

# Analysis and Reflection on the Strategy Benchmarking of Power Battery Management in China and Europe

Pan Wang<sup>1,2</sup>, Ming Cheng<sup>1,2</sup>, Xiuxu Wang<sup>1,2 \*</sup>

<sup>1</sup>Automotive Data of China Co., Ltd., Tianjin, China

<sup>2</sup>China Automotive Technology and Research Center Co., Ltd., Tianjin, China

\*Corresponding Author.

**Abstract:** In 2023, the European Union (EU) enacted the *Regulation on Batteries and Waste Batteries* (hereinafter referred to as the *New Law on Batteries*), which strengthens the regulatory framework for the entire lifecycle of power batteries. This development presents both challenges and opportunities for global power battery manufacturers and operators. As a significant player in the global power battery industry chain and the world's largest producer of electric vehicles and power batteries, China must systematically assess the impact of global battery management strategies, including the EU's *New Law on Batteries*, from a lifecycle perspective. This understanding is crucial for maintaining China's competitive edge in the global power battery market and achieving mutually beneficial outcomes in international trade negotiations. This paper constructs a strategy analysis framework based on the lifecycle approach. By summarizing the power battery management strategies of both the EU and China, it provides a comprehensive overview of strategies across different countries, highlights the key regulatory focus areas, and offers relevant strategy recommendations. The main conclusions and insights are as follows: (1) The *New Law on Batteries* achieves lifecycle regulation from "cradle" to "grave" and back to "cradle". (2) China emphasizes the management of waste power batteries, with an increasingly robust strategy system at the recycling stage, yet lacks comprehensive measures for other lifecycle stages. (3) The EU has established a comprehensive lifecycle strategy management system centered on the *New Law on Batteries*, characterized by strong coordination and a synergistic combination of strategies across different sectors. Finally, this paper identifies three major compliance challenges posed by the *New Law on Batteries*, necessitating

enhanced strategy development and implementation in the areas of carbon footprint management, circular economy, and digital battery passports.

**Keywords:** Law of EU on Batteries; Management Strategy; Lifecycle; Carbon Footprint; New Energy Vehicle Batteries

## 1. Introduction

As an important energy carrier, batteries play a key role in promoting sustainable development, green mobility, clean energy and carbon neutrality. Among them, the transition of vehicle energy from fossil fuels to electrification is regarded as one of the basic conditions for achieving carbon neutrality <sup>[1]</sup>. With the rapid development of global transportation vehicles, including electric vehicles, the demand for power batteries in various countries has soared, and the strategic importance of the battery market in the future will become more and more prominent <sup>[2]</sup>. In 2023, China will dominate the global EV battery market, accounting for more than half of the total EV batteries. The European Union and the United States together account for 30% of total EV battery use <sup>[3]</sup>. To ensure that battery management policies contribute to carbon reduction at the global level, it is necessary to ensure sustainability at all stages of the battery life cycle. Therefore, in recent years, major economies including China, the European Union, the United States and Japan have introduced relevant policies to promote the sustainable development of the power battery industry. As the world's largest power battery producer and electric vehicle market, China, while vigorously developing electric vehicles, also pays attention to the life cycle traceability management of power batteries and the comprehensive utilization of waste batteries. Since 2016, China has issued and implemented a series of power battery management policies,

and established a "four beams and eight pillars" of power battery recycling management policies. On August 17, 2023, the European Union's "Battery and Waste Battery Regulation" (hereinafter referred to as the "New Battery Law") officially came into force, and all batteries put into use in the EU market will be subject to full life cycle management to promote the sustainable and recyclable development of the EU battery industry <sup>[1]</sup>. The EU's New Battery Law, together with other battery-related management policies, constitutes the EU's comprehensive battery management system. In addition, the EU has developed the "Battery 2030+ Roadmap" <sup>[4]</sup>, which aims to develop ultra-high performance batteries that are safe, affordable, sustainable and have a long life, and maintain a long-term leadership position in existing markets and future emerging areas, so as to achieve the objectives of the European Green Deal <sup>[5-7]</sup>.

The product lifecycle encompasses the stages from raw material acquisition or generation from natural resources, through production and usage, to waste disposal. The lifecycle of power batteries includes raw material acquisition, material processing, component processing, battery manufacturing, usage, end-of-life collection, secondary utilization, and recycling, spanning the process from "cradle" to "grave". The EU's *New Law on Batteries* strengthens regulation across these key lifecycle stages from a lifecycle perspective. Analyzing different countries' battery management policies from a lifecycle perspective is therefore crucial for understanding policy management priorities and addressing potential challenges and opportunities. However, research on this topic is currently lacking. Based on this, this paper innovatively examines the power battery management policies and development trajectories of various countries from a lifecycle perspective. It aligns the key points of regulatory changes with the lifecycle stages of battery management, providing a systematic analysis of policy changes. This paper aims to construct a pioneering policy analysis framework based on the lifecycle approach. Firstly, it reviews the power battery management policies of the EU and China from a global perspective, highlighting the comprehensive overview of the EU's power battery management policies. Secondly, it focuses on the EU's *New Law on Batteries*, exploring the characteristics of policy

evolution and changes in regulatory boundaries, further clarifying the relationship between power battery regulations and other related policies. Finally, it identifies the compliance challenges brought by the lifecycle regulatory changes under the *New Law on Batteries*, and on this basis, proposes policy management recommendations and compliance strategies for enterprises.

## 2. Overview of Battery Management Policies in China and Internationally

### 2.1 The EU

The panoramic view of the EU's power battery management policies and regulations covers five dimensions: target roadmap, strategy, acts/laws, regulations, and directives, categorized according to the regulatory aspects of different policies and regulations. At the level of target roadmap, it includes overarching frameworks such as the *European Green Deal*, near-term objectives like *Fit for 55*, long-term targets like *2040 Climate Targets*, and the *Sustainable Finance Action Plan*. The *European Green Deal* stands as a flagship initiative aimed at transforming Europe into a modern, resource-efficient, and highly competitive economy. It encompasses a wide array of areas from carbon emissions reduction to promoting economic growth, spanning sectors such as energy, transportation, agriculture, construction, and industry <sup>[5-7]</sup>. *Fit for 55* is a pivotal component of the *European Green Deal*, designed to ensure a reduction of at least 55% in greenhouse gas emissions by 2030. This plan involves increasing the share of renewable energy usage, improving energy efficiency, implementing carbon pricing, and expanding carbon emissions trading systems. The *2040 Climate Targets* represent a longer-term ambition within the framework of the *European Green Deal*, aiming to steer the EU towards climate neutrality over a more extended period. On February 6, 2024, the European Commission released a statement proposing a 90% reduction in the EU's net greenhouse gas emissions from 1990 levels by 2040. Strategically, the *Battery Strategy Action Plan* and the *Battery 2030+ Roadmap* <sup>[4]</sup> are two key strategic initiatives aimed at advancing battery technology and ensuring the sustainability of the battery industry. Together, these plans constitute a comprehensive EU strategy in the battery domain, seeking to propel

the development of the European battery industry and enhance global competitiveness through innovation and sustainability. They not only address current market and technological demands but also focus on long-term scientific research and technological innovation.

At the regulatory level, the EU has enacted three battery-related regulations: the *New Law on Batteries*, the *Vehicle Design Circularity Requirements and End-of-Life Vehicle Management Regulation*, and the *Eco-design for Sustainable Products Regulation* (ESPR). The *New Law on Batteries* governs five categories of batteries: electric vehicle power batteries, portable batteries, automotive starter, lighting, and ignition (SLI) batteries, light transport vehicle (LMT) batteries, and industrial batteries. The regulatory content primarily includes aspects such as carbon footprint, recycled metal usage ratio, battery labeling and passports, recycling of waste batteries and battery materials, chemical performance and durability, and supply chain due diligence <sup>[1]</sup>. The *EU Taxonomy* encourages manufacturers to design recyclable batteries and use recycled materials, covering waste generated during production and at the end of the product lifecycle. Additionally, the EU is formulating complementary regulations from both the design and recycling ends to further enhance battery sustainability. In terms of eco-design, the ESPR aims to improve product sustainability throughout the entire lifecycle. By promoting the Digital Product Passport (DPP), it mandates that companies provide detailed information about the product lifecycle, thereby increasing product transparency and traceability. This will further solidify the battery passport requirements under the *New Law on Batteries*. To strengthen end-of-life vehicle management and promote a circular economy, the EU has proposed the *Vehicle Design Circularity Requirements and End-of-Life Vehicle Management Regulation*. This regulation seeks to link design issues with end-of-life treatment, promoting more circular business models and considering mandatory recycling content for specific materials to improve recycling efficiency. Moreover, sustainability and due diligence requirements for enterprises have become increasingly stringent, with more explicit demands on sustainable management for battery companies. Policies related to the upstream supply chain of battery materials include the *Carbon Border Adjustment*

*Mechanism* (CBAM) and the *EU Emissions Trading System* (ETS), both of which have been published and implemented.

## 2.2 China

Since 2016, the Chinese government has issued a series of policy measures, establishing a comprehensive framework for the management and recycling of used power batteries. In February 2018, the *Interim Measures for the Management of the Recycling and Utilization of New Energy Vehicle Power Batteries* was released as the top-level policy. This regulation mandates that automobile manufacturers bear the primary responsibility for the recycling of power batteries, ensuring their effective use and environmentally friendly disposal. It emphasizes the need to adhere to a product lifecycle approach, integrating environmental, social, and economic benefits, and leveraging market mechanisms. In December 2023, the Ministry of Industry and Information Technology (MIIT) issued the *Measures for the Comprehensive Utilization Management of New Energy Vehicle Power Batteries (Draft for Comments)*, with the final measures scheduled for implementation in 2024. As a joint departmental regulation, this measure includes mandatory punitive provisions, enhancing the comprehensive management of used power batteries, elevating previous “recommendations” to “legal regulation”, and further promoting high-quality development in the comprehensive utilization of power batteries. Regarding traceability management, the national standard *Coding Rules for Automotive Power Batteries* and relevant policies regulate the coding, identification, and usage. Additionally, the *Interim Provisions on the Traceability Management of New Energy Vehicle Power Batteries* stipulates the establishment of the “National Monitoring and Comprehensive Management Platform for the Recycling and Utilization of New Energy Vehicle Power Batteries”. This platform collects information throughout the entire lifecycle of power batteries, from production and sales to usage, scrapping, recycling, and utilization, and monitors the fulfillment of recycling responsibilities by relevant entities. As traceability management advances, MIIT released the *Notice on Strengthening the Traceability Management of the Recycling and Utilization of New Energy Vehicle Power Batteries*. This notice initiates comprehensive local inspections and

responsibility supervision, strengthening guidance and oversight, establishing a reporting mechanism for inspection results, and effectively enhancing enterprises' capacity to fulfill their responsibilities. Another policy related to post-event supervision is the *Notice on Conducting Monitoring of the Recycling and Utilization of New Energy Vehicle Power Batteries*, which mandates the establishment of accounting records for recycling enterprises, strengthens the collection of recycling information, and improves the information reporting mechanism. In terms of industry standards, in 2021, the MIIT along with several other ministries issued the *Management Measures for the Cascade Utilization of New Energy Vehicle Power Batteries*, to enhance the management of their cascade utilization. Additionally, in 2019, MIIT released the *Guidelines for the Construction and Operation of New Energy Vehicle Power Battery Recycling Service Outlets* and revised the *Normative Conditions for the Comprehensive Utilization of Waste Power Batteries of New Energy Vehicles (2019 Edition)*. For pilot demonstrations, MIIT released the *Implementation Plan for the Pilot Recycling and Utilization of New Energy Vehicle Power Batteries* in 2018. In 2023, the State Administration for Market Regulation and MIIT jointly issued the *Announcement on Conducting Product Certification for the Cascade Utilization of New Energy Vehicle Power Batteries*. Furthermore, to leverage the fundamental and leading role of standardization in promoting the development of the recycling industry, China has gradually issued numerous national and industry standards related to the recycling and utilization of waste batteries, covering multiple stages of the battery lifecycle, including production, sales, usage, recycling, and reuse [8-10]. In March 2024, the State Administration for Market Regulation, along with six other departments, issued the *Notice on Issuing the Action Plan for Equipment Upgrades and Old-for-New Consumption with Standard Enhancement as a Pull*, which aims to improve and perfect the standards for the recycling and utilization of new energy vehicle batteries, proposing to increase the supply of recycling standards and vigorously promoting industrial recycling flow. In summary, China's power battery management policies focus mainly on the recycling stage, with automobile manufacturers bearing the primary responsibility

for recycling power batteries. While emphasizing the lifecycle approach, there is a lack of policy management tools for other lifecycle stages. Moreover, the establishment of a regular management mechanism for the recycling and utilization of waste power batteries has greatly promoted the healthy and orderly development of the battery recycling industry in China, forming a standardized and orderly battery recycling industry chain.

### 3. Conclusion and Recommendations

This paper constructs a lifecycle-based policy analysis framework. By summarizing and comparing the battery management policies of the EU and China, it outlines the comprehensive landscape and regulatory focuses of different countries. The analysis reveals that China's power battery management policies are primarily concentrated on the recycling and utilization stages, lacking comprehensive management policies for other lifecycle stages. In contrast, the EU, with its *New Law on Batteries* at the core, has established a policy framework covering the entire battery lifecycle, with different departmental policies supporting and coordinating with each other. The paper identifies three major compliance challenges arising from changes in the lifecycle regulatory boundaries of battery regulations: carbon footprint management, circular economy, and data security. To address these challenges, the paper offers the following specific recommendations: First, it is recommended that China introduce a rigid linkage management system for batteries. This should involve expanding the regulatory boundaries to include upstream raw materials, recycled materials, and battery production stages. Additionally, supply chain due diligence, recycled materials, carbon footprint, and battery passports should be incorporated into the regulatory framework to create an efficient, interconnected management mechanism among various departments. It is also suggested to close the regulatory gaps in battery management by formulating and enacting stringent overarching laws. In terms of recycling and utilization management, further regulation of battery recycling enterprises is needed. Utilizing the full capacity of waste batteries, enhancing recycling supervision and traceability through digital means, and improving the battery recycling rate are crucial steps. Second, there should be an increase in

innovation and research and development of key technologies and low-carbon technologies for new batteries. A well-planned international market development strategy is necessary. On one hand, efforts should be made to overcome low-carbon barriers; on the other hand, promoting the industry's green transformation will contribute positively to achieving carbon neutrality. Finally, considering the potential impact of the EU's *New Law on Batteries* on bilateral trade and industrial development, the paper suggests that China should draw lessons from the strategic experiences of developed countries such as Europe and the United States. A battery development strategy tailored to the characteristics of China's new energy vehicle and related industries should be formulated. This strategy would enhance the sustainable development competitiveness of China's battery and new energy vehicle industries. It is recommended to promote the coordinated international expansion of the entire battery industry chain. Upstream, there should be a focus on accelerating the development of key battery mineral resources and building a robust resource guarantee system for the battery and related industries. Midstream, the establishment of localized production and supply networks overseas is crucial, along with active international cooperation in green, low-carbon initiatives. Downstream, constructing an overseas battery recycling management network will leverage China's technological advantages in battery recycling, improve the recycling rates of waste batteries in international markets, and increase the supply of recycled battery materials.

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