EXECUTIVE SUMMARY
Session 5 – PLANNING AND SYSTEM DEVELOPMENT

SUMMARY

The session published 132 high quality papers divided into four blocks. The acceptance rate from abstracts to publication is around 50%. The attention of researchers has been largely attracted by demand and production flexibility in distribution systems. Models for load and generation forecast to exploit the "atomic" knowledge of the customers' behaviour gathered with smart meters have been proposed. Finally, the inclusion of flexibility in development and planning studies has enforced the need of probabilistic – risk oriented models with an updated greater attention to LV systems.

MAIN SESSION 5 - BLOCK 1
Risk assessment and asset management

Two papers have been presented on this topic. The discussion was about the interoperable and vendor independent system, homogenous with the core 61850 operational functions of the devices, to enable an efficient management of the equipment inventory as proposed by EDF R&D. The main debate was if IEC 61850 is capable to connect Intelligent Electronic Devices spread out of primary substations. According to the authors, IEC 61850 is the best standard for creating a database of IED's within companies but activities are still necessary for full interoperability.

MAIN SESSION 5 - BLOCK 2
Network development

Seven papers have been discussed in the Session. The first point of discussion is about the role that ICT systems have gained in guiding and influencing the design of power distribution system. The general conclusion is that communication systems are not an add-on of the power system. They are part of the system. The best network development can be achieved by considering the mutual interactions of both systems with particular reference to continuity of service, reliability and resiliency. The development of the system to cope against extreme weather events has been also dealt with. The general remark is that the probability of extreme events is growing, and network development should consider those events in expansion/reinforcement plans with strategic guidelines and raodmaps that involve all stakeholders.

MAIN SESSION 5 - BLOCK 3
Distribution planning

Eight papers have been presented. The role of demand flexibility was deeply discussed since it can completely change the results of distribution planning. Lacking in considering demand flexibility, storage and local generation can result in non-optimal development plans. Low voltage distribution has to be included in planning studies making data analytics a necessity not an opportunity. Huge amount of data cannot be used without filtering the information that distribution planning needs. LV and MV DC architectures are valuable options to include in development plans. Finally, the radial operation of distribution systems, used for decades in distribution systems, can be re-thought. Meshed operated networks can avoid huge investments for increasing hosting capacity. ICT is the enabling technology for new fast and selective protection systems towards closed loop networks.

MAIN SESSION 5 - BLOCK 4
Methods and tools

Eight papers have been presented dealing with many interesting topics related to methods and tools for network development. The discussion focused on the role of flexibility and demand in planning and on methods that are suitable to engineers and not only to academics. Storage for network services only and for increasing flexibility needs accurate cost-benefit analysis since cheaper options can be used. Demand forecast on different time scales, capable to capture the participation of customers or of aggregation of customers is crucial. Research is doing a lot of work in this field as confirmed by the valuable discussion held, but more studies are still necessary. Information from second-generation smart meters should give a strong impulse in this direction. The better knowledge of loads can also allow to implement simple actions such as the conservative voltage reduction that can have many

positive effects on distribution systems provided that the correlation between voltage and current and energy required by loads is suitable.

ROUND TABLE 6

Requirements for smart, flexible, future power system architectures

RT 6 was chaired by Graham Ault (UK) with contributions from Konstantin Staschus (Germany), Lars Jendernalik (Germany), Mark McGranaghan (USA), Robbie Aherne (Ireland) and Mike Kay (UK). The main topics covered the comparison of power system architecture challenges in USA and Europe to face RES and DER integration, flexible demand and other major changes. The discussion was about the role of TSO and DSO with new architectures, interoperability of devices and technical solutions.

ROUND TABLE 8
Innovative grid architectures and control strategies for 2030+ power systems

RT 8 was chaired by Luciano Martini (Italy) with contributions from Helfried Brunner (Austria), Alexander Prostejovsky (Denmark), George Kariniotakis (France) and Stephen McArthur (UK). Concepts as fractal networks, Web of Cells, Autonomic Power systems have been illustrated with particular attention to practical applications for RES and DER integration. Discussion topics covered the application in developed countries where only brown-field development can be expected, and the current legislation as well as regulation that are not completely ready to accept some of these terrific changes.

ROUND TABLE 15
Blockchain: which use cases in the energy industry

RT 15 on the usage of electronic money in power distribution was chaired by Diego Dal Canto (Enel, Italy) with contributions from Carsten Stoecker (Germany), Gerhard Gamperl, (Austria), Joseph Stanley (UK), and Paul Ellis (UK). Preliminarily, blockchain and electronic money were introduced and explained to the audience. Then, with the aid of advanced application cases the benefit and the importance of electronic money have been shown. The discussion was about why this new way of payment with electronic cash can allow opening new local markets (flexibility and service markets, electric vehicle charge, etc.)

RESEARCH & INNOVATION FORUM SESSION 5

Six oral presentations led the discussion deeply on the use of probabilistic methodologies as well as on the application of analytical and heuristic techniques for optimal distribution design and planning. Analytical models with suitable decompositions (e.g., Bender's one) can be successfully applied thanks to the availability of efficient and accurate solvers. The applications proposed in this domain span from the classical feeder routing to the integrated planning of microgrids. Anyway, analytical methods need many assumptions in real optimization problems. Heuristics and artificial intelligence represent the quickest and the simplest way to solve complex optimization problems. Computation time and poor control on the quality of results are typical issues to be fixed. The discussion proved both techniques have pros and cons. In this context, the greatest effort should be paid in incorporating the probabilistic behaviour of generation and demand with accurate, real scale models.

POSTER TOURS

Eight poster tours were organised. The topics were the same as the ones addressed during the main sessions. On average, twenty persons were active at each tour interacting with authors with valuable comments and questions.

CONCLUSIONS

The papers, presentations, posters, round table discussions and other contributions across all Session 5 activities have been of high quality. It is my great pleasure to report good levels of engagement from participants in main sessions, poster tours, round table and RIF sessions and this emphasises the topicality, diversity and quality of contributions. The CIRED app enabled interaction and has created a participative, open and quality platform for contribution at the sessions. With regards to the technical content and prospective topics, the inclusion of demand flexibility at all stages of distribution business should be further tackled as well as the challenges related to data analytics.