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Editorial

Distributed Energy Resources Management

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1. Introduction

The impact of distributed energy resources in the operation of power and energy systems is nowadays unquestionable at the distribution level but also at the whole power system management level. Increased flexibility is required to accommodate intermittent distributed generation and electric vehicle charging. Demand response has already been proven to have great potential to contribute to increased system efficiency while bringing additional benefits, especially to consumers. Distributed storage is also promising, particularly when used jointly with photovoltaic (PV) panels.

This Special Issue addresses the management of distributed energy resources, which is increasingly important to ensure sustainable and efficient power and energy systems. The issue focuses on methods and techniques to achieve optimized operation, aggregate the resources by means of virtual power players, and remunerate them. The integration of distributed resources in electricity markets is also addressed as a main path for the efficient use of resources.

The topics of this Special Issue include the following:

- Demand response
- Distributed energy resources
- Distributed generation
- Electric vehicles
- Energy resource optimization
- Energy storage
- Intelligent resource management
- Renewable energy sources
- Smart grids

Thirteen research papers have been published in this Special Issue. The following statistics apply:

- Submissions: 23; published: 13; rejected: 10
- Average article processing time: 58.76 days
- Authors' geographical distribution:
    - Spain (3), Portugal (3), China (3)
    - Korea (2), Denmark (2)
    - Italy (1), USA (1), Japan (1), India (1), Brazil (1)

2. Contributions

This paper provides a summary of the *Energies* Special Issue covering the published articles [1–13], which address several topics related to distributed energy resources management. Table 1 identifies the most relevant topics in each publication; most of them cover three or more topics.

Table 1. Topics covered in each publication.

Topic	References												
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
Demand response		x	x	x			x	x		x		x	x
Distributed generation	x		x		x	x	x	x	x				x
Operation and control	x			x	x	x			x	x	x		
Electricity markets and aggregation		x	x					x				x	x
Energy storage		x			x	x	x						
Intelligent resource management	x			x	x	x	x		x				x
Renewable energy sources		x	x			x			x			x	
Laboratory simulation	x			x									
Total	**3**	**4**	**4**	**4**	**4**	**5**	**4**	**3**	**4**	**2**	**1**	**3**	**4**

One can see that, regarding the type of resources, most of the publications focus on demand response and distributed generation. Energy storage is also included in four papers. Looking at the proposed methods and/or addressed problems, most of the papers are dedicated to operation and control aspects and intelligent resource management. Electricity markets and resource aggregation are addressed in five papers. Specific challenges of integrating renewable energy sources are addressed in five papers. Finally, two papers make relevant contributions regarding laboratory simulation with some hardware for emulating power system components.

Reference [1] proposed a coordinated distributed control strategy for a hybrid AC/DC microgrid, taking into consideration several resource characteristics. A two-level control structure was developed, with local controllers linked to a central controller and a central controller that performs the energy management.

With a deep focus on demand response and aggregation, the authors of [2] developed a method of producing optimal bidding curves for an aggregator participating in day-ahead and intraday markets, with the objective of minimizing the costs of purchasing energy. The three-step approach involves optimal bidding to the day-ahead market, after the day-ahead market clearing when rescheduling is fulfilled, and new optimal bidding to the intraday market, taking advantage of the lower marginal prices.

Another perspective on energy trading and pricing is provided in [3], which formulates a hierarchical game between the energy provider as the leader and consumers as the followers. The uncertainty of the energy supply is also considered.

As seen in Table 1, one relevant topic for this Special Issue is simulation, which was addressed in [1,4]. Reference [4] presented a platform with real-time simulation skills adequate for demand response and distributed generation. The integration of centralized and distributed control approaches is discussed and validated through the emulation of power system components for a more realistic simulation of the microgrid and the validation of the computational models. A virtual power player manages the resources, aiming at minimizing operational costs.

A microgrid operation methodology was proposed in [5]. The economic operation strategy is devoted to both normal and emergency operation modes. Without a central controller, the proposed methodology is able to minimize the global operation cost. Looking more specifically at combined heat and power (CHP) generation, the microgrid operation costs were minimized in [6] by using the Lyapunov approach. Fault location detection is addressed in [11].

A multiagent-based approach is used in [9], supporting a decentralized method for microgrid restoration. In the proposed approach, local controllers are assigned to specific agents. The available information on generation and consumption is used to establish the best sequence for the restoration.

In [7], a predictive dispatch model was used for home energy management, and the uncertainty of PV generation is modeled by the InterStoch hybrid method. In the first stage of the method, day-ahead energy management is performed. The second stage runs in real time.

From a different perspective, the discomfort costs associated with demand response and the generation costs are minimized in [10]. The discomfort costs are formulated based on Fanger thermal comfort.

Moving to large-size consumption and generation, reference [8] applied the cat swarm optimization technique to a demand–response-based unit commitment, including a real-time-based demand response program that is used during peak hours. The developed approach makes it possible to maximize the profit of both generation companies and demand response providers.

A case study of the Nordic electricity market was presented in [12]. It includes a strengths, weaknesses, opportunities, and threats (SWOT) analysis of four business models devoted to building participation in demand response programs. There is also a focus on aggregation aspects.

Finally, reference [13] presented a methodology addressing the rescheduling of resources in a sequence of the definition of a new aggregation and remuneration process. A representative tariff for each group of distributed energy resources is obtained.

Conflicts of Interest: The authors declare no conflict of interest.

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