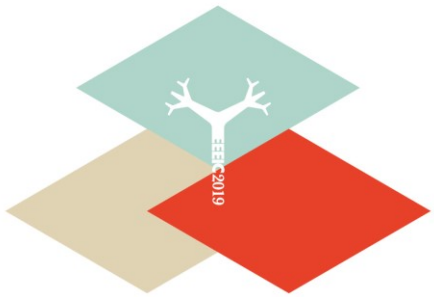

3RD IEEE I&CPS EUROPE
INDUSTRIAL AND COMMERCIAL POWER SYSTEM EUROPE

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INTERNATIONAL CONFERENCE ON ENVIRONMENT AND ELECTRICAL ENGINEERING

SPECIAL SESSION

CONTROL AND MARKET SOLUTIONS FOR FLEXIBLE DEMAND RESPONSE

ORGANIZED AND CHAIRED BY:
Dr. Vincenzo Trovato
Research Engineer at EDF R&D UK Centre - London
Visiting Researcher at Department of Electronic & Electrical Engineering, Imperial College London (1)
Dr. Antonio De Paola
Lecturer at Department of Electronic & Electrical Engineering, University of Bath (2)

CONTACT EMAIL:
(1)**vincenzo.trovato@edfenergy.com** (2)**a.de.paola@bath.ac.uk**

OBJECTIVE AND TOPICS

Electricity grids are experiencing an unprecedented transformation following the continued growth and promotion of Renewable Energy Sources (RES) to diminish the share of traditional carbon-intensive generation. Renewable sources are typically intermittent and unpredictable. In their standard configuration, they reduce system inertia and offer limited capability to support system frequency control. Furthermore, RES are often connected to the low voltage distribution network, e.g. Photovoltaic Panels (PVs) installed on houses' rooftops and feeding the local demand. Hence, transmission system operators in charge of network operation and security may not be able to control and dispatch such a distributed generation.

The transition towards a low-carbon system has opened up the range of innovative technologies to enable a secure and efficient system operation. Alternative sources of control and flexibility are progressively replacing traditional providers of ancillary services. In particular, tapping into the collective flexibility offered by domestic storage (e.g. static batteries as well as electrical vechicles with V2G technology) and "smart" appliances (e.g. thermostatically controlled loads) has large potential benefits. These technologies may profit from the provision of a variety of services to the power system. Time-dependent tariffs or direct access to wholesale electricity markets may encourage them to realise energy arbitrage, consuming more energy when the electricity prices are low and less when they are high. Other applications include frequency services, where it is possible to provide short-term balancing services, either quasi-continuously to balance a generation and demand mismatch or in response to large frequency deviations.

However, in order to fully realize this significant potential, many open questions need to be addressed. At an operational level, it is not clear how to coordinate large numbers (potentially millions) of new loads and devices with paradigms that are scalable and robust to uncertainties (both exogeneous and endogenous). It is crucial to devise control schemes that align the global objectives of the system (reduced operational costs) with the local goals of large numbers of customers (lower electricity bills). Ongoing research on this topic is split mainly between two fundamental approaches. A cooperative coordination envisages the need for intermediate entities - such as aggregators - to trade demand side flexibility and distribute the aggregate profit. This approach may benefit from lower implementation requirements and a closer alignment to the current regulatory framework. On the other hand, a competitive approach would let individual assets trade their own flexibility, achieving "fair" market equilibrium solutions. Regardless of the choice between a competitive or cooperative approach, research has demonstrated the value for demand side response under distributed control implementations, i.e. where the control actions are implemented locally.

In parallel, a consensus still has to be reached on the most suitable market paradigms to fully integrate new entities such as aggregators, private customers and DSOs. Clear business models are required to facilitate investments in demand side applications and develop an optimized portfolio of new technologies. Many countries are now positively experiencing the roll out of new fast frequency response products, which foster and effectively reward the higher degree of flexibility associated to demand response actors. Moreover, several studies have revealed the benefits of integrating wholesale electricity markets with various ancillary services.
The proposed special session offers a compounded vision of the main issues and developments around the deployment of demand side actions in future low carbon power systems. The session brings together leading researchers from French, Dutch, British and Australian institutions (including industrial partners) and presents advances and challenges of novel control and market solutions for demand response.

Topics

- Demand side response
- Flexibility in low carbon power systems
- Electricity markets
- Energy storage
- Distributed control
- Multi energy vectors
- Thermostatically controlled loads
- Integration of electrical vehicles in smart grids
- Optimization techniques
- Game theory
- Distributed energy resources
- Numerical methods
- Distributed storage planning and management
- Solar and wind power integration

All the instructions for paper submission are included in the conference website: https://www.eeeic.net/eeeic