

# **Carbon Emission Reduction Strategies for Power Batteries Under EU Battery Regulations**

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## **Abstract**

Carbon reduction of power batteries is crucial to the low-carbon sustainable development of electric vehicles (EVs) and the realization of carbon neutrality goals. Based on the carbon footprint management requirements proposed by EU battery regulations, this study constructed a Stackelberg game model covering a battery material supplier, a power battery manufacturer, and an EV company, comparatively analyzed four carbon reduction strategies, and explored the impact of consumer environmental awareness on carbon emissions. The study reveals that for power batteries with lower initial carbon footprints, an increase in consumer environmental awareness significantly aids in reducing carbon emissions. Conversely, in cases of power batteries with higher initial footprints, the influence of consumer environmental consciousness exhibits complexity. Below a certain threshold, a rise in environmental awareness aids in carbon emission reduction; beyond this point, however, greater environmental consciousness could paradoxically increase emissions. Furthermore, the findings indicate that when consumer environmental awareness is low, the adoption of collaborative emission reduction strategies by supply chain parties may lead to higher carbon emissions despite yielding greater economic returns. As environmental awareness increases, the material supplier implements emission reduction measures independently, while the battery manufacturer and an EV company cooperate to reduce emissions, and this combination of strategies proves to be the most effective in achieving the balance between economic benefits and carbon emission reduction.

**Keywords:** Carbon footprint management; Carbon reduction strategies; Consumer environmental awareness; Stackelberg game theory; Sustainable development