Multi-step optimization of the purchasing options of power retailers to feed their portfolios of consumers

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Summary

The liberalization of the retail market of electricity increased the tariff choice of end-use consumers. Retailers compete in the retail market for customers, obtaining private portfolios of end-use consumers to manage. Retailers buy electricity at wholesale markets to feed their customers' demands. They can use spot, derivatives and bilateral markets to acquire the energy they need. The increasing levels of variable renewable energy sources trading at spot markets, increase the price volatility of these markets. To hedge against the volatility of spot prices, retailers may negotiate standard physical or financial bilateral contracts at derivatives markets. Alternatively, they can also negotiate private bilateral contracts. This article addresses the optimization of the retailers purchasing options, to increase their return from electricity markets. Considering the risk attitude of the retailer, it makes use of a multi-step purchasing model considering a multi-level risk-return optimization and a decision support system. The article presents an agent-based study considering a retailer with a portfolio of 312 real-world consumers. The multi-step purchasing model obtains different solutions according to the risk attitude of the retailer. Results from the study prove that retailers may obtain returns closer to optimal how smaller are their price and quantity forecast errors. The results support the conclusion that wholesale markets of electricity are more favourable to risk-seeking retailers. However, in case of small prices' forecast errors the proposed multi-step purchasing model increase the return of risk-neutral retailers. Furthermore, by using the proposed decision support system, risk-averse retailers may significantly increase their return.

Highlights

- The adaptation of the retailers' portfolio of consumers dual-objective optimization model to maximize the return and minimize the risk of the portfolio according to the risk attitude of the retailer. The equipment of agent-based retailers with the aforementioned optimisation model, trading strategies, and forecast methodologies;
- Description and simulation of a formal model of an agent-based retail competition.

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Info

The TradeRES project will develop and test innovative electricity market designs that can meet society's needs of a (near) 100% renewable power system. The market design will be tested in a sophisticated simulation environment in which real-world characteristics such as actors' limited foresight into the future and risk aversion are included.