



Guest Editorial : Local energy markets for local energy systems integration

1 | INTRODUCTION

In the transition to carbon neutrality, conventional energy systems are experiencing a radical change with the proliferation of distributed energy resources (DERs), including distributed generation (especially renewable power generation), energy storage, flexible demand and electric vehicles. With the support of advanced control, information and communication technologies, DERs in nearby geographical areas form local energy systems (LESs) for facilitating local power and energy balance and supporting the operation of bulk energy systems. Local energy markets (LEMs) are potential arrangements for achieving effective and efficient management of LESs and further paving the path towards fully transactive energy systems.

This Special Issue focuses on LEMs for LES integration, including four papers covering different key aspects. The brief description for the papers is presented as given below, and we encourage the readers to refer to the papers for more details.

2 | PAPERS IN THE SPECIAL ISSUE

Virtual power plants (VPPs) are an important framework where DERs can be grouped to participate in both local and bulk energy markets. There are two papers on VPPs in this Special Issue. In the paper 'Aggregating buildings as a VPP: Architectural design, supporting technologies, and case studies', Luo et al. focussed on industrial/commercial/residential buildings and designed a comprehensive architecture of building VPPs with the relevant key supporting technologies identified. One prominent contribution of the proposed architecture is identifying the need for interaction between VPP management systems and existing building energy systems and the associated Internet of Things (IoT) devices, with good sense of practical application. Besides the well-known technical VPPs and commercial VPPs, Luo et al. also proposed 'occupant-centric VPPs' (O-VPPs), which is able to facilitate local energy sharing, resilience enhancement and energy usage knowledge sharing among buildings.

The other paper on VPPs is 'Virtual Power Plant (VPP) scheduling with uncertain multiple locational marginal prices (LMPs)'. This paper focussed on another important practical issue when applying VPPs in practice—the DERs managed by a

VPP may be located in different parts of an electricity transmission network, thus faced with different levels of LMPs. Khandelwal et al. proposed a scheduling framework that tackles this issue, and at the same time considering the correlated price uncertainties and addressing them using the Markowitz's mean-variance criterion.

Local electricity markets are the most heavily researched LEMs. The paper 'Hosting a community-based local electricity market in a residential network' established a simplified modelling approach where the market and network model simulations are performed in a cascaded and decoupled fashion. Saif et al. evaluated the network impact of the local electricity market and the implications of different types of DERs (mainly photovoltaics and energy storage) on the outcome of local electricity market.

Local energy markets involve multiple energy sectors and even wider sectors like transportation, and also need to be supported by advanced information and communication technologies. In the paper 'Information and communications technology (ICT) infrastructure supporting smart local energy systems (SLES): A review', Vedantham et al. provided a comprehensive review of ICT infrastructure supporting SLES, based on a systematic survey of existing research work and industrial projects. Various SLES measurements were described and categorised for various energy carriers and technologies, and communications infrastructure for SLES was described with various communication technologies summarised. Moreover, the ICT infrastructures for SLES were categorised and summarised based on their objectives and technologies. Finally, the challenges and recommendations were presented. The findings from this paper can serve as a convenient reference for developing future SLES.

3 | CONCLUDING REMARKS

Local energy markets for LES integration are an emerging research area at the cutting edge. Although a lot of research and practice have been conducted by both the academia and industry globally, they are still not enough, and the large-scale deployment of LEMs in practice is still faced with many challenges with a long way to go. Local energy markets and LES integration are a part of the fundamental change of future


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energy supply paradigm towards zero carbon emissions, needing and our continuous efforts.

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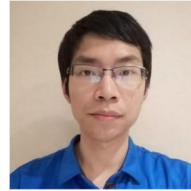
DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

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