Status and Problems of Closed-Loop Supply Chain of Traditional Power Battery in China

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ABSTRACT

The power battery supply chain in China currently lacks stable cooperation and effective information exchange. The competitive pressure brings about irregular recycling channels, reducing the operation and efficiency of the power battery supply chain. Besides, some regular power battery recycling enterprises fabricate data to obtain subsidies by taking advantage of the loopholes in the relevant policies of the state on recycling subsidies. Due to the high price of recycling in the black market, some regular enterprises resell the batteries recycled through regular channels, later purchasing the batteries with no utilization value to obtain the national recycling subsidies by cheating at the same time. Fig. 3 shows the present network structure of the traditional Chinese power battery closed-loop supply chain

Ⅰ. Introduction

The application of power battery is related to new energy equipment: it is mainly used in new energy vehicles as energy storage equipment, the “heart” of new energy vehicles. At present, China’s power battery supply chain lacks stable cooperation and effective information exchange.

The competitive pressure brings about irregular recycling channels, making the power supply chain a lack of operation and low efficiency. Besides, some regular power battery recycling enterprises, in order to obtain subsidies by taking advantage of the loopholes in the relevant policies of the State on recycling subsidies, fabricate data to obtain subsidies by cheating. Some regular enterprises within the market, due to the high price of the black market recycling market, resell the batteries recycled through regular channels and then purchase the batteries with no utilization value to obtain the national recycling subsidies by cheating at the same time. The lack of relevant supervision efforts of the State and the different recycling standards and disassembly and utilization technologies of various recycling enterprises in the power battery supply chain fails to reasonably recycle and utilize precious metals and other practical resources, resulting in serious resource waste, which is contrary to the goal of the State to invest much energy in the development of new energy and power battery-related policies.

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Ⅱ. Background

At present, the network structure of the Chinese traditional power battery closed-loop supply chain is shown in Figure 1. The following is a description of the traditional power cell supply chain process from the forward and reverse supply chains:

The suppliers of raw materials for power batteries are upstream enterprises in the supply chain, responsible for the supply of raw materials required for the manufacture of power batteries. The second-class materials required for the manufacture of power batteries, including the positive and negative extremely precious metal materials of batteries, diaphragms, electrolytes, etc. The acquisition of raw materials for power batteries is mainly from two sources: the mining and smelting of mineral raw materials, and the production is subject to primary processing. The other comes from the extraction from waste power batteries' recycling to provide raw materials for power battery manufacturers.

Upon receipt of raw materials, power battery manufacturers shall produce finished power battery

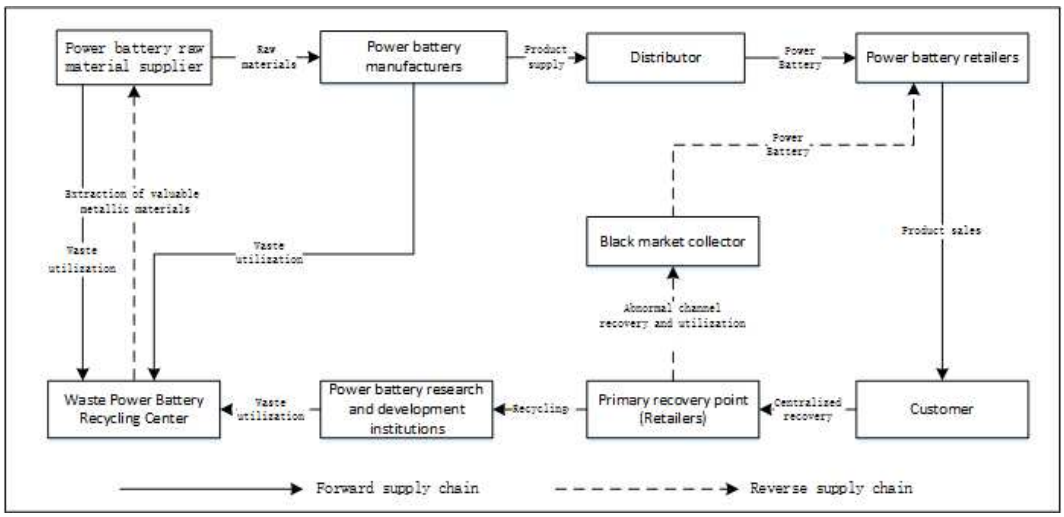

Figure 1. Basic network structure of closed-loop supply chain of traditional power battery in China

products through batching, battery production, and other processes and sell or directly sell finished power battery products through distributors or directly docking with manufacturers of new energy equipment.

III. Results and Conclusion

Due to different battery types and uses, sales channels are also different, some of which are directly connected with new energy equipment vendors. Others are sold with distributors for specific purposes.

Retailers sell their vehicles mainly through the assembly of new energy-related equipment such as electric vehicles and electric bicycles. Customers obtain power batteries by purchasing the appropriate new energy-related equipment. Also, retailers replace batteries after customers exit the new energy-related equipment after being used for a long time.

In order to obtain the decommissioned batteries, it is necessary to identify the source of the batteries. Customers are the end of the positive supply chain and the beginning of the reverse supply chain. Decommissioned waste power batteries mainly come from customers, followed by waste power batteries or related raw materials produced by manufacturers due to improper storage or disposal of some raw materials used in the production of power batteries and obsolescence in the sales process of distributors at all levels.

Upon completing recycling, the retailer needs to transport the batteries to the battery research and development testing institution through third-party logistics for classification testing and value rating. If the batteries meet echelon utilization conditions, they shall be used for echelon utilization. The batteries shall enter into the disassembly process after being completely discarded as useless; if the batteries cannot be used for echelon utilization, they shall be taken back for re-manufacture or disassembly.

After testing by the research, development, and testing institution of power batteries, the altogether scrapped power batteries shall be delivered to the recycling and disposal center of waste power batteries, and the precious metals in the waste power batteries shall be extracted through a specific process in the process of disassembly. Through the professional third-party logistics company transfer to the power battery raw materials suppliers. However, due to the variety, structure, and process of power batteries, it is difficult to use the same standard for flow operation, and disposal center disassembly technology is not uniform. It is not easy to achieve the production of the disassembly.

The raw materials of power batteries shall be recycled and disposed of as secondary raw materials that the manufacturers can use for processing. The materials shall be processed into materials that can be used for the production of power batteries. The power battery manufacturers shall remanufacture such materials and finally produce the finished

products of new power batteries.

Customers in the reverse supply chain can recycle batteries through two channels, one through regular retailers and the other through illegal recycling by retailers into the black market. Retailers may replace power batteries after customers have used them. Retailers provide two options: regular power batteries and batteries with a high performance-to-price ratio for customers to choose from, and retailers sell waste power batteries replaced by customers to the black market for recycling. The latter is inspected by small workshops on the black market to produce and refurbish power batteries suitable for refurbishment and then flow them to retailers for use as customers' replacement of power batteries. Batteries that have been scrapped upon inspection are dismantled, and precious metals are extracted for value recycling. Unofficial channels for recycling, monitoring of recycling levels at small workshops, and uncertainty in disassembly and refurbishment techniques have led to the dismantling of a large number of reusable power batteries, with the sale of precious metals as the primary means of profit.

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