



EXECUTIVE SUMMARY

Session 1 – NETWORK COMPONENTS

SUMMARY

138 papers were selected for session 1 and divided into 4 Blocks focusing on complementary topics.

MAIN SESSION 1 - BLOCK 1

Disruptive innovation, new usages and prospective

The three first oral presentations were dealing with the use of power electronics to adapt the network for energy transition while making the system more efficient and resilient: DC network arrangements, DC charging systems and fault protection. The following paper addressed the lessons learned and guidance to deploy large-scale battery storage system. The next paper presented how increase of resiliency of a city centre network in the US is achieved thanks to a MV superconducting cable able to exchange “transmission level” power between primary substations. And the last paper gave an overview of the smart substation experiences developed during the Flexigrid project. This session showed how technologies such as electronics, batteries or superconductivity could play a key role in developing and securing future distribution networks.

MAIN SESSION 1 - BLOCK 2

Monitoring and diagnostics

Two first presentations focused on sensors for GIS and the interpretation of associated measurements. A pressure gauge combined with a 2-points temperature measurement and the associated model allows determining the gas density in a GIS with a good accuracy. The second paper opened new perspectives in PD monitoring for SF6 free GIS, with the development of PD source and propagation models. The two next papers concerned cable testing in labs or at a very challenging site: offshore windfarms. The two last papers reported use cases of condition monitoring of circuit breaker and primary transformer fleets in operation. In conclusion, this session was a good opportunity to present the latest advances in sensors, monitoring and diagnostics for components, which is key in the era of component sensorization and digitalization.

MAIN SESSION 1 - BLOCK 3

Context evolution driving development and studies on components

The two first papers discussed the benefits and the difficulties to carry out Life Cycle Analysis and to encourage circular economy within the distribution grid community from supply and operation to end of life of assets. The following paper proposed a novel configuration of overhead line protection systems to improve safety, wild life protection and maintenance at the same time. The next paper was presenting the organisation of fast intervention procedures including repair kit to reduce outage duration or curative maintenance. In order to reduce the environmental impact of oil transformers, a novel design of transformer using natural ester was presented. The last paper gave the root causes and the associated solution for wood pole ignition due to pollution. In conclusion, the new challenges for assessing and reducing environmental impacts on networks assets require increasing awareness, systematizing the collection and improving the quality of data and identifying the best compromises to improve operability and sustainability.

MAIN SESSION 1 - BLOCK 4

Data, models and prediction for components

The 6 oral presentations aimed to give an overview of the use of data and models for components at different stages and for different applications. First, data and models at edge, including feature extraction, simplification, possibly self-learning methods, with two presentations dealing with circuit breaker and network monitoring applications. The two next presentations focused on the use of big data and models for asset management: optimization of installation of overvoltage protection devices on the network, and system view of dynamic load management for the identification of the bottlenecks. One paper presented an electrical inductive/capacitive model to estimate the inrush current in PST transformers. The last paper described the advantages of a multifunctional communication and control device to manage data in a unified way for secondary substation.



RT “Smart Networks: from the secondary substation to the LV networks “

Together with smart metering infrastructure, Secondary Substations and LV Networks are the first layer providing solutions to facilitate the integration of DER, improve the flexibility of the distribution system and optimize energy flows on the LV grid. The RT was an opportunity to show "behind the scenes" of the energy transition through innovative projects and prototype applications of secondary substation solutions and smarter low-voltage networks. The final “think tank” of the roundtable discussed dynamic voltage regulation, energy storage management, next-generation IoT-based monitoring, vertical integration of HEMS and DER in the distribution system and made it possible to understand how local intelligence at the level of future substations and smart LV networks would enable significant progress to be made.

RT “Lifetime extension options for electrical equipment” (main results of WG 2020-1)

Distribution networks are experiencing an ambitious grid expansion to manage the integration of renewable energy generation. At the same time, existing networks include a significant portion of components that could reach end of life within the next decade. For the DSOs, a massive renewal is not possible because of the major effort due to the energy transition. So existing grid components have to stay in service. The roundtable therefore addressed lifetime extension options for electrical equipment. The outcome of WG 2020-1, which is covering this topic, was briefly presented. Afterwards four experts illustrated their experiences by showing case studies for lifetime extension of switchgears and power transformers. During the following vivid discussion, valuable feedback was also gathered from the audience: For example, the main challenge is not seen in the increasing age, but rather in the increasing loads due to the integration of renewable energies. Also preventive maintenance and monitoring are seen as good approaches to slow down ageing.

RT “Green Network Solutions”

A lot of effort is made on the development of new components that are more respectful of the environment, but this should not lead to neglect the legacy infrastructure: The innovation on self-healing fluids for cable repair presented in 2021 made it to the market, so the variety of old fluid-filled cables which can be repaired is now covers a wide portfolio. The bird life protection experience opens the discussion about the importance of public private partnerships by inclusion of local NGO's. The impact and the interpretation of LCA methods for grid components was discussed. Finally, the holistic view on switchgear design and its impact to standardization was in the focus as well: defining the right mission profile and anticipating not only performance indicators and durability indicators in future. It was shown that the electrothermal losses during the operational life of equipment has a tremendous impact to the overall LCA, even more critical than the use of SF6. Finally, it is very important to monetarize all efforts reducing the ecological footprint of the distribution grid. Here, a large DSO reported on its efforts to reduce the company's carbon footprint while extending the network to meet the challenges of energy transition. Another interesting view was given by a service provider to DSOs and industrial customers: A software solution was presented to evaluate the optimal investment in green network solutions, and it was shown that decision on an ecological investment could be driven by profitability facts.

RESEARCH & INNOVATION FORUM

The RIF Session included 5 presentations of innovative projects: one about the use of AI for MV OHL fault prevention, and four challenges in the field of DC. In this area, questions about the future technologies for DC switching were discussed (using standard fuses, bringing adapted conventional DC CB designs to their limits or applying faster hybrid-/solid-state prototypes ?) and on how protection coordination for DC grids will look like (trade-off between power converters with overcurrent limiting capabilities and external fast DC switches as alternatives to oversizing ?).

POSTER TOURS

2 tours for each of the 4 blocks were completed. Each of the papers received by the session had an opportunity to display and present their poster. Attendance for each tour was between 20 and 40 persons.

CONCLUSIONS

Traditionally guided by the search for technical and economic performance, innovation in components is effectively supported by digitalization and is increasingly part of the energy transition, with adaptation to new uses of electricity and an increased consideration of the environment.