

CIGRE SC C2 System Operations and Control

Virtual Conference 2020

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For power system expertise

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Mission of SC C2

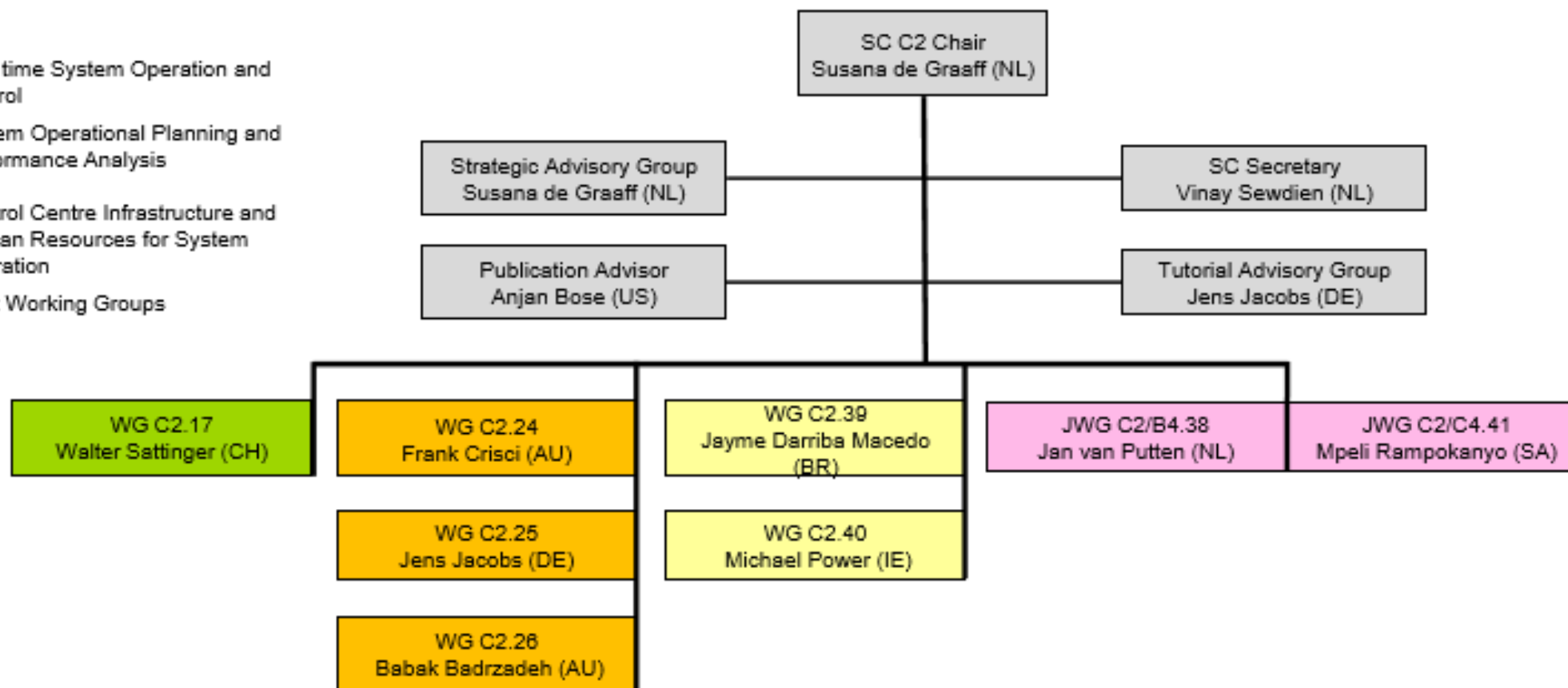
- To facilitate and promote knowledge dissemination and worldwide collaboration for system operations and control of power systems, providing adequate conditions for progress of engineering
- Facilitating unbiased technical information exchange, integrating solutions and recommendations for system operations issues and problems
- Prepare for the foreseen future challenges by integrating and consolidating available knowledge
- Engage and encourage young members

Main technical directions SC C2

- Real-time System Operation and Control
- System Operational Planning and Performance Analysis
- Control Centre Infrastructure and Human Resources for System Operation

Structure of SC C2

- Real time System Operation and Control
- System Operational Planning and Performance Analysis
- Control Centre Infrastructure and Human Resources for System Operation
- Joint Working Groups



Preferential subjects SC C2 (1)

PS 1: Capabilities Required for Future System Operation

- Operator Training
- Decision support tools including new methodologies
- Wide area monitoring and control

Special Reporter: Marija Zima

PS2: System Operation Interfaces: Improving Observability and Controllability

- TSO-TSO interface/cooperation/data exchange
- TSO-DSO interaction/cooperation/data exchange

Special Reporter: Anjan Bose

Preferential subjects SC C2 (2)

Joint C2/C6 PS3: System Operation Challenges with Increasing Use of Distributed Energy Resources

- Enhancing flexibility and resilience
- Providing grid services through aggregators
- Aggregator interaction

Special Reporter: Renuka Chatterjee

Paper sessions – statistics

- In total 81 papers from 35 National Committees
- Virtual video paper presentations with some questions for each paper
- Questions could be sent in upfront or interactively during the session

- PS 1: 40 papers from 27 national committees, 184 (morning) and 190 participant (afternoon)
- PS 2: 12 papers from 9 national committees, 145 participants
- PS 3: 29 papers from 17 national committees, 236 participants

PS1: Capabilities Required for Future System Operation



- Importance of having new procedures for restoration of the system and operators' training
- Online security assessment which includes varying generation renewable energy resources (RES) profiles (behind the converter)
- Rapidly changing characteristics of the power system (voltage, inertia, short circuit power) with high RES penetration
- “Smart documents” to replace operation manuals
- Root cause analysis with Artificial Intelligence (AI) – risk for vegetation growth or fire danger
- Data fusion to improve forecasting of severe weather conditions (wind & solar)
- Capability of controllable devices for voltage stability and frequency control
- Interarea oscillation monitoring to become a standard in control centres

PS1: Capabilities Required for Future System Operation



- Importance of having new procedures for restoration of the system and operators' training
- Optimized Phase Measurement Units location
- Improved remedial action schemes and modern automation technologies
- Resilience, efficiency and a reliable communication system
- Massive digitalisation to support innovation

PS2: System Operation Interfaces: Improving Observability and Controllability



- Data interchange across the TSO-TSO and the TSO-DSO boundaries to increase observability and controllability
- Regional Security Coordinators and in future Regional Coordination Centers
- TSO-DSO interaction and improved restoration using load and DER
- Using common standards for TSO-DSO for congestion and restoration management
- Improved forecast needs of load and generation
- Predictive indices for hybrid AC-DC systems improving situational awareness
- Post-operative analysis to detect frequency oscillations

Dutch paper contributions:

- TSO-DSO cooperation in a system of systems (C2-208, Gerda de Jong)
- New challenges in the evolving Transmission system operator and security coordinators business (C2-203, Danny Klaar)

Joint C2/C6 PS3: System Operation Challenges with Increasing Use of Distributed Energy Resources



- Frequency, regulation and black start services through distributed resources (DER)
- Understanding the new capabilities while also recognizing that there will be continued reliance on traditional resources
- No explicit comments were made on purely relying on DER for these services
- Data exchange and interactions and increased coordination required between TSOs and DSOs and to ensure grid reliability
- Tools and technology needed to run a power system with high rate of DER
- Maintenance related to use of dynamic rating
- N-1 criterion related to reliability might change in the future

Dutch paper contribution:

Objectives and set-up of an aFRR pilot in the Dutch electricity system
(C2-C6 311, Jasper Frunt)

Conclusions

- Observability and Decision support: crucial real-time and operational planning awareness and decision support (AI and importance of adequate forecast)
- Flexibility: extreme need for a flexible power system with need for ancillary services provided from a diverse source of resources. Need to unlock the flexibility
- Controllability: capabilities and interaction of power electronic interfaced devices to enhance power system control. WAMS development enhancing system's security.
- Cooperation and coordination: platforms and services are in place to facilitate the interaction of several players
- Human factor and Operator training: need for development of skills and knowledge of our operators, who are vital to keep "the lights on".

System operations and controls will keep on developing innovative solutions and concepts to operate the system today and in the future.

Backup slides

Large disturbance workshop (market & system operation)

- 19 August 2019 GB system incident: 2.9 GW generation loss due to lightning strikes
- June 2019 Large system imbalances in Germany
- 16 June 2019 Argentina's blackout due to malfunctioning of regional SPS
- 7 June 2019 Partial decoupling of single pan European cross-zonal electricity market
- September 2018 Hokkaido whole area blackout due to earthquake
- 25 August 2018 Australian loss of synchronism event
- Proliferation of shale gas in the United States of America

C2 tutorial on Capabilities and requirements definition for Power Electronics based technology for secure and efficient system



The main recommendation is that System Operators and vendors should have transparent discussions on the use and capabilities of Power electronics interfaced devices (PEID). Often, System Operators are not aware of the full range of PEID capabilities. This is a lost opportunity, as many of such capabilities can be used to enhance system operation.

Furthermore, the following topics need further attention:

- Grid forming controls
- Standardisation
- Protection
- Modelling and simulation tools

Activities in SC C2

- WG C2.17 Wide Area Monitoring Systems - support for control room applications
- WG C2.24 Mitigating the risk of fire starts and the consequences of fires near overhead lines for system operations
- WG C2.25 Operating strategies and preparedness for system operational resilience
- WG C2.26 Power system restoration accounting for a rapidly changing power system and generation mix
- WG C2.39 Operator training in electricity grids at different control Levels and for different participants/actors in the new environment
- WG C2.40 TSO-DSO Co-operation – control centre tools requirements
- JWG C2/B4.38 Capabilities and requirements definition for power electronics based technology for secure and efficient system operation and control
- JWG C2/C4.41 Impact of high penetration of inverter-based generation on system inertia of networks