

EXECUTIVE SUMMARY

Session 4: Distributed energy resources and active demand integration

SUMMARY

The paper review process delivered 125 high quality, diverse papers for the conference proceedings in Session 4. The Main Session featured 20 papers selected on the basis of particularly high quality and relevance. Most other papers featured in the Research & Innovation Session and Poster Sessions. The papers spanned the many challenges of adapting distribution networks to facilitate the integration of low carbon, renewable and distributed energy resources (DER) including distributed generation (DG), energy storage, new loads (e.g. electric heating and electric vehicles), active demand, and aggregation of DER (e.g. Virtual Power Plants).

Of particular interest in the session papers and discussions were the technologies and solutions for the smart, flexible integration and utilisation of energy storage, electric vehicles, generation, responsive demand and active customers into existing distribution grid infrastructure and the provision of services to multiple stakeholders. Much progress on technological and commercial solutions is evident and with many important topics emerging to underpin successful wide deployment. Ongoing and emerging topics for Session 4 include the technical aspects of DER flexibility, DSO roles and responsibilities, DER market participation, transmission interaction management, decentralisation of control, interaction with other energy vectors and network infrastructures, the rise of EVs and the use of smart meter data for state estimation and hosting capacity assessment.

MAIN SESSION 4: Block 1

DER concepts, designs, studies, planning, analysis techniques and tools

The papers presented in this block covered several significant new topics in DER and active demand integration. The topics presented included Transactive Energy, TSO-DSO Interaction, Energy Storage, Flexible DG connection and operation, and the interoperability and standardisation of metrics for laboratory testing. A wide ranging discussion touched on market design for DER services, revenue stacking and customer information and interaction.

MAIN SESSION 4 - BLOCK 2

DER grid integration enablers

The papers featured in this block included enhancing DG hosting capacity analysis with distribution system measurements, state estimation and co-simulation with emphasis on Demand Response. The discussion covered issues related to data gathering, including the minimum number of smart meters and their location on a network that will allow state estimation to be performed accurately, on the trade-off between the investment and maintenance cost associated with the deployment of equipment allowing for aggregated PV and the benefits accrued through that control, including the resulting hosting capacity increase associated with active control methodologies and on model/control assumptions.

MAIN SESSION 4 - BLOCK 3

Technical and commercial DER grid integration methods and solutions

The papers presented in this block covered energy storage charge/discharge control strategies, reactive and active power control from DG in MV networks, public car park EV aggregated service provision, grid scale batter storage trials and flexibility estimation and mapping. The discussion covered issues of business cases for the different approaches presented, ICT requirements as enablers for the solutions, participating DER capacity and network voltage level, control constraints and model/control assumptions.

MAIN SESSION 4 - BLOCK 4

DER integration field trial results, tests and standards

The papers in this session included the results from significant field trial and deployment projects covering DSO-TSO cooperation, wind farm stability contribution, demand side management and

energy storage. One clear outcome from the paper presentations and discussion is that it is possible to demonstrate and quantify Demand Response and Demand Side Management potential from different demonstration projects, sites and countries and show an interesting level of potential for further development and roll-out.

ROUND TABLE 11

Flexibility from DER: Generation, storage and responsive demand

This Round Table on DER flexibility was chaired by Marcus Merkel (EWE-Netz, Germany) with speakers Enno Weiben (EWE Netz, Germany), Sotiris Georgiopoulos (UK Power Networks, UK), Goran Strbac (Imperial College, UK), Graham Ault (Smarter Grid Solutions, UK/US) and Gonçalo Faria (EDPD, Portugal). A wide international sweep of the requirements, progress and emerging topics on DER flexibility was covered including Germany's 3% flexibility/curtailment rule, the value and increasing significance of flexibility, deployment of flexible generation connections in the UK, platforms and technologies for flexibility and the role of storage. Discussion highlighted the customer, compensation and market services, structures and rules for the development of flexibility.

ROUND TABLE 13

DER enabled local system management and microgrids

This Round Table on local systems and microgrids was chaired by Goran Strbac (Imperial College, UK) with contributions from Stewart Reid (Scottish & Southern Energy Networks, UK), Fernanda Resende (INESCTEC, Portugal), Peter Jones (ABB, UK) and Ioannis Vlachos (NTUA, Greece). Topics included the technologies (equipment and control solutions) to deliver microgrids, the role of energy storage in microgrids, operational experience around the world (from Australia to Alaska) and the long experience of microgrids on the Greek archipelago. Discussion topics included operational responsibilities in microgrids, managing the grid to island transition in operations, the role of microgrids in utility, grid connected microgrids, security/reliability and black start in microgrids, and the role of Demand Response in microgrids.

RESEARCH & INNOVATION FORUM SESSION 4

13 papers were presented in 5-minute presentations to enable a wide set of emerging research and innovation topics to be presented and discussed. The topics presented were optimisation of residential electrical and thermal storage, prosumer 'decoupling' from system with energy storage, reactive power provision from converters in EV chargers, operational planning to schedule industrial demand response to address MV network constraints, holistic/coordinated approach to energy storage in urban areas, LV storage forecast for storage scheduling for peak reduction, seasonally variant deployment of storage (for winter peak shaving and summer PV energy capture), contribution of energy storage and demand response to security, maintaining voltage quality in LV network with high PV penetration using OLTC MV/LV transformer, unified control of flexible generation and load, an automatic phase identification algorithm using smart meter data, enhancing residential demand forecasting from disaggregation of PV and load, and energy storage active/reactive power control coordination for multiple flexibility service provision.

POSTER TOURS SESSION 4

8 poster tours provided two opportunities for group discussion at every poster in each of the four blocks displayed in the interactive section. The posters covered the full spectrum of blocks and topics reported in the Special Report from the earliest stage research concepts to full field trial of new approaches and equipment for DER integration and management. Approximately 25-30 authors and other participants joined each tour.

CONCLUSIONS

The papers, presentations, posters, round table discussions and other contributions across all Session 4 activities has been of a high quality. It is pleasing to report high levels of engagement from participants in main sessions, poster tours, round table and RIF sessions and this emphasises the topicality, breadth and quality of contributions. The CIRED app enabled interaction has created a participative, open and quality platform for contribution at the sessions.