processes

MDPI

Editorial

Special Issue on "Multi-Period Optimization of Sustainable Energy Systems"

Jui-Yuan Lee [1,*], Adeniyi Jide Isafiade [2] and Yongzhong Liu [3]

[1] Department of Chemical Engineering and Biotechnology, National Taipei University of Technology, Taipei 10608, Taiwan
[2] Department of Chemical Engineering, University of Cape Town, Rondebosch 7701, South Africa; aj.isafiade@uct.ac.za
[3] Department of Chemical Engineering, Xi'an Jiaotong University, Xi'an 710049, China; yzliu@mail.xjtu.edu.cn
* Correspondence: juiyuan@ntut.edu.tw; Tel.: +886-2-2771-2171 (ext. 2524)

check for updates

Citation: Lee, J.-Y.; Isafiade, A.J.; Liu, Y. Special Issue on "Multi-Period Optimization of Sustainable Energy Systems". *Processes* **2022**, *10*, 1386. https://doi.org/10.3390/pr10071386

Received: 1 July 2022
Accepted: 13 July 2022
Published: 15 July 2022

1. Introduction

Sustainable energy systems are an essential response to climate change challenges. Important measures include energy efficiency enhancement, the increased use of renewable energy, and carbon capture and storage. A holistic management system would thus be necessary to integrate these initiatives for a low-carbon-emission society for climate-resilient economic growth. Systematic methods for the optimal synthesis, design, and operation of efficient, low-carbon energy systems have been developed. Efficient and multi-functional energy systems are considered an important engineering solution to reduce carbon emissions. For example, polygeneration systems can take advantage of *process integration* from the simultaneous production of multiple products, thereby achieving improved fuel efficiency and reduced carbon emissions. The integration of renewables into the energy mix can achieve similar benefits. *Process Systems Engineering* (PSE) methods can be applied to the synthesis of such sustainable energy systems, which may need to be designed with multi-period consideration to account for variations in product demand and resource availability, as well as changes in external factors such as electricity price.

This Special Issue, entitled "Multi-Period Optimization of Sustainable Energy Systems", aims to curate novel advancements in the development and application of PSE methods and alternative tools to address longstanding challenges in the synthesis and design of sustainable energy systems for multi-period operations. Three contributions addressed multi-period optimization for negative-emission polygeneration plant design [1], biorefinery supply network synthesis [2], and inter-plant hydrogen integration [3]. In addition, two contributions dealt with multi-objective optimization for the allocation of distributed generation (DG) and electric vehicle charging stations (EVCSs) [4] and multi-stage membrane separation system design [5].

2. Brief Synopsis of Papers in the Special Issue

Pimentel et al. [1] employed the P-graph framework for the design of polygeneration plants with negative-emission technologies (NETs). In their case study, a polygeneration plant which integrated NETs to further reduce the carbon footprint was synthesized for multi-period operations. Potrč et al. [2] developed a multi-period optimization model for the synthesis of a biorefinery supply network with the objective of maximizing sustainability profit. Their case study evaluated the capabilities of countries in the European Union to meet the renewable energy target in the transport sector by 2030. Han et al. [3] developed a simultaneous optimization approach to the design of multi-period inter-plant hydrogen networks for the minimum total annualized cost. They presented an industrial case study of a three-plant hydrogen network to demonstrate their approach.

Liu et al. [4] established a DG-EVCS bi-level joint planning model for the coordination of a distribution network and proposed an improved harmony particle swarm optimization (PSO) algorithm to solve the bi-level model. Their method was tested using a case study of two distribution systems. Su et al. [5] presented a superstructure-based optimization model for the design of multi-stage membrane separation systems and used a case study of the separation of a bagasse hydrolysis solution to demonstrate the application of their model.

Polimeni et al. [6] proposed a two-layer hierarchical energy management system for islanded photovoltaic (PV) microgrids. The first layer was used to evaluate the optimal unit commitment, and the second layer dealt with the power-sharing in real time. Their energy management system was experimentally tested under three PV forecast models. Zhang et al. [7] used the density-based spatial clustering of applications with noise (DBSCAN) algorithm to identify the outliers in the wind power and wind speed data and used linear regression to correct the outliers for improved prediction accuracy. The authors then carried out short-term wind power prediction using a back-propagation neural network optimized using the genetic algorithm. Hernández-Gómez et al. [8] proposed the immersion and invariance method to develop an oxygen pressure estimator based on the voltage, electrical current density, and temperature measurements in proton exchange membrane fuel cell (PEMFC) systems, so as to replace oxygen sensors for fault diagnosis.

Author Contributions: Writing—original draft preparation, J.-Y.L.; writing—review and editing, J.-Y.L., A.J.I. and Y.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

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

References

1. Pimentel, J.; Orosz, Á.; Aviso, K.B.; Tan, R.R.; Friedler, F. Conceptual design of a negative emissions polygeneration plant for multiperiod operations using P-graph. *Processes* **2021**, *9*, 233. [CrossRef]
2. Potrč, S.; Čuček, L.; Martin, M.; Kravanja, Z. Synthesis of European Union biorefinery supply networks considering sustainability objectives. *Processes* **2020**, *8*, 1588. [CrossRef]
3. Han, R.; Kang, L.; Jiang, Y.; Wang, J.; Liu, Y. Optimization of an inter-plant hydrogen network: A simultaneous approach to solving multi-period optimization problems. *Processes* **2020**, *8*, 1548. [CrossRef]
4. Liu, L.; Xie, F.; Huang, Z.; Wang, M. Multi-objective coordinated optimal allocation of DG and EVCSs based on the V2G mode. *Processes* **2021**, *9*, 18. [CrossRef]
5. Su, C.-Y.; Ji, B.-Y.; Yu, P.-J.; Wang, M.-H.; Hung, W.-C.; Chang, Y.-H.; Lee, J.-Y. Optimal design of a hydrolysis sugar membrane purification system using a superstructure-based approach. *Processes* **2021**, *9*, 168. [CrossRef]
6. Polimeni, S.; Nespoli, A.; Leva, S.; Valenti, G.; Manzolini, G. Implementation of different PV forecast approaches in a multiGood microGrid: Modeling and experimental results. *Processes* **2021**, *9*, 323. [CrossRef]
7. Zhang, P.; Wang, Y.; Liang, L.; Li, X.; Duan, Q. Short-term wind power prediction using GA-BP neural network based on DBSCAN algorithm outlier identification. *Processes* **2020**, *8*, 157. [CrossRef]
8. Hernández-Gómez, Á.; Ramirez, V.; Saldivar, B. Development of an oxygen pressure estimator using the immersion and invariance method for a particular PEMFC system. *Processes* **2020**, *8*, 1095. [CrossRef]