

## EXECUTIVE SUMMARY

### Session 1 – Network Components

#### SUMMARY

Globally, the interest of papers submitted, the quality of discussions, the number of participants show that Session 1 on Networks Components is a unique opportunity to share views between manufacturers, Distribution System Operators (DSOs) and research institutes.

To prepare the networks of the future, new solutions and innovative network components have to be designed and implemented.

A total number of 143 papers have been selected for Session 1 and 24 of them have been presented orally during the main session.

#### MAIN SESSION 1 - BLOCK 1

##### ***Research & Development of Network Components – Cables Systems***

The 5 papers presented in the block 1 were related to the development of new qualification and monitoring methods to increase the level of performances and reliability of cable systems in distribution network. The presentations were focused on the coupling of several constraints on cable and accessories leading to premature ageing or to default identification. The influent parameters identified were giving some guideline for improvement of performances.

#### MAIN SESSION 1 - BLOCK 2

##### ***Research & Development of Network Components – Substations***

The 6 papers selected for oral presentation in this block were related to substitution of SF6 (targeted as a potent greenhouse gas) by, either alternative gases (4 papers), or vacuum interrupter technology as a breaking medium for MV circuit-breakers. The first group of 4 papers presented different solutions developed by major manufacturers of HV and MV switchgear and raised many questions as it appeared that there is no agreement on a single alternative gas that could replace SF6 in all its applications.

#### MAIN SESSION 1 - BLOCK 3

##### ***Solutions for managing the installed base of Network Components – Cables & their environment***

The 6 papers presented were covering the evaluation of monitoring and diagnostic systems (4) as well as methodology to ensure proper specification & installation (2). Lot of interest has been raised by the diagnostic system showing different and affordable routes to get more and more reliable information to manage operation and assets. The question and answers on the mountability of connectors has highlighted the importance and criticality of human parameters to improve the quality. The seek for coherent LVDC approach has shown the most likely first application of LVDC in distribution networks.

#### MAIN SESSION 1 - BLOCK 4

##### ***Solutions for managing the installed base of Network Components – Substations***

Various aspects of the asset management of substations components were addressed by the papers presented in this block: ageing behaviour of MV air insulated switchgear depending on the service conditions in secondary distribution substations, retrofit solutions as an alternative to replacement for life extension of MV switchboards and safety improvement (2 papers), partial discharges and condition monitoring (2 papers) and enhanced thermal ratings for upgrading capacity of power transformers.

## ROUND TABLE 5

### ***Reduction of technical and non-technical losses in distribution networks***

The scope of the round table was to share the approach and main findings of the CIRED working group “Reduction of Technical and Non-Technical Losses in Distribution Networks” (CIRED WG CC-2015-2 – Report to be published a few weeks after the Conference):

- Proposal of a combined definition of losses, which is to help losses management at different steps (from measurement to management and mitigation)
- Statement that Technical Losses (TL) and Non-Technical Losses (NTL) mitigation requires different and specific approaches, and that “Smart” and regulation are boosters, in support of “traditional” approach

Some concrete illustrations have been discussed on NTL traditional mitigation measures, on key role of Data mining in Network Losses reduction, and on new approach on Losses mitigation, from Smart Meters to Smart Networks.

## ROUND TABLE 7

### ***Digital Solutions for Network Maintenance: Drones and Image Processing, Virtual and Augmented Reality, Big Data, Data Analytics and IoT***

To summarize the roundtable two key messages are important: also if the title covers a lot of actual buzzwords, it was exciting to see how toys have developed to affordable tools in the last 5 years. The second important message is that customers are very much focussed on solutions, able to solve problems or adding a remarkable benefit to their business. As most of the technologies were basically known to the auditorium, the discussion could focus on questions towards data security, consolidation of data, integration of non-electronic available data as well as information and result ownership. Another major chapter was the contribution of the new technologies like augmented reality on the personal safety of workers on-site, the improvement of the behaviour of workers in critical environments, and the online support of maintenance staff with technical expertise via new collaborative tools and virtual reality. The topic with longest coverage was dedicated to the experience of the utilities to generate an effective commercial benefit with the integration of these new technologies. As final statement it can be stated that the benefits of the technologies are clearly indicated, local regulations are still a major hurdle to roll out the technologies in an extended framework.

## ROUND TABLE 9

### ***Smart secondary substations, technology developments and distribution system benefits***

The MV/LV secondary substations are becoming an increasingly strategic feature of networks in order to improve the quality of the service thanks to the possibility to monitor capacity flows, manage renewables and the automation and control of networks.

In particular, during the meeting the results of a work group dedicated to innovation of the main components of MV/LV substations, equipment for medium and low voltage, MV/LV transformers, automation and control systems were illustrated. These instruments enable the evolution towards a concept of ‘smart’ secondary substations: an innovative model that provides a high level of automation, improving system efficiency, the quality of the service (faster resolution of faults and other problems) and the resilience of the networks, while meeting the requirements of the regulatory authority. Digitalizing the infrastructure means, moreover, collecting a large quantity of data that, once elaborated, enables predictive and management activities with notable positive effects in terms of costs and decision-making.

## RESEARCH & INNOVATION FORUM SESSION 1

The 8 papers selected for presentation in the RIF covered a variety of topics related to research and innovation activities in the field of network components: application of data analysis algorithms (for prediction of remaining life of batteries, fault diagnosis of circuit-breakers, accurate thermal modelling

of transformers), new testing facilities (power hardware in the loop, combined testing), experimental methods (for arc plasma diagnosis or thermal measurements in-situ) and development of new materials for cable insulation.

### **POSTER TOURS**

Two guided interactive poster tours have been organised for each block. An average number of 30 delegates attended each tour.

### **CONCLUSIONS**

The sessions gave a broad view of the on-going innovation in the field of network components. Five main drivers can be identified and were covered during the Conference.

- Energy transition: new components such as innovative sensors or voltage regulation devices are needed to allow the connection of intermittent decentralised generation and the development of e-mobility.
- Digital revolution: a wide range of new solutions for the maintenance of networks are developed. A very successful dedicated round table was organised on this topic, but the impact of the digital revolution was also covered by a large number of papers.
- Efficiency of network operation, asset management and cost reduction: solutions for components monitoring, condition assessment and diagnosis methods are being constantly improved and bring benefits to operators and their customers.
- Environment protection: different options for SF6 alternative gases were presented, compared and discussed, together with vacuum technology.
- Workers' health and safety: innovative solutions were presented on this issue which is the first priority of all network operators.

The change in the pace of innovation associated to the digital revolution was quite noticeable as some solutions presented in Glasgow and already used in the field were not even mentioned two years ago in Lyon. It seems clearly that our "traditional" industry got organized to take full advantage of all the opportunities it may bring. In this evolving context, an effective cooperation between equipment manufacturers, DSOs and research institutes is, more than ever, a key factor to design and implement the innovative solutions which are needed.