EXECUTIVE SUMMARY

Session 1 – Network components

SUMMARY

Out of 221 submitted abstracts, the Session Advisory Group selected 174 accepted abstracts, which led to 152 submitted articles published at the Conference. The main session and the poster tours have been structured in 4 blocks as follows :

MAIN SESSION A – 4 BLOCKS :

BLOCK 1 : Electrification and disruptive

During session A, six papers have been presented. The two first papers were dealing with transformers: for the first presentation the use of mobile high-power transformer to increase grid resilience has raised a lot of question regarding the easiness of integration and required performances, for the second paper presenting hydride transformer the questions were focused on the discrepancy of lifetime and maintenance between power electronic and the more robust transformer part. The third paper gives an evaluation of the electric field distribution of an AC surge arrester under DC voltage, showing very different localisation of max electric field. The fourth paper gave an overview of the industrial and human efforts mobilized to achieve the delivery, testing and installation of the first commercial superconducting cable in the railway network, the audience was interested in the comparison of losses with conventional technology. The fifth presentation dealt with optimisation of rectifier thanks to multi-pulse architecture. The last presentation was giving an overview of how to change civil work processes at EDP to speed up electrification thanks to direct trenching or horizontal directional drilling.

Block 2 : Diagnostics, sensors and automation

During session B, six papers have been presented. The first presentations explained the latest development and applications of switchgear digitalization, both on primary and secondary side, especially with the adoption of LPIT and IEC 61850. Then, centralized protection and control, with the validation plan of the process bus was detailed in the following paper. The three last presentations were focussed on the cable and network side: with a paper describing the analytics associated to overhead clamp sensors to estimate elongation of cables. The two last paper were dealing with partial discharge: an innovative method for testing critical cale infrastructure, and permanent partial monitoring for the last one.

Block 3 : Context and environment

During session C, six papers have been presented. Current interruption was discussed in the three first papers, with first a characterization on contact erosion in vacuum circuit breaker, and the selection of alternative materials in gas load break-switch nozzle, to replace PTFE. In both cases, they raised question of dielectric recovery after switching. This was also discussed in the next presentation, promoting the use of R-C snubbers, to limit fast front overvoltage, that could damage winding of transformers. Two presentations were dealing with environmental aspects: eco-design optimization methods, and impact of eco-design on use phase of a transformer. The last presentation presented a digital passport to gather all information during the life cycle of a component, as well as data from IoT sensors, that could be accessible to all third parties interacting with the component, though internet and a QR code.

Block 4 : Models and prediction (including ageing)

During session D, six papers has been presented. The first two presentations were dealing with cable system. The first described the different type of thermal models to predict soil temperature from weather conditions, the author précised that the aim is, once a soil model is validated with experiment, to add the cable taking the soil state from the model for given weather conditions. The second paper investigated the impact of harmonics on accessories with high permittivity layer showing that peak electric field are still acceptable even with the presence of harmonics.
In the third paper the influence of dry air insulation on bus bar was investigated with very pure copper with or without silver plating. The chemical analysis revealed no oxidation of the copper but higher content of oxygen at the surface. in the fifth presentation the authors showed that the addition of volt/var monitoring

allow to more accurately predict reduction of lifetime of PV inverter according to the real usage. The last presentation was an attempt to find some correlation between failure on switchgears and PV production from a temporal and geographic point of view. Very week correlations have been found on the hourly data but probably coming more from coincidences that with obvious root causes.

ROUND TABLES

Power Electronics in Distribution Grids : impact, new functions, new technologies, new challenges

This RT coordinated by Uwe Kaltenborn was dedicated to exploring the opportunities and challenges of the power electronics development : DER inverters, converters for most appliances, but also new grid components such as Statcoms. The panel was composed of Frederik Geth fromGridQube, Pierre Lemetayer from Supergrid Institute, Archie Chapman from the University of Queensland, Jun Ting Loh from the University of Applied Sciences Zittau/Goerlitz, Ifedayo Oladeji from Hitachi Energy and Dong Jin Yun from LS Electric.

DC and hybrid AC/DC Networks

This RT coordinated by Gerhard Jambrich discussed the developments of DC equipment in distribution grids. The use cases in which DC development looks promising and the technical path to a complete industrialization of solutions, as well as the economical aspects of the DC development were discussed. The panel was composed of Frederic Reymond Laruina from EDF R&D, Pierre Lemetayer from Supergrid Institute, and Pawel Novak from Schneider Electric.

How Lifecycle assessment (LCA) has changed component design and management, by concrete application examples.

This RT coordinated by George Andreakos explored the changes in equipment design due to environmental footprint, and especially lifecycle assessment. Discussions were held about the footprint evaluation methodology and the different approaches, which could englobe or not sustainability items about raw materials or durability for instance. Different types of equipment were discussed, such as transformers or switchgears. The panel was composed of Thierry Cormenier from Schneider Electric, Samuel Rader from ABB, Filipa Capela from e-redes and Ghazi Kablouti from Hitachi Energy.

RESEARCH & INNOVATION FORUM

6 papers have been presented. A first presentation aimed to compare properties of DC arcing vs. AC, for detection and protection purpose. It highlighted a distinct behaviour in term of energy balance, as well as arc feet displacement, however the influent parameters remained the same, allowing the same effectiveness in protection and detection than in AC (with for sure some adaptation). Another paper on the arc topic aimed to improve black-box electrical arc models (as Cassie or Mayr) to consider the effect of gas blow in a nozzle. This could be a great design tool for the SF6 free solutions. Another interesting paper aimed to develop a new auto-adaptative statistical method to estimate the electric strength during a lightning impulse test series, and to overcome the limits of the well-established up-and-down method. One paper was dealing with cable joint ageing, another with the estimation of an equivalent radial thermal conductivity for bundles of cables. The last paper aimed to monitor the condition of transformers using low-cost vibration sensors, and AI-driven analytics to detect abnormalities.

POSTER TOURS

8 poster tours were held at the conference, each representing 16 to 22 papers. The tours were structured as the main session blocks :

- Morning : Electrification and Disruptive' and 'Diagnostics, Sensors and Automation' : 2 tours each topic
- Afternoon : 'Context and Environment' and 'Models and Prediction (including ageing)' : 2 tours each.

Each tour was accompanied by a SAG member, and the audience was from 15 to almost 40 people. The least followed tours were at the last time slot (Thursday 4:30pm to 6pm), during which some attendees had to leave.

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.