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EDITORIAL

Production optimisation in carbon reduction engineering management

Global climate change is a common and serious problem faced by all countries in the world. Due to the consumption of fossil fuels, carbon dioxide is released into the atmosphere and thus causing global climate disruption. Since the implementation of the Paris Agreement, many countries have proposed various policies to combat climate change. In this process, carbon reduction engineering, as one of the most challenging but feasible ways to achieve carbon neutrality or zero-net carbon emissions, has received extensive attention from both practical and academic perspectives. Carbon reduction engineering, also known as climate engineering, is an umbrella term for engineering measures targeted at combating climate change and achieving carbon neutrality.

Decarbonisation of production processes stands as a pivotal pursuit within carbon reduction engineering, garnering considerable attention across production and supply chain management. In production management, research endeavours delve into optimising carbon emission reduction pathways, enhancing carbon-efficient production processes, planning energy production, evaluating reduction efficiency, and employing optimisation and simulation techniques to analyse carbon reduction initiatives. In supply chain management, focus is directed towards making production decisions within carbon reduction frameworks, allocating emission allowances, and fostering low-carbon and sustainable supply chain operations. Furthermore, the development of assessment and optimisation methodologies, as well as the examination of policy instruments' impact, hold paramount significance for advancing carbon reduction engineering efforts. Therefore, there exists a critical need to explore the scientific management of carbon reduction engineering, grounded in management and production optimisation theories alongside relevant disciplinary frameworks.

This special issue is dedicated to seeking original research on production optimisation in carbon reduction engineering from both theoretical and application perspectives. We have received a total of 118 submissions. After rigorous reviews of multiple rounds, 20 papers are finally selected for inclusion in this special issue. The contributions in this volume span 4 categories, including carbon reduction in the production process, operations and optimisation related to low-carbon and sustainable supply chains, assessment and optimisation methodologies, and policy instruments in carbon reduction engineering management.

Five papers focus on management and optimisation issues related to carbon reduction in the production process. The study of Kong et al. (2023) focused on the application of deep reinforcement learning for advancing the decarbonisation of manufacturing processing through optimisation of scheduling. They emphasised ensuring green development in the semiconductor industry in Chinese context and suggested the firms to pair the strategies with improved scheduling. The study of Fan et al. (2023) effectively scheduled the production of renewable energy sources thereby alleviating the contradiction between higher utilisation and stable power system operation which further reduced carbon emission and the total cost of the system. The proposed approach can assist decision-makers in effectively implementing electricity production schedule of integrated energy systems to achieve desired low-carbon and economic benefits. The study of Chen et al. (2024) considered the heterogeneity of both regions and industries to measure carbon emission efficiency (CEE) in China and found low CEE mostly due to management inefficiency. The study provided insights regarding carbon emission reduction potential among regions and industries. The study of Niu et al. (2023) focused on firms' tradeoffs among green investment, product price, and consumer attractiveness paying special attention to the impact of varying degrees of market saturation. The study provided insights into environmental performance, social welfare, and consumer eco-awareness. This study could be a way forward to the firms to make decisions for carbon emission reduction considering the market saturation. The study of Du et al. (2024) found that the unit manufacturing cost of firm's E-packaging design and cost coefficient of carbon reduction are critical considerations for package-type decisions. This study provided insights for packaging manufacturers, firms, and environmental regulatory agencies, which could help to promote E-packaging.

Six other studies dealt with operations and optimisation related to low-carbon and sustainable supply chains. Given that sustainable production and consumption are constantly driving innovation, transformation, and upgradation of the operational modes of enterprises, the study of Niu, Xi, and Li (2024) assessed the impact

of sustainable consumption (i.e. product sharing) on sustainable production decisions and the choice of the optimal operation mode. This study provided combination strategies for sustainable supply chains in the context of carbon emission reduction. He, Wang, and Liu (2024) studied the interplay of government subsidising arrangement and information asymmetry on manufacturers' emission reduction and retailers' low-carbon promotion. This study proposed governmental subsidising schemes to achieve system-wide improvement in the performance of low-carbon supply chains under various situations of information asymmetry. The findings of Wang et al. (2023b) suggested that green technology investment in either a direct channel and an online retail platform leads to Pareto improvement in profits of both the platform and the manufacturer while the investment induced the platform to reduce carbon emissions. This study provided insights regarding the operational decisions and the influences of the regulation on the interactions under the cap-and-trade regulation for the supply chain members. The study of Cheng et al. (2023) revealed that promoting cleaning and matching degree level in the context of cap-and-trade regulation could extend the market portion and realise more profit in addition to carbon emission reduction. The study further provided insights to supply chain members regarding the cost coefficient of improving cleaning and matching degree level and coal production costs on optimal decisions and profits. The study of Li et al. (2024) considered the case of BYD auto enterprise in China to assess a two-level carbon emission reduction supply chain composed of a single manufacturer and a single retailer. This study discussed the change of revenue sharing coefficient on the decision variables and the profit of carbon emission reduction supply chain members. Xu et al. (2023) explored the operational decisions and coordination of a typical supply chain composed of a manufacturer and an e-platform under the cap-and-trade scheme. This study illustrated how online demand affects offline demand, and platform-enabled power expands the market demand.

Five papers proposed several assessment and optimisation methodologies aimed at achieving carbon reduction goals while fostering sustainability development. The study of Hsieh, Tsai, and Chu (2023) evaluated activity-based cost optimisation decision-making process for the production data of Taiwan wheel companies to explore the impact of different carbon emission costs on a company's product mix with pricing decisions. This research could fulfil social responsibilities of enterprises while ensuring profitability and serve as a reference for making net-zero transformation decisions. The study of Liu et al. (2023) developed an effective method to evaluate the energy-water-carbon network, providing more insights toward understanding the carbon emission reduction responsibilities of industrial supply chains. This study provided a reference for reducing the energy-water-carbon footprint and achieving the carbon reduction goal of China. The profit maximum and emission reduction targets considering customers' green awareness through selection option and warehousing contracts were assessed by Wang et al. (2023a). This study provided a way forward for increasing green awareness which inspired emission reduction and intervention to influence consumer demand as an efficient way to achieve both profitability and sustainability. The study of Shen, Tang, and Zhang (2024) adopted predictive control algorithms to examine its performance in optimising a heating, ventilation, and air conditioning (HVAC) system operation. This study offered valuable insights for product manufacturers seeking to reduce the carbon emissions produced during building operations. Cappelletti and Germani (2023) presented a novel eco-design approach that involves the remanufacturing of industrial scraps considering the case of four Italian companies to reduce raw materials and CO_2 emissions. The study derived guidelines and design strategies supporting the successful implementation of the methodology and establishment of industrial symbiosis.

Four articles discussed the role of policy instruments in the management of carbon reduction engineering, offering managerial insights for industry stakeholders and policymakers alike to foster carbon reduction. The study of Pi (2023) explored the production and decarbonisation of conventional automakers by focusing on their transition from gasoline to electric vehicles under pure subsidy, pure regulation, and hybrid subsidy-regulation policies. This study provided insights not only for gasoline vehicle automakers to respond to policy changes but also for governments to design incentives for electric vehicle diffusion. The study of Yu et al. (2024) considered multistep electricity pricing schemes to solve distributed flow-shop scheduling problems which minimised the completion time of production, the total cost of multistep electricity pricing, and reduced carbon emissions. The findings of this study could lead to management implications for both governments and utility companies. Zhao et al. (2023) illuminated the impacts of EU's Carbon Border Adjustment Mechanism (CBAM) on China's steel export and carbon reduction. The findings of this study provide a comprehensive policy for adopting more emission reduction measures which could greatly improve the carbon reduction efficiency, effectively reduce the negative impact of CBAM and maintain the stability of steel exports. Gayon and Hassoun (2024) demonstrated a newsvendor problem with greenhouse gas emissions at the disposal stage regulated by a cap-and-trade policy

to evaluate the flexibility of the optimal dynamic replenishment decisions in order to reduce costs. This study suggested the regulator plan and deploy more effective cap-and-trade emission reduction regulation policies.

Finally, the guest editors wish to take this opportunity to extend their deepest appreciation to all the authors and reviewers for their exceptional contributions. We would also like to express our sincere gratitude to Professor Alexandre Dolgui, Editor-in-Chief of the International Journal of Production Research, for his invaluable support towards this special issue.

References

Cappelletti, F., and M. Germani. 2023. "Carbon Reduction Engineering Through Value Chains Intersection, Product and Process Re-Design, Industrial Processes' Scraps De-Manufacturing." *International Journal of Production Research*, 1–22. https://doi.org/10.1080/00207543.2023.2243527.

Chen, Y., Y. Pan, T. Ding, H. Wu, and G. Deng. 2024. "A Three-Level Meta-Frontier Directional Distance Function Approach for Carbon Emission Efficiency Analysis in China: Convexity Versus Non-Convexity." *International Journal of Production Research*, 1–25. https://doi.org/10.1080/00207543.2024.2315315.

Cheng, L., L. T. Zhao, F. R. Li, and K. X. Yang. 2023. "The Coordination Strategies of Coal Supply Chain Considering Carbon Emissions Reduction." *International Journal of Production Research*, 1–16. https://doi.org/10.1080/00207543.2023.2291522.

Du, S., M. Liu, T. Nie, and Y. Zhu. 2024. "Package-Type Strategies and Packaging's Carbon Reduction Decisions in the Take-Out Industry." *International Journal of Production Research*, 1–31. https://doi.org/10.1080/00207543.2024.2321594.

Fan, B., F. Liao, C. Yang, and Q. Qin. 2023. "Two-Stage Electricity Production Scheduling with Energy Storage and Dynamic Emission Modelling." *International Journal of Production Research*, 1–20. https://doi.org/10.1080/00207543.2023.2280186.

Gayon, J. P., and M. Hassoun. 2024. "The Newsvendor Problem with GHG Emissions from Waste Disposal Under Cap-and-Trade Regulation." *International Journal of Production Research*, 1–21. https://doi.org/10.1080/00207543.2023.2300739.

He, L., H. Wang, and F. Liu. 2024. "Emission Abatement in Low-Carbon Supply Chains with Government Subsidy and Information Asymmetry." *International Journal of Production Research*, 1–29. https://doi.org/10.1080/00207543.2024.2305807.

Hsieh, C. L., W. H. Tsai, and P. Y. Chu. 2023. "Analyzing Production Optimization Models Across Various Carbon Pricing Policies." *International Journal of Production Research*, 1–19. https://doi.org/10.1080/00207543.2023.2296971.

Kong, M., W. Wang, M. Deveci, Y. Zhang, X. Wu, and D. Coffman. 2023. "A Novel Carbon Reduction Engineering Method-Based Deep Q-Learning Algorithm for Energy-Efficient Scheduling on a Single Batch-Processing Machine in Semiconductor Manufacturing." *International Journal of Production Research*, 1–24. https://doi.org/10.1080/00207543.2023.2252932.

Li, S., S. Qu, M. I. M. Wahab, and Y. Ji. 2024. "Low-Carbon Supply Chain Optimisation with Carbon Emission Reduction Level and Warranty Period: Nash Bargaining Fairness Concern." *International Journal of Production Research*, 1–23. https://doi.org/10.1080/00207543.2024.2333108.

Liu, X., R. Xiong, S. C. Perera, and P. Guo. 2023. "Collaborative Management of the Energy-Water-Carbon Footprint: Analysing the Spatial Network Characteristics." *International Journal of Production Research*, 1–21. https://doi.org/10.1080/00207543.2023.2258225.

Niu, S., Y. Xi, and Y. Li. 2024. "Sustainable Supply Chain Operations Driven by 'Remanufacturing + Product Sharing': Operation Mode Selection and Decision Optimisation." *International Journal of Production Research*, 1–25. https://doi.org/10.1080/00207543.2024.2306903.

Niu, B., N. Zhang, F. Xie, and H. Zhang. 2023. "Optimisation of Carbon Emission Reduction in a Competitive Market with Varying Saturation and Eco-Conscious Consumers." *International Journal of Production Research*, 1–24. https://doi.org/10.1080/00207543.2023.2245065.

Pi, Z. 2023. "Production and Decarbonisation of Conventional Gasoline Vehicle Automakers Under Subsidy and Regulation Policies." *International Journal of Production Research*, 1–19. https://doi.org/10.1080/00207543.2023.2220057.

Shen, M., B. Tang, and K. Zhang. 2024. "Low Carbon Operation Optimisation Strategies for Heating, Ventilation and Air Conditioning Systems in Office Buildings." *International Journal of Production Research*, 1–20. https://doi.org/10.1080/00207543.2024.2325582.

Wang, S., S. H. Choi, J. Xiao, and G. Q. Huang. 2023a. "Low-Carbon Supply Chain Coordination Through Dual Contracts Considering Pareto-Efficiency." *International Journal of Production Research*, 1–22. https://doi.org/10.1080/00207543.2023.2296976.

Wang, Q., S. Xiu Xu, X. Ji, and N. Zhao. 2023b. "Joint Decisions on Selling Mode Choice and Emission Reduction Investment Under Cap-and-Trade Regulation." *International Journal of Production Research*, 1–28. https://doi.org/10.1080/00207543.2023.2296974.

Xu, X., X. Chen, J. Chen, T. C. E. Cheng, Y. Yu, and S. S. Liu. 2023. "Adoption of Blockchain Considering Platform's Information Sharing and Service Effort Under the Cap-and-Trade Scheme." *International Journal of Production Research*, 1–25. https://doi.org/10.1080/00207543.2023.2296015.

Yu, X., H. Du, D. Zhou, Q. Wang, and G. Lin. 2024. "Bi-Objective Carbon-Efficient Distributed Flow-Shop Scheduling with Multistep Electricity Pricing." *International Journal of Production Research*, 1–17. https://doi.org/10.1080/00207543.2024.2312209.

Zhao, L. T., Z. Y. Chen, Y. X. Duan, and R. X. Qiu. 2023. "How Will CBAM Affect the Decarbonisation of Steel Industry in China? A System Dynamics Approach." *International Journal of Production Research*, 1–22. https://doi.org/10.1080/00207543.2023.2285397.

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