

Booming Industry Accelerated by ESG

—— Power Battery Recycling Industry Overview

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ABSTRACT:

- On July 7, the National Development and Reform Commission and other departments issued a notice of the "14th Five-Year Plan" circular economy development plan, and the power battery recycling action is one of the 11 key projects.
- As an emerging industry, power battery recycling has a huge potential market size and is continuously attracting the attention of capital to layout or access. Power battery recycling mainly consists of two parts: echelon utilization and recycling. In this part, we present an overview of the technology.
- For the industry trends, we are projecting it by considering three dimensions, policy orientation, raw materials markets, and future demand.
- Although industry potential is gradually being realized, investors should still be wary of the risk of overheating. With diversified sources of organizations competing in this field, any optimism regarding one single company should be backed up with rigorous analysis.

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Industry overview: History

The Chinese government has published a series of important laws and regulations related to power battery recycling since 2012. Before 2014, according to the power battery recycling data, the output only increased slightly. By 2015, the power battery shipments climbed to 15.7Gwh, a year-on-year increase of nearly three times, which also laid the foundation for the power battery recycling industry to take off in 2020.

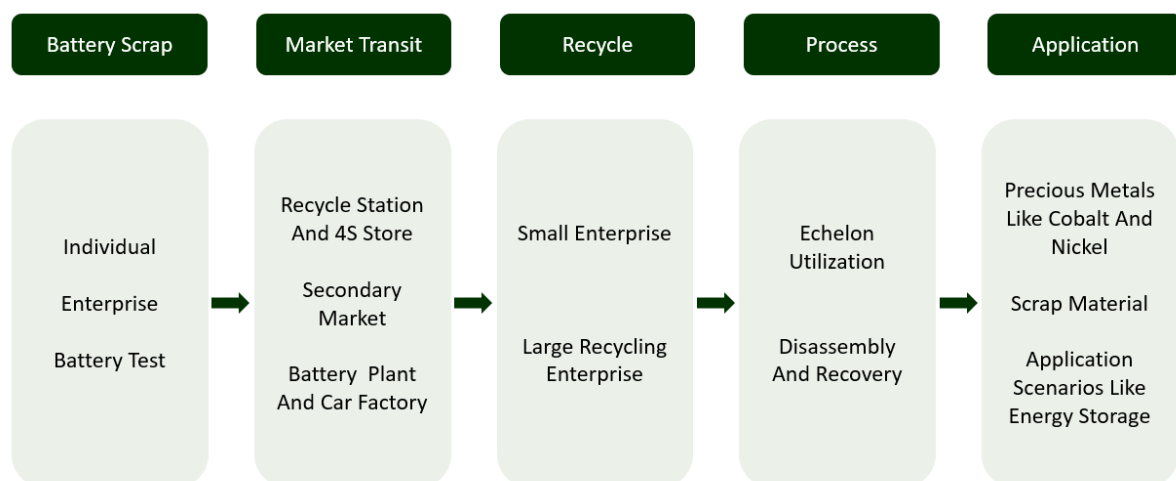
Several relevant government departments released the "Pilot Implementation Plan for Recycling and Utilizing Power Batteries for New Energy Vehicles" in February 2018. Select areas with a large number of new energy vehicles, a good foundation for power battery recycling, and a strong regional drive to carry out power battery recycling pilots. The plan proposes to set up a recycling system and explore diverse business models to encourage enterprises to develop waste battery recycling and recycling technologies and to promote the innovative application of advanced technologies. The new energy power battery recycling industry has greatly benefited from this plan.

Industry overview: Business side

The battery Recycling Market has reached a global market cap of \$8.0 billion in 2018 and is continuously growing.

With the booming production and sales of new energy vehicles in China, the first batch of new energy power batteries has entered a period of large-scale retirement: around 800,000 tons of power batteries are projected to be retired in China by 2025. Power batteries are about to reach the peak of their decommissioning, and recovering these batteries becomes a big problem.

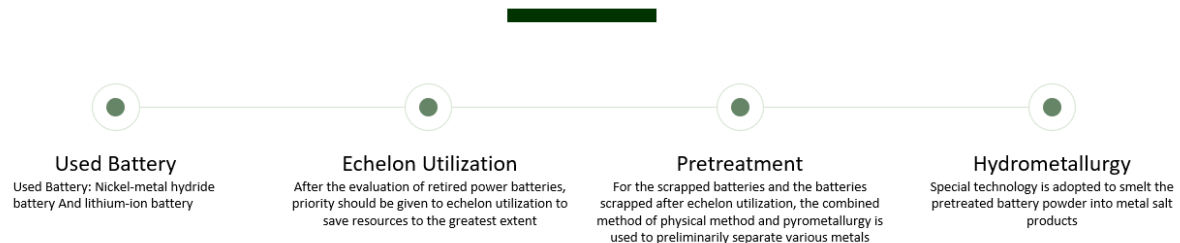
Graph1: Industry supply chain – 5 major stages of recycling batteries



Source: 电池网

Graph2. How the recycling stage goes

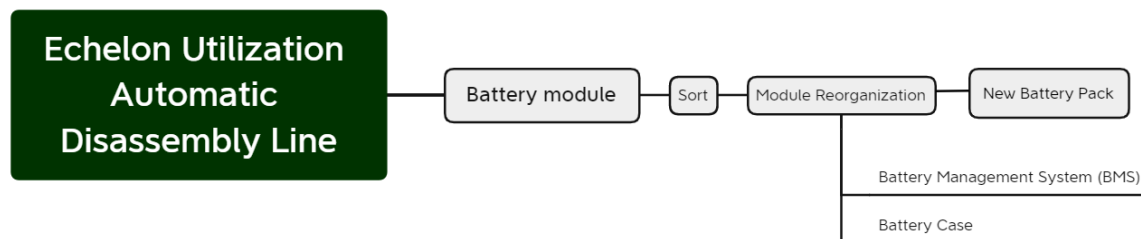
Schematic Diagram of Recycling Process



Source: 豪鹏科技

The second part of the recycling stage, echelon utilization, is to use it in different fields in different periods according to the remaining capacity of the power battery, thereby extending the service life of the battery.

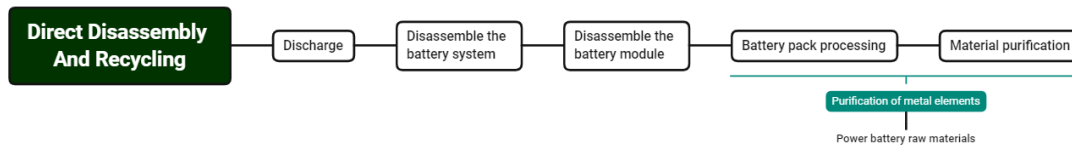
Graph3. How the echelon utilization goes



Under normal circumstances, if the capacity of the power battery is lower than 80% of the initial value, it will no longer meet the use standards of electric vehicles. and other occasions. When less than 50% of the initial reserve is used, the battery cannot be reused, and the battery is disassembled to recover the electrode material.

The recycled batteries still have a lot of practical uses, such as civilian power storage, lighting power supply, etc. At present, the echelon utilization of retired power batteries is mainly concentrated in low-speed electric vehicles, energy storage, renewable energy access, communication base station backup power, and other fields. Different application fields have different requirements for batteries. Direct recycling can thus reduce carbon emissions caused by direct production greatly.

Graph4. How the direct dismantling of batteries goes



Meanwhile, as the peak of power battery scrapping is approaching, the current echelon utilization is difficult to apply on a large scale. So, another solution is to get the scrapped power batteries directly disassembled. The electrode materials, casings, and precious metals such as lithium, cobalt, and nickel are then recovered.

Industry overview: Forecast and trend

Factor1: The impact of pandemic needs to be restored

In 2020, the coronavirus epidemic caused a critical impact on the economy and trade of all countries, including the recycling of renewable resources and the production of new energy battery materials. Meanwhile, in the first quarter of 2021, China's economy continued to rebound, especially the secondary sector. In the secondary industry, added value increased by 6.5% on average in two years, which is close to the normal level before the epidemic (5% ~ 6%).

Factor2: Raw materials supply is tight, prices keep rising

In 2020, the price of cobalt and nickel fluctuated dramatically. The cobalt market was volatile, and the cobalt price rose and fell sharply from February 2020 to February 2021, nickel prices continued to go up, and nickel prices fell in March 2021. In 2020, affected by the oversupply of the tungsten industry and other factors, the tungsten price is bear, weak. As of May 20, 2021, the average price of a nickel plate is ¥ 129,000 / ton, the market price of tungsten concentrate is ¥ 97,000 / ton, and the average price of cobalt is ¥ 353,000 / ton.

Due to the war between Russia and Ukraine, a sharp increase in global nickel has occurred, but it has now trended back down. Russia accounts for 6.4% of the global share of refined nickel production and ranks first in the world in terms of export value. Russian export restrictions will inevitably lead to a reduction in the total amount of nickel on the market, which will lead to a higher nickel price squeeze. In the short term, nickel prices will continue to rise is a constant trend. At the same time, this year, Indonesia's nickel ore production is expected to increase significantly, and when countries compromise with each other and Russia's nickel exports return to normal, the world nickel supply will be greatly improved.

Factor3: Demands will increase further in future

According to the China Energy Network, global power battery installed capacity is expected to reach 623GWh in 2025; domestic installed capacity will reach 312GWh. Ternary batteries have an installed capacity of 137.4GWh with a lithium iron phosphate solution. By 2030, they expect binary battery recycling to reach 292,500 tons, and end-of-life lithium-ion batteries to total 313,300 tons. Diving into each material, lithium is 27,400 tons, nickel is 114,700 tons, cobalt is 28,000 tons, and manganese is 32,300 tons.

Companies overview: Competition

Driven by the current tide of power battery retirement, major power battery recycling manufacturers have made efforts to accelerate the staking. Power battery recycling and new energy vehicles, two leading companies in related industries, are bound to each other and layout the power battery recycling market to quickly occupy the market and seize the opportunity.

There are many participants in the field of battery recycling, and leading companies can be divided into two categories:

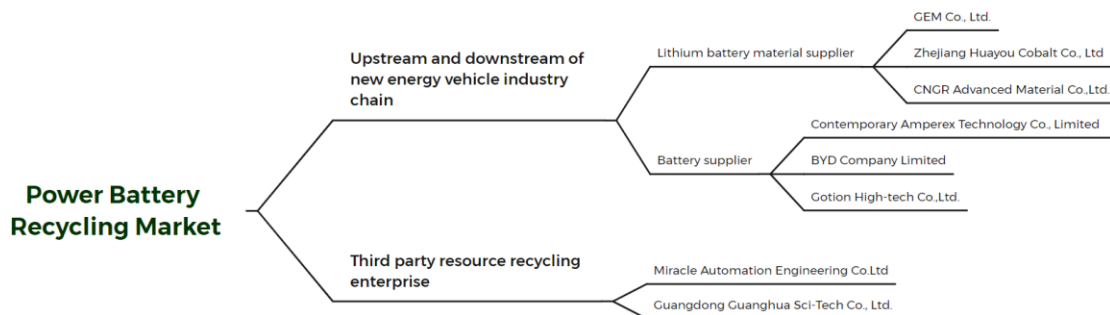
- Third-party resource recycling companies.

Third-party recycling companies such as Guanhua Technology and Tianqi Co., Ltd. are the forerunners of this track.

- Upstream and downstream companies in the new energy vehicle industry chain, such as vehicles, materials, and batteries.

Lithium battery material suppliers are actively participating, such as GEM, Huayou Cobalt, Zhongwei, Ganfeng Lithium, and Ganzhou Highpower, which is held by Xiamen Tungsten Industry. Other battery suppliers such as BYD, CATL, Guoxuan Hi-Tech, and OEMs such as Weilai are also actively deploying. CATL acquired Bangpu Cycle as early as 2015 to produce ternary cathode precursors by recycling metal elements in used batteries. Its wholly-owned subsidiary, Ningde Jiaocheng, also operates a battery recycling system; BYD has set up more than 40 power battery recycling outlets around the world;”, the goal is not just to do recycling, but to do full life cycle management of batteries.

Graph5. Power Battery Recycling Industry Chain



As many as 26,646 companies involved in the recycling of “waste batteries” were established in 2021, a year-on-year increase of 358.07% compared to 5,817 in 2020. These all imply rising competition in the industry.

Relation between ESG and this industry.

ESG investment-related index

Holding the belief that ESG information is the multidimensional embodiment of enterprise management performance and the indicator of risk management, more and more investors pay attention to ESG investment. The related investment system also gets improved and developed. According to GSIA, at present, the mainstream ESG investment strategies in the world can be divided into seven categories: negative elimination, positive screening, principal screening, ESG integration, theme investment, influence investment, and shareholder behavior.

Though born with the characteristic of recycling, the battery recycling industry won’t always perform well in the ESG rating. Taking MSCI as an example, when calculating the MSCI ESG Rating, it uses the Industry-Specific Weight method. Each company will be divided into one sub-industry of the 158 Global Industry Classification Standard and be rated with six ESG key issues in different assigning weights. Companies can’t just simply start the battery recycling sector to increase their ESG ratings. Instead, they should carefully consider the adaptability between their previous business and battery recycling, then take steps to attract ESG investors.

Table 1. MSCI Rating of Related Stocks

Stock Name	Sub-Industry	Ticker	MSCI Rating
Gotion High-tech Co.,Ltd.	Electrical equipment industry	002074	BB
Zhejiang Huayou Cobalt Co., Ltd	Metals and mining - non-precious metals industry	603799	BB
GEM Co., Ltd.	Specialty chemicals industry	002340	BBB
Contemporary Ampere Technology Co., Limited	Auto components industry	300750	BBB
Xiamen Tungsten Co., Ltd.	Metals and mining - non-precious metals industry	600549	CCC
BYD Company Limited	Automobiles industry	002594	A

ESG promotes the industry by supporting policies & setting standards

Policies support the development of batteries recycling

With existing technology, power batteries are less profitable. According to "Lithium-ion Battery Recovery and Resource Utilization Technology", every recycled ton of ternary battery will make a profit of ¥3015, and every recycled ton of lithium iron phosphate battery will lose ¥1496.

Table 2. Cost and Profit of Power Battery Recycling

Items	Pyrometallurgical recycle of ternary material battery (¥/t)	Pyrometallurgical recycle of lithium iron phosphate battery (¥/t)
Raw material recycling price	8900	4000
Relevant costs of recycle process	5490	5490
Profit of positive electrode material	13775	5222
Profit of other parts	3630	2772
Net profit	3015	-1496

Source: 《锂离子电池回收与资源化技术》, Zhongtai Securities, 2021

Policies standardize the development of batteries recycling

With the issuance of new policies and the formation of a formal competitive environment, battery recycling companies face a higher challenge of ESG compliance. Meanwhile, the challenge is also an opportunity. Under the protection of the policy, those companies following ESG regulations will gain greater impetus to development in the following years

Table 3. Recent Policies

Policy	Publishing Department	Main content
Implement Plan of Manufacturer Extended Responsibility System《生产者责任延伸制度推行方案》 2017.01.03	The State Council	Electric vehicle and power battery manufacturers shall be responsible for establishing waste battery recycling network and recycling waste batteries by using after-sales service network. Power battery manufacturers shall implement product coding and establish a full life cycle traceability system
Interim Measures of New Energy Vehicle Battery Recycling《新能源汽车动力电池回收利用管理暂行办法》 2018.01.28	Ministry of industry and information technology, etc	Clarify the responsibilities for power battery design, production and recycling, as well as the qualification requirements for recycling enterprises
Guide of New Energy Vehicle Battery Recycling Service Branch Construction and Operation《新能源汽车动力电池回收服务网点建设和运营指南》 2019.10.31	Ministry of industry and information technology	The qualification, construction, operation, safety and environmental protection requirements of waste power battery recycling service network of new energy vehicles are put forward
New Energy Vehicle Waste Power Battery Comprehensive Utilization Industry Specifications《新能源汽车废旧动力电池综合利用行业规范条件（2019 年本）》 2020.01.02	Ministry of industry and information technology	Make specific requirements for the layout of new energy battery enterprises, project site selection, technical equipment and process, comprehensive utilization of resources, energy consumption and environmental protection
The Fourteenth Five-Year Plan on Development of Circular Economy《“十四五”循环经济发展规划》 2021.07.01	National Development and Reform Commission	Strengthen the rectification of illegal enterprises in the renewable resources recycling industry and create a fair market competition environment.

Policy guidance consists of three key time nodes

Point1: 2018: The Milestone of the Market with New Policies

2018 is a critical year for the power batteries recycling industry. In the year, several policies were published by the regulators in China to standardize the recycling process of power batteries. The Ministry of Industry and Information Technology published two batches of 26 enterprises into the "new energy vehicle waste power battery comprehensive utilization industry specification conditions" list, commonly known as the "whitelist". The publications might be the response to the high market growth in the past year. These highly related policies directly boosted the power batteries recycling industry. In the same year, the financial market in China extended the Environmental disclosure requirement to all the listed companies based on the "Noncompliance is interpreted" principle of "Guidelines on building a green financial system".

In 2018, the total number of retired power batteries reached 74,000 tons, but the first five "whitelist" enterprises only recycled about 5,000 tons of power batteries. (GGII) The remaining 60,000 tons of power batteries flew into informal channels or didn't get recycled in accordance with regulations. Since those tiny workshops needn't worry about the environmental influence and formal process, they can use higher prices to collect end-of-life batteries, which may harm the benefit of formal enterprises and slow down the development of battery recycling.

Poiint2: 2019~2021: Steady Development Period

Following the critical year of 2018, the power battery market had a correction in 2019 but overall shows steady growth. Ministry of Industry and Information Technology of the People's Republic China (MIIT) released Industry Specification conditions for Comprehensive Utilization of Waste Power Batteries of New Energy Vehicles in 2019 and "New Energy Vehicle Power Battery Cascade Utilization Management Method" in 2020 to guide the industry to smartly managed the used batteries. In 2020, the release of the Carbon Peak and Carbon Neutral policy was good news for the industry. The industry responded rapidly to the stimulus. From 2019 to 2020, the number of registered companies has an exponential growth as the response.

Point3: 2022: Beginning of the Climax

The most critical year for the industry is likely to be 2018, that is why 2022 so important to us. As estimated, the service life of power batteries is about 4-6 years, thus 2022 is the beginning of the climax of recycling.

Counterintuitive Clarification on the Character of ESG

ESG certainly plays an important role throughout the development of the industry. The intuitive explanation of the industry is that the environmental-friendly characteristic makes the companies in the industry perform better in ESG grade, which helps them to enjoy the benefits and get financed by ESG Investors. However, this idea is false, shown by data.

The ESG performance of leading companies in the industry is not significantly better than others, mainly because of the performance in the G sector. The popular ESG rating standards are more compliance-oriented and less focused on the overall value. The power batteries recycling industry is more innovative, while innovation is not stressed in the ESG rating.

However, the development of ESG still accelerates the industry by making more investors aware of the value of the Environment from various perspectives. The companies in the industry generally perform better in the ESG rating which emphasizes environmental, especially Sino-securities Carbon Neutral index.

Risk and investment opportunities

The investment return of the industries is highly related to the market performance of the lithium battery industry and the environmental industry.

The market performance of the lithium battery concept has a growth of 122.56% in 2021 while the environmental industry rose 81.51%(Wind). Both industries are considered likely to be overvalued by the market. However, in the first two weeks of 2022, the lithium battery dropped by 5.49% while the environmental industry dropped by 7.78%.

The current problem of the industry is the cooperation mechanism between companies. In January 2022, the Ministry of Industry and Information Technology and several leading power battery manufacturers attended a seminar, stressing the importance of establishing a traceability system and related public service platforms.

Moreover, the center has decided to further clarify the specific supervision responsibilities of relevant national and local departments, refine the supervision requirements for each link of power battery recycling, and increase supervision constraints.

All these imply a rising focus on the “G” part of ESG consideration. Policies and central focus push corporations to follow constraints and join the public cooperative service platforms, which may end up reducing the corporations’ efficiency to extend the scale of echelon utilization.

Thus, an increase in rating of “G” may lead to a corresponding decrease in a rating of “E” in the short run.

Overall, we hold cautious optimism about the battery recycling industry.

Focused Equity:

(002009.SZ) Miracle Automation Engineering Co., Ltd