field Experience, Substation Automation System.

Current Practices of Acceptance, Commissioning and Field Testing for Protection, Automation & Control System in a Transmission Utility, its Efficacy and Benefits

Nikunj KANJARIYA, Sanjay JADAV, Jayesh GANDHI

Gujarat Energy Transmission Corporation Limited

C1 - POWER SYSTEM DEVELOPMENT AND ECONOMICS

PS1 - STEERING THE ENERGY TRANSITION: COOPERATION, ACHIEVING TOP-DOWN TARGETS THROUGH BOTTOM-UP INVESTMENT DECISIONS

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C1 POWER SYSTEM DEVELOPMENT AND ECONOMICS - Full Papers

Topics: C1 PS1 - Steering the Energy Transition: Cooperation, achieving Top-Down Targets through Bottom-Up Investment Decisions

Keywords: electrolysis capacities, production of hydrogen, Power-to-Gas, electricity system

The challenges of developing electrolysis for the French electricity system over different time horizons

Marc LE DU*, Mathilde FRANÇON, Marie-Alix DUPRE LA TOUR, Cédric LEONARD

RTE, France

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Topics: C1 PS1 - Steering the Energy Transition: Cooperation, achieving Top-Down Targets through Bottom-Up Investment Decisions

Keywords: flow-based, studies, exchange capacity, models, long-term

Modelling flow-based exchange capacities in medium to long-term studies

Nicolas LHUILLIER*, Jean-Yves BOURMAUD, Marjorie COSSON, Marion LI, Emily LITTLE, Paul PLESSIEZ, Harry UNG

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An optimization tool for the planning of transmission grid investments and development

Elia D'ANDREA

TERNA, Italy

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Off-shore network development to foster the energy transition

Michela MIGLIORI

TERNA, Italy

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Topics: C1 PS1 - Steering the Energy Transition: Cooperation, achieving Top-Down Targets through Bottom-Up Investment Decisions

Keywords: Capacity Planning, Electrification, Climate Change, Adaptation, DER

From Resilient and Ready to Used and Useful: Managing Temporal and Locational Uncertainty in Electrification, DER Adoption, and Climate Adaptation

Kevin HAPP¹, Shaun MORAN¹, Vincent WESTFALLEN¹, Ryan BURG²

¹Commonwealth Edison, United States of America; ²National Renewable Energy Laboratory (NREL), United States of America

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C1 POWER SYSTEM DEVELOPMENT AND ECONOMICS - Full Papers

Topics: C1 PS1 - Steering the Energy Transition: Cooperation, achieving Top-Down Targets through Bottom-Up Investment Decisions

Keywords: Continental System Modelling, Global Grid Development, HVDC, Long-term Studies, Optimization

From Regional to Continental Scale System Development: a New Methodological Approach to Studies of an Intercontinental Global Grid

Charlie SMITH¹, Angelo L'ABBATE², Enzo SAUMA³, Ali MOEINI⁴, Antonio ILICETO⁵, Robert GAUGL⁶, Karthik S. BHAT⁷, Xiao-Ping ZHANG⁸, Jay CASPARY⁹, David POZO¹⁰

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Jun WEN¹, Maigha FNU², Sherry LI³, Sarah CARKNER⁴, Logan ROLLES⁶, Katherine INGE⁸, Shuying ZHEN¹, Beth LAROSE⁷, Hyekyung KIM⁵

¹Southern California Edison, United States of America; ²Commonwealth Edison, United States of America; ³GE Digital, United States of America; ⁴New York ISO, United States of America; ⁵Argonne National Lab, United States of America; ⁶Burns & McDonnell, United States of America; ⁷GE Power, United States of America; ⁸MPR Associates, United States of America

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Keywords: Transmission Margin Contracting, Access to the Transmission System, Competitive Margin Procedure, Transmission system Development

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Keywords: Renewable Sources, Solar Energy, Distributed Generation, ADMS, Storage, Brazilian Utilities

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Keywords: Electrification, Energy supply chain, Energy transition, Hydrogen, PtoG

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¹EDF, France; ²Centrale-Supelec, France

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Keywords: RES, VSC-HVDC, Energy Storage System, Planetary System.

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¹CNTEE Transelectrica SA; ²UNSTPB - National University of Science and Technology

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Yanda HUO^{1,2}, Zhen WU¹, Wei DUAN¹, Jianfeng DAI¹, Jintao JIANG³

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¹RSE, Italy; ²Terna, Italy

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Keywords: Integrated energy systems, flexibility, thermal networks, energy markets, consumer energy resources

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Keywords: electrical energy storage systems, energy efficiency, flexibility, resilience

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Nikolay SHUBIN¹, Fedor NEPSHA¹, Vladimir TARASOV², Evgeniy SATSUK³

¹RTSoft Smart Grid, LLC, Russian Federation; ²INTER RAO Engineering, LLC, Russian Federation; ³JSC SO UPS, Russian Federation

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¹EPRI, Spain; ²EPRI, Ireland; ³EPRI, USA

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¹BH K CIGRE, Bosnia and Herzegovina; ²Elektroprivreda BiH, Sarajevo, Bosnia and Herzegovina

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Keywords: Coincidence factor, Electric vehicles, Residential flexibility, Smart charging

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¹Statnett Norway; ²Technical University of Denmark -DTU / Statnett Denmark; ³Norwegian University of Life Sciences Norway

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¹Statnett/NTNU; ²Statnett, Norway

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Keywords: Clustering, long-term planning, load flow convergence, machine learning, scenario-based analysis, unsupervised learning

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Keywords: Battery Energy Storage System, Flexibility, Energy Arbitrage, Power Production Optimization, Variable Renewable Energy Systems Integration, Technical & Economic Performances, Grid Balancing, Jordanian Power Sector, Energy System Management, Long-Term Plan

Battery Energy Storage System Techno-Economic Performance to Meet the Grid Flexibility: Case Study of Jordan's Power Sector

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Keywords: Pumped-Hydro Energy Storage, Flexibility, Energy Arbitrage, System Development, Electricity Generation Optimization, Renewable Energy Integration, RES, Technical & Economic Performances, Grid Balancing, Jordanian Power System, Energy System Management, Lo

Enhancing Grid Stability and Renewable Integration: Examining the Potential of Pumped Hydro Storage as a Key Player in Jordan's Power Sector

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¹50Hertz Transmission GmbH, Germany; ²Hamburger Energiewerke GmbH, Germany

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Keywords: Green Hydrogen, Power System Expansion; RES Generation

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Keywords: Optimal capacity expansion planning, multi-energy system planning, flexibility resources, 100% renewable power system

100% RES Power System Supported by Flexibility Resources

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Keywords: Investment cost, power system economics, profitability, seasonal flexibility, VRE

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Sebastien PEZZA¹, Sandrine SELOSSE², Edi ASSOUMOU², Caroline BONO¹, Fabien BRICAULT¹

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State Grid Zhejiang Electric Power Research Institute , Hangzhou, China

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China Electricity Council, China

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Keywords: IBR power, scenarios, RMS simulation, frequency, rotor angle stability

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RSE, Italy

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Keywords: Power System Planning and Operation, Renewable Resources, Grid Transformation, Decarbonization, Distributed Resources

Creating a Sustainable National Electric Infrastructure While Maintaining Reliability and Resiliency of the Grid

Vijay VITTAL¹, Anjan BOSE², Damir NOVOSEL³, Mark LAUBY⁴, Chanan SINGH⁵, Gordon van WELIE⁶

¹Arizona State University, United States of America; ²Washington State University, United States of America; ³Quanta Technology, United States of America; ⁴North American Electric Reliability Corporation (NERC), United States of America; ⁵Texas A&M University, United States of America; ⁶ISO New England, United States of America

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Topics: C1 PS3 - Resilience as Pivotal Criterion for System Development

Keywords: Resilience, substation, power system development, flexibility of power supply, availability of infrastructure

Evaluation of Substation Configuration as an Element of Resilience Management in System Development

Maksymilian PRZYGRÓDZKI¹, Sławomir KAŁUŻA¹, Agnieszka DZIENDZIEL^{1,2}, Paweł KUBEK^{1,2}, Piotr RZEPKA^{1,2}

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Keywords: Resilience, Disruption, Governance, Leadership, Teams, Electrical System, Decision Makers, Attributes

Governance and its importance for the success of an electric power company from the point of view of resilience

Josias MATOS DE ARAUJO¹, Antonio SIMÕES PIRES², Marcelo COSTA DE ARAUJO³

¹Brazilian NC of CIGRE, Brazil; Eng Smart Lead; ²Consultant; ³Eletronorte

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C1 POWER SYSTEM DEVELOPMENT AND ECONOMICS - Full Papers

Topics: C1 PS3 - Resilience as Pivotal Criterion for System Development

Keywords: HVDC – Reliability – Resilience – Architectures – Topology

Reliability and Resilience needs for future hybrid AC/DC Grid

Asif KHAN¹, Colin FOOTE¹, Benjamin MARSHALL¹, Paul MCNAMARA², Lampros PAPANGELIS³

¹The National HVDC Centre UK; ²EPRI International Ireland; ³Engie Impact Belgium

ID: 11462

C1 POWER SYSTEM DEVELOPMENT AND ECONOMICS - Full Papers

Topics: C1 PS3 - Resilience as Pivotal Criterion for System Development

Assessment of the Resilience of the Colombian Electricity Sector

Jaime ZAPATA¹, Juan MOLINA², Luisa BUITRAGO²

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ID: 11505

C1 POWER SYSTEM DEVELOPMENT AND ECONOMICS - Full Papers

Topics: C1 PS3 - Resilience as Pivotal Criterion for System Development

Keywords: Resilience, Transmission Planning, Risk Maps

Proposed Methodology for Incorporating Resilience Criteria into Transmission Planning based on Risk Mapping

Lilian HERNANDEZ¹, Francisco BECERRA², Roger MELLADO³

¹Comisión Nacional de Energía, Chile; ²STM, Chile; ³Coordinador Eléctrico Nacional, Chile

ID: 11576

C1 POWER SYSTEM DEVELOPMENT AND ECONOMICS - Full Papers

Topics: C1 PS3 - Resilience as Pivotal Criterion for System Development

Improving Distribution Network Climate Resilience Using Statistical Models For Conventional And Technology Agnostic Solutions

Kiran SINGH, Pankaj KUMAR, Rakesh KUMAR, Naveen SRIVASTAVA

POWERGRID, India

ID: 11625

C1 POWER SYSTEM DEVELOPMENT AND ECONOMICS - Full Papers

Topics: C1 PS3 - Resilience as Pivotal Criterion for System Development

Keywords: HVDC, Renewable, transmission, power grid

Less connection for more security – Novel transmission and power grid design in NEOM grid with 100% renewable

Grain ADAM¹, Nand SINGH², Ying JIANG HAFNER³, Mauro MONGE⁴

¹ENOWA, KSA; ²ENOWA, KSA; ³Hitachi Energy, SWEDEN; ⁴Hitachi Energy, SWEDEN

C2 - POWER SYSTEM OPERATION AND CONTROL

PS1 - CREATE OPERATIONAL RESILIENCE TO EXTREME/UNPREDICTABLE EVENTS

ID: 10214

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Emergency Dispatch and Electricity Sales Strategies for Distribution Networks Considering Diverse User Demands and Resilience Enhancement

Mingqian XU, Gengfeng LI, Siyuan SUN, Minghao LI, Wenqiu ZOU

Xi'an Jiaotong University, China

ID: 10439

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Geomagnetically Induced Current, Geomagnetic Disturbance, Power Transformers, Power Systems, Magnetotelluric

Verification of a 3-Dimensional Geoelectric Field Model for Geomagnetic Disturbance and Geomagnetically Induced Current Studies

Christopher BALCH², Matthew CAHER¹, Gary KOBET¹, Ian GRANT¹, Anna KELBERT³

¹Tennessee Valley Authority, United States of America; ²CIRES/NOAA, United States of America; ³United States Geological Survey, United States of America

ID: 10440

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Resource Adequacy, Probabilistic Analysis, Extreme Events in Power Systems

Weather and Operational Uncertainty in Electricity Market Operations: Stochastic Nodal Adequacy Pricing Approach

F. Selin YANIKARA², Alex RUDKEVICH², Russ PHILBRICK¹, Richard TABORS³

¹Polaris System Optimization, United States of America; ²Newton Energy Group, United States of America; ³Tabors Caramanis Rudkevich, United States of America

ID: 10507

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Infrastructure, Resilience, Power Lines, Fuel Management, Wildfires, Vegetation Management, Extreme Events, Shared Value, Landowners, Wildland Urban Interface

Increasing the resilience of electric transmission grid to extreme events

Pedro MARQUES¹, Luís Mário RIBEIRO², João GASPAS¹, Miguel ALMEIDA², David ALMEIDA²

¹REN - Redes Energéticas Nacionais, SGPS, S.A.; ²Univ Coimbra, ADAI, Department of Mechanical Engineering

ID: 10776

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Direct Transfer Trip, Discharge Class, Duty Cycle, Interlock, Sequence Network, Resonance

Mitigating the Risk of Damaging Overvoltages Caused by Back Feeding an Isolated 230 kV Cable System

Bruce CHEN, Baiké SHEN, Anil PRADHAN, Edward BURT

BC Hydro, Canada

ID: 10821

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Determination of Reference Incidents as a Key Tool for Reliable Power System Operation

Vladimir DIYACHKOV, Igor OKSHIN

JSC SO UPS, Russian Federation

ID: 10872

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Photovoltaic Power Generation, Penetration, Satellite Image, Snow Cover, Solar Radiation

Advancing Forecast Technique for Photovoltaic Power Generation in Kansai Area under Snow Conditions

Shiho NAKATA¹, Takayuki YOSHIDA¹, Shota MIYAKE¹, Masaaki SAWASAKI¹, Nozom TAKADA², Naoki INABA²

¹Kansai Transmission & Distribution, Inc., Japan; ²Meteorological Engineering Center, Inc., Japan

ID: 10874

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Information dissemination, Reserve margin, Supply capacity countermeasures, Unseasonably weather

Tight supply-demand due to unseasonably hot weather and the establishment of countermeasures to deal with the situation

Toshiro KATAOKA, Koji ENYA

TEPCO Power Grid, Inc., Japan

ID: 10929

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Alarm Management, SCADA, Data Engineering, Machine Learning, Operation

Comprehensible Alarm Text Clustering for Reconfiguration and Real-Time Support

Jhelum CHAKRAVORTY¹, David MARINO¹, Antony HILLIARD¹, Faeza HAFIZ², Susanne SCHMITT³, Georgios MITRENTSIS³, Giancarlo DALLE AVE¹, Zhaohan SUN¹

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ID: 10932

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Resilience, HILF events, operational resilience, new generation mix, climate change

Power System Resilience: Some Lessons Learned & Best Practices Already Identified, and Other Proposed Measures to Improve the BIPS Operational Resilience

Paulo GOMES¹, Nelson MARTINS²

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ID: 10933

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: HVDC - Electrode sharing - Operating procedure - Installation sharing

Electrode sharing in the Madeira's HVDC and Xingu's HVDC systems – Synergy for an integrated operation

Guilherme AMBONI¹, Ana Bárbara FERNANDES NEVES¹, Edinoel PADOVANI¹, Hanni GONÇALVES¹, Hannah Maria CALDEIRA ANGELKORTE¹, Paulo Eduardo MARTINS QUINTÃO¹, Karina STOCKLER HERSZTERG¹, Sergio Luiz SARDINHA¹, Fernando CATTAN JUSAN¹, Rafael ZYMLER¹, Andre Luiz BARBOSA CORREA¹, Paulo Victor SANTOS², Mário ALBUQUERQUE³, Edson CARVALHO⁴, Victor TEIXEIRA⁵

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ID: 10937

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Commutation Failure, HVDC, Artificial Neural Networks, Synchrophasor Measurement, Predictive Index

Commutation Failure Prediction in the HVDC Multi-Infeed Scenario in Brazil Using Neural Network Technique Application

Rafael DE OLIVEIRA FERNANDES, Maria Cristina DIAS TAVARES

Brazilian NC of CIGRE, Brazil; Unicamp University

ID: 11051

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Distribution Three-phase Linear State Estimator, Phasor Measurement Units (PMUs), Microgrid, Situational Awareness and Control, Distributed Energy Resources (DERs)

Pioneering Development and Deployment of Distribution Linear State Estimator: One Utility's Journey

Ali ALVI¹, Thomas ALFORD¹, Marianna VAIMAN², Farnoosh RAHMATIAN³

¹ComEd, United States of America; ²V&R Energy, United States of America; ³NuGrid Power Corp., Canada

ID: 11252

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Impacts of High Renewable Integration on Interconnector Transient Stability – Case Study of Australian Grid

Germane ATHANASIOS, Rodney REUBEN

APD Engineering, Australia

ID: 11397

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: 2021 Jordan blackout, power system resilience, black start units (BSUs), non-black start units (NBSUs), power plant response, preparedness and response strategies, Samra Power Plant, artificial intelligence (AI) techniques, restoration sequences, power gr

Enhancing Power system Resilience: A Case Study of Samra Power Plant Preparedness and Power Restoration during Blackout 2021 in Jordan

Yousef MASHAGBEH, Sara ZYUOD

Samra Electric Power Company, Jordan, Hashemite Kingdom of

ID: 11398

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: power distribution networks, operational resilience, control center, Irbid district electricity company, renewable energy projects

Operational Resilience for Irbid District Electricity Company (IDECO)

Zayed ALHAMMOURI, Haneen BAIDAS

IDECO

ID: 11441

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Current Zero-Missing, Compensated Cable Circuits, Operational Philosophy, Protection Design

Holistic Approach to Solving the Current Zero Missing Phenomenon in Cable Compensated Networks

Fabian KOEHLER, Keith HARMER, Mark STOCKTON

SSEN Transmission UK

ID: 11483

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Development of a Platform for Energy and Power Demand Forecasting Using Advanced Prediction Models, Considering Variables of the Electrical System Operation

Leonardo SANDOVAL¹, Maria ASPRILLA¹, Luis SANTANDER², Maria HERNANDEZ¹

¹Celsia; ²Guane Enterprises

ID: 11564

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Operation Strategy & Impact Assessment of Extreme Severe Cyclonic Storm 'Biparjoy' on Indian Power System

Akhil GUPTA¹, Tushar R MOHAPATRA¹, Aman GAUTAM¹, Rohit ANAND¹, M ANANTHAKRISHNAN¹, B M SHAH²

¹Grid Controller of India Limited, India; ²Gujarat Energy Transmission Corporation

ID: 11636

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Power System Stability, Voltage and Frequency Recovery, and Oscillation

Analytical review of major disturbances in the electric power system and their impact on the overall power system stability and reliability

Ahmed TAHA, Zain ALABDEEN

Emirates Water & Electricity Company, UAE

ID: 11685

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Interarea mode, Prony's method, Real-time mode estimation

Real-Time Estimation of Interarea Oscillation Mode Using Sliding Window Prony's Method

Manuel Leonardo SOSA RIOS¹, Oscar Miguel SANTACRUZ SILVERO¹, Luis Fernando COSTA ALBERTO², Glauco NERY TARANTO³

¹Itaipu Binacional; ²University of São Paulo; ³Federal University of Rio de Janeiro

ID: 11697

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Operational Planning for High-Demand Periods in the Indian Power System: Leveraging Operational Experience and Policy Interventions

Talluri SUDHEER*, Anuj KUMAR, Rohit ANAND, Ashok KUMAR, S. C. SAXENA

Grid Controller of India Ltd. India, India

ID: 11797

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Methodology of calculating Balancing Reserves in Georgian Power System

David TKESHELASHVILI, Irakli VAKHTANGADZE, Irakli GORDIASHVILI, Ivane MCHEDLISHVILI, Archil KOKHTASHVILI

Georgian State Electrosystem

ID: 11877

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS1 - Create Operational Resilience to Extreme/Unpredictable Events

Keywords: Distribution Network Resilience, Co-optimizing Restoration, Electric Vehicle, Electric Bus

Resilient Recovery of Distribution Systems in Typhoon Scenario: Co-Optimizing Restoration Service with Multiple Distributed Resources

Wenqiu ZOU

Xi'an Jiaotong University

PS2 - CHANGES ON SYSTEM OPERATION AND CONTROL CONSIDERING THE ENERGY TRANSITION

ID: 10219

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Approximate optimal control of wind-HESS system for online frequency regulation based on fuzzy logic control

Zao TANG¹, Jia LIU¹, Pingliang ZENG¹, Youbo LIU², Peng LI³

¹Hangzhou Dianzi University, China; ²Sichuan University, China; ³North China Electric Power University, China

ID: 10276

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Ring distribution network, Technical energy losses, Repairing time, Power load flow, Switching strategy

Switching Strategy for Minimizing Energy Losses in Ring Distribution Network during Repairing Time

Abd-El Fattah S. HAMMAD¹, Hossam A. ABD EL GHANY², Ahmed M. AZMY²

¹Behira Electricity Distribution Company; ²Faculty of Engineering, Tanta University

ID: 10282

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Automatic Voltage regulators (AVR), French transmission system, SVR

Impact of an enhanced secondary controller on the voltage regulation performance in the French Transmission System

Julien CALLEC, Adrien GUIRONNET, Carmen CARDOZO, Philippe JUSTON

RTE, France

ID: 10379

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

An Innovative Indicator for Instability Risk Assessment

Giorgio GIANNUZZI

TERNA, Italy

ID: 10446

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Battery Energy Storage System, Inverter-Based Resource, Dynamic Modelling, Ride-Through, Solar Photovoltaic

Key Findings and Recommendations Regarding Systemic Performance and Modeling Issues for Bulk Power System Inverter-Based Resources

Alex SHATTUCK¹, Ryan QUINT², Aung THANT¹, Rich BAUER¹

¹North American Electric Reliability Corporation (NERC), United States of America; ²Elevate Energy Consulting, United States of America

ID: 10448

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Adaptive Capability, Continental Europe Synchronous Area, Inter-area Oscillation, Phasor Measurement Unit (PMU), Wide-area Damping Control

Mitigating Continental Europe North-South Oscillations Using An Adaptive Wide-area Damping Controller: Field Implementation and Testing

Lin ZHU¹, Evangelos FARANTATOS¹, Xinlan JIA², Wenpeng YU², Yi ZHAO², Yilu LIU^{2,4}, Salvatore TESSITORE³, Pietro PAU³, Guido COLETTA³, Cosimo PISANI³, Giorgio GIANNUZZI³

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ID: 10508

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Reactive Power Compensation, DSO-TSO Coordination, Distributed Energy Resources (DER) Integration, Reactive Power Monitoring System

Coordinated Reactive Power Compensation: A Collaborative DSO-TSO Approach

Miguel LOURO¹, Rita LOPES MOURÃO¹, Gonalo SANTOS¹, Jos  VIEIRA COUTO², Filipe RIBEIRO²

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ID: 10528

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Congestion Management, Topological Remedial Actions, Decision Support, Multi-Objective Optimization, Artificial Intelligence, DC load flow, Human-Machine Interface

GridOptions Tool: Real-World Day-Ahead Congestion Management using Topological Remedial Actions

Jan VIEBAHN¹, Sjoerd KOP¹, Joost VAN DIJK¹, Hariadi BUDAYA¹, Marja STREEFLAND¹, Davide BARBIERI¹, Paul CHAMPION², Mario JOTHY², Vincent RENAULT², Simon TINDEMANS³

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ID: 10553

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Energy Transition, Low Frequency Demand Disconnection, Low-Inertia, RoCoF, System Defence

Improving Frequency Defence Schemes for Critical System Conditions in the Continental European Power System

Padraig BUCKLEY¹, Aleksandar BORIĆIĆ², Martijn JANSSEN⁴, Timothy PLEVIER⁴, Jorrit BOS³, Danny KLAAR³, Marjam POPOV¹

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ID: 10593

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Protection Schemes for Renewable Energy Sources Integration in Romanian Power Grid

Roxana A ISTRATE¹, Costel CONSTANTIN¹, Lucian TOMA²

¹CNTEE Transelectrica SA; ²University Politehnica of Bucharest

ID: 10596

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Optimal allocation of Distributed Energy Sources and Capacitor Banks in Distribution Network using Genetic Algorithm

Nikolina MRAKOVIC¹, Zoran MILJANIC²

¹Montenegrin Transmission System; ²Faculty of Electrical Engineering

ID: 10640

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Voltage control sandbox in the Spanish Power System

Juan Juli n PEIR , Pablo MART NEZ-FRESNEDA, Hugo GONZ LEZ, Nicol s SANTOS, Agust n D    , Marta CABALLERO, Carlos RAMOS

Red El ctrica, Spain

ID: 10675

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Power system inertia, VRE, PFR, RoCoF

Effects of increasing variable renewable energy (VRE) integration on the power system inertia - South African power system

Fiona OLOO

The Council for Scientific and Industrial Research

ID: 10686

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Standards-based interoperable Testbed for Development and Assessment of stability monitoring Applications in the Nordic interconnected Grid

Emil HILLBERG

RISE, Sweden

ID: 10688

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Challenges of Frequency and Transient Stability arising from the Increased Renewable Energy

Ju-Yong KIM, Tae-Gyun KIM, Hoon-Chul SHIN, Tae-Yong SONG, Jun-Young JOO

Korea Power Exchange, Korea, Republic of (South Korea)

ID: 10748

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Outage Planning, Outage Planning Coordination, Net Transfer Capacity, Mixed Integer Linear Programming, Contingency Analysis, DC Power Flow, Operational Planning, Asset Management

Outage Planning Automation and Optimization at Swiss Electricity Transmission Grid with High Shares of Hydropower Generation

Marcel STOECKLI¹, Davood RAOOFSHEIBANI^{*2}, Evangelos VRETTOS², Felipe ALVAREZ², Beat LOETSCHER², Jose ANICETO², Adrian SCHULZE², Oliver HAUBENSAK², Matthias BUCHER²

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C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Power System Stability, Cooperative Control, Multi Purpose, BESS, RES

Development of multi-purpose cooperative control method of BESS for a power system with a high share of RES

Ryo YAMAGUCHI¹, Shigeyuki SUGIMOTO¹, Suresh Chand VERMA¹, Kotaro HATTORI²

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ID: 10876

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Distribution Network, Electricity Demand, Hydrogen, Modelling, Open Data, Renewable Energy, Time Series Data

Development of Future Energy Service Demand Model for Integrated Assessment of High Penetration Renewable Power Generations

Takeyoshi KATO, Chiyori URABE

Nagoya University, Japan

ID: 10927

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Wind Generation, Synthetic Inertia, Load-Generation Control, Underfrequency, Overfrequency, Power System Dynamics, Fast Frequency Response

Operation Performance of the Brazilian Electric System with the Contribution of Frequency Controls from the Wind Farms

Flávia FERREIRA¹, Dilton VASCONCELOS¹, Leonardo SANTOS¹, Darlanny DINIZ¹, Arlindo LINS²

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ID: 10972

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: IT platform architecture, Data exchange, Situational awareness, Voltage stability, Phasor Measurement Units

Wide Area Monitoring and Protection - Application Developments and IT infrastructure

Kjetil O. UHLEN¹, Kjell P. MYHREN², Hallvar HAUGDAL³, Daniel BALTENSPERGER¹, Ole FINSETH², Aldrich ZENO¹, Valeria Monteiro DE SOUZA¹

¹NTNU Norway; ²Statnett Norway; ³SINTEF Energy Norway

ID: 11170

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Adaptive Parameterization of Grid-Supporting Inverters: An Investigation into Complex Coupling Effects for Islanded Operation

Carina LEHMAL, Ziqian ZHANG, Herwig RENNER, Robert SCHÜRHubER

Graz University of Technology

ID: 11182

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Island System, Load Sharing, Power/Frequency Control, Isochronous, Secondary Control, Hybrid Station, Storage

Power sharing and secondary frequency control for Greek island systems supplied by RES+storage hybrid stations and thermal generating plants

Apostolos PAPAkonstantinou, Georgios PSARROS, Stavros PAPATHANASSIOU

National Technical University of Athens (NTUA), Greece

ID: 11185

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Non-Interconnected, Isolated Microgrids, Renewable Energy, Wind Park, Control, SCADA

Advanced functionalities for managing Wind Parks in non-interconnected Islands

Stefanos KOKKINELIS, Despoina KOUKOULA, Charalampos PAPPAS, Eleni LAMPRINIDI, Argyro MAGKANIOTI, Konstantinos KAOUSIAS, Andreas REPPAS, Theodora PATSAKA

HEDNO S.A., Greece

ID: 11396

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Impact of the balancing strategy in future meshed HVDC offshore systems

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ID: 11557

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Operation And Control Challenges With Large Penetration Of Renewable Energy Resources In The Indian Grid

Pankaj Kumar JHA*, M. S. HADA, Jiten DAS

POWERGRID, India

ID: 11574

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Solar Forecasting for Medium Voltage Distributed Energy Resource across a region

Chun Yin FOON, Azizul Hilmi ZULKIFLI, Dg Fatimah AHMAD

Tenaga Nasional Berhad, Malaysia

ID: 11660

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

A Concept for Frequency Control and Power Balancing in NEOM Grid of the Future

Lie XU¹, Ramon GIMENEZ², Md HABIBURRAHMAN³, Nagaraju POGAKU³, Peng LI³, Nand SINGH³, Grain ADAM³

¹University of Strathclyde, UK; ²University Polytechnic of Valencia, SPAIN; ³ENOWA, NEOM, KSA

ID: 11693

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Hydroelectric plants, Itaipu Binacional, Monte Carlo simulation, short-term operation planning, uncertainties

Itaipu's experience using Monte Carlo Simulation based tool for short-term operation planning

Ricci OVIEDO, Reinaldo GONZALEZ, Rafael ANDRADE

Itaipu Binacional

ID: 11811

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Solar photovoltaic (PV), Intra-hour power generation forecasting, Artificial neural network (ANN), Satellite imagery, Power system operation

Enhanced Intra-hour Solar PV Power Generation Forecast with Satellite Imagery

Jarudate VORASEE, Surat ASVAPOOSITKUL, Somphop ASADAMONGKOL, Somruedee TIPMABUTR

Electricity Generating Authority of Thailand (EGAT), Thailand

ID: 11835

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

An approach to evaluate Under-frequency Load Shedding System of Power System with high share of distributed source

Viet Anh VO HAI*, Anh Tuan NGUYEN, Quynh PHAM, Minh Long VU, Thanh Hai TRAN, The Van NGUYEN, Minh Ha HOANG, Cong Man LE

EVNCRDLC Vietnam

ID: 11872

C2 POWER SYSTEM OPERATION AND CONTROL - Full Papers

Topics: C2 PS2 - Changes on System Operation and Control Considering the Energy Transition

Keywords: Renewable Energy Sources, Energy Transition, Power System Operation, Phasor Measurements Units, Situational Awareness, Linear State Estimation, Oscillations

AEP's Operation Strategy for High Share of RES: Linear State Estimator and Oscillation Monitoring

Horacio SILVA¹, S. WHALEN¹, B. ABU-JARADEH¹, J. KOUTSOURAIS², Y. LU², P. P. NIEVES²

¹Electric Power Group (EPG); ²American Electric Power Service Corporation (AEP)

C3 - POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE

PS1 - PUBLIC ACCEPTANCE AND STAKEHOLDER ENGAGEMENT IN POWER SYSTEM GENERATION, TRANSMISSION & DISTRIBUTION INFRASTRUCTURES

ID: 10515

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS1 - Public Acceptance and Stakeholder Engagement in Power System Generation, Transmission & Distribution Infrastructures

Keywords: stakeholder engagement, public acceptance, biodiversity, sustainability, nature, nature-inclusive design

Harmonizing Nature's Symphony: biodiversity as a powerful tool for public acceptance

Paul HARTMAN¹, Claire DEURVORST², Henk SANDERS²

¹Antea Group; ²TenneT

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C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS1 - Public Acceptance and Stakeholder Engagement in Power System Generation, Transmission & Distribution Infrastructures

A geodesign-based framework that implements BIM methodology with GIS tools and involve stakeholders in transmission infrastructures projects

Francisco Javier MORENO MARIMBALDO

Red Eléctrica, Spain

ID: 10669

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS1 - Public Acceptance and Stakeholder Engagement in Power System Generation, Transmission & Distribution Infrastructures

Public acceptance of Facilities in Power Transmission Network in Montenegro

Ljiljana VUČINIĆ, Gordana PEROVIĆ

Crnogorski elektroprenosni sistem

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C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS1 - Public Acceptance and Stakeholder Engagement in Power System Generation, Transmission & Distribution Infrastructures

Multidisciplinary approach to managing wildlife risk in a DSO

Rudi KRUGER

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Topics: C3 PS1 - Public Acceptance and Stakeholder Engagement in Power System Generation, Transmission & Distribution Infrastructures

Levels of Electromagnetic Field in the Vicinity of Transmission Overhead Power Lines with Special Conductors

Maja GRBIC¹, Nada CUROVIC², Ivan MILANOV³, Aleksandar PAVLOVIC¹

¹Nikola Tesla Institute of Electrical Engineering, Republic of Serbia; ²Elektromreza Srbije JSC, Republic of Serbia; ³Elektroistok – Projektni biro, Republic of Serbia

ID: 10938

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS1 - Public Acceptance and Stakeholder Engagement in Power System Generation, Transmission & Distribution Infrastructures

Keywords: Social Impact – Social Licence to Operate – Stakeholders – Stakeholders Engagement – Stakeholders Perception

Periodic stakeholder perception mapping combining social impact and relationship assessments: A strategy to assess and enhance levels of social legitimacy for enterprises

Delfim ROCHA

Brazilian NC of CIGRE, Brazil; Ferreira Rocha Assessoria e Serviços Socioambientais

ID: 10942

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS1 - Public Acceptance and Stakeholder Engagement in Power System Generation, Transmission & Distribution Infrastructures

Keywords: Dam removal, public acceptance of dam, social impacts, life cycle assessment

Stakeholder Engagement in the Hydropower Decommissioning Process: a Groundbreaking Study in Latin America

Raquel LOURES¹, Marcelo MICHERIF², Mariana COELHO², Eduardo VAN DEN BERG³, Paulo POMPEU³, Adriano LEMOS¹, Yuri CALDEIRA¹, Rafael SOUZA¹, Rafael A. FIORINE¹

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ID: 10943

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS1 - Public Acceptance and Stakeholder Engagement in Power System Generation, Transmission & Distribution Infrastructures

Keywords: Hydroelectric Generation – Indicator Systems – Socio-environmental Programs and Projects – Evaluation Methodology – Efficacy – Effectiveness

Indicator Systems to Measure Efficacy and Effectiveness of Socio-Environmental Programmes of Hydroelectric Power Plants

Ricardo CAVALCANTI FURTADO, Maria F. G. FURTADO, Marcelo FURTADO, Elena FLORISSI

Brazilian NC of CIGRE, Brazil; Diversa Sustainability

ID: 11001

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS1 - Public Acceptance and Stakeholder Engagement in Power System Generation, Transmission & Distribution Infrastructures

Keywords: public, risk perception, project feasibility

Dialogue as an Important Link for Increasing the Level of Projects Feasibility

Katarina Ana LESTAN¹, Ana CERK², Urška KUGOVNIK³, Erik MARČENKO⁴, Masa DJURICA⁵, Maja IVANOVSKI⁶, Damjan KOVACIC⁷, Andrej SUSTERSIC⁸, Rudi VONCINA⁹

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ID: 11069

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS1 - Public Acceptance and Stakeholder Engagement in Power System Generation, Transmission & Distribution Infrastructures

Keywords: Photovoltaic power generation (PV), Feed-in Tariff, Land use statistics, Satellite image

Investigation on Current Trend of Land Use of Installation Site for Photovoltaic Power Generation Systems

Takeyoshi KATO, Chiyori URABE

Nagoya University, Japan

ID: 11406

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS1 - Public Acceptance and Stakeholder Engagement in Power System Generation, Transmission & Distribution Infrastructures

Assessing the Sustainability of Future Regional Energy Systems: Integrating Stakeholder Perspectives

Witold POGANIETZ², Johannes GAISER², Ines JENDRITZKI², Peter NOGLIK¹

¹Hitachi Energy Germany AG, Germany; ²Karlsruhe Institute of Technology, Germany

ID: 11535

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS1 - Public Acceptance and Stakeholder Engagement in Power System Generation, Transmission & Distribution Infrastructures

Design & Development of India's 1st Indigenous Pivoted Type Insulated Cross Arm for 400kV Transmission Line

Ashish Kr SINGH*, Mahendra CHAURASIA, Chandra KANT, Neeraj Singh GAUTAM, Rajesh GUPTA, Dr Subir SEN, Abhay CHOUDHARY

POWERGRID Corporation Of India Limited, India

PS2 - CLIMATE CHANGE AND IMPACT ON POWER SYSTEM, A HOLISTIC APPROACH

ID: 10120

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Keywords: Near to Zero Liquid Discharge (NZLD) - Egyptian Electricity Holding Company (EEHC) – Water rationalization - Dissolved Air Flotation process- Filtration system

Installation of Near to Zero Liquid Discharge (NZLD) Units at New Capital Combined Cycle Power Plant (NCCCPP)

Marwa Mansour HUSSEIN¹, Maher Aziz BEDROUS², Ismail Yehia Ali ELSAWI¹

¹Egyptian Electricity Holding Company EEHC; ²Senior Counsellor for Energy & Environment

ID: 10237

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Climate Change Impacts on Low Power Output of Photovoltaic in China

Zongpeng SONG, Bo WANG, Xiaolin LIU, Zheng WANG

China Electric Power Research Institute, China

ID: 10381

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Future projections of extreme conditions affecting the Italian Energy System with a multi-hazard approach

Paola FAGGIAN

RSE, Italy

ID: 10450

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Keywords: Electrical Substation, Grid Resilience, Climate Change, Coastal Flooding, Substation Cost Estimation

From Risk to Resilience: Quantifying the Financial Impact of Proactive Physical Infrastructure Improvements in Substations

Charlie {Chun} LI¹, Brian P. HERRMANN¹, Matthew D. UBER²

¹Burns & McDonnell, United States of America; ²J-Power USA, United States of America

ID: 10750

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Keywords: capacity expansion planning, climate impact, energy planning, European energy system, weather variability

Impact of Climate and Weather Variability on Energy System Planning

Marcel STOECKLI¹, Sebastian PORRAS APARICIO^{*2}, Alexandre OUDALOV², Georgios MAVROMATIDIS³

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²Hitachi Energy, Switzerland; ³ETH Zurich, Switzerland

ID: 10974

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Keywords: area planning, carbon emission, land-use change, mitigation, peat

Highlighting forgotten emissions: Calculate and mitigate carbon loss from infrastructure construction on peatland

Ellen TORSÆTER¹, Magni O. KYRKJEEIDE², Marte FANDREM³

¹Statnett SF Norway; ²NINA Norway; ³NTNU Norway

ID: 11166

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Impacts on T&D products by climate change and visa verse

Martin A. STOESSL¹, Ewald SCHWEIGER², Eduardo GOMEZ HENNIG³

¹Siemens Energy Austria; ²Siemens Energy Germany; ³Siemens Energy Canada

ID: 11484

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Methodology for the Use of Live Line Works as an Effective Solution During Environmental Phenomena and Regulatory Changes in Developing Countries

William SANTANA, Juan VARELA

ISA Intercolombia

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C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Risk Management of Fluvio-Torrential Events on Electric Transmission Infrastructure in the Face of Climate Change: Lessons Learned from the Mocoa Disaster

Judy VALVERDE, Hernán CORTÉS

Enlaza Grupo Energía Bogotá

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C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Climate Change Adaptation in Distribution Network Planning: A Resilient Approach for Sustainable Power Systems

Priyanshu PRALIYA*, Ankur SANGWAN, Sovik SHARMA, Akash KUMAR

Tata Power Delhi Distribution Limited, India

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C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Keywords: damages, components reliability, climate change, analytic hierarchy process

Faults and damages in the distribution network due to impact of climate change

Krešimir UGARKOVIC, Ivan ANDRIĆ, Hrvoje JELIĆ, Dinko HRKEC

HEP ODS d.o.o., Croatia

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C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Development of Trinity Renewable Energy for the Future of East Nusa Tenggara Electricity

Halomoan PARNINGOTAN, Tommy NOVIANTO, Ansats Pram Andreas SIMAMORA, Cristine C BUBRE

PT.PLN (Persero), Indonesia

ID: 11879

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Keywords: Climate change, transmission grid, adaptation, risk, downburst, flood, scenario, TSO, the Netherlands

The impact of climate change on the Dutch transmission grid: Leading risks and adaptation strategies

Joris DEN BREEJEN¹, Astrid SCHELLINGS-KOEKOEK²

¹TenneT TSO; ²Movares

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C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

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ID: 11592

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Keywords: Electrical resilience, Climate change, Climate resilience, Renewable energy sources, Institutional Energy framework, Pollution, Energy taxation, Kuwait

Achieving electrical resilience in the face of climate change in Kuwait

Nayef ALHADAD¹, Jana ALI²

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ID: 11716

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

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HEP ODS d.o.o., Croatia

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PT.PLN (Persero), Indonesia

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C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS2 - Climate Change and Impact on Power System, a Holistic Approach

Keywords: Climate change, transmission grid, adaptation, risk, downburst, flood, scenario, TSO, the Netherlands

The impact of climate change on the Dutch transmission grid: Leading risks and adaptation strategies

Joris DEN BREEJEN¹, Astrid SCHELLINGS-KOEKOEK²

¹TenneT TSO; ²Movares

PS3 - SUSTAINABILITY STARTING FOR THE SUPPLY CHAIN

ID: 10286

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS3 - Sustainability Starting for the Supply Chain

Keywords: Ecodesign, Green Procurement, Grids supply chain, LCA, Sustainability

Ecodesign aspects to enhance circularity and boost sustainable

Marcela MANTILLA, Pascale PRIEUR, Samuel NGUEFEU

RTE, France

ID: 10287

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS3 - Sustainability Starting for the Supply Chain

Keywords: Product Circularity, High-Voltage equipment, Circularity Strategies, Critical Raw Materials, Life Cycle

Circularity for High-Voltage Equipment

Christophe PERRIER, Thomas BERTELOOT, Eliott PEREZ, Clémence DUMOULIN

GE Grid Solutions, France

ID: 10451

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS3 - Sustainability Starting for the Supply Chain

Keywords: Construction, Embodied Carbon, Power Infrastructure, Sustainability

A Framework for Sustainability-centric Decision Making in the Selection of Construction Materials for Power System Projects

Alexander D. PAGNOTTA, Lyndsey COVERT

Burns & McDonnell, United States of America

ID: 10885

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS3 - Sustainability Starting for the Supply Chain

Keywords: Audible Noise, Corona Effect, HV Overhead Transmission Line

Audible noise reduction of high-voltage overhead lines by applying an eco-design approach while considering impact on the environment

Nebojša PETROVIĆ¹, Iva SALOM², Nada CUROVIĆ¹, Vladimir ČELEBIĆ², Valerijan AKSIĆ¹, Dejan TODOROVIĆ³, Milenko KABOVIĆ²

¹Elektromreža Srbije JSC, Serbia; ²Institute Mihajlo Pupin, University of Belgrade, Serbia; ³Dirigent acoustics LLC, Serbia

ID: 10944

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS3 - Sustainability Starting for the Supply Chain

Keywords: Carbon footprint; water footprint, life cycle assessment; sustainability

A step forward on sustainability in the electricity sector: putting LCA on the table

Denise MATOS, Katia GARCIA, Alexandre MOLLICA, Igor RAUPP, Juliano ABREU, João Gabriel LASSIO

Brazilian NC of CIGRE, Brazil; Eletrobras CEPEL

ID: 11067

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS3 - Sustainability Starting for the Supply Chain

Keywords: Electric vehicle (EV), EV Charger, Modelling, Renewable Energy, Road Traffic Census, LCA

Development of EV Charging Demand Estimation Model based on Road Traffic Census Data for Impact Assessment of High Penetration EV

Takeyoshi KATO, Chiyo URABE

Nagoya University, Japan

ID: 11078

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS3 - Sustainability Starting for the Supply Chain

Keywords: CO2 Emissions, Life Cycle Assessment, Lithium-ion Battery, Stationary Battery Energy Storage System, Carbon Intensity of Electricity, Degradation, Repurposing, Lifespan

Identifying key factors to mitigate life cycle carbon emissions of stationary battery energy storage systems

Reiko TAKAHASHI¹, Koji NEGISHI¹, Takenori KOBAYASHI¹, Hideki NODA², Mami MIZUTANI²

¹Toshiba Energy Systems & Solutions Corporation, Japan; ²Toshiba Infrastructure Systems & Solutions Corporation, Japan

ID: 11303

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS3 - Sustainability Starting for the Supply Chain

Tackling Scope 3 GHG Emissions of Grid Investments: Creation of Accounting Platform and CO2 Models for Tracking Emissions of Purchased Goods and Works

Vincent DU FOUR, Philipp VON NORMANN

Elia Group, Belgium

ID: 11395

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS3 - Sustainability Starting for the Supply Chain

CO2-reduced steel in transformers & challenges with impact evaluation

Matthias SCHICK¹, Marcel HILGERS¹, Georg PUKEL³, Christina LOSIFIDOU², Julian SUER¹, Katherine SCHWIND²

¹Thyssenkrupp Electrical Steel, Germany; ²Siemens Energy, Germany; ³Siemens Energy, Austria

ID: 11694

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS3 - Sustainability Starting for the Supply Chain

Transforming Sustainable Procurement in the Power Transmission Sector: Evolving Qualification Requirements and Evaluation Criteria

M Siddhardha SIDDHARDHA, Karan SINGH, Priti NAHAR*, Amit BHARGAVA, B Anantha SARMA, G RAVISANKAR

POWERGRID, India

ID: 11789

C3 POWER SYSTEM SUSTAINABILITY AND ENVIRONMENTAL PERFORMANCE - Full Papers

Topics: C3 PS3 - Sustainability Starting for the Supply Chain

Keywords: Renewable Energy, Energy Transition, Digitalization, PPA

RENOVA: Traceability System for the Trading of Renewable Energies in the Chilean Electric Market based on Blockchain Technology

Juan AVALOS, Barbara ACEVEDO, Juan Carlos OLMEDO

Coordinador Eléctrico Nacional, Chile

C4 - POWER SYSTEM TECHNICAL PERFORMANCE

PS1 - POWER SYSTEM DYNAMIC ANALYSIS IN THE ENERGY TRANSITION: CHALLENGES, OPPORTUNITIES AND ADVANCES

ID: 10102

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Nordic Power System, Power Electronic Interfaced Devices, PEID, Inverter Based Resources, IBR, Converter Stability

Changes in Nordic Power System Dynamics due to Massive Introduction of Wind and Solar Power

Antti HARJULA¹, Herman HÖRNEQUIST², Robert ROGERSTEN², Christian FLYTKJÆR³, Olli-Pekka JANHUNEN¹, Jun Bum KWON³, Eli Maria STENSETH⁴, Knut Styve HORNNES⁴

¹Fingrid Oyj; ²Svenska Kraftnät; ³Energinet; ⁴Statnett

ID: 10289

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Grid connexion requirements, IBR, RMS model validation

An Open-Source Tool for the Validation of Power Park Modules Generic Models

Carmen CARDOZO¹, J. L. MARIN², M. DE MIGUEL², G. OMS², Adrien GUIRONNET¹

¹RTE R&D, France; ²Grupo AIA, Spain

ID: 10291

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Co-simulation, EMT-type simulation, FMI, HVDC transmission, Interactions

Parallel simulation of a wide-area EMT model with high penetration of power electronic converters using co-simulation: a real case study

Boris BRUNED, Mehdi OUAFI, Ambroise PETIT, Valentin COSTAN, Yannick VERNAY

RTE, France

ID: 10292

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Power systems, Inverted-Bases Resources (IBR), Battery energy storage systems (BESS^o), Renewable energy sources (RES)

Study of New Types of Dynamic Interactions in Power Systems with Mixed Conventional and Renewable Generation

Pamela ZOGHBY^{1,2,3}, Bogdan MARINESCU^{2,3}, Antoine ROSSE¹, Grégoire PRIME¹

¹EDF R&D, France; ²Ecole Centrale Nantes, France; ³LS2N, France

ID: 10383

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Dynamic assessment of Power System Strength in systems with a large share of generation from renewable sources

Luca BELMONTE

TERNA, Italy

ID: 10384

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

System stability in dynamic analysis of large power systems enhanced with HVDC reinforcement: HVDC Foggia-Forlì

Andrea URBANELLI

TERNA, Italy

ID: 10386

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Regulating Resistors: an Advanced Control Strategy to Achieve Overall System Stability in the Italian Transmission Grid

Cosimo PISANI

TERNA, Italy

ID: 10456

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Available Short Circuit MVA, Grid Forming, Positive Sequence Models, Synchronous Condensers

Location and Sizing of Grid Forming Devices in Transmission Power Networks

Deepak RAMASUBRAMANIAN

Electric Power Research Institute (EPRI), United States of America

ID: 10457

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Frequency Stability, Inverter-based Resources, Power/Frequency Control, Voltage Control

Unlocking Capability in Transmission Connected Inverters for Improved Reliability of Transmission Power Networks

Deepak RAMASUBRAMANIAN¹, Sushrut THAKAR¹, Julia MATEVOSYAN²

¹Electric Power Research Institute (EPRI), United States of America; ²Energy Systems Integration Group (ESIG), United States of America

ID: 10458

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Offshore Wind Farm, Inter-array Cable, Collector System, Collector Network Equivalent, Electromagnetic Transient

Collector System Equivalencing with Frequency-Dependent Representation for Electromagnetic Transient Models

Swetha SRINIVASAN, Monica PADALA, David ROOP, Kaitlyn BABIARZ, Adam SPARACINO

Mitsubishi Electric Power Products, Inc., United States of America

ID: 10459

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Battery Energy Storage System, Grid Forming, Inverter-Based Resource, Modelling

Grid Forming Functional Specifications and Verification Tests for North American Bulk Power System Connected Battery Energy Storage Systems

Aung THANT¹, Hongtao MA¹, Andrew ISAACS², Lukas UNRUH², Ryan QUINT⁶, Deepak RAMASUBRAMANIAN³, Julia MATEVOSYAN⁴, Andy HOKE⁵

¹North American Electric Reliability Corporation (NERC), United States of America; ²Electranix, Canada; ³Electric Power Research Institute (EPRI), United States of America; ⁴Energy Systems Integration Group (ESIG), United States of America; ⁵National Renewable Energy Laboratory (NREL), United States of America; ⁶Elevate Energy Consulting, United States of America

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Inertia Trend, Rate of Change of Frequency, Field Measurement, Generation Mix

Inertia Trend Analysis in the U.S. Eastern Interconnection with Field Measurement Data

Chengwen ZHANG¹, Mark BALDWIN², Hongyu LI¹, Zhihao JIANG¹, Saurav DULAL¹, Yilu LIU^{1,3}

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: 1% Frequency Droop, Primary Frequency Response, Frequency Containment, Inverter-based Resources, Battery Energy Storage Systems (BESS)

Evaluation of Primary Frequency Response from Inverter-based Resources with 1% Droop Setting

Shruti RAO¹, Jason MACDOWELL¹, Sheila MANZ¹, Sebastian ACHILLES¹, Nicholas MILLER², Nitika MAGO³, Weifeng LI³, Pengwei DU³, Luis HINOJOSA³, Shun Hsien {Fred} HUANG³

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Simultaneous Voltage and Power Oscillation Damping Control: Towards robust and scalable Grid Requirements and control Solutions

Joakim BJÖRK

Svenska kraftnät, Sweden

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Impact on Frequency Stability of the Feedback in the active Power Control for synchronous Generation

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Impact of active Distribution Networks on Power System Stability – a Case Study

Frédéric SABOT¹, Pierre HENNEAUX¹, Ifigeneia S. LAMPRIANIDOU², Panagiotis N. PAPADOPOULOS², Keith BELL²

¹BEAMS, Université libre de Bruxelles, Belgium; ²Dept. of Electronic and Electrical Engineering, University of Strathclyde, United Kingdom

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Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Impact of Converter-based Demand on Frequency Quality in the Ireland and Northern Ireland Power Systems

Taulant KERCI, Connor DUGGAN, Usman FAROOQ, Simon TWEED, Marta VAL ESCUDERO

EirGrid

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Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Development of Look Ahead Reactive Power Resource Optimisation Tool for Voltage Security in IBR Dominated Systems

Mohammad JAFARIAN¹, Marta VAL ESCUDERO¹, Niall RUTHERFORD¹, Eoin KENNEDY¹, Diarmaid GILLESPIE¹, Mary HENNESSY¹, Narsi VEMPATI², Roger TREINEN², Fernando MAGNAGO², Joseph BRIGHT², Mauro PRAIS², Roozbeh EMAMI², Madhusudhana SADAGOPAN², Wesley VANCE²

¹EirGrid; ²Resource Innovations

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Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Enhancing the Evaluation of Rate of Change of Frequency During Fault Contingencies Simulated in Phasor-Domain Tools

Mostafa BAKHTVAR¹, Dusko NEDIC², Mohammad JAFARIAN², Ismail IBRAHIM², Emma FAGAN², Marta VAL ESCUDERO², Eoin KENNEDY²

¹SSE Thermal; ²EirGrid

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Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Energy Storage to enhance Transmission Capacity - a Case Study on the Swedish Transmission Grid

Arvid BJÖREMARK

DNV Sweden AB, Sweden

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Power System, Frequency Stability, Frequency Containment Reserve, Demand-Side Device, Lighting Device

Experimental Evaluation of Lighting Device's Potential for Securing Frequency Control Reserve Using Demand-Side Devices

Hayato SATOH, Ayako YASUOKA, Muneki MASUDA

Central Research Institute of Electric Power Industry, Japan

ID: 11096

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Automated framework, control interaction, machine learning, python framework, stability analysis, subsynchronous oscillations

Automatic Detection of Subsynchronous Oscillations

Diptargha CHAKRAVORTY¹, Alexandru Christian NEAGU², Jochen I CREMER²

¹TNEI Services Ltd UK; ²Delft University of Technology Netherlands

ID: 11099

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Automated framework, control interaction, eigenvalue, frequency domain analysis, grey box method modal analysis, machine learning, small signal analysis, subsynchronous oscillation

Framework for Identification of Subsynchronous Oscillation Risks

Diptargha CHAKRAVORTY¹, Jaime TRIVINO¹, Sami ABDELRAHMAN²

¹TNEI Services Ltd UK; ²National Grid ESO UK

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Identifying potential sub-synchronous oscillations using impedance scan approach

Shahil SHAH¹, Jingwei LU², Nilesh MODI¹

¹National Renewable Energy Laboratory, USA; ²Australian Energy Market Operator, Australia

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Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Large scale grid forming BESS replaces synchronous generation enabling high renewable penetration & low system load in Australia's major northern grid

Brendan TRUONG¹, Stanislav CHEREVATSKIY², Stephen SPROUL², Vimeshan PILLAY¹, Heath LANG³

¹Power and Water, Australia; ²Hitachi Energy, Australia; ³Owners Engineer - Territory Generation, Australia

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Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

On the Use of the Congestion Forecast Processes for Early Warning of Possibly Tensed Situations

Benoît BLETTERIE¹, Martin LENZ¹, Mike Alexander LAGLER¹, Herwig RENNER²

¹Austrian Power Grid; ²Graz University of Technology

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Impact of Grid-Forming Solutions on North-Western Victorian Network in Australia

Logan PETERS, Yiju MA

Australian Energy Market Operator, Australia

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Phasor Measurement Units, Real Time Monitoring, Voltage Stability Assessment, Power System Security, Oscillation Damping

PMU Applications for Voltage Stability monitoring and Oscillation analysis

Costas VOURNAS¹, Panos MANDOULIDIS¹, Orestis DARMIS¹, Spiros CHOUNTASIS², Stavros TSAKIRIS², George KORRES¹

¹ECE NTUA, Greece; ²IPTO, Greece

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Photovoltaic (PV), Distributed Resources (DR), Sudden Voltage Change, Point of Common Coupling (PCC), Grid Impact Study (GIS), Energy and Mineral Regulation Commission (EMRC).

A Novel Methodology for Grid Impact Studies of Photovoltaic Systems

Saddam ALTAMIM, Sawsan ABDELAH, Ahmad ALSAYIS

IDECO

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: PMU, Dimensionality Reduction Techniques, Principal Component Analysis, Singular Value Decomposition.

Oscillation Modes Identification Via Singular Value Decomposition and Principal Component Analysis

Carlos FERRANDON¹, Abraham ALVAREZ¹, Jonathan CERVANTES², Zia EMIN³

¹PSC UK; ²Energinet Denmark; ³EPRI UK

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Load Model Evolution for the Colombian Power System

Neby CASTRILLÓN¹, Juan GONZÁLEZ¹, Estefania GALLEGÓ¹, Natalia BARROS¹, Sebastián LOAIZA², Juan MESA², Juan GALINDO³, Juan HOYOS³

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: EMT Analysis, Inverter-Based Resources, RES, SCR

EMT Modeling and Analysis of the Chile's Power Grid with High Penetration of Inverter-Based Renewable Energy Sources

Victor VELAR, Rodrigo ESPINOZA, Eugenio QUINTANA, Simon VELOSO

Coordinador Eléctrico Nacional, Chile

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Variable Renewable Energy, ESCR, EMS-SCADA

Real Time System Strength Monitoring in the Chilean National Electric System

Jorge VARGAS, Rodrigo ESPINOZA, Victor VELAR, Gretchen ZBINDEN

Coordinador Eléctrico Nacional, Chile

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

STATCOM Modelling Assessment and Performance Analysis in Rajasthan Renewable Complex of India

Ebin Cherian MATHEW*, Priyam JAIN, Gaurab DASH, Aman GAUTAM, Rahul SHUKLA, Manas Ranjan CHAND, Vivek PANDEY, Surajit BANERJEE, S.C. SAXENA

Grid Controller of India Limited, India

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Strategies for Mitigation of Oscillations in IBR Penetrated Network in India

Ebin Cherian MATHEW *, Aman GAUTAM

Grid Controller of India Limited, India

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Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Enabling System-Level EMT Studies of Danish Power Systems

Yicheng LIAO¹, Liang LU¹, Jun Bum KWON¹, Nan QIN¹, Dharshana MUTHUMUNI², Yousef PIPELZADEH², Karl DIRKS²

¹Energinet; ²Power Systems Technology Centre

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

SSSC Model Validation Experience for the Colombian Power System

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Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Comprehensive Analysis of Colombian Power System Oscillations

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Data Center, Generator Pool, Pulse Load, Model Validation, Dynamic Security

Evaluation of the robust operation of a diesel Generator Pool in new proposed Data Center electrical topology considering specific Generator manufacturer

Georgios KARVELIS¹, Christos AGATHOKLEOUS¹, Vassilis BAKOLAS¹, Drazena BROCILO², John WILTSHIRE², Salver CORHODZIC²

¹PROTASIS SA, Greece; ²META, USA

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Enhancing Dynamic Performance Validation of Transient Stability Models using Argentina's Phasor Measurement Units

Nicolás DE SAN JUAN, Félix GALLEGGO, Trinidad UBICI

CAMMESA

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS1 - Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Type IV Wind Turbine Generator, Model Validation, EMT Modelling, Offshore Wind, Machine Learning

EMT-Based Machine Learning Model for Fault Ride-Through Assessment in Type IV Offshore Wind Turbine Generators

Gabriel Miguel Gomes GUERREIRO¹, Ranjan SHARMA¹, Frank MARTIN¹, Guangya YANG²

¹SGRE; ²Technical University of Denmark (DTU)

PS2 - POWER QUALITY (PQ) AND ELECTROMAGNETIC COMPATIBILITY (EMC) ANALYSIS IN THE ENERGY TRANSITION: CHALLENGES, OPPORTUNITIES AND ADVANCES

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: EMT simulation, harmonic studies, sensitivity analysis, wind parks

Sensitivity Analysis Methods for Onshore Harmonic Studies

Benoît DE FOUCAUD, Xavier-Marie VIEL

RTE, France

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Load Composition Modelling, Frequency-Dependent Impedance, Distribution Network, Modelling Process, Motor Load

Influence of Composition-Dependent Load Modelling on System-Wide Harmonic Impedance Characteristics

Peter BONINO, Samantha DEENEY, David ROOP

Mitsubishi Electric Power Products, Inc., United States of America

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Geomagnetic Disturbance, Geoelectric Field Grid Map, Nearest Neighbor Search, Geomagnetically-Induced Current, Transmission Line Branch Induced Voltage

Real Time Geomagnetic Disturbance Analysis of Bulk Power System Grid using Geoelectric Field Grid Maps

Krishnat PATIL¹, Christopher BALCH²

¹Siemens Power Technologies International, United States of America; ²CIRES & NOAA Space Weather Prediction Center, United States of America

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Inverter Based Resources, Power Quality, Harmonic Model, Harmonic Summation, Harmonic Aggregation

Estimation of Harmonic Exponent Summation Factors for Type 3 DFIG Wind Turbines

Amir KAZEMI, Jagdeep KAUR

GE Consulting Services, United States of America

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Emission, Supraharmonics, Summation, Aggregation

Harmonic and Supraharmonic emission and Aggregation Characteristics of some end use loads sold in the US

Gaurav SINGH, Jason JOHNS

Electric Power Research Institute (EPRI), United States of America

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Power quality, voltage unbalance, negative phase sequence, overhead lines

Voltage unbalance in overhead lines with EHV and HV circuits combined in the same tower

Jeroen VAN WAES¹, Frederik GROEMAN², Tam MAI², Kees KOREMAN³

¹TenneT TSO / Eindhoven University; ²DNV; ³TenneT TSO

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Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances
Advancing Power Quality Measurements in the Swedish Transmission Grid
Oscar LENNERHAG
 Independent Insulation Group Sweden AB, Sweden

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers
Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances
Keywords: Power Quality, Voltage Dips, Energy Transition
Post-Energy Transition Voltage Dips Assessment: A Dutch Transmission Network Case Study
Roosbeh TORKZADEH¹, Jeroen VAN WAES², Sjeef COBBEN¹
¹Eindhoven University of Technology; ²TenneT TSO BV and Eindhoven University of Technology

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers
Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances
Keywords: Geomagnetically induced currents, Power quality, Reactive power Q-loss, Voltage stability
Towards A Novel Approach To Voltage Magnitude, Harmonics, And Voltage Stability In The Presence Of GICs
Trevor GAUNT¹, Pitambar JANKEE¹, Hilary CHISEPO², Michel MALENGRET³
¹University of Cape Town; ²ESP Consulting; ³MLT Drives, South Africa

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Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances
A Methodology to Define Radiated High Frequency Emission of In-Situ Measurements in Harsh Environments
Emil ERIKSSON
 Hitachi Energy Sweden AB, Sweden

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers
Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances
Voltage Harmonics Trends based on Field Measurements on the Irish Transmission Network
Daphne SCHWANZ¹, Aisling CARROLL², Chandrasekaran SUBRAMANIAN¹, Oisín GOULDING¹, Alan ROGERS¹
¹EirGrid; ²University College Dublin

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Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances
Keywords: Power quality – Harmonic - Harmonic Emission - Background Harmonic - Harmonic Responsibility - Superposition Method - Wind Farm - Wind Turbine - Harmonic Study
Reduction of the Influence of the Background Harmonic Voltage on the Assessment of Harmonic Current at WT Terminals by the Application of the Superposition Method
Miguel P. DE CARLI, Leonardo O. GRANDER
 Brazilian NC of CIGRE, Brazil; Eletrobras CGT ELETROSUL

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Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances
Keywords: power system, electromagnetic compatibility, investigation method, power plants and substations, monitoring system
Electromagnetic Compatibility in Auxiliary DC Power Supply System
Ruslan BORISOV¹, Andrey GOLDUN², Maxim SMIRNOV²
¹National Research University «MPEI», Russian Federation; ²RPC ELNAP Ltd., Russian Federation

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Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances

Harmonic Assessment in Renewable Energy Zones

Yilun SUN, Jiacheng LI, Nalin PAHALAWATTA, Salim ANWARI, Sarath PERERA
HATCH, Australia

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Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: HVDC, GIS, VFTO, EMC, IEC Standards

EMC Issues within HVDC System under GIS Environment

Keesang SONG¹, Insoo PARK¹, Gearoid OHEIDHIN², Olivier CLEMENCON¹, Chanhyuk YIM³

¹KAPES, Republic of Korea; ²GE Grid Solutions, United Kingdom; ³KEPCO, Republic of Korea

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Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances

Exploratory Analyses of Power System Harmonic Measurements Using Principal Component Analysis

Bjarne S. BUKH¹, Vladislav AKHMATOV¹, Chris L. SKOVGAARD¹, Filipe F. DA SILVA², Claus LETH BAK²

¹Energinet; ²Aalborg University

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Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances

Flexible network model to study the impact of future changes in transmission systems on harmonic levels and impedance

Ana M BLANC¹, Max DOMAGK¹, Jan MEYER¹, Marco LINDNER²

¹Dresden University of Technology, Germany; ²TransnetBW GmbH, Germany

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances

Multi-Platform Analysis for Harmonic Emission Assessment of M-SSSC FACTS Devices in the Santa Marta Substation (Colombia)

Juan BOTERO¹, Carlos BORDA¹, Jhon CALDERON²

¹Smart Wires Inc; ²ISA Interconexión Eléctrica

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS2 - Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances

Keywords: Power Quality, Background Harmonics, Amplification Factor, Planning Level, Data Analysis

Background harmonics: Quantifying network assumptions and impacts

YiLin {Inez} ZHENG

Goldwind

PS3 - INSULATION CO-ORDINATION AND LIGHTNING INTERFERENCE ANALYSIS: CHALLENGES, OPPORTUNITIES AND ADVANCES

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS3 - Insulation Co-Ordination and Lightning Interference Analysis: Challenges, Opportunities and Advances

Keywords: ATP, Grounding Grid, Lightning stroke, Soil Resistivity, Transmission Line Approach (TL), Frequency content, Uniform Soil

Effect of frequency content on the effective area of grounding grid at uniform soil resistivity

Adel Z. EL DEIN¹, Sara YASSIN OMAR²

¹Aswan University, Thebes Technological University; ²Upper Egypt Electricity Distribution Company

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS3 - Insulation Co-Ordination and Lightning Interference Analysis: Challenges, Opportunities and Advances

Keywords: Overvoltage withstand, transformers, TOV, insulation coordination

Transformer withstand capability to temporary overvoltages: a general determination method from standard input data

Manuel MARTINEZ-DURO

EDF, France

ID: 10326

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS3 - Insulation Co-Ordination and Lightning Interference Analysis: Challenges, Opportunities and Advances

Keywords: Incipient Fault Detection, Online Condition Assessment, Condition Based Maintenance, Waveform Analytics

Utilizing Substation-based Monitoring to Improve Condition Assessment of Distribution Networks

Jeffrey WISCHKAEMPER, B. Don RUSSELL, Carl BENNER, Karthick MANIVANNAN

Texas A&M University, United States of America

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS3 - Insulation Co-Ordination and Lightning Interference Analysis: Challenges, Opportunities and Advances

Long Tail Withstand Voltage Test (TOV) on the HVDC Cable and Accessories of the Italy-France Interconnection: a comparison between laboratory and infield results

Grazia BERARDI

PRYSMIAN GROUP, Italy

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS3 - Insulation Co-Ordination and Lightning Interference Analysis: Challenges, Opportunities and Advances

Contamination Map and Design Optimization for Increased Transmission Reliability and Resilience: The Italian Experience

Massimo MARZINOTTO¹, Alessandra BALZARINI², Piero BERARDI¹, Michele DE NIGRIS², Paolo OMODEO GIANOLO², Alberto PIGINI³, Giovanni PIROVANO², Guido PIROVANO², Pierluigi PORTOGHESE¹, Roberto SPEZIE¹, Anna Maria TOPPETTI²

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS3 - Insulation Co-Ordination and Lightning Interference Analysis: Challenges, Opportunities and Advances

Keywords: Protection, System Interaction, Transients, Transformer Modeling

Enhancing Power Transformer Reliability: High-Frequency Modeling, Transient Interactions, and Overvoltage Protection Scheme

F. NASIRPOUR¹, B. BEHDANI¹, A. HEIDARY¹, M. GHAFARIAN NIASAR¹, F. GHASSEMI², K. VELITSIKAKIS³, M. VAN RIET⁴, M. WILKINSON⁵, M. VAN DER MEIJDEN³, S. NAUTA⁴, I. TANNEMAAT³, J. VEENS⁵, M. POPOV¹

¹Delft University of Technology, Faculty of EEMCS; ²National Grid Electricity Transmission plc; ³TenneT TSO B.V.; ⁴Alliander N.V.; ⁵Royal SMIT Transformers B.V.

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS3 - Insulation Co-Ordination and Lightning Interference Analysis: Challenges, Opportunities and Advances

Keywords: non-standard waveform, re-ignition, temporary overvoltage, TOV, harmonic resonances, vacuum circuit breaker

Service Experience in the Dutch Transmission Grid with Non-standard Overvoltage Waveforms & their Impact on the Component Insulation

K. VELITSIKAKIS, I. TANNEMAAT

TenneT TSO B.V.

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C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS3 - Insulation Co-Ordination and Lightning Interference Analysis: Challenges, Opportunities and Advances

Keywords: Earthing impedance, high frequency, lightning strike, measurement, simulation

A methodology of measuring, modelling and simulating of high frequency earthing impedance

Aman LAMBA, Jiayang WU, Ebbo DE MEULEMEESTER, Onno NOBEL, Leo LAGENDIJK

DNV

ID: 10751

C4 POWER SYSTEM TECHNICAL PERFORMANCE - Full Papers

Topics: C4 PS3 - Insulation Co-Ordination and Lightning Interference Analysis: Challenges, Opportunities and Advances

Keywords: Harmonic, EHV Cable, Inrush Current, Overvoltage

Overvoltages with high harmonics when connecting step-up transformers in a pumped-storage power plant: A case study

Marcel STOECKLI¹, Florian BRANTSCHEN², Romain BIRBAUM², Cecile JOST³, Yves PANNATIER⁴, Georg KOEPPL⁵

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Keywords: Gas insulated substations - Clean Air insulation – Sulfur Hexafluoride insulation – Very Fast Transient Overvoltage – Conducting Pipe Modelling - Transformer Modeling

Very Fast Transient Overvoltage Analysis in Clean Air and SF6 Gas Insulated Substation Modules Using the Extended Transmission Line Theory

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Keywords: Climate change, Lightning, Transmission Line

Climate Characterization and Historical Changes in Density and Intensity of Lightning around the 500 kV Bacabeira-Parnaíba Transmission Line

Rafael SILVA ALÍPIO¹, Ana Clara MARQUES³, Pedro REGOTO³, Luciano RITTER³, Euro PINTO DE ALMEIDA⁴, William MEJIA⁵, Fernando DINIZ², Thiago Luiz FERREIRA², Fabian ROJAS⁵, Oscar GONZALEZ⁵

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Topics: C4 PS3 - Insulation Co-Ordination and Lightning Interference Analysis: Challenges, Opportunities and Advances

Keywords: Transient Overvoltage, Isolated Ground Systems, Mitigation, Voltage Scaling, Intermittent Earth-Fault

Voltage Scaling Phenomenon in Isolated Ground Systems – Approach and Proposal for Mitigation Analysis of a Real Case in Brazil

Rafael DE OLIVEIRA FERNANDES¹, Caio ELEUTÉRIO²

¹Brazilian NC of CIGRE, Brazil; ²UNICAMP University; ³ARGO Energia

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Keywords: Lightning, Surge, Electromagnet transient analysis, Finite-difference time-domain method, Power cable, Control cable, Transmission line, Substation, Switching

Recent progress in three-dimensional FDTD-based electromagnetic transient analysis of electric power facilities

Akiyoshi TATEMATSU¹, Yoshihiro BABA², Toshiaki UEDA³, Toshihiro TSUBOI⁴, Soichi MORIGUCHI⁵

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Keywords: Effective Length, Ground Return Impedance, High Frequency Cable Model, Impulsive Grounding Impedance

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Melih GÜNERI¹, Bora ALBOYACI²

¹Kratis Engineering Türkiye; ²Kocaeli University Türkiye

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Keywords: ATPDraw, backflashover, lightning overvoltage, transmission line modelling

Evaluation of the Impact of Underbuilt Wire on Backflashover Critical Current in Transmission Line

William Gonzalo FLORES RUIZ¹, Jaimis S. LEON COLQUI², Jose PISSOLATO FILHO²

¹National University of Engineering, Peru; ²State University of Campinas, Brazil

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Keywords: lightning current, measurement, surge arrester, waveshape

Measurement of lightning current circulating in line arresters and through the transmission line tower

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¹Croatian Transmission System Operator (HOPS), Croatia; ²Faculty of Electrical Engineering and Computing University of Zagreb, Croatia

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Keywords: Critical flashover voltage, EMTP simulations, HV testing, insulator string flashover model, lightning overvoltages

Modelling of Flashover on Insulator Strings of Overhead Lines Due to Lightning Overvoltages

Bozidar FILIPOVIC-GRČIĆ¹, Nina STIPETIĆ¹, Franjo VUKOVIĆ¹, Dalibor FILIPOVIC-GRČIĆ²

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Keywords: Electricity Market, External Shock, Governance, Resilience, Technology Integration, Innovation

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Hiroki SAKAI¹, Kenichi SUGAHARA², Yuki KATAOKA¹, Akihiro MAEKAWA³, Ken FURUSAWA⁴

¹Chubu electric Power Grid Co., Inc., Japan; ²Chubu electric Power Co., Inc., Japan; ³Kansai Transmission and Distribution, Inc., Japan; ⁴Central Research Institute of Electric Power Industry, Japan

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Keywords: Balancing Reserves, Capacity Allocation, Cross-Zonal Capacity, Electricity Markets

Comparing the Co-Optimized and Market-Based Allocation of Cross-Zonal Capacity for the Exchange of Balancing Capacity

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¹Xi'an Jiaotong University, China; ²Cardiff University

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¹TERNA, Italy; ²CESI GROUP; ³University of Trieste, Italy

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Topics: C5 PS2 - Preparing for the Future with Moving Targets

Keywords: Distributed Energy Resources (DER), Grid Services, Wholesale Electricity Markets, TSO-DSO Coordination

Structuring the Coordination Across Transmission and Distribution to Support Value Stacking Scenarios Combining Multiple DER-Provided Grid Services

Tanguy HUBERT

Electric Power Research Institute (EPRI), United States of America

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Keywords: Dynamic Reserves, Intermittent Energy Sources, Operating Reserve Requirements, Price Formation, Wholesale Electricity Market Structure

Dynamic Procurement of Reserves in New York Electricity Markets

Pradip KUMAR¹, Matt MUSTO¹, Nate GILBRAITH¹, Rana MUKERJI¹, Michael DESOCIO²

¹New York Independent System Operator (NYISO), United States of America; ²Luminary Energy, United States of America

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Keywords: Combined-Cycle Generator, Operational Flexibility, Multiple Configuration Resource Model, Wholesale Electricity Market

Optimizing Combined-Cycle Generators in PJM's Wholesale Electricity Markets Using a Hybrid Multiple Configuration Resource Model for Enhanced Flexibility

Anthony GIACOMONI, Danial NAZEMI

PJM Interconnection, United States of America

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Keywords: Real-time Pricing, Bid-in Demand, Demand Response, Flexibility, Wholesale Electricity Markets

Finding Flexibility in Large Flexible Loads: Making Demand Equivalent to Generation in Wholesale Markets

Debra LEW¹, Richard O'NEILL², Erik ELA³, Mark AHLSTROM⁴

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Keywords: Brazil; Competitiveness; Market; Offshore; Wind; Perspectives; Regulation; Technology

Analysis on the integration of new technology in the Brazilian electricity market – Offshore wind case

Solange DAVID¹, Vinícius DAVID²

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C5 ELECTRICITY MARKETS AND REGULATION - Full Papers

Topics: C5 PS2 - Preparing for the Future with Moving Targets

Keywords: Clean energy transition, Connection products, Firm properties, Non-firm properties

Connection products in electricity networks

Eivind GRAMME¹, Selina KERSCHER²

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Implementation of Virtual Power Purchase Agreements to Support Carbon Neutral Investments in the Russian Electricity Market

Vladislav BEREZOVSKY¹, Anna PAVLYCHEVA², Sergey GAFAROV³, Andrey SVIRIDOV³, Victor BALYBERDIN⁴

¹Carbon Zero LLC, Russian Federation; ²University of Chicago, USA; ³Association «NP Market Council», Russian Federation; ⁴SKM Market Predictor AS, Norway

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Impact of Carbon Pricing on Wholesale Electricity Prices and Energy Transition Scenarios in Russia

Vladislav BEREZOVSKY¹, Nikita IVANOV², Tatiana REMIZOVA³, Ljubov CHERNEY⁴, Dmitry KOSHELEV⁵

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Keywords: Renewable Energy, Storage, Grid Congestion, Connection Agreement, Power Limitation, Hosting Capacity

Connection agreements subject to limitations for renewable generation and storage facilities in Greece

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Keywords: Distributed Energy Resource (DER), Distributed Energy Trading Market, Demand Side Electrical Value, Energy Management System (EMS), Distribution Locational Marginal Price (DLMP), Value of Lost Load (VoLL)

Mechanisms for Trading the Electrical Value of the Demand Side to Promote the Usage of Distributed Energy Resources

Takeshi YAMASHITA¹, Hideki KIBATA¹, Tokunari ANAI¹, Hiroshi OKAMOTO²

¹Tokyo Electric Power Company Holdings. Inc., Japan; ²TEPCO Power Grid. Inc., Japan

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Topics: C5 PS2 - Preparing for the Future with Moving Targets

Keywords: Capacity Calculation – Market Coupling – Flow-based – Domain – PTDF – Bidding Zone – Active Constraints – Shadow Price – Price Spread – Market Clearing Point

Introduction of the Operational Core Day-Ahead Flow-Based Capacity Calculation and Market Coupling through Active Constraints and Price Spread

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Keywords: Energy Transition, Decarbonization, Coal Phase-Out

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Keywords: regulation, grid connection, RES, benchmarking

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Alvaro CASTRO

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Topics: C5 PS2 - Preparing for the Future with Moving Targets

Keywords: Prosumer, Peer-to-Peer (P2P) Energy Trading, ERC Sandbox, Hyperledger Fabric Blockchain, Wheeling Charge

Peer-to-Peer Energy Trading via Automated Matching with Public Profit-Sharing Algorithms: A case study for ERC Sandbox in Thailand

Nakarin RACHJARIT

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C5 ELECTRICITY MARKETS AND REGULATION - Full Papers

Topics: C5 PS2 - Preparing for the Future with Moving Targets

Keywords: Electricity-Carbon Coupling, Market Relationship, Price Correlation, Product System, Emission Factor

Research on Market Mechanism in Electricity-Carbon Coupling System: The Practice of CSG

Nan SHANG

Energy Development Research Institute, China Southern Power Grid

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C5 ELECTRICITY MARKETS AND REGULATION - Full Papers

Topics: C5 PS3 - Emerging Markets and Forms of Markets

Keywords: Bidding, Energy Market, Optimization, Battery Energy Storage Systems, Price Uncertainties

Automated Market Bidding for Battery Energy Storage Systems

Faeza HAFIZ¹, Iiro HARJUNKOSKI², Mohamed EISSA³, Elisabetta VALLARINO³, Silvia PICERNO³

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C5 ELECTRICITY MARKETS AND REGULATION - Full Papers

Topics: C5 PS3 - Emerging Markets and Forms of Markets

Keywords: Distributed Energy Resources (DERs), Wholesale Electricity Markets, Grid Services, Metering Telemetry, Measurement & Verification (M&V)

New Market Rules to Meter Behind-the-Meter DERs Participating in Wholesale Electricity Markets: Overcoming Technical Limitations and Economic Barriers

Tanguy HUBERT

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C5 ELECTRICITY MARKETS AND REGULATION - Full Papers

Topics: C5 PS3 - Emerging Markets and Forms of Markets

Keywords: Energy Trading, Energy Price Forecasting, Ancillary Service Price Forecast, Probabilistic Forecast, Quantile Forecast

Evaluating the Quality of Probabilistic Forecast for Energy and Ancillary Service Trading

Xiaoming FENG¹, Nandinee HAQ²

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C5 ELECTRICITY MARKETS AND REGULATION - Full Papers

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Keywords: peak load hours, demand response, forecasting, machine learning

Enhancing Power Consumption Efficiency: a Comprehensive Analysis of Demand Response and Tariff-Based Mechanisms

Vyacheslav VORONIN¹, Fedor NEPSHA², Mikhail KRASILNIKOV², Kirill PEREVALOV²

¹T.F. Gorbachev Kuzbass State Technical University, Russian Federation; ²RTSoft Smart Grid, LLC, Russian Federation

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C5 ELECTRICITY MARKETS AND REGULATION - Full Papers

Topics: C5 PS3 - Emerging Markets and Forms of Markets

Keywords: socially vulnerable customers, total cost of delivering electricity solar power plants, prosumer facility, public supplier, financing model

Financing model for the construction of solar power plants on prosumer facilities provided by Public Supplier

Senad AGANOVIC¹, Elvisa BECIROVIC², Dzemail HADZIOSMANOVIC³, Edina AGANOVIC⁴

¹FERK, Mostar, Bosnia and Herzegovina; ²Elektroprivreda BiH, Sarajevo, Bosnia and Herzegovina; ³Elektroprivreda HZ HB, Mostar, Bosnia and Herzegovina; ⁴NOS BiH, Sarajevo, Bosnia and Herzegovina

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Topics: C5 PS3 - Emerging Markets and Forms of Markets

Keywords: Hydrogen – Certification – Renewable Energy – Decarbonization

Certification of the electricity used to produce hydrogen

Ricardo GEDRA¹, Vanessa GRUNWALD¹, Anant VENKATESWARAN²

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Aadit GARG¹, Ahmed SAAD²

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Keywords: Intraday auctions, Cross-zonal capacity, Market Coupling, Croatian electricity market

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Keywords: Cross-border Electricity Trading, ASEAN, Greater Mekong Subregion, LTM-PIP, LTMS-PIP, Renewable Energy

ASEAN Cross-Border Electricity Trading Lessons From the LTM-PIP and LTMS-PIP: The Proposed GMS Regional Renewable Energy Market

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Keywords: Metering services, metering aggregation, power markets, retail competition, unbundling

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Keywords: Demand Shift – Domestic Demand Response – Local Network Management – Distributed Generation – Curtailment Avoidance

Local Network Management and Distributed Generation Curtailment Avoidance through Domestic Demand Response

Kailash SINGH¹, Russell BRYANS¹, Gerard BOYD¹, Malcolm BEBBINGTON¹, Guy SHAPLAND¹, Wendy MANTLE¹, ShengJi TEE¹, Kieron STOPFORTH²

¹SP Energy Networks UK; ²Octopus Energy UK

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Distributed Energy Resources (DERs), Distribution Services, Flexibility Services, Distribution Planning, Distribution System Conditions

Revisiting the Terminology Used in Distribution Planning to Describe System Conditions Triggering DER-Provided Flexibility Services

Tanguy HUBERT

Electric Power Research Institute (EPRI), United States of America

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Distribution Services, Flexibility Services, Contingency Planning, Contingency Management

Understanding Risk Factors and Risk Management Practices Related to DER-Provided Flexibility Services in the Planning and Operational Timeframes

Tanguy HUBERT

Electric Power Research Institute (EPRI), United States of America

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Distribution Systems, Operational Coordination, Distribution Operations, Distributed Energy Resource System, Integrated Grid

The Evolving Distribution Operations Architecture for a Future Integrated Grid

Jessica LAU, Yashar KENARANGUI, Beth CHACON

Xcel Energy, United States of America

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: DER, Framework, Capacity, Outage Support, Line Loss Reduction

Quantification of Distribution Grid Value of Distributed Energy Resources

Imran RAHMAN¹, Shikhar PANDEY¹, Farnaz FARZAN², Ralph MASIELLO², Michael LEE¹, Kathleen KREMER¹, Jessica MILEY¹, Matthew LUDWIG¹

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Climate Change, Distribution Planning, Extreme Weather Events, Reliability, Resilience

Distribution Planning for Reliability and Resilience

Jouni PEPPANEN, Nick HEINE, Prajjwal GAUTAM, Matthew RYLANDER, Sarmad HANIF

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Demand Flexibility, Demand Response, Demand-side Integration, Distribution Modeling, Distribution Planning

Evaluating Demand Flexibility as a Distribution Planning Alternative

Jouni PEPPANEN¹, Angela CHUANG¹, Alison O'CONNELL²

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Dynamic Stability, Electric Vehicles, Equipment Standards, Grid Transformation

Modelling and Studying Increasing Electric Vehicle Charging Loads on Bulk Power System Dynamic Performance: Insights and Recommendations

John Paul SKEATH¹, Ryan QUINT⁵, Joseph ETO², Parag MITRA³, Lakshmi SUNDARESH³, Shruti RAO⁴

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: ADMS, Hardware-in-the-Loop, FLISR, Grid Modernization, Distribution

Ensuring ADMS Functionality and Flexibility with Hardware-in-the-Loop Verification

Josh SNODGRASS¹, Christopher HUFF², Aleksandar PARMAKOVIC³

¹POWER Engineers, Inc., United States of America; ²Pacific Gas and Electric, United States of America; ³Schneider Electric, Serbia

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Energy Storage, Grid Edge Solution, Market Revenue, Microgrid, Renewable

Business Cases for Energy Storage Project at Distribution Level Participating in European Electricity Markets with Examples of Real Projects

Takashi USAMI¹, Hamideh BITARAF², Ernesto SORESSI³

¹Hitachi, United States of America; ²Hitachi Energy, United States of America; ³Hitachi Energy, Italy

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Distributed Energy Resources, Flexibility Mobilization, Congestion Management and Voltage Control, Market-based Flexibility Services, Sensitivity-based methods

Coordinated voltage control between Medium and Low Voltage distribution grids with market-based flexibility

Clara GOUVEIA¹, Gil SAMPAIO¹, Fábio RETORTA¹, Ricardo BESSA¹, José VILLAR¹, Miguel LOURO², Christian MERCKX³, Féres BENOTHMAN³

¹INESC TEC, Portugal; ²E-Redes, Portugal; ³ENGIE Impact, Belgium

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Portable energy storage; Grid congestion; Demand-side management; Flexible power network

Portable Energy Storage Systems as an Alternative to Reinforcement in Distribution Networks

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Cardiff University UK

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Distributed Energy Resource, Monte Carlo Simulation, Gaussian Mixture, Network Congestion, Distribution Network

Evaluating the Impact of New Technology Deployment on Future Congestion of LV Distribution Grids

Na LI¹, Anton ISHCHENKO², Simon TINDEMANS¹, Kenneth BRUNINX¹

¹Delft University of Technology; ²Phase to Phase BV

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Congestion, Congestion Management, System Operation, Flexibility, Hosting Capacity, Risk Management

Implementing congestion management in Dutch distribution grids

Chris RIPKEN, Evert DE HAAN, Atze PETERS, Bart PLUIJMS

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Methodology and benefits of integrating a BESS system in the operation of an isolated power systems – Design Approach and Dynamic Simulation

Laura CASADO¹, Pedro RIBEIRO², Renato VERISSIMO², José DAMASIO², José MORI¹, Miquel ESCOTO¹, Fernando HENRIQUES³

¹Siemens, Spain; ²Siemens, Portugal; ³EDA, Portugal

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Energy Router, Flexibility, Optimal Operation, Linearized AC Power Flow, Voltage Stability

Optimal Operation of Distributed Energy Resource Integrated Energy Router to Enhance Local Flexibility

Dongjun HAN, Seungwoo NAM, Dongjun WON

Inha University, Korea, Republic of (South Korea)

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: electric vehicle, charging station, demand side management, V2G

Development of an Electric Vehicle Charging Control System for Substation Load Management

Vyacheslav VORONIN¹, Fedor NEPSHA²

¹T.F. Gorbachev Kuzbass State Technical University, Russian Federation; ²RTSoft Smart Grid, LLC, Russian Federation

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Topics: C6 PS1 - Flexibility Management in Distribution Networks
Keywords: Active distribution grids, operational planning, flexibility resources, grid

Rethinking Distribution Network Operational Planning with Flexibility Resources

Merkebu Z. DEGEFA¹, Gunnar VIST², Mathias F. ELIASSEN³, Åshild VATNE⁴, Rubi RANA¹, Line BERGEFJORD⁵, Iver BAKKEN SPERSTAD¹, Sigurd H. JAKOBSEN¹, Raymundo E. TORRES-OLGUIN¹

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks
Keywords: Flexibility – Resources – Digitalisation – Distribution – Planning

Flexibility for increased electrification and utilisation of the distribution grid

Gerd KJØLLE¹, Oddbjørn GJERDE¹, Merkebu Z. DEGEFA¹, Stig SIMONSEN², Mariona ZHURI², Katrine UTVIK³

¹SINTEF Energy Research Norway; ²Lede Norway; ³Elvia Norway

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Topics: C6 PS1 - Flexibility Management in Distribution Networks
Keywords: Battery energy storage systems, Electric vehicles, Fast charging stations, GAP analysis

Evaluation of battery energy storage systems (BESS) in the Norwegian power grid to cope with increased vehicle electrification

Heidi S. NYGÅRD¹, Ruth OLERUD¹, Petter LUNDE²

¹Norwegian University of Life Sciences (NMBU) Norway; ²Tronrud Engineering Norway

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks
Keywords: electricity fast-charging infrastructure, direct current recharging stations, DC stations, decarbonising transport, e-mobility, electric vehicles, electricity grid connexion, Alternative Fuel supply infrastructure, TEN-T road network

A Methodology for Determining optimal DC Charging-station Locations and Operation for Electric-vehicles based on typical technical and commercial Requirements in Europe

Ursula KRISPER

Elektro Ljubljana, d.d.

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks
Keywords: Load forecasting, machine learning, microgrids

Optimal Design of a Microgrid Considering Load Forecasting

Esra AYDIN, Belgin TURKAY, Cenk ANDIC

Istanbul Technical University Türkiye

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks
Keywords: Wide Area Control, Synchrophasor, System Restoration, Zonal co-ordinated control, Grid Services, Distribution restoration, Virtual Power Plant

Trialling Distribution-based Electricity System Restoration and Other Services

Douglas WILSON¹, Marta LATERZA¹, Marcos SANTOS¹, Richard DAVEY¹, Ian MACPHERSON², Mark MORRISON², James YU²

¹GE Vernova UK; ²SP Energy Networks UK

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Two-stage stochastic programming for optimal BESS & DER Total Cost of Ownership and sizing considering grid services in data centre applications

Marco GIUNTOLI¹, Dario CICIO², Fabrizio LANDINI³

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks
Keywords: Active Network Management; Digital Substations; Distributed Energy Resources; Distributed Energy Resource Management Systems; Flexible Connections; Flexibility Services; Wide Area Monitoring, Protection and Control

Local Active Network Management (LANM) and the role of Smart Substations in Minimising Curtailment of Flexible DER Connections

Peter WALL¹, Douglas WILSON¹, Lihong HAO¹, Andreas GLATZ¹, Yusen FEI¹, Ivan MARTIN¹, Richard DAVEY¹, Boris YAZADZHIYAN², James MILLS², Mayamiko HARA², Tam SOKARI-BRIGGS², Tim MANANDHAR²

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

DER integration and optimisation to enable Australia's first fully electric public road transport system

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¹Hitachi Energy, Australia; ²Hitachi Energy, USA; ³Hitachi Energy, Italy

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Distributed Energy Resource, Electric Vehicle, Photovoltaic, System Analysis

Eliminating overload in distribution systems by utilizing DER

Yoshifumi IKEMOTO¹, Masahiro MINAMI¹, Noriaki KANO¹, Shinya YOSHIZAWA², Yohei YAMAGUCHI², Yutaka OTA²

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Distributed Energy Management System (DERMS) for Solar and Storage to Demonstrate Grid Flexibility and Reliability

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Low voltage measurement system to support distribution system state estimation

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Kopernikus projects - Field applications and OT-IT-integration to enable the full potential of future power systems

Peter NOGLIK¹, Marco GIUNTOLI⁵, Katarina KNEZOVIC⁹, Antony HILLIARD¹⁰, Maximilian DAUER², Maximilian ROSE⁸, Michael GRATZA³, Andreas SCHLERETH⁴, Robert SCHMIDT⁶, Stephan RUPP⁷, Sebastian BRUSKE⁷, Alexander MAGES⁴

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Wide area protection, Active distribution network, synchrophasor measurements, phasor measurement unit

A New Wide Area Protection Scheme for Active Distribution Network

Khaled AL-MAITAH¹, Abdullah AL-ODIENAT²

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Data analytics, planning of distribution networks, PV hosting capacity, smart meters

Revisiting PV Regulatory Connection Rules in LV Jordanian Distribution Feeders through Leveraging Smart Metering Data

Sereen ALTHAHER¹, Alia WEDIAN², Sahban ALNASER¹

¹University of Jordan; ²IDECO

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Smart Meters: A Key to Sustainable Energy With Applied Study Cases in Palestine

Dana BANNOURA

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Efficient Identification of Customer Types in Energy Consumption Data: Leveraging Dimensionality Reduction and K-Means Clustering Method

Leonie RIEDL¹, Martin BRAUN¹, Philip HEHLERT²

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Distribution Network - Transformer Utilisation - Machine Learning - Monitoring

Evaluating Distribution Transformer Utilisation for Flexibility and Enhanced Observability using Multiple Sources of Data

Jelena PONOCKO, Rebecca THRELFALL, Josephine O'BRIEN, Shengji TEE, Russell BRYANS, Malcolm BEBBINGTON

SP Energy Networks UK

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks

Energy Storage System Design Considering Multiple Revenue Streams for Large Scale Solar in Malaysia

Junainah SARDI¹, Wan Syakirah WAN ABDULLAH², Hazriq Hakimi YAACOB², Ahmad Amirul Hakim MOHD HAMID²

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Topics: C6 PS1 - Flexibility Management in Distribution Networks

Investigating the Capabilities of Weight-Based Gravity Storage for Delivering Ancillary Services

Alexander SIEMSEN¹, Rasmus VIG JENSEN¹, Lisa CALEARO¹, Jill MACPHERSON²

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Hybrid power, non-interconnected islands, Pelton turbine, deflector control, needle control, primary frequency response

The challenge of smooth cooperation of hydroelectric Turbines with thermal Units to provide FCR and aFRR in a Non-Interconnected Island

Anastasis TSOUMANIS¹, Stefanos KOKKINELIS², Konstantinos NATSIS¹, Stavros PAPATHANASSIOU³, Despoina KOUKOULA², Charalampos PAPPAS², Eleni LAMPRINIDI², Theodora PATSAKA²

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Virtual Inertia; Hybrid; Generation; BESS; ESS; Grid Codes; Grid Stability

Impact of hybrid generation and storage system, including virtual inertia, on the grid connection for planning studies

Jorge PÁRRAGA ORTEGA

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Distribution Grid, Renewable Energy Source, Distributed Energy Resource

The Issues for Japan's Future Distribution Grid

Yuki KAWACHI

Kansai Transmission and Distribution, Inc., Japan

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Distributed Energy Resources, Energy Storage System, Audio Frequency Load Control, Solar Soak, Demand Flexibility

The Use of Thermal Energy Storage from Residential Hot Water Systems for Flexible Network Demand Management

Wei Jian CHAN

Energex & Ergon Energy (part of Energy Queensland), Australia

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS1 - Flexibility Management in Distribution Networks

Keywords: Electricity theft, illegal connections, non-technical losses (NTL), ground surface conductors, zero sequence current (ZSC), network studies, payment levels, MV-medium voltage, LV-low voltage

How to detect and mitigate electricity theft in a South African distribution network in spite of the inadequacy of the network to be a fully smart system

Ndoro NETSHIPALE

Eskom Holdings SOC Ltd, South Africa

PS2 - POWER ELECTRONIC BASED SOLUTIONS FOR SMART DISTRIBUTION SYSTEMS

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS2 - Power Electronic based Solutions for Smart Distribution Systems

Keywords: Wireless power transfer Inductive power transfer (IPT), capacitive power transfer (CPT), and radio waves wireless power transfer (RW-WPT).

Classification of Highly Resonant Wireless Charging Techniques for Light EVs and Similar Low Applications

Eman GOMAA¹, Ahmed SHAWKY², Mohammed SAAD², Mohammed ORABI²

¹Upper Egypt Electricity Distribution Company; ²Aswan University

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS2 - Power Electronic based Solutions for Smart Distribution Systems

A Hybrid Networking Scheme With Grid-forming and Grid-following Converters for Resilient Active Distribution System

Zuhua HUA, Lei SHANG, Xuzhu DONG

Wuhan University, China

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS2 - Power Electronic based Solutions for Smart Distribution Systems

Keywords: Grid Forming (GFM) Control, Black Start, Unbalanced Systems, Current Limiting

Black Start Operation of Grid-Forming Converters Based on Generalized Three-phase Droop Control Under Unbalanced Conditions

Zexian ZENG¹, Prajwal BHAGWAT², Maryam SAEEDIFARD¹, Dominic GROSS²

¹Georgia Institute of Technology, United States of America; ²University of Wisconsin-Madison, United States of America

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS2 - Power Electronic based Solutions for Smart Distribution Systems

Soft Open Point at Bermeo substation to improve distribution system reliability and hosting capacity

Markel ZUBIAGA¹, David SANTOS², Eneko OLEA², Javier CHIVITE², Javier CAÑAS¹, Raul PEÑA³

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ID: 10753

C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS2 - Power Electronic based Solutions for Smart Distribution Systems

Keywords: Low-Voltage Direct Current (LVDC), Microgrids, DC Systems, DC Fault Protection, Solid-State Circuit Breaker (SSCB), Semiconductor Circuit Breaker (SCB), Power Electronics, Integrated Gate-Commutated Thyristor (IGCT)

Semiconductor circuit-breaker based on RB-IGCT to protect LVDC microgrids

Marcel STOECKLI¹, Antonello ANTONIAZZI², Thomas MASPER², Thorsten STRASSEL³, Umamaheswara VEMULAPATI⁴, Christian WINTER⁴, Tobias KELLER⁴

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS2 - Power Electronic based Solutions for Smart Distribution Systems

Synthesis of Adaptive Control System of Converter-Interfaced Generation Based on a Virtual Synchronous Generator

Alisher ASKAROV¹, Aleksey SUVOROV¹, Pavel ILYUSHIN²

¹National Research Tomsk Polytechnic University, Russian Federation; ²Energy Research Institute of the Russian Academy of Sciences, Russian Federation

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS2 - Power Electronic based Solutions for Smart Distribution Systems

Keywords: Electric Vehicle, Dynamic Pricing, Distribution System, Voltage Variation

Evaluation of the Effect of Dynamic Pricing on EV Charging to Voltage Variation in Distribution Lines

Toko MANNARI, Hiroyuki HATTA, Masahito TAKAHASHI

Central Research Institute of Electric Power Industry (CRIEPI), Japan

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS2 - Power Electronic based Solutions for Smart Distribution Systems

Keywords: Power Distribution System, IBR, Virtual Inertia Function

Development of GFM Inverters for Increased Penetration of Variable Renewable Energy

Yusuke NISHIDA, Teru MIYAZAKI

Tokyo Electric Power Company Holdings, Inc., Japan

ID: 11414

C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS2 - Power Electronic based Solutions for Smart Distribution Systems

Keywords: Active distribution networks, Conventional inverters, CYMDIST, Distribution systems, IDECO, Renewable Energy Resources, Smart Inverters, Voltage Regulation, Volt-VAR Control

Volt-Var Technique Utilization for Voltage Control in Distribution Networks with Smart Inverters – A Case Study of Jordan

Walaa THIABAT, Mu'men BODOOR, Mahdi ALSHATNAWI, Abdalrheem JAWARNEH, Mohammad NASER

IDECO

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS2 - Power Electronic based Solutions for Smart Distribution Systems

Keywords: Fault limiting converter model, DC microgrid protection, fault current limiter, short circuit characteristics

Average Models and Characteristics of Current-Controlled Converters for Fault Analysis in DC Microgrids

Jin-Su KIM¹, Ji-Song HONG¹, Young-Bin CHO¹, Seok-Chan LEE¹, Sang-Yun YUN²

¹LS ELECTRIC Co., Ltd., Korea, Republic of (South Korea); ²Chonnam University, Korea, Republic of (South Korea)

ID: 11804

C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS2 - Power Electronic based Solutions for Smart Distribution Systems

Keywords: Solar photovoltaic-based microgrid, Distribution systems, Voltage rise suppression, PV curtailment, Financial loss

Voltage Rise Suppression Strategies for Utility-Scale Solar Photovoltaic-based Microgrids

Krit KONGURAI

Electricity Generating Authority of Thailand (EGAT), Thailand

ID: 11866

C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS2 - Power Electronic based Solutions for Smart Distribution Systems

Keywords: smart transformer; real-time simulation; power quality; control system

Smart Transformer Real-time Simulation Model with External Control Script Implementation and Performance Analysis

Ville OLLIKAINEN

VTT Technical Research Centre of Finland

PS3 - RURAL, ISLANDED AND INDUSTRIAL ELECTRIFICATION STANDARDS, PRACTICES AND TECHNOLOGY OPTIONS

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options

Keywords: Microgrid, Effective Grounding, Distributed Energy Resources (DERs), Photovoltaic (PV), Resiliency Enhancement

Design and Simulation of Locks Campus Microgrid

Genesis ALVAREZ¹, Robert ALLISON¹, Lung-An LEE¹, Justin SMITH⁴, Katelynn VANCE¹, Lou COLANGELO², Hermann KOCH³, Peter GROSSMAN², Adam ADDESSO²

¹Dominion Energy, United States of America; ²RCM Technologies, United States of America; ³RCM Technologies, Germany; ⁴Power System Analytics, United States of America

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options

Energy Management System to Improve Resilience in Islanded Interconnected Microgrids

Fundiswa MTHETHWA

Eskom

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options

The Design of an Islanded Microgrid in the Kalahari Desert of South Africa: Noenieput Settlement Off-grid Electrification

Soni M

Eskom SOC Ltd

ID: 10861

C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options

Keywords: protection, direct current, symmetrical monopole, pole to ground fault

Protection scheme for single pole to ground faults in multi-terminal MMC-MVDC grid utilizing sequential tripping

Gvan Chun CHO^{1,2}, Seul-Ki KIM¹, Gyeong-Hun KIM¹, Jihui HWANG¹

¹Korea Electrotechnology Research Institute, Korea, Republic of (South Korea); ²National Research University 'Moscow Power Engineering Institute', Russia

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options

Keywords: DERs, fault detection, open conductor fault

Detection of Open Conductor Fault using Multiple Measurement Factors of RTUs in Active Distribution Networks with DERs

JiSong HONG

LS ELECTRIC, Korea, Republic of (South Korea)

ID: 11299

C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options
Keywords: Grid Connected Microgrid, Independent Operation, Resilience

Challenge to establish decarbonized, resilient, and semi-independent microgrid in islands

Hideo ISHII¹, Naoto HIGA², Tomohiro SHIOHAMA³, Satoru NAKAMURA³, Kiyomasa KOHATSU³

¹Waseda University, Japan; ²NEXTEMS, Japan; ³Okinawa Electric Power Company, Japan

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options
Keywords: Distribution System, Off-Grid, Storage Battery, Photovoltaic

Validation of Off-grid System in Real Cases

Keisuke UEKAWA, Yoshikazu IIDA, Keiichi FUJIMOTO, Yoshiki KAKUMOTO, Noriaki KANO, Yuki KAWACHI

Kansai Transmission and Distribution, Inc., Japan

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options
Keywords: Microgrid, Transmission Investments, Renewable Energy Integration, RES, Batteries, Techno-Economic Analysis, Jordanian Power System, Energy Trading, Peak Power Demand Charges, Bulk Supply

Best Investment Planning of Microgrid Networks: Jordan Case Study

Suad S. ALMATTAR

National Electric Power Company, Jordan, Hashemite Kingdom of

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Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options

Case study promoting a state of art solution for growing residential load in Palestine using community microgrid

Ibrahim KIRIAKOS

JDECO

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Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options

A model for future load profiles considering extreme weather conditions

Michael DAHMS, Torsten SOWA

AMPERIAS GMBH, Germany

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options
Keywords: Optimal Restoration, Grid-forming, HILs

Optimal Service Restoration Using Distributed Generations After Blackout in Distribution Networks

Saehwan LIM^{1,2}, Jin-Oh LEE¹, Hyeong-Jun YOO¹, Gyeong-Hun KIM¹

¹Korea Electrotechnology Research Institute, Korea, Republic of (South Korea); ²Yonsei University

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options

Achieving successful community engagement in the evolving power system landscape: A case for micro- and mini-grids

Tshwanelo RAKAIBE

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Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options

A Combined Prepaid and Post-Paid Scheme for Non-Connected Zones and Migration from a Conventional Energy-Based Tariff to an Availability Solution in Terms of Time

Luis BERRÍO, Jimena RAIGOZA, Catalina GARCÉS, Ángela BURITICÁ, Juan FRANCO, Rafael LUNA

EPM

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options

Validation of the Engineering for a Protection System in a Microgrid at the Universidad del Valle Campus in Colombia

Andres DÍAZ, Edison FRANCO, Eduardo GOMEZ

Universidad del Valle

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options

Impacts and Challenges of the Integration of Connected to the Grid-Microgrids: Colombian Case

Luisa ESCOBAR, Eduardo GÓMEZ

Universidad del Valle

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C6 ACTIVE DISTRIBUTION SYSTEMS AND DISTRIBUTED ENERGY RESOURCES - Full Papers

Topics: C6 PS3 - Rural, Islanded and Industrial Electrification Standards, Practices and Technology Options

Keywords: Off-grid power system, electrical energy storage system, autonomous hybrid power plant, solar power plant, gas piston generator, diesel generator, automatic control system, frequency control, abruptly variable load, power quality

An automatic frequency control system for off-grid power systems with energy storages

Gleb NESTERENKO¹, Vyacheslav ZYRYANOV²

¹SO UPS, JSC «Branch Regional Dispatching Office, Energy System of Novosibirsk Region, Altai Territory and the Altai Republic, Russia; ²Novosibirsk State Technical University, Russia

D1 - MATERIALS AND EMERGING TEST TECHNIQUES

PS1 - TESTING, MONITORING AND DIAGNOSTICS

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

A High Performance Differential Acoustic Emission Sensor for Partial Discharge Detection

Yongling LU¹, Zhen WANG¹, Chengtao LUO², Yang SONG²

¹State Grid Jiangsu Electric Power Company Ltd. Research Institute, China; ²Shanghai Jiao Tong University, China

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Differential Pressure Method for Measuring Gas Leakage of Dynamic Sealing Units in GIS

Zhiqiang TAO¹, Liang SONG², Lu LIU¹, Manuel NAEF², Luopeng LIU², Yang WANG¹

¹Hitachi Energy Research; ²Hitachi Energy High Voltage Technology Center

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: UHF monitoring, narrow band system, Power Transformers, noisy environment, SF6-alternatives

Use of narrow band UHF monitoring system for Power Transformer and GIS including SF6-free solution in laboratory and site environments

Raphael LEBRETON, Sebastien LOUISE

GE Vernova, France

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Testing, Measuring and Diagnostic Partial Discharge: use case examples in MV applications

Marco RIVA, Massimo SCARPELLINI, Marco TESTA, Stefano MELZI, Andrea CRESPI

ELDS Technology Centre – ABB spa Italy

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Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Use of state observer and load cell sensors for monitoring overhead line ice sleeve overload and conductor temperature

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Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Compensating Losses in On-line HFCT Partial Discharge Measurements under High Load Current Conditions

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SP Group Singapore

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: Dielectric Frequency Response (DFR), Gas Chromatography, High Molecular Weight Acids, Low Molecular Weight Acids, Water

Determination of Low and High Molecular Weight Carboxylic Acids by Chromatography and Possible Implications for Dielectric Frequency Response Measurements

Lance R. LEWAND, Ronald HERNANDEZ, Zach HOLLAND

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: Bushings, Dielectric Frequency Response, DFR Baseline, Diagnostic Test, Early Detection

Application of Performing DFR on Bushings: Utility Perspective

Poorvi PATEL¹, Peter ZHAO², Varun GOYAL², Timothy RAYMOND¹

¹Electric Power Research Institute (EPRI), United States of America; ²Hydro One, Canada

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Challenges on atmospheric Corrections for external Insulation Design and Testing - Revisited

Liliana AREVALO

Hitachi Energy Sweden, Sweden

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Diagnostic of On-Load Tap-Changer based on vibroacoustic Measurements

Joachim SCHIESSLING

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: Power Transformers, Dissolved Gas Analysis, Stray Gassing

Stray Gassing of Insulating oils - Transformer condition assessment tool

Anabela PEIXOTO, Cláudia FARINHA, João VALENTIM, Rui MARTINS

EDP Labelec, Portugal

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: Condition Assessment, Data Analytics, Early Failure, Forecasting, Weibull Distribution, Prognostics, Parameter Estimation, Weighted Linear Regression, Linear Regression, Reliability

Condition Assessment after Early Failures in Power Equipment despite successfully passed Factory Acceptance and Commissioning Tests

Robert ROSS¹, Aart-Jan DE GRAAF², Peter YPMA², Maria ROSS²

¹TU Delft; ²IWO

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Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Pseudo passive sensing of partial discharges of electrical assets in multiple and remote locations

Daniel BLANCO¹, Fco. Javier DE PAZ², Rafael FUERTES², Ricardo GÓMEZ¹, Ricardo REINOSO¹, Gonzalo DONOSO¹, Elena NOGUEROLES¹

¹Red Eléctrica, Spain; ²DXIoT Systems, Spain

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: T&D equipment, High Voltage, Disconnectors, TSO, Cyclic Corrosion test, Galvanic corrosion, Type Test, Life Expectancy, Maintenance

Cyclic Corrosion Testing of HV Disconnectors Under Continuous Current

Hélène GAUTHIER, Catherine LE POSTEC

Hydro-Québec, Canada

ID: 10754

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: Lifetime, Ageing, GIS Switchgear, RCR Divider, RC Divider, Superimposed Voltage, Impulse Voltage

Lifetime analysis and extended impulse and superimposed impulse voltage tests on a GIS voltage divider for HVDC applications

Marcel STOECKLI¹, Uwe RIECHERT^{*2}, Erik SPERLING³, Andreas DOWBYSCH⁴

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²Hitachi Energy, Switzerland; ³Omicron electronics, Switzerland; ⁴Technische Universität Dresden, Germany

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Dissolved Gas On-line Monitor Based on Tunable Diode Laser Absorption Spectroscopy and Enhanced by Vacuum Extraction

Dmitriy VODENNIKOV¹, Alexander GUK¹, Artem KLIMCHUK², Mikhail BALANOV², Leonid POSPEEV²

¹PJSC ROSSETI, Russian Federation; ²Individual expert, Russian Federation

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: chemical markers, methanol, power transformer, insulation ageing, normalization, seasonal changes

Monitoring of Seasonal Changes in the Concentrations of Chemical Markers Dissolved in Power Transformer Oil

Leonid DARIAN¹, Sergey ASOSKOV², Vladimir POLISHCHUK³, Roman OBRAZTSOV¹, Alexey MAKSIMCHENKO¹

¹JSC «Technical Inspection UES», Russian Federation; ²LLC Gazprom Energo, Russian Federation; ³Joint Institute for High Temperatures of the RAS, Russian Federation

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: X-ray, mobile system, high-voltage equipment, diagnostics, radiation safety

Mobile Diagnostic X-ray System for Inspection of High-voltage Equipment in Operation

Leonid DARIAN¹, Roman OBRAZTSOV¹, Oleg OZEROV², Pavel GOLUBEV¹, Pavel GONCHAROV³

¹JSC «Technical Inspection UES», Russian Federation; ²Dukhov Research Institute of Automatics, Russian Federation; ³PJSC «Rosseti South», Russian Federation

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: Diagnostics, Dissolved Gas Analysis, HV Equipment, Partial Discharges

Generation of Gases Related to Partial Discharges in High Voltage Equipment: a theoretical-practical approach

Adriana DE CASTRO PASSOS MARTINS¹, Sheila SOUTHGATE DE OLIVEIRA², Alain François SANSON LEVY³, Arthur DE CASTRO RIBEIRO⁴, Alexandre R. MARTINS⁵

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Alternative methods for the simultaneous determination of diagnostic parameters

Ivanka HOEHLEIN, Carolin SCHUETT, Zhe SHAN

Siemens Energy, Germany

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: Space-charge, XLPE-cables, Pulsed-electro-acoustic-method, Load-cycles

Novel Space Charge Measurement System for Full-size XLPE cables under Actual Operating Voltage and Temperature Conditions

Shosuke MORITA¹, Norikazu FUSE¹, Takayuki MATSUBARA², Yoshinao MURATA², Yoshinobu MURAKAMI³, Naohiro HOZUMI³

¹Central Research Institute of Electric Power Industry, Japan; ²Sumitomo Electric Industries Ltd., Japan; ³Toyohashi University of Technology, Japan

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: Current, Integration, Charge, Q(t) method, Dielectric Properties, Diagnosis

Direct Current Integrated Charge Method as a Useful Tool for Dielectric Measurements

Yoitsu SEKIGUCHI¹, Takashi KURIHARA², Hiroaki MIYAKE³, Tatsuo TAKADA³

¹Sumitomo Electric Industries, Japan; ²CRIEPI, Japan; ³Tokyo City University, Japan

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

AI-based DGA Interpretation Method for On-Load Tap-Changers

Rainer FROTSCHER¹, Eva KELEMEN², Alexander ALBER¹, Jim RIPPON²

¹Maschinenfabrik Reinhausen GmbH, Germany; ²ALTALINK, L. P., Canada

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Development and verification of an online method for determining the oil condition of on-load tap-changers and transformers

Andreas KURZ¹, Roland GÖTZ¹, Julia MASSMANN², Johannes VEIT²

¹Maschinenfabrik Reinhausen, Germany; ²Amprion GmbH, Germany

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Optical PD Measurements on GIS and Power Transformers

Claus NEUMANN¹, Maximilian VOGL²

¹Technical University of Darmstadt, Germany; ²Vogl electronic, Germany

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Effects of Glass Transition Temperature (T_g) of Composite Core Rod on Performance of Polymer Insulators

Nitin SHINGNE*, Uday PUNTAMBEKAR, Satish CHETWANI

Electrical Research and Development Association (ERDA), India

ID: 11326

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: transformer health, DGA, sampling, extraction, measurement

Imperative Technicalities for Managing Reliable Dissolved Gas Analysis and Adequate Diagnosis of Contemporary Oil-Filled Power Transformers

Marius GRISARU

Transformer oil tests independent consultant and educationalist at Transformer Academy, Israel

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Partial discharge behaviour in GIS with C4-FN mixtures: Comparison of conventional and UHF measurement techniques

Johanna LINKE¹, Uwe RIECHERT², Stephan SCHLEGEL¹, Willy JAROSCZINSKY¹

¹Technische Universität Dresden, Germany; ²Hitachi Energy, Switzerland

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Evaluation of the Dielectric Strength of Silicone Elastomers at DC Stress

Stefan KUEHNEL¹, Stefan KORNHUBER¹, Jens SEIFERT³, Jens LAMBRECHT², Christiane BAER²

¹Hochschule Zittau/Görlitz, Germany; ²Wacker Chemie AG, Germany; ³Maschinenfabrik Reinhausen, Germany

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Tests experiences of Temporary Over-Voltage for HVDC cable system

Dae-Jin PARK, Tae-Ho LEE, Sang-Taek PARK, Jin-Ho NAM, Sung-Yun KIM, Jung-Nyun KIM

LS Cable & System

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Model To Estimate Solid Insulation Ageing in Power Transformers via Alcohol Based Chemical Indicators

Abhay CHAUDHARY, Dr Subir SEN, B.B MUKHERJEE, V K BHASKAR, Abhishek ABHISHEK, N K BHASKAR, Dr Satish KUMAR, Dr Arun Prakash UPADHYAY*

Power Grid Corporation of India Ltd, India

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

New Approach in Condition Monitoring of Power Transformers Oil Pumps

Sebastián LAURIA, Franco LEIVA, Agustín AVALOS, Andrés LANTOS

Laboratorio Dr. Lantos

ID: 11820

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: DISSIPATION FACTOR, INSULATION POWER FACTOR, POWER TRANSFORMER

High Insulation Power Factor in Power Transformer!!! Deep Diagnostic Approaches for Root Cause Analysis

Pongpon SINGKHAWAT, Anchalee TONG-IN

Electricity Generating Authority of Thailand (EGAT), Thailand

ID: 11825

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: CORROSIVE SULFUR, IMAGE PROCESSING, POWER TRANSFORMER, TRANSFORMER OIL

How Can Image Processing Empower Decision-Making in Corrosive Sulfur Analysis of Transformer Oil?

Wutthipan PARIYOTHA, Sirapa THONGDEE

Electricity Generating Authority of Thailand (EGAT), Thailand

ID: 11856

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS1 - Testing, Monitoring and Diagnostics

Keywords: Lightning impulse, negative polarity, positive polarity, dielectric liquids, breakdown voltage, acceleration voltage, mineral oil, ester liquids, bio-based hydrocarbon, GTL

Lightning Properties of selected insulating Liquids based on the Acceleration Voltage Parameter

Filip STUCHALA, Pawel RÓZGA

Lodz University of Technology, Institute of Electrical Power Engineering, Poland

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: SF6, equation, data, electrical transmission, distribution equipment

Several equations of state for SF6: how to avoid errors?

Nathalie BARNEL, Alain JEANMAIRE

EDF R&D, France

ID: 10138

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: Fluoronitrile mixtures, SF6, Gas Insulated Substations (GIS), liquefaction properties, thermodynamic experimental approach

Characterization of the liquefaction properties of fluoronitrile mixtures by a thermodynamic experimental approach

Caterina TOIGO¹, Antoine PEREZ¹, Frank JACQUIER¹, Alain GIRODET¹, Michael INVERSIN², Didier LASSERRE²

¹SuperGrid Institute, France; ²RTE, France

ID: 10250

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Effect of temperature on the development and partial discharge characteristics of electrical trees under combined AC/DC voltage in epoxy resin

Yingman SUN¹, Xuandong LIU¹, Gaoyi SHANG¹, Hao SUN¹, Hao TANG², Xining LI²

¹Xi'an Jiaotong University, China; ²China electric power research institute, China

ID: 10251

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Modelling and decoupling of the dielectric response of silicone rubber composites used for outer insulation

Qian WANG, Ying ZHOU, Chao WU, Xidong LIANG

Tsinghua University, China

ID: 10252

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Research progress in environmentally friendly epoxy resins

Qiang FU¹, Lei PENG¹, Li ZHANG¹, Chengxi FU², Musong LIN¹, Zhi LI¹

¹Guangdong Key Laboratory of Electric Power Equipment Reliability, Electric Power Research Institute of Guangdong Power Grid Co., Ltd., China; ²School of Energy and Environment, City University of Hong Kong, China

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Study on Epoxy Resin Insulation Characteristics of Valve-Side Bushing in Converter Transformer Under Composite Voltage and Thermal Field

Hao SUN¹, Xuandong LIU¹, Wanhao SHI¹, Yingman SUN¹, Hao TANG², Xining LI²

¹Xi'an Jiaotong University, China; ²China electric power research institute, China

ID: 10254

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Study on water ingress characteristics of HTV silicone rubber

Ying ZHOU¹, Xidong LIANG¹, Zhou ZUO¹, Chao WU¹, Qian WANG¹, Shuming LIU¹, Shuqi LIU¹, Yanfeng GAO²

¹Tsinghua University, China; ²State Grid Jibei Electric Power Co. Ltd. Research Institute, China

ID: 10297

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: Resin Impregnated Paper (RIP), HVDC, reliability, DC voltage, breakdown value

Ageing behaviour of RIP material under several DC voltages and temperature

Matthieu DALSTEIN¹, Laura DE FINA², Thanh VU-CONG¹, Franck JACQUIER¹, Armando PASTORE²

¹SuperGrid Institute, France; ²GE RPV, Italy

ID: 10298

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: mineral oil, ester oil, biodegradable hydrocarbons, thermal ageing, ageing markers

Alternative liquids for transformers: thermal ageing comparison and ageing markers correlation

Anthony JEANNETON¹, Christophe PERRIER¹, Abderrahmane BEROUAL²

¹GE Grid Solutions, France; ²Ecole Centrale de Lyon, France

ID: 10299

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: Dielectric properties, liquid nitrogen, resistive superconductive, pre-conditioning, DC applications

Dielectric properties of liquid nitrogen for the design of Resistive Superconductive Fault Current Limiters

Diego BRASILIANO, Christophe CREUSOT, Nicolas DEVEAUX, Alain GIRODET, Laurent MATHRAY

SuperGrid Institute, France

ID: 10487

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: Interfacial Dielectric Strength, Breakdown Strength, Cable Joint, Compatibility

Evaluating the Interfacial Compatibility of Dielectric Materials for Cable Joints

Paul MWASAME¹, Xiaoshuang WEI¹, Timothy PERSON¹, Saurav SENGUPTA¹, Michael CHERRY¹, Wenbo XU¹, Joel CERVA¹, Yuanqiao RAO¹, Junsu GU¹, Robert DRAKE²

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ID: 10824

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: accelerated testing, thermal aging, ethylene vinyl acetate

Investigation of Aging of the Polymer Cable Composition Based on Ethylene Vinyl Acetate

Darya BOLOTINA¹, Alexander KONONENKO¹, Alexey POMERANTSEV², Alexander TSIKANIN¹

¹RISI JSC, Russian Federation; ²RISI JSC, FRCCP RAS, Russian Federation

ID: 10826

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: cellulose, insulation, degree of polymerization, supramolecular structure, grinding

The influence of Preparation Method of Cellulose Insulation Samples on Determining the Degree of Polymerization

Leonid DARIAN¹, Victor GAVRILYUK², Darya VERAKSO¹

¹JSC «Technical Inspection UES», Russian Federation; ²MIREA — Russian Technological University, Russian Federation

ID: 10855

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: Contamination, Finite element method, Insulating paper, Partial discharges

Use of Finite Element Model for Simulation of Partial Discharge Detection Circuit in Contaminated Paper-Oil Insulation Systems

Carlos Kleber DA COSTA ARRUDA¹, Adriana DE CASTRO PASSOS MARTINS², Alain François SANSON LEVY³, Orsino BORGES DE OLIVEIRA FILHO¹

¹Brazilian NC of CIGRE, Brazil; Eletrobras CEPEL; ²CEMIG; ³Consultant

ID: 10856

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: Natural Ester - Paper degradation - IEEE Std C57.100 - Arrhenius curve - Thermal Class - Thermal Index - Sealed Tube - IEC 60076-14

Thermal class of thermally upgraded paper in natural ester and in mineral insulating oils according to IEEE C57.100-2011

Helena Maria WILHELM¹, Paulo FERNANDES¹, Richard MAREK²

¹Brazilian NC of CIGRE, Brazil; Vegoor; ²Consultant

ID: 10857

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: Aramid/Cellulose - Hybrid Paper - Natural Ester - Paper degradation - IEEE Std C57.100 - Arrhenius curve - Thermal Class - Thermal Index - Sealed Tube - IEC 60076-14

Thermal stresses of hybrid paper (aramid/cellulose) in natural ester and in mineral insulating oils

Helena Maria WILHELM¹, Paulo FERNANDES¹, Richard MAREK², Marco MARIN³, Germano F. MORAES³, Nelson VELOSO³, Tiago MARCHESAN⁴, Vitor BENDER⁴

¹Brazilian NC of CIGRE, Brazil; ²Vegoor; ³COPEL; ⁴UFMS University

ID: 10893

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: DBDS, elemental sulphur, mineral oil, mitigation, OLTC, oil treatment, silver corrosion, synthetic ester

Silver Corrosion Testing and Mitigation

Jelena LUKIĆ¹, Jelena JANKOVIĆ¹, Draganja MIHAJOVIĆ¹, Sandra GLIŠIĆ², Aleksandar ORLOVIĆ²

¹Electrical Engineering Institute Nikola Tesla, Serbia; ²Faculty of Technology and Metallurgy of the University of Belgrade, Serbia

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Assessing dissolved Gas Analysis on inhibited and uninhibited Mineral Oils and natural Esters under simulated Thermal Fault

Pär WEDIN, Elena MINCHAK, Robert FAIRHOLM, Jessica SINGH, Thomas NORRBY

Nynas AB, Sweden

ID: 11054

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: Dry Air, ϵ -Functionally Graded Materials (ϵ -FGM), Insulating Spacer, Gas-Insulated Switchgears (GIS), Gas-Insulated Transmission Lines (GIL)

Enhancing Electrical Insulation Performance of Insulating Spacers using Functionally Graded Materials in Natural-Origin Gas GIS

Kenji OKAMOTO¹, Naoki HAYAKAWA², Katsumi KATO³, Naoki OSAWA⁴, Masahiro KOZAKO⁵, Hitoshi OKUBO⁶

¹Fuji Electric Co., Ltd., Japan; ²Nagoya University, Japan; ³N. I. T., Niihama College, Japan; ⁴Kanazawa Institute of Technology, Japan; ⁵Kyushu Institute of Technology, Japan; ⁶Aichi Institute of Technology, Japan

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Comparison of PRPD Pattern of Electrical and UHF PD Measurements at Cable Terminations

Rouven BERKEMEIER¹, Robert BACH¹, Niklas PECK¹, Stefan TENBOHLEN²

¹South Westphalia University of Applied Sciences Soest, Germany; ²Universität Stuttgart, Germany

ID: 11317

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Keywords: Polymeric insulators, Self-cleaning, Superhydrophobic, Tracking

Development of Superhydrophobic Coating for Outdoor Polymeric Insulators

M-Ramez HALLOUM, Subba REDDY B*

Indian Institute of Science, India

ID: 11495

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

Degassing Simulator for XLPE Cables

Taeuk KIM, Jonghae KIM, Youngjae CHOI, Youngseng KIM

LS Cable & System, Korea, Republic of (South Korea)

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D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

On the development of multiscale conductivity models for extruded HVDC Cable Insulation

Mikael UNGE - NKT AB, Sweden

ID: 11583

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS2 - Materials for Electrotechnical Technical Purposes and Modelling

SF6 Gas Disposal Using Microwave Plasma Technology

Sethuraman MUTHUKARUPPAN¹, Avinash Ashwin Raj RAJA GOPAL², Nur Syazwani ABDUL BAHARI²

¹Tenaga Nasional Berhad Malaysia; ²TNB Research Sdn. Bhd. Malaysia

PS3 - MATERIALS TO ENABLE THE ENERGY TRANSITION

ID: 10755

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS3 - Materials to enable the Energy Transition

Keywords: Gaseous Dielectrics, Gas-Insulated System, SF6 Alternative, Fluoronitrile, C4-FN, Material Compatibility, Decomposition

Chemistry of C4-FN gas mixtures and application in high-voltage equipment

Marcel STOECKLI¹, Lise DONZEL^{*2}, Saskia BUFFONI², Pawel KRAWCZYK², Michael GATZSCHE²

¹ELECTROSUISSE, Switzerland - CIGRE NC Secretariat; ²Hitachi Energy, Switzerland

ID: 11025

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS3 - Materials to enable the Energy Transition

Environmentally friendly and highly efficient novel corrosion protection coatings for electrical equipment under harsh environmental conditions

Ivanka HOEHLEIN², Jürgen BÜTTNER¹, Valentin KOPP¹, Christian SCHRAMM¹

¹Chemische Industrie Erlangen, Germany; ²Siemens Energy, Germany

ID: 11057

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS3 - Materials to enable the Energy Transition

Keywords: Rechargeable battery cells, lithium ion battery (LiB), All-solid-state battery (ASSB), Dielectric capacitors

Recent development of nanomaterials for batteries and dielectric capacitors for energy storage in Japan

Yasunori TANAKA¹, Makoto KAMBARA², Minoru OSADA³, Shigemitsu OKABE⁴, Akiko KUMADA⁴

¹Kanazawa University, Japan; ²Osaka University, Japan; ³Nagoya University, Japan; ⁴The University of Tokyo, Japan

ID: 11058

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS3 - Materials to enable the Energy Transition

Keywords: SF6 Alternative, Eco-friendly, Dielectric Breakdown Strength, Machine Learning, Quantum Mechanics

Data-driven Exploration for SF6 alternative Gas with Quantum Mechanics-assisted Machine Learning

Masahiro SATO, Hajime SHIMAKAWA, Akiko KUMADA

The University of Tokyo, Japan

ID: 11644

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS3 - Materials to enable the Energy Transition

New C4-FN and C4-FN mixture gas models as a common reference for users and equipment manufacturers

Christian IHMELS¹, Max CLAESSENS², Michael GATZSCHE², Maxime PERRET³, Thomas BERTELOOT⁴, Christophe COQUELET⁵

¹LTP GmbH, Germany; ²Hitachi Energy, Switzerland; ³GE Vernova, Switzerland; ⁴GE Vernova, France; ⁵IMT Mines Albi, France

ID: 11861

D1 MATERIALS AND EMERGING TEST TECHNIQUES - Full Papers

Topics: D1 PS3 - Materials to enable the Energy Transition

Keywords: Biodegradable; dielectric response; FDS; Kraft paper; mineral oil; moisture; PDC; vegetable oil

Experimental evaluation of the dielectric properties of insulating paper impregnated in mineral and vegetable oil as function of moisture

Ismael ANTOLIN, Pedro J. QUINTANILLA, Cristina MENDEZ, Cristian OLMO, Pablo GOMEZ

Departamento de Ingeniería Eléctrica y Energética, Universidad de Cantabria Santander, Spain

D2 - INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY

PS1 - IT/OT SOLUTIONS TO IMPROVE THE EFFICIENCY AND RESILIENCE OF ELECTRIC POWER SYSTEMS

ID: 10270

D2 INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Exploration and Practice of Cloud Orchestration in New Power System Distribution Scenarios

Fuyou SUN¹, Xiaolong REN², Yunzhan LI¹, Shoubin ZAI¹, Wenbo XIA¹, Lianchang SONG¹

¹Huawei Technologies Co., Ltd., China; ²State Grid Corporation of China, China

ID: 10273

D2 INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: DoA estimation, Substation asset management, Switched beam antenna array, WSN

Design of smart planar antenna array with optimal directivity in eight directions detecting ISM band wireless sensors for IT/OT solutions and substation asset condition monitoring & deep learning applications

Reham Elsamnty EL SAMNTY¹, Sabah Mashaly MASHALY¹, Ahdab El Morshedy MORCHEDY²

¹Egyptian Electricity Transmission Company (EETC) Egypt; ²Egyptian National Committee of Cigre

ID: 10300

D2 INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: Open-source, standardization, grid-related data models, IEC CIM semantic standards, IOT

A possible win-win cohabitation of open-source and standardization

Laurent GUISE¹, Gilles NATIVEL², Benoît JEANSON³, Philippe TAILHADES⁴, Boris DOLLEY³, Eric LAMBERT⁵, Camille BLOCH⁶

¹Emergysemantic.com, France; ²ENEDIS, France; ³RTE, France; ⁴GIMELEC, France; ⁵EDF, France; ⁶Schneider Electric, France

ID: 10344

D2 INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: energy data, electric power system, AI solutions, common semantic data model, IEC standards

OMEGA-X: Energy Data Space for improving efficiency of electric power systems leveraging semantic interoperability and AI

Eric LAMBERT¹, Erik MAQUEDA², Javier VALIÑO³, Olivier GENEST⁴, Valentina JANEV⁵, Bruno TRAVERSON¹, Maxime LEFRANÇOIS⁶, Lina NACHABE⁶, Amélie GYRARD⁴, Antonio KUNG⁴

¹EDF R&D, France; ²Tecnia, Spain; ³ATOS, Spain; ⁴Trialog, France; ⁵Pupin Institute, Serbia; ⁶Mines St Etienne, France

ID: 10397

D2 INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

The journey of digitalization: how Smart Digital Substations can drive the Industrial Internet of Things revolution

Alessandro PEDRETTI

Hitachi Energy, Italy

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D2 INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Digital twin for asset management of electric power systems based on IEC CIM and BIM integration

Enea BIONDA

RSE, Italy

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Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Market driven architecture for remote monitoring of HV assets

Sebastiano SCARPACI

HITACHY ENERGY, Italy

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Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Orchestrated ICT architecture for grid monitoring of distribution power grid

Roberta TERRUGGIA

RSE, Italy

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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: SEE REMARKS

Development of Common Distribution Power System Model (CDPSM) based profiles and the proposed validation process

Harish KRISHNAPPA, Stephan LUPP, Bas KRUIMER, Lino PRKA

DNV

ID: 10565

D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: Artificial Intelligence, Asset Defect Detection, Computer Vision, Distribution Reliability, Drone Technology

Integrating Artificial Intelligence Models and Synthetic Image Data for Enhanced Asset Inspection and Defect Identification

Po-Chen CHEN¹, Reddy MANDATI¹, Vladyslav ANDERSON¹, Ankush AGARWAL¹, David BARNARD², Michael FINN², Jesse CROMER², Tatjana DOKIC¹, Andrew MCCAULEY², Clay TUTAJ², Neha DAVE², Bobby BESHARATI¹, Jamie BARNETT², Timothy KRALL¹

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ID: 10568

D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: PMU Database, Fault Detection, Fault Location, Grid Security, Artificial Intelligence

A.I. Searchable Synchrophasor Database for Power System Protection

Alberto RAMIREZ ORQUIN, Vanessa RAMIREZ

Resilient Grids LLC, United States of America

ID: 10570

D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: Artificial Intelligence (AI), Asset Management, Cloud Computing, Digital Transformation

AI and Cloud-based Digital Transformation of Utility Asset Management and Inspections

Junhui ZHAO, Jing YANG, Umair ZIA, Asim FAZLAGIC

Eversource Energy, United States of America

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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Digitalization of distribution assets by use of DSO-API-REST

Markel SANZ HERAS¹, David SANTACRUZ PELAEZ¹, Fernando IBÁÑEZ ALAMEDA², Jonathan GONZÁLEZ RÍOS³

¹I-DE, Spain; ²Tecnalia, Spain; ³Merytronic, Spain

ID: 10780

D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: AI, Reinforcement Learning, ESS, Optimal Operation, HILS test

Development and HILS Test of an AI Model for Optimal Operation of ESS in Renewable Energy Integrated EV Charging Station

Yundong SEO¹, Seungho HWANG¹, Gilsung BYEON², Dongjun WON³

¹SK Telecom Co., Ltd.; ²Korea Electrotechnology Research Institute, Korea, Republic of (South Korea); ³Inha University, Korea, Republic of (South Korea)

ID: 10830

D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: common information model (CIM), data verification, grid model verification, network model management

Data Verification in Power System Modelling

Nikolay BELYAEV, Roman BOGOMOLOV

JSC SO UPS, Russian Federation

ID: 10831

D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: big data, machine learning, RES, forecasting

Improving the Accuracy of RES Generation Forecast to Ensure Their Reliable Operation in the Power System

Irina BOBRITSKAYA, Aleksandr KRYMOV, Alexey ARKHIPOV

JCS SO UPS, Russian Federation

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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Big Data Processing and Representation in the Low-frequency Oscillations Analysis

Andrey RODIONOV¹, Kirill BUTIN², Aleksandr POPOV¹, Dmitry DUBININ³, Olga ZHURAVLEVA³

¹Energoservice, Russian Federation; ²NARFU, Russian Federation; ³JSC SO UPS, Russian Federation

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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: AI, ADMS, Big Data, decision support system, distribution networks, neural networks, state estimation, power flow forecasting

Symbiosis of Artificial Intelligences in Automated Systems of Supervisory Control of the Electrical Grid of a Distribution Grid Company

Sergey RYKOVANOV, Mikhail KHOZYAINOV

SYSTEL LLC, Russian Federation

ID: 10858

D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: Technology; Virtual reality; Power Transmission, Distribution and Generation

Virtual Reality and gamification as tools for training operation teams, maintenance of substations and energy transmission lines

Leandro Henrique DA SILVA¹, Juliano CORTES DE SOUZA², Josias MATOS DE ARAUJO³

¹Brazilian NC of CIGRE, Brazil; ²Virtual Engenharia; ³Comando Engenharia; ³Eng Smart Lead

ID: 10859

D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: Utility Communications, Substation IED Management, Telecom Management

Advanced Management and Control of Grid Substation's IEDs and Communication Devices in the Electric Power Utility

Marcelo ZAPPELLA, Ramesh POTLAPULA, Adriano PIRES, Mehrdad MESBAH

Brazilian NC of CIGRE, Brazil; GE Grid Solutions

ID: 10860

D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: WAMPAC, 5G, IEC 61850, Power System

Enhancing WAMPAC Systems in the Digital Transformation Era: Applied Research on IEC 61850 over 5G

Mayara Helena SANTOS¹, Nicolas FULLI¹, Fabio BRUNS², Ana Carolina PEDREIRA CAPELLA³, Joyce MEIRELLES², Yona LOPES²

¹Brazilian NC of CIGRE, Brazil; UFF Fluminense Federal University; YSMART ECT; ²UFF Fluminense Federal University; ³TIM Brasil

ID: 11009

D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: Hyperparameter tuning, Key Performance Indicators estimation, Machine Learning Regression algorithm, Management decision-making support, Multi-step annual Failure Forecasting, Remote Terminal Unit analog modules

Leveraging Machine Learning for Multi-Step Failure Forecasting in RTU Analog Modules and Estimating Key Performance Indicators to Support Management Decision-Making

Daniel FELIP, Eduardo CORONEL

Itaipu Binacional

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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Probabilistic framework for resilience enhancement of distribution grids

Ashwin SHIRSAT², Jishnudeep KAR², Kevin SCHOENLEBER¹, Milos SUBASIC¹, Katarina KNEZOVIC³, Dmitry SHCHETININ³, Lena SEMBACH¹, Elise FAHY³, Hennie NEL⁴

¹Hitachi Energy Research, Germany; ²Hitachi Energy Research, USA; ³Hitachi Energy Research Switzerland; ⁴Hitachi Energy South Africa

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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Optical Fiber Monitoring and Management System (ONMS)

Ariel CAMPOS

TRANSENER

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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Digital Edge Platform applied on Power Systems as a Key to Energy Transition

Fabián Edgardo LÓPEZ, Edgardo Exequiel NOGARA, Gabriel Franriq BONILLA, Edgardo Rubén FONOLL

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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: AI, Machine Learning, Deep Learning, Predictive Maintenance, Wind Turbine

Data collection considerations for AI and machine learning in wind power equipment

Tsuyoshi SUGIYAMA

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Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

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Keywords: Unified Asset Management Platform, Data Integration, Big Data Analytics, OT integration

UDAAN - Creation of a Unified Asset Management Platform via IT/OT Integration for Big Data Management in POWERGRID

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Monitoring of remote S/S through Robotics, Augmented Reality and Artificial Intelligence

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Grafana for Grid data Monitoring and Visualization at Western Regional Load Despatch Centre (WRLDC), GRID-INDIA

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Energy Optimization in Blockchain Enabled Smart Distribution Grid

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Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: Energy, Residential Load Consumption, Electricity Forecasting, Long Short-Term Memory, Multilayer Perceptron

State-of-the-Art Algorithms for short-term residential Load forecasting for Smart Grids

Vasileios LAITSOS¹, Georgios VONTZOS², Georgios LOUKOS¹, Paschalis PARASCHOUDIS¹, Sotiris CHRISTOPOULOS¹, Konstantinos KAOUSIAS¹, Katerina DRIVAKOU³, Despoina MAKRYGIORGOU⁴, Dimitrios BARGIOTAS²

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Enhancing Power Grid Failure Data by Leveraging AI-driven Text Classification: A Danish Case Study

Konrad SUNDSGAARD

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Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: Big data, Data Lake, data acquisition, lightning induced faults, transmission network, transient analysis

Analyses of Lightning Induced Faults Recorded by Diverse Monitoring Systems in the Transmission Network Based on a New Concept of Data Lake Design

Bozidar FILIPOVIC-GRIC¹, Bojan FRANC¹, Bruno JURISIC², Tihomir JAKOVIC², Tomislav ZUPAN², Antonija IVISIC³, Ivan STURLIC⁴, Alan ZUPAN⁴

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Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

IT/OT Convergence and Standard Architectures for DERs Considering Companion Specifications, Interoperability, IoT Technologies and Cloud Solutions

Luis BERRÍO, Daniel URQUINA, Rafael LUNA, Fabio GIRALDO, Melqui CAMACHO, Omar ALZATE, Marcela GIRALDO
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Driving and Empowering Digital Transformation: Successful Implementation of IIoT Pilots for Advanced Monitoring

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Topics: D2 PS1 - IT/OT Solutions to improve the Efficiency and Resilience of Electric Power Systems

Keywords: Artificial Intelligence, Automatic control system, Biogas power plant, Load forecasting, Peak demand reduction

Artificial Neural Network-Based Peak Demand Forecasting and Biogas Power Plant Control for Peak Demand Reduction in Factory

Praditthon PATCHARAUBONGASEAM, Supatchaya LEELUDEJ
Electricity Generating Authority of Thailand (EGAT), Thailand

PS2 - CYBERSECURITY IN EMERGING APPLICATION DOMAINS AND TECHNOLOGIES FOR SECURING ENERGY ORGANISATIONS

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Topics: D2 PS2 - Cybersecurity in Emerging Application Domains and Technologies for Securing Energy Organisations

Cybersecurity In the Loop for multi energy infrastructures

Giovanna DONDOSSOLA
RSE, Italy

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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS2 - Cybersecurity in Emerging Application Domains and Technologies for Securing Energy Organisations

Keywords: Cybersecurity, Operation Technology, OT Device-management, Data-management, Attribute-based-access-control, Privileged-access-management-(PAM)

The Elektrilevi's Advanced Remote Engineering Platform (AREP)

Indrek KÜNNAPUU¹, Hando LUUS², Rene VOOG¹, Ameen HAMDON³
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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS2 - Cybersecurity in Emerging Application Domains and Technologies for Securing Energy Organisations

Keywords: EV risks, risk, cybersecurity, threats, attacks, risk mitigation, security controls

Performing Risk Assessments of EV Charging Systems

Djenana CAMPARA¹, Nikolai MANSOUROV², Adnan BOSOVIC³, Svetlana MISUT³, Adnan AHMETHODZIC³, Meludin VELEDAR¹
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Lessons Learned from Infrastructure Attacks on Substations A Lens on North and South America.

Pablo NARVAEZ¹, Elkin CANTOR²

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A Strategy for Cyber Risk Mitigation in Smart Grids Through Traffic Management

Oscar TOBAR¹, German RUEDA¹, Johan CASTRO¹, Octavio DIAZ¹, German ZAPATA¹, Rodolfo GARCÍA²

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Cybersecurity for Communication Systems for Digital Electrical Substations Leveraging Emerging Network Technologies

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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS2 - Cybersecurity in Emerging Application Domains and Technologies for Securing Energy Organisations

Keywords: Cybersecurity, protection device management, cloud

Implementing a Protection Management System in AWS Cloud: Strict Cyber Security Standards & Rules and experience of system in Production

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Implementation of Cyber Security in IEC 61850 based Substation Automation System – Experiences, Challenges and Enhancement in Prevailing Practices

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Cyber Security Assessment of Digital Substation using Petri Nets

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Hardened (Air-gapped) IT-OT Interconnection – A Case study on Proof of Concept in Context of Power System Operation

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Topics: D2 PS2 - Cybersecurity in Emerging Application Domains and Technologies for Securing Energy Organisations

Evaluation of the Maturity of Cybersecurity in the Colombian Power System

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Topics: D2 PS2 - Cybersecurity in Emerging Application Domains and Technologies for Securing Energy Organisations

Analysis of High-Impact Scenarios for Cybersecurity in the Colombian Power System

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Topics: D2 PS2 - Cybersecurity in Emerging Application Domains and Technologies for Securing Energy Organisations

Enhancing Cybersecurity in Critical Infrastructure: Leveraging Next Generation Firewalls (NGFW) for Robust Protection in OT and Substation Environments

Kgomotso MANYAPETSA

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PS3 - MEETING THE CHALLENGES OF ENERGY TRANSITION WITH RELIABLE, SCALABLE, AND EFFICIENT TELECOMMUNICATIONS NETWORKS

ID: 10101

D2 INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: 5G, 5G Standalone, Protection, Fault, Fault Indication, Edge Computing

Exploring the Reliability of Commercial 5G Standalone Networks for Virtual Fault Passage Indication

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: 5G, Edge computing, Fault, Line differential, Protection

Applicability of 5G Communication to Line Differential Protection for Distribution Networks

Petri HOVILA, Petri SYVÄLUOMA, Anna KULMALA, Rajasekaran DEVADASS, Petteri VAARA

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D2 INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: MPLS-TP, teleprotection, PTP, inter substation communications

Migration from TDM Networks to MPLS-TP, Field Experiences

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: MPLS-TP, SDH, Line Differential Protection, Teleprotection

Optical Systems Performance for Line Protection Schemes

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D2 INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: Utility Infrastructure, Network Telecommunication, Radio Frequency, Smart Metering, Smart City

The Next Generation of Joint-Use Utility Infrastructure

Mahavish MAHMOOD, Marianne GUIEB, Gregory R. BELL

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ID: 10572

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: Passive Optical Network (PON); Gigabyte Passive Optical Network (GPON); Expedited, Deterministic, Redundant, PON (EDRP); Optical Line Terminal (OLT); Optical Network Terminal (ONT)

Redundant Passive Optical Network (PON) Transport for Grid Intelligence

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: Evolved Packet Core (EPC), Private Long-Term Evolution (PLTE), Radio Access Network (RAN), User Equipment (UE)

PLTE Testing of Utility Use Cases in Support of Grid Modernization

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Migration from MPLS-TP & SDH Hybrid Networks to OTN Optical Transport Networks

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Mapping Multiprotocol Services into a MPLS Critical Infrastructure Network

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: Quantum Key Distribution, QKD, MPLS-TP, ETSI GS QKD 014, Encryption, IEEE 1588 PTPv2, Quantum Computing, Post Quantum Cryptography, PQC, Wide Area Network, WAN, Operational Technology, OT, Cybersecurity

Quantum Key Distribution for MPLS-TP Traffic Encryption

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: design concept IP MPLS network, high availability, flexibility, and scalability

Electric Power Industry of Serbia IP MPLS network application for communications of technical information systems

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Implementation of “Software-Defined Networking” as an Alternative for Efficient Traffic Management in Digital Substations

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D2 INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: redundant system, resilience measures, triplex redundancy, virtual switch

IP Network Availability Improvement Initiatives

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: Internet protocol, Network, Microwave, MPLS TE, Resilient

Techniques and methods in building resilient networks that support critical applications for Electricity Power Utilities

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: MPLS-TP, Packet-switched network, Resiliency, TDM, Wireless microwave network

Requirements for resilient packet-switched network using MPLS-TP and wireless microwave technology

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: IEC 61850, Process Bus, Availability, Parallel Redundancy Protocol, High-availability Seamless Redundancy

A Fast and Accurate Calculation Method of Availability for Protection Relays Applying the IEC 61850 Process Bus

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D2 INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: Internet Protocol Security, Optical Fiber Ground Wire, Time Division Multiplexing

Implementing Telecommunications Network For Remote Operation Of Substations From National Transmission Asset Management Centre (NTAMC) By POWERGRID – A Novel Experience

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Implementation of HVDC-Emergency Power Control at HVDC Raigarh by Integrating Two Different Geographical Locations Through IEC 61850 Platform Over SDH Network

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Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Overview of State-of-the-Art Unified Network Management System for Managing Multivendor and Multi-Technology Power System Communication Network and attaining more Reliable, Scalable & Efficient Communication Network

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D2 INFORMATION SYSTEMS, TELECOMMUNICATIONS AND CYBERSECURITY - Full Papers

Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks

Keywords: IoT, Wireless communication, 5G, Private 5G, Smartification, Smart industrial safety

Development of Wireless Communication Environments for the Smart Industrial Safety in Power Plants

Kazunari KUWAHARA, Ryota HIGASHI, Tetsuya KOTOKA, Kazuaki NARIAI, Koushiro NAKAGAWA

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Strengthen cybersecurity and device management of cellular communication systems

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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers
Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks
Keywords: ANDE, BGP, Fast ReRoute, OSPF, PDC, PMU, Pseudowire, MPLS-TP, SDN, SDH, WAMPAC.
MPLS-TP as a communication protocol for Critical Infrastructure transport networks: Challenges in the implementation of the protocol in WAMPAC systems of ANDE - Paraguay
Chrystian RUIZ DIAZ¹, Enrique DAVALOS², Cecilia VEGA¹
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D2 INFORMATION SYSTEMS, TELECOMUNICATIONS AND CYBERSECURITY - Full Papers
Topics: D2 PS3 - Meeting the Challenges of Energy Transition with Reliable, Scalable, and Efficient Telecommunications Networks
Keywords: failure detection, network management, network monitoring, Operational Technology, OT, SCADA
Implementation and Impact of Network Management and Monitoring Systems on ANDE's Operational Technology (OT) Network
Ricardo LOREIRO, Chrystian RUIZ DIAZ
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