

# Distributed Energy Resources Management 2018

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## 1. Introduction

The Special Issue “Distributed Energy Resources Management 2018” includes 13 papers [1–13], and is a continuation of the Special Issue “Distributed Energy Resources Management” published in [https://www.mdpi.com/journal/energies/special\\_issues/distributed\\_energy\\_resources\\_management2018](https://www.mdpi.com/journal/energies/special_issues/distributed_energy_resources_management2018). The success of the previous Special Issue, for which the summary is published in [14], shows the unquestionable relevance of distributed energy resources in the operation of power and energy systems at both the distribution level, and at the wide power system level. Improving the management of distributed energy resources makes possible the accommodation of a higher penetration of intermittent distributed generation and electric vehicle charging stations. Demand response (DR) programs, particularly the ones with a distributed nature, allow for consumers to contribute to increased system efficiency while receiving benefits.

This Special Issue addresses the management of distributed energy resources with a focus on methods and techniques to achieve optimized operation, to aggregate resources within the scope of virtual power players and other types of aggregators, and to remunerate them. The integration of distributed resources in electricity markets is also addressed as an enabler for their increased and efficient use.

The topics of this Special Issue include the following:

- DR;
- electricity markets;
- renewable energy integration;
- real-time simulation;
- smart grids; and
- virtual power players.

13 research papers have been published in this Special Issue, with the following statistics:

- Submissions: 16; published: 13; rejected: 3.
- Average paper processing time: 43.98 days.
- Authors’ geographical distribution: Belgium (1), China (1), Korea (1), Portugal (5), Slovakia (1), Spain (4), The Netherlands (1).

## 2. Published Papers Highlights

This paper provides a summary of the Special Issue of *Energies* 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 of the 2018 Edition. These topics have been selected by the Editors as the most relevant among the 13 papers published.

**Table 1.** Topics covered in each publication.

Topic	Publication												
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
Demand response (DR)	x			x	x		x				x	x	x
Distributed generation	x	x	x		x		x	x	x	x			x
Electricity markets and aggregation	x	x	x	x	x								x
End-users and their comfort	x			x	x	x		x			x	x	
Energy storage				x				x	x				x
Intelligent resource management	x		x			x	x			x			x
Operation and control		x				x	x	x	x	x			
Renewable energy sources			x		x				x	x			
<b>Total</b>	<b>5</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>2</b>	<b>3</b>	<b>4</b>

As shown in Table 1, most of the publications focus on DR and distributed generation, while four papers include energy storage. Most of the papers are dedicated to end-user aspects, namely consumer comfort, and to electricity markets and resource aggregation.

In the work presented in [1], Faria et al. presented a methodology to schedule distributed energy resources in order to minimize operation costs. While the focus is given to DR programs, distributed generation units were also addressed. The consumers and the generation units were aggregated using clustering methods in order to establish remuneration groups.

A multi-agent coordination scheme was proposed by Castillo-Cagigal et al. in [2] with a deep focus on contexts of high penetration of renewables, mainly photovoltaic generation. Swarm intelligence and coupled oscillators were combined in the innovative methodology using the SwarmGrid algorithm. The objective was to increase the stability of and reduce stress on the electrical grid, allowing for an increase in renewables penetration.

Gao et al. [3] proposed a bidding mechanism that enables a virtual power plant (VPP) to internally find the resources needed for each context, considering uncertainties. A multi-agent and game theory-based approach was used in a double-layer nested dynamic game bidding model. The game played between the VPP and the internal resources was played with the goal of maximum self-interest.

From a market perspective, Minniti et al. [4] provided insights into the most important aspects that can enable flexibility trading. The current implementation of aggregators in Europe is discussed, pointing out that there is a long way to go before the desired situation was achieved.

Song [5] et al. presented a multi-disciplinary study of distributed resources in China. A comprehensive benefit evaluation index system was developed, and the benefits are evaluated through a case analysis.

Smart buildings are addressed in [6]: Casado-Vara et al. proposed the use of continuous-time Markov chains and a cooperative control algorithm in a novel model-based predictive hybrid control algorithm. The maintenance and reliability of an internet of things network was improved by optimal sensor positioning, and by replacing the sensors that the algorithm predicts will not properly work in the future.

With focus on microgrids, demand side management was managed using a multi-objective approach proposed by Singh and Jha in [7]. Usability indices (peak shaving for example) were determined in order to analyze the contribution of demand side management to the optimal operation of the microgrid.

Moon et al. [8] proposed a method for real-time active power control in a microgrid with energy storage systems and diesel generators operating in island mode. Distributed energy resources were managed in order to ensure an active power balance while keeping the frequency and voltage within determined levels.

In [8], the energy storage unit was addressed as a resource for diesel generators that contribute to maintaining an active power balance in real-time. In [9], Galván et al. proposed a method to optimally schedule the energy storage unit in a microgrid based on priorities. The battery's state of charge was properly considered, and a particle swarm approach is used to find the optimal solution.

A control framework for the strategic operation of wider distribution networks was proposed by Kotsalos et al. in [10]. The proposed approach addressed a large set of distributed energy resource types, namely photovoltaics, energy storage, electric vehicles, and controllable loads. The objective was to improve the integration of renewable resources while keeping within the bounds of the voltage and the load in the secondary substation.

In the review presented in [11], Šujanová et al. discussed several methods for the evaluation of the comfort levels in buildings. The paper highlighted the need for a human-centric design of the built environment, where the efficiency of technology can be measured only if it is successfully implemented and used by a building's occupants.

In [12], Gazafroudi et al. proposed an agent-based approach for energy trading at the local level. The proposed iterative approach allowed for interaction between end-users and the distribution network operator. The developed algorithm is also adequate for energy resource aggregators.

Finally, in [13], optimal energy resource management at the residential house level was obtained using particle swarm optimization, as proposed by Faia et al. The energy storage unit was managed by considering the available photovoltaic generation, the energy cost, and the use of flexible loads.

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