



“Gheorghe Asachi” Technical University of Iasi, Romania



HOW TO ACHIEVE CARBON EMISSION REDUCTION IN THE POWER INDUSTRY: PERSPECTIVE FROM THE POWER GRID COMPANY

Changhai Yang¹, Xi Yang¹, Yalu Sun¹, Boyang Chen¹, Xiaoxu Wu^{2*}, Mengmeng Dong²

¹*Economic and Technological Research Institute of State Grid Gansu Electric Power Company, Lanzhou, 730030, China*

²*School of Economics and Management, Beijing Jiaotong University, Beijing, 100044, China*

Abstract

How to strengthen the cooperation between thermal power plants and green power plants with the help of a power grid company for reducing carbon emissions in the power industry is an important issue worth studying. This study presents a model for a two-echelon power supply chain that includes a thermal power plant, a green power plant, and a power grid company. The yield of the green power plant is uncertain. The power grid company has two objectives: to increase downstream demand for green electricity through green power publicity efforts and to encourage the upstream thermal power plant to reduce carbon emissions by sharing a certain percentage of the carbon emission reduction cost. A Stackelberg game model is built, and backward induction is used to solve the model. Our findings suggest that the power grid company will only implement green power publicity efforts if it shares the carbon emission reduction cost. Furthermore, the higher the percentage of the carbon emission reduction cost that the power grid company shares, the greater the level of green power publicity efforts. Although sharing the cost of carbon emission reduction increases the power grid company's total cost when the carbon emission level of the thermal power plant is high, the power grid company's guidance to the upstream and downstream can effectively reduce carbon emissions in the power supply chain. When the carbon emission level of the thermal power plant is reduced to a certain extent, the power grid company's cost-sharing policy can reduce its total cost. In addition, we suggest that the green power plant's feed-in tariff should be reset after introducing the cost-sharing mechanism. Finally, we provide numerical examples to support our research conclusions.

Key words: carbon emission reduction, cost sharing, green power publicity, power supply chain, yield uncertainty

Received: April, 2023; Revised final: June, 2023; Accepted: October, 2023; Published in final edited form: December, 2023

* Author to whom all correspondence should be addressed: e-mail: 21120599@bjtu.edu.cn; Phone: +86 15120029755