Report to the CIGRE Australian Technical Council

A1

Power Generation and Electromechanical Energy Conversion

Australian Panel AU A1 Event Report 20/11/2025

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Event Report 2025

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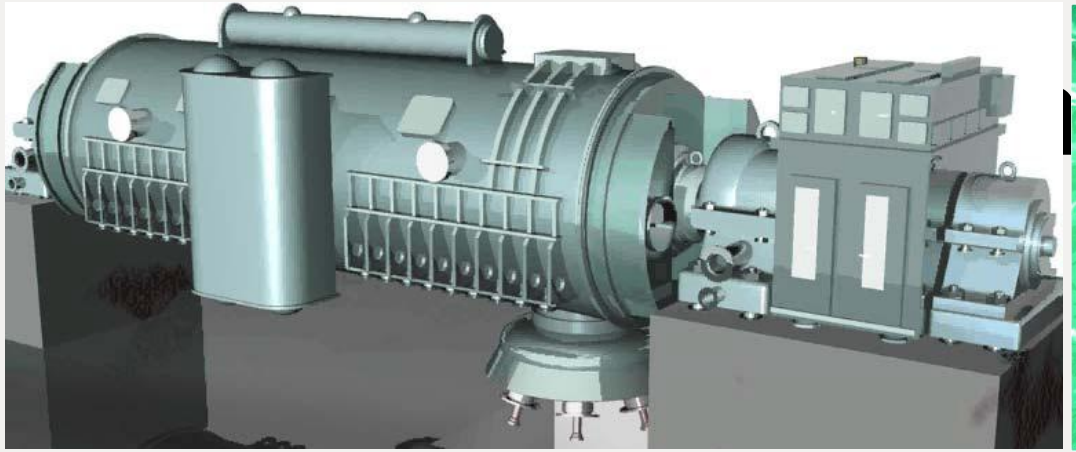
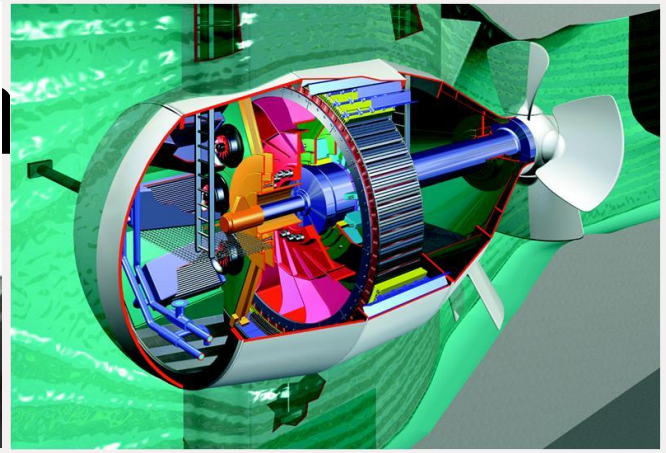
SC A1 Overview

Study Committee Purpose

SC A1 focuses on the development of new technologies and the international exchange of information and knowledge in the field of rotating electrical machines, to add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing guidelines and recommendations.





SC A1 Overview

Four Advisory Groups (study areas)

- **Turbo generators: (AG A1.01)** focuses on condition assessment, maintenance, refurbishment, power upgrade, asset management and long-term health assessment.
- **Hydro Generators: (AG A1.02)** focuses on condition assessment, maintenance, refurbishment, power upgrade, asset management and long-term health assessment.
- **Wind Generators and New Technologies: (AG.05)** focuses on wind turbine generators and other technologies not covered by the other advisory groups, e.g. superconducting machines.
- **Large and High Efficiency Motors: (AG.06)** focus on motors >1kV and >1000kW as well as smaller high efficiency motors used for dispersed generation. Also covers Voltage Frequency Drives (VFDs) and their considerable potential for improved energy efficiency.

SC A1 Symposium Montreal – Canada Sept 29th - Oct 2nd 2025

Preferential Subjects

PS1: SYSTEM ENHANCEMENT, MARKETS AND REGULATION

- Energy sector integration for efficient decarbonization
- Power system dynamics and interaction
- Renewable energy, DER, microgrids, EV, storage
- Power systems with high percentage of renewables
- Electrical installations on offshore and artificial Islands
- Large-scale renewable energy integration, transmission and regional Interconnection
- DC applications in distribution and transmission: onshore and offshore
- Substations, switchgears, MV and HV Equipment
- Increase transfer capacity

PS2: APPLICATION OF TECHNOLOGIES, INFORMATION TECHNOLOGY (IT) AND ARTIFICIAL INTELLIGENCE (AI)

- Innovative approaches on system design, construction, monitoring and maintenance
- Power quality performance
- Experiences with communication and cyber security in HVDC/FACTS systems
- Innovations and development of technologies, IT and AI tools for operation and maintenance

PS3: CLIMATE CHANGE AND EXTREME WEATHER EVENTS

- Identification, risk assessment and management for extreme weather events and increasing temperatures
- Managing assets for power systems and industry as climate changes
- Evolution of industry standards
- Development and deployment of equipment suitable for extreme weather events EHV & UHV AC AND DC
- Insulation coordination
- Design of UHV/EHV AC and DC equipment
- Factory and field testing of UHV equipment
- Large projects based on UHV and EHV

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SC A1 Symposium Montreal – Canada Sept 29th - Oct 2nd 2025

The Symposium was attended by approximately 2,000 delegates from 10 CIGRE Study Committees

38 papers were presented by speakers from 10 countries in 6 technical sessions

- Sessions 1 & 2 - Partial discharge , AI & ML applications
- Sessions 3 & 4 - Condition monitoring and assessment
- Sessions 5 & 6 – Asset Management

Papers received award

- Overall best SC A1 paper – “Stator windings neutral inversion case study” by Claude Hudon
- Overall best SC A1 NGN paper - “Understanding and extending Hydro-generator capability through thermal diagnostics and probabilistic modelling” by Ghofril Kahwati, Antonie Tahan, Arezki Merkhouf and Kamal Al-Haddad
- Overall best SC A1 student paper: “Overview of Localized Partial Discharge Activity Analysis with Results from Dissection of Individual Stator Bars and Coils” by Alexandre Simard, Melanie Levesque, Eric David and Helene Provencher

Tutorial: “The black out of the Iberian Peninsular on April 28, 2025” – Spain

Advisory Group meetings

- AG A1.01 (Turbogenerator) met on Sept 29th
- AG A1.02 (Hydrogenators) met on Sept 29th

Study Committee Meetings / updates

- SC A1.70 “DDF measurements on stator windings” met on Oct 1st
- SC A1.75 “Large air-cooled turbo-generator, State of the art, limits and perspectives for small modular reactors. Met on Oct 2nd

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CIGRE General Session in Paris, August 23–28 2026.

Preferential Subjects for SC A1 are:

PS 1: Rotating electrical machines and the energy transition

- Impact of the energy transition on the role, duty and flexible operation of rotating electrical machines.
- Eco-design and sustainability.
- Update of international standards for electrical machine requirements to reflect future applications.

PS 2: Evolution and development

- Technology developments for wind generators, variable speed pump-storage, synchronous compensators and SMR applications., manufacture, efficiency, Improvements in design, manufacture, efficiency, insulation, cooling, bearings and materials.
- Enhancements in the performance, reliability and control of rotating electrical machines.
- Design evolution of rotating electrical machines based on operational experience.

PS 3: Asset management and new challenges

- Digital twin: Condition monitoring, diagnosis, prognosis of rotating electrical machines including the use of artificial intelligence, deep learning techniques, Industry 5.x requirements.
- Improved maintenance practices to ensure power supply reliability.
- Extending operational performance and service life of installed base.

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SC A1 Key Focus Areas

TD 1: Asset Management

- Extend the life of existing generators or to recommend their replacement
- Enhancements in the construction of large turbo and hydro generators

TD 2: Machine / Grid interaction and support

TD 3: Renewable generation

- Energy Transition and Sustainability

TD 4: Machine monitoring, diagnosis and prognosis to perform optimal maintenance

TD 5: High efficiency and efficiency improvement of electrical machines

- High efficiency rotating electrical machines with new materials,
- Improving cooling and insulation systems in generators and motors
- Utilization of Polymer nano-composites as near-future HV electrical insulation in rotating machines
- Large motors and high efficiency motors

SC A1 Working Groups Update - 2025

WGs anticipated to deliver Technical Brochures in 2025

- WG A1.42: Influence of key requirements to optimize the value of hydro generators
- WG A1.45: Guide for Determining the Health Index of Large Electric Motors
- WG A1.53: Guide on Design Requirements of Motors for Variable Speed Drive Application
- WG A1.56: Survey on Lap and Wave Winding and their Consequences on Maintenance and Performance
- WG A1.58: Selection of Copper Versus Aluminium Rotors for Induction Motors
- WG A1.61: Survey of Partial Discharge Monitoring in Large Motors
- WG A1.63: Turbo Generator Stator Winding Bushings – Design and Field Experience
- WG A1.64: Guide for Evaluating the Repair/Replacement of Standard Efficiency Motors

Active Working Groups

- 11 WG's in progress (A1.42, A1.45, A1.53, A1.55, A1.56, A1.58, A1.61, A1.62, A1.63, A1.64, A1.67, A1.68, A1.69, A1.70, A1.71)
- 6 New WG's (A1.72, A1.73, A1.74, A1.75, A1.76, A1.77)

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Relevance to Australia

Turbo and Hydro generators

- TB 860 (A1-33) Guide for Cleanliness and Storage of Generators.
- TB 879 (A1-44) Guideline on Testing of Turbo and Hydro Generators.
- TB 878 (A1-48) Guidance on High-Speed Testing of Turbo Generator Rotors
- TB 690 - Vibration and stability problems met in New, Old and Refurbished Hydro-generators, Root Causes and Consequences
- WG A1-54 (finalize) Impact of Flexible Operation on Large Motors.
- WG A1-29 Guide on New Generator - Grid Interaction Requirements. - Relevant to prevention of widespread state blackout; similar to that in 2016 in SA.
- WG A1-31 State of the Art of Stator Winding Supports in slot area and winding overhang of hydro generators
- WG A1-37 Generator Stator windings support systems experience. - Highly relevant to the older turbo and hydro generators where they experience in high end winding vibration.
- WG A1/C4-66 - Guide on Synchronous Condensers for System Inertia, Short Circuit withstand capability (fault levels) and MVAr support in power grids with high level of renewable energy generation. - Highly relevant to South Australia due to high proportion of wind and solar generation.
- WG A1.70 Dielectric Dissipation Factor Measurements on Stator Windings. - Highly relevant to diagnostics to the ageing generator fleet in Australia.

AU A1 Activities

- The AU A1 panel currently has 13 members, 2 guest experts and 1 NGN
- AU A1 panel met face to face in Adelaide on 13/11/25 with a technical tour at Torrens Island Power Station and Barker Inlet Power Station
- Representation from Utilities, Consultants, Service Providers and Testers, all states of Australia,
- Members participate 4 SC A1 working groups
- Three technical paper synopses were submitted to Paris Session 2026
- Members share experience in the form of technical presentations at panel meetings in a wide range of relevant topics such as generator & motor failures, abnormal operations, major overhaul experience, new industry practice and technologies, condition monitoring, management of aged generators and renewable generation.
- One synopsis accepted for Paris Sessions 2026
- Technical networking

Looking Ahead Proposed Study Topics

Turbo-generators AG-01

- Transient currents in rotor forgings
- Energizing at standstill (generator considerations at startup)
- Generator core integrity
- Issues related to stator wedges (tightness, ripple spring replacement, cracking) and wedge testing methods
- Generator operation without cooling water
- Developing a guideline for design reviews of major generator refurbishment projects
- Capacitance mapping and other stator winding evaluation techniques
- Factory quality assurance testing requirements

Looking Ahead Proposed Study Topics

Large Motors and Drives AG-06

- State of the art in new advanced motor technologies
- Guide on specification and selection of motors for various industry applications
- Guide on methods for detection of broken bars in squirrel age induction motors
- Guide on rotor faults detection in squirrel-cage induction motors by current signature analysis
- Guide on specification and design of large synchronous compensators
- Guide on starting and speed/torque control methods for large three phase induction motors
- Guide on experience of implementation of IE4 efficiency class
- Guide for specification/operation of motors in explosive environments
- Guide for special application motors: marine motors. Water cooled motors, brake motors, motors for high ambient temperatures, traction motors
- Motor performance under abnormal conditions
- Effect of different types of windings on efficiency, torque and harmonics of induction motor
- Guide on use of expert systems for determining the risk of failure in motors

Thank You

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