

# CIGRE SESSION 2024

## SC A2 – Power Transformers and Reactors



**cigre**

For power system expertise

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## Introduction to SC A2 – Power Transformers and Reactors

- Power transformers, including industrial, dc converter, and phase-shifting transformers for distribution, transmission, and renewable energy applications,
- Reactors, including shunt, series, saturated, and smoothing,
- Transformer components including bushings, tap changers and accessories.
- Within this framework additional specific areas of attention include:
  - Theory principles and concepts, functionality, technology development, design, performance and application of materials, efficiency,
  - Manufacturing, quality assurance, application guidance, planning, routing and location, construction, installation, erection, installation,
  - Reliability, availability, dependability, maintainability and maintenance, service, condition monitoring, diagnostics, restoration, repair, loading, upgrading, uprating,
  - Refurbishment, re-use/re-deployment, deterioration, dismantling, disposal.



## CIGRE Session 2024

- Tutorial – Analysis of Transformer Reliability
  - New TB 939
- Workshop A2-A3-B3-C3-D1
  - Driving T&D substations and equipment towards ZERO emissions
- Study Committee Meeting
- Poster Session
- Group Discussion Meeting
- Awards – David Walker, Distinguished Member



## Special Reporters

- Main reporter – younger member
  - PS1 Bruno Jurišić (HR)
  - PS2 Tara-Lee Macarthur (AU)
  - PS3 Sebastian Schreiter (DE)
- Additional Reporter – senior member
  - PS1 Žarko Janic (HR)
  - PS2 Patrick Picher (CA)
  - PS3 Elizabeth MacKenzie (UK)

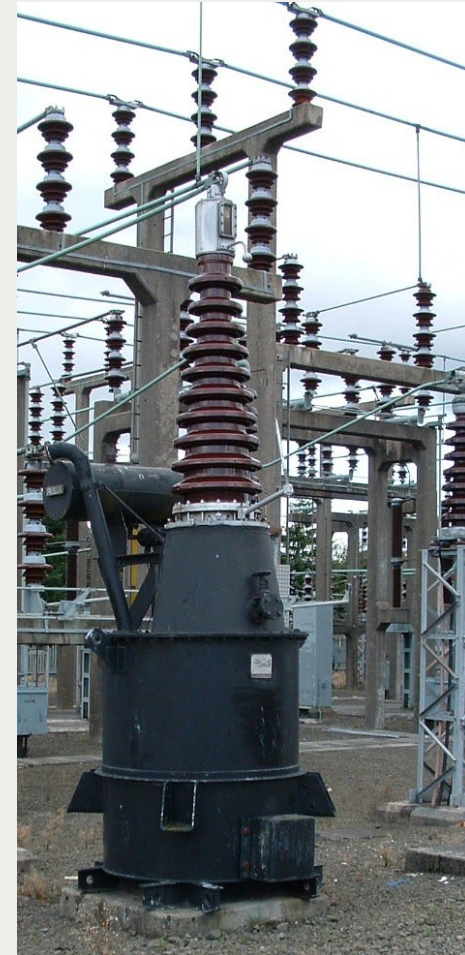


## General Session – Preferential Subject 1

- Preferential Subject 1 (PS1): Design of resilient transformers
  - Stresses from the environment: Impact of global warming, high temperatures heavy rain, high winds, offshore installations, etc.
  - Stresses from the system: switching impulses, reverse flow, emergency overloading, harmonics, GIC, short-circuits and internal arcing etc.
  - Specifications: design criteria, materials and testing requirements for new transformers. Suitable maintenance standard and refurbishment strategies.
- Sub-topics
  - PS1-1: Stresses from the environment (2 papers)
  - PS1-2: Stresses from the system (18 papers)
  - PS1-3: Materials, testing and others (17 papers)
- 5 papers with UK authors listed

## Best papers PS1

- Best paper
- “On-Site GIC Withstand Experiment on a 1000 MVA 3-limb Autotransformer and a 300 MVA 5-limb Transformer (Part I and II)” by a team of investigators from Norway, Germany, and Sweden
- Keynote speech was delivered by Gabor GURSKY (HU)
- NGN presentation, “Impact of Cellulose Degradation on Space Charge Dynamics and Conductivity of Synthetic Ester Liquid-Impregnated Kraft Paper Insulation,” presented by Abdelrahman ALSHEHAWY (UK).





## Contributions PS1





## General Session – Preferential Subject 2

- Preferential Subject 2 (PS2): Advances in transformer analytics
  - Data management: digitalisation and information model, online and offline test data, integration of condition and multiple data sources, data preparation for analytics
  - Diagnostic and on-line monitoring: algorithm/guidelines for on-line monitoring, advanced interpretation of condition data, case studies
  - Modelling: transformer digital twins (thermal, dielectric, mechanical, etc.), physics-based and hybrid models, failure probability and ageing models, applications of artificial intelligence
- Sub-topics
  - PS2-1: Diagnostics and on-line monitoring (19 papers)
  - PS2-2: Modelling (13 papers)
  - PS2-3: Applications of artificial intelligence (7 papers)
  - PS2-4: Data management, assessment indices, and reliability aspects (12 papers)
- 3 papers with UK authors listed

## Best papers PS2

- Best paper
- “Analysis of Non-Accelerated Aging of Model Windings Immersed in Mineral Oil and Natural Ester” by a team of investigators from USA, Argentina and Italy
- Keynote speech was delivered by Luiz CHEIM (US)
- Two NGN presentations on “Modelling of Dual Core Phase Shifting Transformer in ATP-EMTP Environment” by Gabriele TRESSO (IT) and on “Estimating the Dynamic Rating of Distribution Transformers using Digital Twins” by Saravanan BALAMURUGAN (IN).



# Contributions – PS2



## General Session – Preferential Subject 3

- Preferential Subject 3 (PS3): Reliability of transformers for renewable energy
  - Transformers for low carbon technologies: voltage < 100kV, wind and photovoltaic parks, battery energy storage and electric vehicle charger etc.
  - Case studies and lessons learned: type of failure, root cause analysis, mode of operation. Recommendations concerning procurement, design, operation and asset management strategies.
  - Failure Prevention: useful diagnostic methods and monitoring systems. Optimization of operating conditions and additional measures such as overvoltage protection, harmonic reduction, cooling optimisation etc.
- Sub-topics:
  - PS3-1: Application and Case Study: Transformers for the integration of renewable energies (5)
  - PS3-2: Design and manufacturing: Proposals for resilient designs to withstand new stresses (6)
  - PS3-3: Life Cycle Considerations for power transformers to reduce environmental impact (3)
- 0 papers with UK authors listed

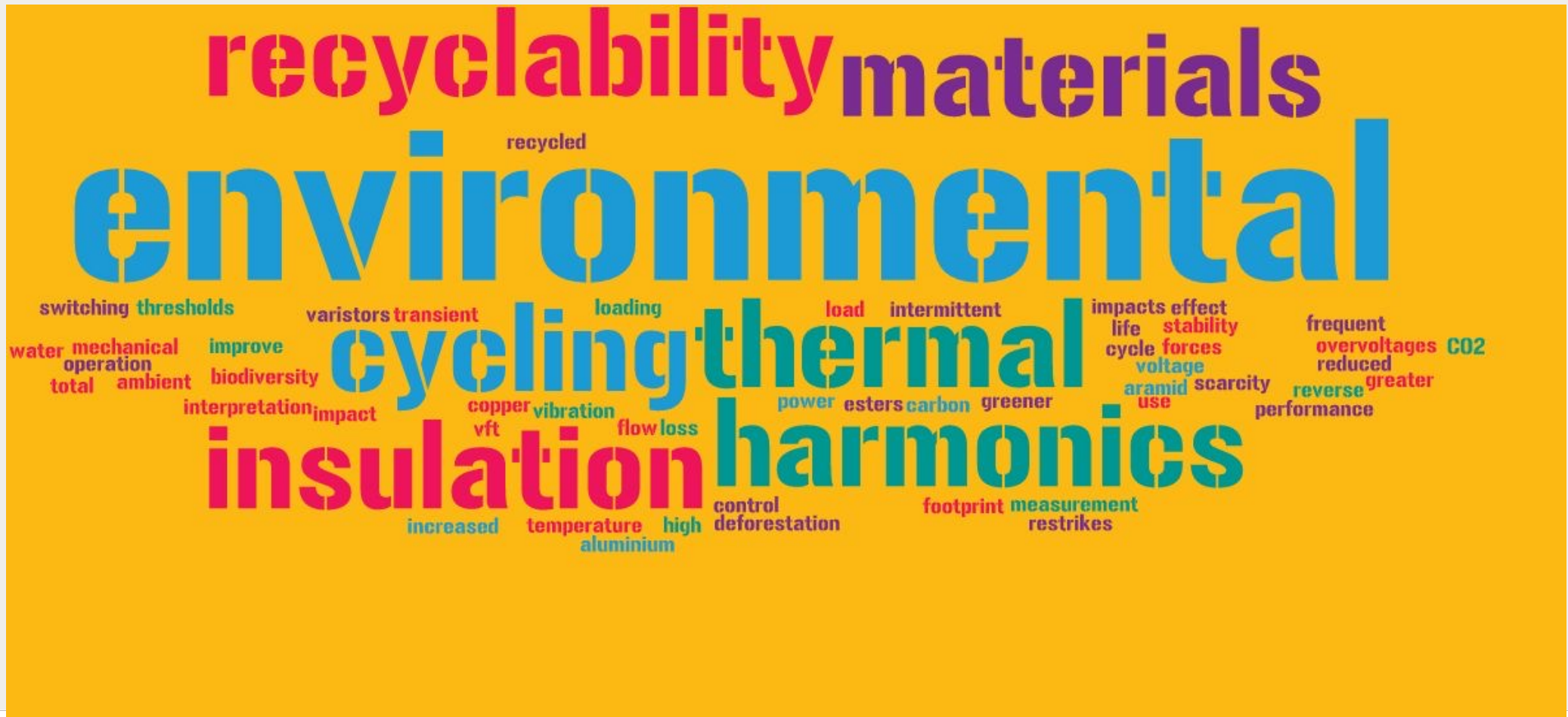


## Best paper – PS3

- Best paper
- “Effects of Rooftop Photovoltaics on the Load and Ageing of Distribution Transformers” by a team of investigators from Australia
- Keynote speech was delivered by Peter WERLE (DE)
- No NGN paper for this PS



# Contributions – PS3





## Future events



CIGRE 2025 Symposium in Montreal, Canada  
September 29 – October 2, 2025



October 26 – November 1, 2025

## Contact and Participation

- Website - [a2.cigre.org](https://a2.cigre.org)
  - Technical activities
  - Events
  - Publications
  - Contact

### WGA2.68 Failure Survey of Lower Voltage GSUs

13 March 2024, Peter WERLE

**How reliable are Transformers in  
Wind Farms and Photovoltaic Parks?**

**CIGRÉ needs your help !**



**Tags :** Survey



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Any questions?