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R&A Electronics **Logistics Report**

In May R&A Electronics:
Quality Inspection Report

Economy misses expectations,
inflation beats expectations US economy
in the first quarte

Chinese battery market raises and rises in 2023

The Boom of **Charging Stations**: Accelerated
Construction of Charging Stations Worldwide

China' s Two Sessions--Focus on
Chinese economy in 2023

03

Jul-Sep

01 Market Report

- [01] R&A Electronics Logistics Report
- [04] R&A Electronics: Quality Inspection Report in May

02 Global Online

- [06] China' s Two Sessions--Focus on Chinese economy in 2023
- [10] Economy misses expectations, inflation beats expectations - US economy in the first quarte
- [13] Europe's GDP Rises, High Inflation deserves all the credit
- [15] Southeast Asia Auto Market Maintains Stable Performance

03 Industry News

- [18] Global New Energy Market Overview and Regional Policies in 2023
- [22] The Boom of Charging Stations: Accelerated Construction of Charging Stations Worldwide
- [28] Energy storage revolution
- [32] Chinese battery market raises and rises in 2023
- [37] Photovoltaic inverter market is heating up

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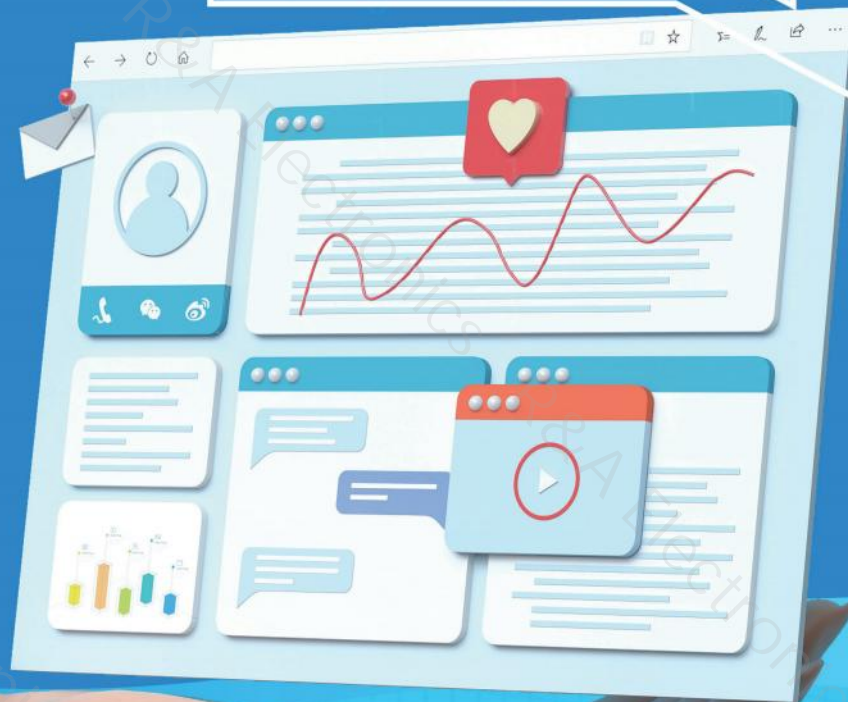
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R&A Electronics Logistics Report

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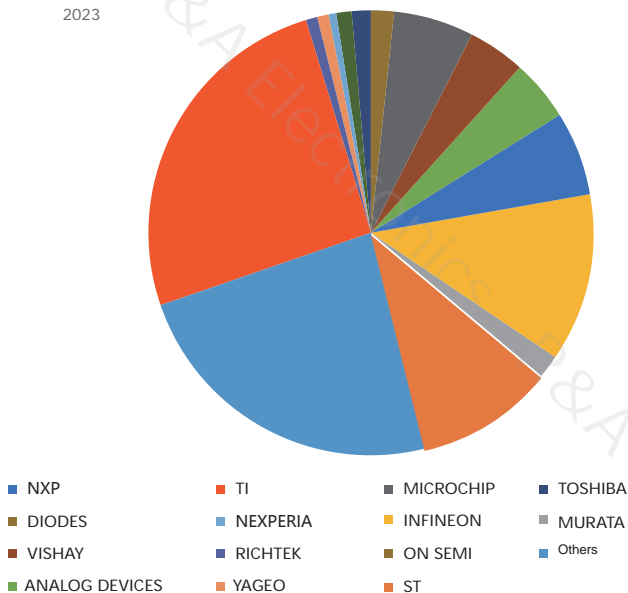




R&A Electronics's market analysis report based on the company's monthly needs and sales, investigate the future directions in the chip market to capture market demand which could recommend a procurement strategy for customers. Meanwhile, the product brands identified unconformable by the R&A anti-counterfeiting detection laboratory would be released in the report. This can warn our customers of risks, effectively protecting their interests. Prevent any unqualified semiconductors from entering into the market as R&A Electronics insists all along.

From March to May, STMicroelectronics and Texas Instruments are the most popular chip brands in R&A's own inventory, especially their automotive chips that attract robust demand. A spiral of demand for new energy vehicles led to vast calls for automotive chips. It is not surprising that the absence of automotive chips is about to grip semiconductor manufacturers for a long term including Texas Instruments, STMicroelectronics, NXP, Onsemi, and Infineon.

Shipment Share by Brand, Mar-May 2023



Due to the devoid of chips for automobiles, their spot prices are fixed at a high level. Also, the delivery times are still around 30 weeks, whereas, the lead time of chips for consumer and industry has sharply been shortened at 6-8 weeks. In terms of R&A's latest data, TI, Infineon, and ST are the hottest brands in sales, followed by MICROCHIP, NXP, and ADI.

Having said that, the general demand for **TI** semiconductors has slumped, while the spot prices of most regular materials have dived to the level as the same as that in the second half of 2021. Their lead times have contracted to 10-12 weeks as well.

Most of **Infineon's** products prices have slashed, expect some premium automotive MCU series. Fr instances, IGBT and high-voltage MOS keep on a dearth, TLE series with a long lead time at roughly 50 weeks. Infineon's revenue in the first quarter of this year leapt by 25% year-on-year, among which the automotive product business shot up 35% compared with the same period last year.

The demand for **ST's** products tumbled amid March and May. Nevertheless, industrial and automotive markets remain a spiral of demand for ST's chips. A scarcity of automotive chips is prominent. It is reported that ST intends to dive 4 billion US dollars into the expansion of production capacity this year. After shifting its consumer capacity to automotive, it is expected to see a shrinkage in delivery time in the third quarter.

Some of **Microchip's** products maintains a high price owing to the shortage of them, although the overall market for Microchip's products is dull.

NXP's automotive chip revenue in the first quarter soared by 17% year-on-year. Automotive chip is going to back the major growth of NXP's revenue in the next six months.



In light of the global economic trends, factor the following reasons to the ebbing:

1) The fall of Global Semiconductor Industry

The global semiconductor industry's sales in April 2023 amounted to \$40 billion, marking a modest 0.3% increase from \$39.8 billion in March 2023, but a sharp 21.6% shrinkage from \$50.9 billion in April 2022, disclosed by the Semiconductor Industry Association (SIA) on June 6, 2023. The latest industry forecast from the World Semiconductor Trade Statistics (WSTS) anticipates a year-on-year 10.3% dip in global annual sales for 2023, followed by a rebound of 11.9% in 2024.

2) Gloomy Economy around the world

The global manufacturing Purchasing Managers' Index (PMI) stood at 48.6% in April 2023, edging down 0.5 percentage points from the previous month, marking a successive decline for two months and dropping to the bottom since June 2020. Fortunately, the downturn was end eventually in May when The global manufacturing PMI soared to 53.5%, a tiny increase of 0.3 percentage points compared to the previous month. Although the global economic growth rate has initially upturned, the efforts for economic recovery needs to be further shored up while the downward pressure still haunts the world.

3) Constant contraction in Exports of China's Electronic Information Manufacturing Industry

In the first quarter of 2023, the output of mobile phones was 331 million units, dipping by 7%, of which smartphones was yielded 239 million units, a year-on-year slump of 13.8%. the yield of microcomputers stood at 7.9 million units, plunging by 22.5% YOY. Integrated circuits were output 72.2 billion pieces, denting by 14.8%. The export delivery value of the electronic information manufacturing industry was slashed by 10.5% year-on-year for the first quarter, a drop of 2.1% from January to February, and 5.2% lower than that of the industry in the same period.

Opportunity: Optimizing procurement strategies in face of signs of recovery in the consumer electronics industry

From last year to the present, the consumer electronics industry as a whole is still in the phase of de-stocking, exhibiting a weak recovery throughout 2023. It is predicted that consumer electronics market will look up in 2024. At that time, the demand for analog chips is expected to surge.

The brands of goods received by R&A in the second quarter mainly cover Texas Instruments, Infineon, STMicroelectronics, Analog Devices, and Onsemi, all of which are first-rate global analog chip-makers, occupying a large proportion of the market share. R&A proceeds to monitor their latest news. When the demand for analog chips experiences explosive growth, R&A can leverage its advantageous channels in this field to conduct global procurement for customers, deeply addressing short supply.

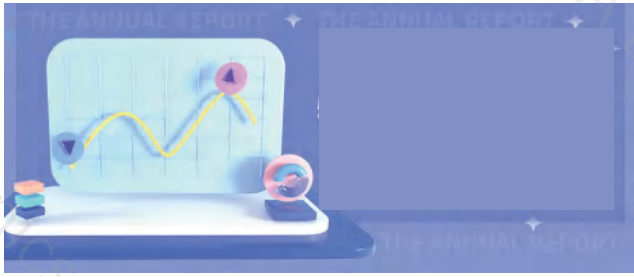
What can we do during the industry's stasis?

- 1) Diversify the supply chain: the diversity of the supply chain is able to enhance the resilience and resistances against risks of scarce supply.
- 2) Deepen supplier selection and rating system: stick to assessment and control of the supply capacity, quality, and lead time of suppliers to stabilize the supply chain.
- 3) Lower the cost: set up more complete purchasing network, continuously search for suppliers with more competitive prices and delivery times. Besides, optimize inventory management for customers.
- 4) Innovate: Explore new technologies and platforms, optimize digital and intelligent solutions, to promote the efficiency and transparency of procurement.
- 5) Dig in customer needs: Communicate effectively with customers, provide consulting services, and offer customized solutions.

A close-up, low-angle shot of a microscope's objective lenses. The lenses are metallic and have a textured, knurled grip. The background is a soft, out-of-focus blue and white, suggesting a laboratory setting. The text is overlaid on the upper right portion of the image.

R&A Electronics Quality Inspection Report in May

Sarah



A market report released by R&A Electronics in terms of the company's monthly sales, analyzes the market trend by observing market developments and sales data, so as to grasp market demand and provide purchasing strategies for customers.

In the report, R&A Electronics lists the nonconforming products with abnormal labels identified by R&A anti-counterfeiting laboratory, with the aim of preventing any rejected chips from entering the market through the firm, warning risks for our customers as well as effectively protecting the benefits of customers.

The R&A Electronics laboratory establishes and completes the quality control system with triple inspections in a bid to prevent forged semiconductors.


Step 1 ● The packaging label of product is checked through comparing with the label and packaging of manufacturer that are recorded in our label database. This step is able to verify and prohibit 90% of counterfeit products.

Step 2 ● On the basis of IDEA-STD-1010B testing standards, the inspectors observe surface, markings and leads of chips by digital microscope and proceed dimensions measurement, acetone and scratch test to verify if there is oxidation, scratches, resurfacing, plating or contamination on the chips.

Step 3 ● Deep inspections are executed by third-party laboratory to check internal structure and elements of chips, involving X-RAY, decapsulation, solderability, cross-section, electrical test.

Based on inspection reports in May, the defraud chip brands were identified as follows:

Step 1:

	Brand	
VNQ7040ARTY-E	ST	
MBR2H200SFT1G	ONSEMI	onsemi
4N33SR2M	ONSEMI	onsemi
SAK-TC222S-16F133F AC	INFINEON	
IRF3315PBF	INFINEON	
IRF3315PBF	INFINEON	
LM2576HVT-12/NOPB	TI	
SN65HVD234DR	TI	
SN65HVD234DR	TI	

Step 2:

Part Number	Brand	Problem	Solution
SPD30P06P G	INFINEON	Severe oxidation	Returns
SPD30P06P G	INFINEON	Oxidation, scratches	Returns
TLE5206-2S	INFINEON	Problems with the label, the body	Failure of inspection and payment
TPS60401QDBVRQ1	TI	a smattering of brass	Sent to laboratory for solderability test. The test shows that the solderability passes
M29W160EB70N6F	MICRON	oxidisation	Returns
DSC1001DL5-012.2880T	MICROCHIP	Presence of rewinding	Returns
FPDB40PH60B-SN00372	ON	Oxidation discolouration, copper leakage	Returns
TOP248YN	Power Integrations	Oxidation, stains	Returns

Our laboratory is equipped with the state-of-art equipment and manned by experienced Quality Inspection engineers. We have been recognized by our partners and ISO9001 certified. With AS6081 as the testing standard, our lab conducts in-depth analysis of electronic components in various aspects.

China's Two Sessions-- Focus on Chinese economy in 2023

Jade





China's National People's Congress convened in Beijing in March of this year, in which Premier Li Keqiang delivered his last government work report in office and the Ministry of Finance presented the government's budget for 2023. During the report, Premier Li Keqiang pointed out that the main targets in 2023 includes GDP growth of around 5%, approximately 12 million new jobs in urban, a drop of around 5.5% on the urban unemployment rate, and the CPI rise of nearly 3%.

Blocked by the epidemic, China only achieved 3% economic growth in 2022, while 2023's growth target is calculated based on this figure. However, some people concern 5% as 2023's goal more conservative.

The Premier also stressed "focusing on the sprawl of internal demand and giving priority to consumption recovery and expansion." The report, although, did not specify the areas' demand which need to be emphasized, three sectors were cleared in the release of the The Central Economic Work Conference late last year: housing improvements, new-energy vehicles and elderly care system.

Tourism and consumption of partial services restore to a quite rapid growth, since China's economy has entered a post-epidemic recovery. At the same time, to effectively accelerate the recovery of the economy is through the positive fiscal policy plus the prudent and solid monetary policy. However, the expiration of the auto-purchase tax halved policy at the end of last year, obviously cut off the rise rate of automobile consumption, which has generated certain restrictions on the overall consumption growth.

The GDP for the first quarter of 2023 gained 28,499.7 billion RMB (around US\$3932.96 billion) by virtue of constant price calculation,

a year-on-year increase of 4.5%, and a quarter-on-quarter increase of 2.2%, according to the preliminary data from National Bureau of Statistics. Specially, value-added agricultural output as the primary sector of economy earned 1157.5 billion RMB (approximately US\$159.7 billion), up 3.7% year on year.

The value-added manufacturing generated a year-on-year hike of 3.3% to 10794.7 billion RMB (roughly US\$1,489.7 billion). And value-added service industry gained 16547.5 billion RMB (nearly US\$2288.5 billion), growing by 5.4% compared with the same period of last year.

Gradually resumption of

The added value of major industrial companies saw an increment of 3.0% year-on-year for the first quarter, 0.3 percentage points faster than that in the fourth quarter of last year. Mainly concentrate on two aspects -- economic types and products -- to analyze the added value of industry.



The total profit of industrial enterprises above designated size in China achieved 887.2 billion RMB (about US\$112.4 billion), down 22.9 percent year-on-year from January and February. By contrast, the figure in March ballooned by 3.9% year on year, 1.5 percentage points larger than that in January-February.

A visible rebound of service industry

The added value of the service industry for the first quarter jumped by 5.4% in contrast to the same period of last year, a rise of 3.1 percentage points month on month. The added value of specific segments: the hotel and catering industry (a growth of 13.6%), information transmission, software and IT

services (a rise of 11.2%), financial industry (a growth of 6.9%), leasing and business services (an increase of 6.0%) as well as wholesale and retail (a rise of 5.5%).

A rapid growth of the investment in high technology: industrial production

Investment in high-tech industries elevated by 16.0%, of which spending on high-tech manufacturing and related service industries has a expansion of 15.2% and 17.8% respectively. Growths of 20.7% and 19.9% were got by the expenses in the electronic and communication equipment as well as medical equipment and instrumentation manufacturing separately that were classified into high-tech manufacturing. The investments surged 51.5% in the e-commerce service and 51.3% in the commercialization of scientific and technological achievements service.

A stable rise in Consumer Price Index, a drop in Producer Price Index for Industrial Products

The consumer price index (CPI) crept up 1.3% year-on-year in the first quarter. For instances, the price of food, tobacco and liquor fulfilled a growth of 2.9%, clothing rising by 0.7% from the first three months of last year. Housing was fallen by 0.2% in price, daily necessities and services climbed by 1.2%. Transportation and communication prices extended by 0.1%, education, culture and entertainment going up 1.7%, and medical care rising 0.9% in price. The rest of supplies and services prices hiked 2.7%.

Producer Price Index for Industrial Products(PPI) cut off 1.6% year-on-year, purchasing Price Index of Raw Material(PPIRM) with a drop 0.8% year-on-year.

A reduction of the surveyed urban unemployment rate

The employment performed stably overall. Keep the average surveyed urban unemployment rate being 5.5% during January and March which lowered by 0.1 percentage point compared with that of last fourth quarter. The figure in March picked up 5.3% YOY, 0.3% slower than that in February.

To sum up, as the economy of China scored a good point in the first three months, the expectation of it apparently improve. The economy is on the uptrend overall.

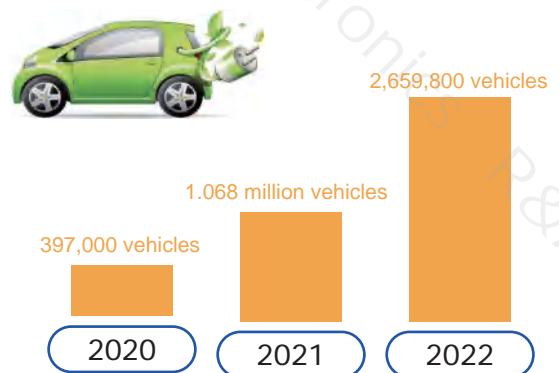
China's new energy vehicles is a bright landscape among industries. It has also staged a boom period this year under the strong support of the state. The new energy vehicles remains widespread - new energy vehicles step into the countryside.

The National Development and Reform Commission, the National Energy Administration jointly issued a new guideline at the end of May to accelerate the construction of charging station and push electric vehicles into village, said Daily News. The electric vehicle market in rural areas of China is still in its infancy as the National Development and Reform Commission spokesman Meng Wei explained. Problems -- a lack of charging infrastructure, economic and practical cars, sales and service capacity -- restrict the promotion and application of electric cars.

The guideline proposed that charging facilities are prioritized to place in enterprises and institutions of county, commercial buildings, transportation hubs, service areas along highways. Subsequently, charging infrastructure will sprawl into the areas where residents relocated from inhospitable areas were resettled together in communities and vital rural tourism villages. At the same time, the existing communities in rural areas should build up charging facilities quickly in line with the local conditions. Positively implement charging infrastructure construction in new communities.

The sales of new energy vehicles in the countryside for 2021, 2022 and the second half of 2020 increased by 169%, 87% and 80%, respectively, staying rapid growth.

New energy vehicles to the countryside for nearly three years, the cumulative model sales have reached more than 4.1 million units.



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In history, China launched twice policies in regard to electric vehicles in villages. The first decision was carried out in 2009 and 2010; The second was in 2019 to 2022. Over almost 14 years from

Several auto makers have tapped into rural EV markets.

Recently Cheryev released a purchasing policy "one thousand RMB(almost US\$138) subsidies per QQ ice cream vehicle in the countryside". It is reported that other auto companies like BYD, Leap motor are also actively deploying related markets .

GAC AION recently posted that GAC Energy Technology Co., LTD., jointly managed by GAC Group and GAC AION, signed a strategic cooperation agreement with SINOPEC Marketing Guangdong Company with respect to construction of charging stations, automobile sales and related value-added services.

China' s GDP grew 3% last year. Given China enter into a post-epidemic recovery stage this year, the expectation for GDP is set up 5% of a growth. Three sectors were cleared to focus on in the release of the The Central Economic Work Conference late last year: housing improvements, new-energy vehicles and elderly care system. Data for the first quarter of this year show the rebound of service sector, rapid growth of the investment in high technology, stable rise in Consumer Price Index and reduction of the surveyed urban unemployment rate. New energy vehicles continue to penetrate.





**Economy misses expectations,
inflation beats expectations -
US economy in the first quarter**

Jade

Recently, U.S. Bureau of Economic Analysis manifests that the GDP of the United States for the first quarter of 2023 slightly ascended by 1.1% of an seasonally adjusted annual rate (SAAR), but visually below the market expectation of 2%. The GDP that has eased for two consecutive quarters fell from the 2.6% growth in the fourth quarter of last year.

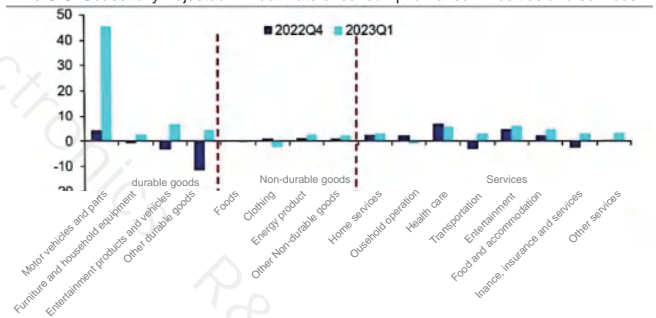
A research group named Meigushe that specially analyzes the United States' economy delivered that the economic structure of the U.S. characters weak investment and strong consumption. The seasonally adjusted annual rate of private investment that was hit by a drop of inventories dived to -12.5% in the first quarter from 4.5% in the fourth quarter of last year, dragging GDP down 2.3%. Generally speaking, the declining inventories concentrate on machinery and equipment in wholesalers, as well as transportation devices and products like petroleum and coal in manufacturers. At present, although, the entire inventory of the United States is still at a high level, with the gradual reduction in demand, the country is cutting off the inventories in the pipeline.

In contrast, consumption has remained robust growth. The SAAR of consumption in the first quarter carried out a bumper result of 3.7%, which was faster than the 1.0% in the fourth quarter of last year, driving GDP rise by 2.5%.

Undoubtedly, consumption becomes the essential driver of GDP growth. In particular, since the expenses on motor vehicles and parts gained a brilliant 45.3% of seasonally adjusted annual rate, the growth rate of goods consumption rebounded sharply. In addition, the pull of net exports, government spending and investment on the economy were 0.1 and 0.8 percentage points respectively, which was relatively stable.

The growth rate of service consumption picked up 2.3% of SAAR in the first quarter. To be specific, entertainment, medical care, as well as accommodation and catering were all unveiled similarly juicy quarterly numbers.

The U.S. Seasonally Adjusted Annual Rate of consumption of commodities and services



Sources: BEA

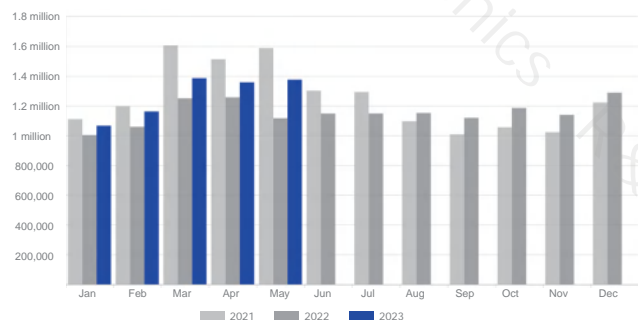
Yet inflation and interest rates have been barely rising. In March from a year earlier, consumer prices inch up 5% which remains high, in light of U.S. Department of Labor, well above the Fed's long-run inflation target of 2%. Food prices surge 8.5 percent and accommodation prices have a hike of 8.2 percent. Millions of American families are "overwhelmed" by high prices.

The Federal Reserve has reinforced efforts against high inflation, declaring another quarter-point benchmark interest rate rise that is the tenth since March, marking the sharpest rate hike over sixteen years.

The sinking of economic growth manifests a decline in external demand for emerging economies. Particularly, a great blow against the economies' exports is in the pipeline, resulting in a heavy pressure above the economic growth. Changes in the price of funds in the United States have a huge impact on global liquidity.

Therefore emerging markets cannot but maintain their interest rates raising to shun a large outflow of funds, exacerbating the crunch of the global liquidity.

The economic growth is not meeting the expectation that the analysts came out, although, the U.S. automobile market is still showing juicy numbers.



Vehicle sales in the United States, 2021-2025

With the continuous improvement of the global new energy industry chain and technology, major regions of the world have introduced policies to accelerate the rapid development of the new energy industry. PV, energy storage, power batteries, and new energy vehicles are four important branches of the new energy industry. This article summarizes and analyzes the market status and regional policies in China, Southeast Asia & South Asia, the US, and Europe.

Light trucks surged by 24.3% year-on-year to 1,075,068 cars, while passenger cars jumped by 17.8% to 299,824 units.

Total inventory in May covered 1.741 million vehicles (similar to the previous month, with 32 days on hand, and 22 days in the same month last year).

The inventory of each manufacturer is as follows. General Motors embraced 43 days of inventory and 390,000 vehicles in stocks, which is 12,000 cars less than last month. Ford had 56 days of inventory and about 379,000 inventory, an increase of 7,000 from the previous month. Stellantis reported 57 days of inventory and 348,000 inventories, an increase of 5,000 vehicles from the previous month. Toyota owned 20 days of inventory and 152,000 stocks, a leap of 7,000 vehicles from the previous month.

Manufacture (May)	Inventory	Stocks	Month-on-month inventories
GM	43 Days	390,000 vehicles	-12,000 vehicles
Ford	56 Days	379,000 vehicles	+7,000 vehicles
stellantis	57 Days	348,000 vehicles	+5000 vehicles
Toyota	20 Days	152,000 vehicles	+7,000 vehicles



**Europe's GDP Rises,
High Inflation deserves all the credit**

Jade

The European Commission predicted in mid-May that the economic growth of the 20 countries in the EMU will reach 1.1% in 2023. An European economist, in an interview with AFP, indicated that this figure now seems overly optimistic. "Since the spring, all the data has been awful," he added.

Eurostat says the GDP of the EMU has fallen for two consecutive quarters, down 0.1% from January to March 2023, the same rate as from October to December 2022. The economy is largely crimped by Germany's industrial production difficulties.

In the first quarter of this year, Germany's economic performance not only lagged behind the overall EU level but also ranked at the bottom among the world's major economies. The International Monetary Fund (IMF) projects that Germany's GDP is possible to contract by 0.1%

Before the Russia-Ukraine conflict, Germany relied heavily on Russian natural gas, much more than the UK and other EU countries. Moreover, Germany, as a long-standing major exporter, highly depends on international markets beyond the European countries. Therefore, the severe shocks from Germany's energy structure transition grips Germany undoubtedly after sanctions on Russia. Germany's economic growth have been struck more visibly by the hike in production costs and the downturn throughout international market as well.

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Although inflation has eased somewhat, the annual inflation rate in the EMU remained high at 6.1% in May, with the prices of food, final goods, and services continuing to rise. The Eurozone economy is also stumbled by the European Central Bank's interest rate hike, which has reduced demand for credit and investment, especially in real estate.

Eurostat stated that in the first quarter of this year, a 0.1% decline in household consumption weighed on the Eurozone economy, along with a 1.6% reduction in government spending as well as changes in goods inventory also suppressed economic growth.

By contrast, imports and exports of food, beverages, tobacco, machinery and transportation all went up year-on-year in Europe in March. To be specific, machinery and transportation exports saw a leap of 16.45% year on year, thanks to the rapid penetration of new energy vehicles. Inflation has led to decreases in the imports and exports of bulk commodities and mining and raw materials manufacturing.



Europe's new energy vehicle sales in May 2023

Country	Sales	YoY	MoM	Penetration rate
German	56,583	8%	36%	22.9%
UK	33,538	47%	15%	23.1%
French	35,369	11%	26%	24.3%
Italy	13,269	65%	32%	8.8%
Spanish	11,146	33%	31%	10.4%
Polish	2,546	53%	6%	6.6%
Sweden	17,632	41%	54%	61.9%
Norway	11,476	17%	40%	86.0%
Switzerland	5,996	41%	24%	61.9%
Denmark	5,953	29%	19%	42.5%
Portugal	5,865	133%	44%	26.6%

The Penetration Rate of New Energy Vehicles in Europe Continues to Rise

Looking at the sales figures in May, Germany, France, and the UK have become the three major leaders in Europe's new energy vehicle market. Meanwhile, countries such as Norway, Sweden, Switzerland, and Denmark have entered a stage of high penetration of new energy vehicles, a trend expected to proceed.

Southeast Asia Auto Market Maintains Stable Performance

Jade



The latest data released by the Association of Southeast Asian Nations (ASEAN) Automobile Federation shows that the automobile sales of six countries, including Malaysia, Thailand, Singapore, and Indonesia, were about 860,000 units, up 4.3% year-on-year for the first quarter of 2023. The automobile production of these six major countries exceeded 1.16 million cars, an increase of 8.2% year-on-year. The recently concluded 44th Bangkok International Motor Show caught more than 1.6 million visitors' eyes, with 45,000 car reservations.

To better promote the development of new energy vehicles, the six governments have made further efforts. It is reported that Thailand has driven its cars to Asia, the Middle East, Africa, Europe, and North America. Sales of 1.05 million vehicles of Thailand in 2023 is on the horizon. The government is seeking to make Thailand a regional and global base for automobile and parts manufacturing, to bring the country's transition to a low-carbon economy.

The Indonesian government announced that the value-added tax on new energy vehicle is going to slash from 11% to 1% from April to December of 2023. At the same time, new energy vehicles with a localization ratio of auto parts between 20% and 40% are eligible to enjoy a 6% value-added tax discount.

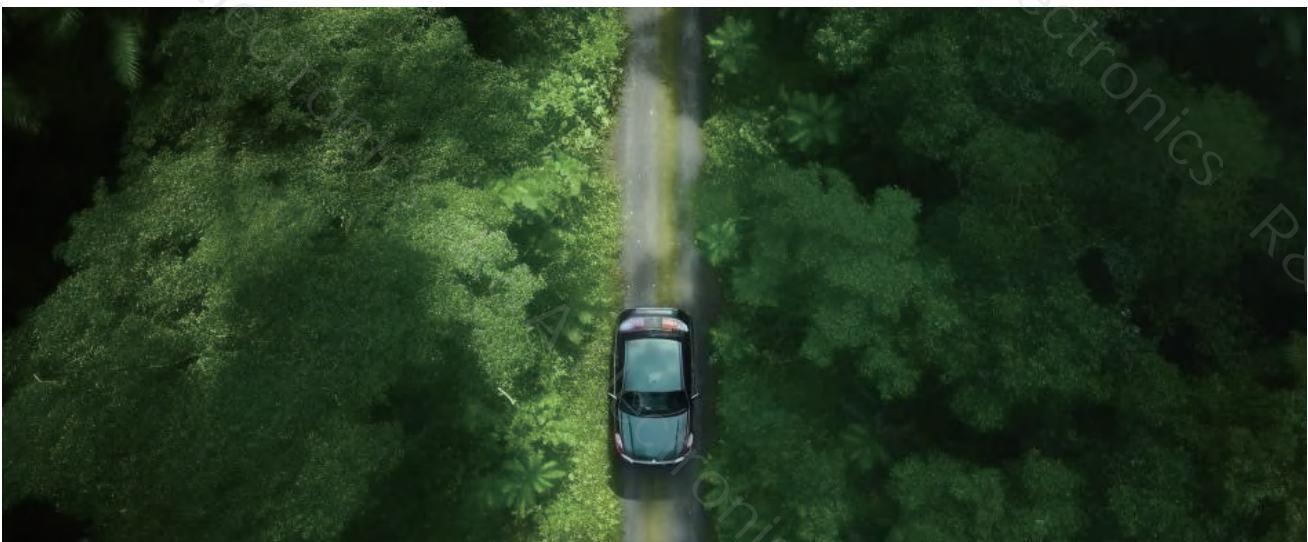
Recently, Malaysia declared projects to set up 10,000 public charging facilities nationwide by 2025, to achieve a 15% proportion of new energy vehicles in the country's total car sales by 2030, and to further elevate this proportion to 38% by 2040.

Auto companies including BYD, Changan Auto, SAIC Motor, Great Wall Motor, and Neta Auto all intend to build factories in Southeast Asia or cooperate with local companies for contract manufacturing, based on knockdown costs of labor and factory in the Southeast Asian market.

Automakers are more focused on exporting or investing in factories in Thailand, Malaysia, and Vietnam. According to data from the Thailand Automobile Association, Chinese brands account for more than 90% of the total sales of new energy vehicles in Thailand.

Currently, Reports stated that Thailand is negotiating with power battery manufacturers such as CATL to build production facilities in Thailand, and warmly welcome more power battery factories to construct in Thailand.

Narong Sritalayon, General Manager of Great Wall Motors' Thai subsidiary, stated that Great Wall Motor will finalize an investment \$30 million to establish a new battery pack assembly plant in Thailand, and is considering setting up a research and development center in Thailand to study electric pickups. In April of this year, Changan Auto revealed that it is in the works that the firm builds a new energy vehicle factory worth 9.8 billion baht (about \$278 million) in Thailand, of which production is scheduled to start in 2024 with an initial capacity of 100,000 vehicles, which will climb up 200,000 vehicles in the second phase.



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In May of this year, BYD made another move in Southeast Asia and plunged in electric vehicle manufacturing and assembly projects in Vietnam. In addition, countries such as the Philippines and Indonesia long to attract BYD to invest in factories.

Neta Auto has been making rapid strides in Southeast Asia.

On March 10, 2023, the construction of the Neta Auto factory in Thailand officially started. In May, a spokesperson for the Thai government said in a statement that

Hozon Auto has signed an agreement with a Thai car assembly company to run local production of the Neta V model from next year.

SAIC Motor-CP Industrial Park formally started construction in Thailand. The factory is about to focus on the localization production of key new energy vehicle parts such as lithium-ion batteries. The first phase of the battery module and PACK production line is foretold to be completed within the year. The entire project is anticipated to finish in 2025. In 2022, "SAIC Motor-CP", a subsidiary of SAIC Group in Thailand, manufactured and shipped 6,684 MG brand vehicles, 82% of which were shipped to Vietnam and 18% to Indonesia.

It is understood that Anwha (Shanghai) Automation Engineering Co., Ltd. has chosen the Eastern Economic Corridor of Thailand as its first overseas production base to produce batteries for the MG brand's electric vehicles.

On April 30, SAIC Motor released that its subsidiary SGMW and the Indonesian Ministry of Marine and Investment Coordination formally signed a memorandum of understanding for investment in new energy vehicle projects, actively spreading investment in Indonesia, introducing an increasing number of new energy vehicles to the local market, and driving the high-quality development of the "Belt and Road" initiative.



Global New Energy Market Overview and Regional Policies in 2023

Jola

With the continuous improvement of the global new energy industry chain and technology, major regions of the world have introduced policies to accelerate the rapid development of the new energy industry. PV, energy storage, power batteries, and new energy vehicles are four important branches of the new energy industry. This article summarizes and analyzes the market status and regional policies in China, Southeast Asia & South Asia, the US, and Europe.

China

In China, with the leading technology and well-established industrial chain, the new energy industry is developing rapidly. From the consumption side of new energy industry, the Chinese market is currently the largest market.

PV

- In March, the Ministry of Natural Resources issued a notice on supporting the standardized land management for photovoltaic power generation industry development.
- In May, the Ministry of Natural Resources released the "Control Indicators for Land Use in Photovoltaic Power Station Projects".
- In June, the Ministry of Natural Resources issued a draft notice on promoting the establishment of Rights in offshore PV & offshore wind power under the premise of not affecting national defense security.

Energy storage

- In March, the National Energy Administration issued the "25 Main Requirements to Prevent Power Production Accidents".
- In April, the National Energy Administration published the "Guidance on Energy Work in 2023".

Power battery

- In February, Eight departments including the Ministry of Industry and Information Technology jointly issued a notice on organizing pilot projects for comprehensive electrification of public vehicles in designated areas.



Southeast Asia & South Asia

In Southeast Asia & South Asia regions, the development momentum of new energy is particularly strong with motivating regulations and policies, and the revision of policy planning documents tends to increase the long-term share of renewable energy.

PV

- India halved import duties on solar panels to offset the production shortfalls under the growing demand for renewable energy. According to ICRA, the Ministry of Power Industry of India has postponed the solar and hybrid power generation projects until March 2024.
- Malaysia updated its renewable energy development goals: the renewable energy will account for about 70% of the power structure in India by 2050, and has revised the Net Electricity Expenditure (NEM) plan for commercial and industrial (C&I) companies.
- The Ministry of Energy of Vietnam has released the "2021-2030 National Power Development Plan (VII)", which intends to deploy photovoltaic rooftop systems in at least half of the commercial and residential buildings in Vietnam.

Energy storage

- India's finance minister announced that the ministry will provide a viability gap subsidy (VGF) for 4 GWh battery energy storage projects and formulate a detailed framework for pumped storage scheme. In addition, India has exempted production materials and machinery required for the production of lithium-ion batteries for EVs from tariffs from Feb 2, and this measure will last until March 31, 2024.

Europe

The European market is the second largest market for new energy, which is mainly due to the fact that the consumers in the Europe have a relatively high acceptance of the concept of new energy, and the demand in European market is relatively large.



PV

The European PV market has maintained a high degree of prosperity. It is expected that the new installed capacity in Europe will reach 70GW in 2023. According to SolarPower Europe, the top 5 countries in Europe for new installed capacity in 2022 are Germany, Spain, Poland, the Netherlands and France.

1. **Germany** has formulated a new tax relief scheme for roof photovoltaic, and two measures will take effect in 2023. The first measure is to reduce the VAT on residential photovoltaic systems up to 30 kW to 0%. The second measure will provide tax-free treatment for small PV system operators.

2. **The Netherlands** approved a legislative proposal submitted by Energy Minister in February: the current net metering scheme will gradually be phased out in favor of PV power generation. In 2023, the Dutch government will reduce the VAT on residential PV systems from 21% to 0%.

3. **Poland** introduced a new regulation to stipulate that the maximum capacity of small-scale PV installations is 50 kW, and a new net-billing system will replace the net metering scheme.

4. **France** has passed a new Renewable Energy Act this year, aimed at accelerating the deployment of renewable energy. Nearly 3.5 GW of wind power projects in France are in the final stage of permitting and awaiting national approval.

Energy storage

The European Commission has proposed the Net Zero Industrial Act, which will increase support for the development of PV, photothermal, wind power, energy storage batteries, geothermal, electrolyzers, fuel cells, biomass energy, CCUS (carbon capture, utilization, and storage), and power grid technologies.

New energy vehicle

France introduced restrictive subsidy reforms in May. According to the latest policy, subsidies in France will be directly related to the carbon dioxide emissions during the production process of EVs, and its low-carbon standard is an insurmountable barrier for products imported from other countries.

the US

Although Americans have relatively high acceptance of new energy products, the development of the new energy industry in the US is restricted in terms of policy. Before the introduction of Inflation Reduction Act, there was little investment opportunities in the US for the lithium-ion new energy industry.

PV

The US Department of the Treasury and Internal Revenue Service (IRS) have issued guidelines for PV utilization in local areas: According to the IRS, Solar power projects that use domestic content are eligible for the full 30% tax credit can increase their tax credit by an additional 10%, to 40% in total, and 0.3 ¢/kWh for projects that use the Production Tax Credit.

IC THE WORLD

Energy storage

The US Department of Energy announced to invest \$27 million to advance energy storage technologies. The department plans to invest \$15 million in the Storage Innovations (SI) 2030 to foster diverse partnerships between companies within storage technology industries to tackle research and development (R&D) challenges. Additionally, The Energy Storage Demonstration and Validation FOA is expected to make up to \$12 million available for R&D and demonstration projects to facilitate the large-scale commercial development and deployment of grid-scale lithium and redox-flow batteries.

New energy vehicle

In April, the US Department of the Treasury released specific regulations for new EVs in the Inflation Reduction Act. According to the regulations, new vehicles eligible for tax credit must be assembled in North America, and the critical minerals and battery components contained in the vehicles must come from the US or countries that have signed free trade agreements with the US.





The Boom of Charging Stations: Accelerated Construction of Charging Stations Worldwide

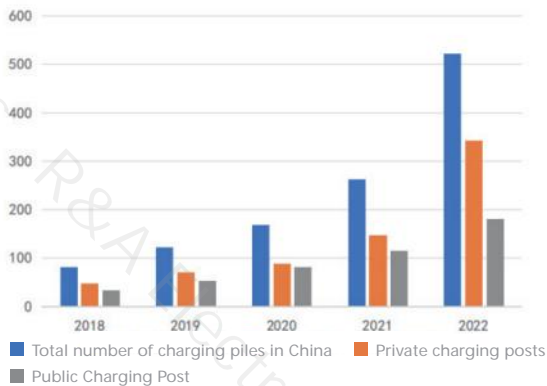
Sarah

With the rapid development of new energy vehicles (EVs), how to alleviate the "range anxiety" of EVs has become a common concern for major automakers and vehicle owners. Charging stations, as the energy supply facilities that maintain the operation of new EVs, become a hot topic in this industry. Although the ownership of new EVs is rising steadily, the construction speed of the supporting charging stations is far behind the growth rate of EVs. There is a huge gap in the charging station market, indicating a broad prospect.

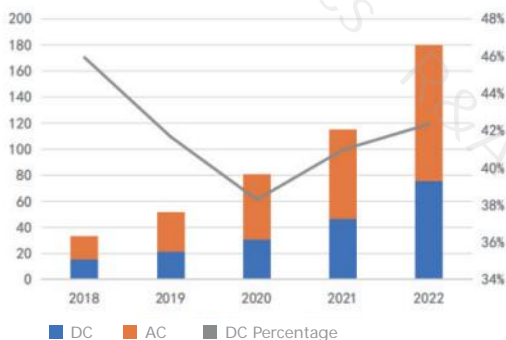
01 China: the boom of new energy industry is constructing a number of new infrastructures

From 2016 to 2022, the number of charging stations in China increased from 141,300 to 1,797,500, with a CAGR of 52.80%. From January to December 2022, the incremental capacity of charging infrastructure reached 2,593,000, with a 91.6% YoY increase in public charging stations and a 225.5% YoY increase in privately owned charging stations. As of December 2022, the total number of charging infrastructure reached 5,210,000 in China, with a 99.1% YoY increase.

Total number of charging piles in China
(Unit: 10,000 units)

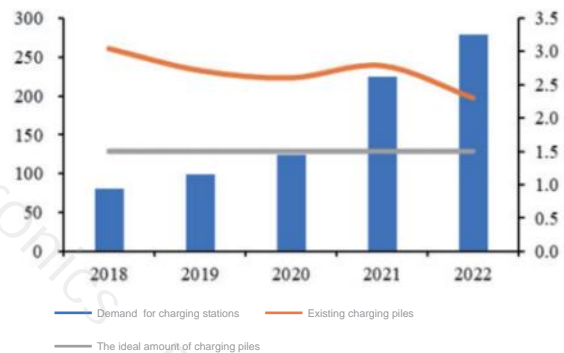
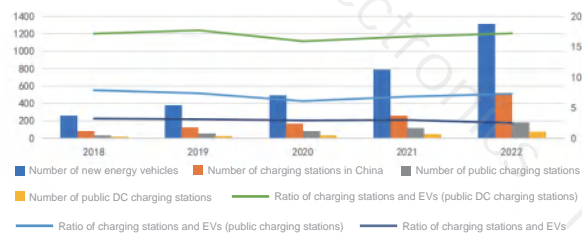


Percentage of DC and AC in public charging posts
(Unit: 10,000 units/%)

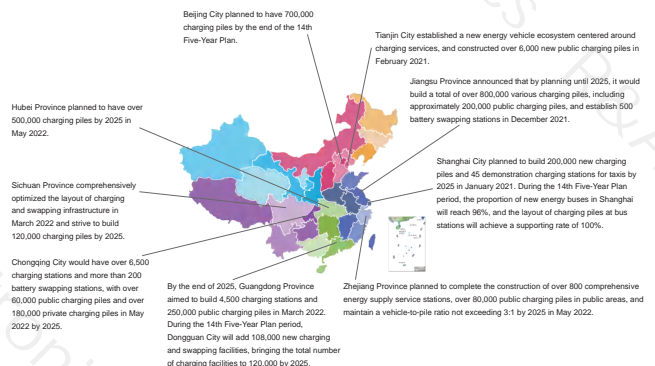


The ratio of vehicles to charging stations has decreased from 3.2:1 in 2018 to 2.5:1 in 2022, while the ownership of both new EVs and charging stations continues to increase. With an ideal ratio of 1.5:1, the demand gap for charging stations in China reached 2,793,000 in 2022 with a 24.3% YoY increase, indicating a continuous growth in the supply-demand gap. The Ministry of Industry and Information Technology (MIIT) in China plans to achieve a vehicle-to-charging station ratio of 2:1 by 2025 and 1:1 by 2030. In the next 10 years, there will still be a gap of 63 million in charging station construction.

The number and ratio of charging stations and EVs
(Unit: 10,000 units)



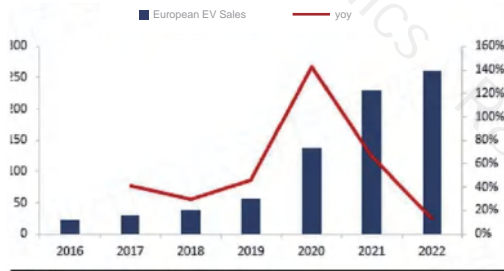
As new energy industry gains momentum and new infrastructure is poised to take off, more than 31 provinces and municipalities in China have introduced policies on charging infrastructure. Local governments have stepped up their efforts in the construction and operation of charging infrastructure, promoting the coordinated development of new energy and new infrastructure.



02 Europe: electrification of vehicles accelerates the construction of charging stations

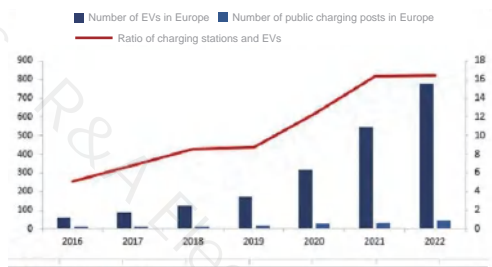
As the second largest market for new EVs, Europe is also struggling to keep up with the growth rate of EVs in terms of charging station construction. According to IEA statistics, the sales of new EVs in Europe increased from 212,000 in 2016 to 2.6 million in 2022. By the end of 2022, the total number of new EVs in Europe reached 7.62 million. However, the number of public charging stations in Europe only increased from 116,100 in 2016 to 474,700 in 2022, with a CAGR of only 26.44%. The construction of public charging stations is far lower than the growth rate of new EVs.

EV Sales Growing Rapidly in Europe
(Unit: 10,000 units)



Source: IEA

The ratio of new energy vehicles to charging posts in Europe is increasing every year
(Unit: 10,000 units)



Source: IEA

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Furthermore, with the continuous development for electrification in Europe, the President of the European Automobile Manufacturers Association, Mr. De Meo, stated that the progress of installation of EV charging stations in EU member states cannot keep up. If Europe wants to support the transition to EVs in automotive industry or provide services for the increasing number of EVs on the road, it needs to add 14,000 charging stations per week. However, only 2,000 charging stations are being installed per week currently.

Country	PEV Sales	Proportion of PEV	PHEV Sales	Proportion of PHEV
German	29,740	14.7%	11,787	5.81%
UK	20,522	15.4%	8,595	6.46%
French	17,173	13.0%	10,878	8.21%
Italy	3,996	3.1%	6,055	4.76%
Spanish	3,438	4.6%	4,325	5.79%
Netherlands	8,275	27.9%	3,000	10.11%
Sweden	6,928	33.7%	4,549	22.10%
Norway	7,471	83.2%	703	7.83%
Switzerland	3,375	18.6%	1,443	7.95%
Denmark	3,471	28.8%	1,519	12.59%
Portugal	2,180	12.3%	1,906	10.73%

Source: IEA

The construction of public charging stations in Europe is urgent, and countries such as Germany, the UK, France, Sweden, the Netherlands, and Iceland have successively introduced incentive policies for charging station construction.

EU

Construction targets: By 2026, the demand for corresponding public car charging facilities on European roads will exceed 16 billion euros. By 2028, the demand for truck charging facilities will exceed 10 billion euros, bringing the total demand for equipment to 20-30 billion euros. On main roads, at least one EV charging station should be set up every 60 kilometers (37 miles), and one truck charging station every 120 kilometers, half of which should be built by 2028.

"EU Connecting Europe Facility Transport Programme": By the end of 2023, 1.5 billion euros will be provided on the TEN-T network for the construction of DC charging stations and hydrogen stations.

"EU EV Charging Masterplan": An investment of 172 billion euros will be made by 2030 for the construction of charging stations, of which, 85 billion euros will be used for the construction of public charging stations.

Spain

For public charging stations with charging power below 50kw, a subsidy of 30% is provided. For those charging power above 50kw, subsidies of 35% to 55% are provided depending on the size of the company. A subsidy of 70%-80% will be provided for the purchase and installation of charging stations at private or shared parking spaces.

Germany

For private charging stations, homeowners, tenants, and residential developers can all apply for a subsidy of up to 900 euros for the construction of charging infrastructure.

Over the next three years, an investment of 6.3 billion euros will be made to increase the number of new energy vehicle charging stations nationwide.

UK

The maximum subsidy for homes and workplaces is 350 pounds, with the standard subsidy for residential street-side stations being 6500 pounds. Companies installing charging infrastructure can receive a 100% tax incentive.

Starting from 2022, all new residential and business buildings in the UK must install EV charging stations, a measure aimed at promoting nationwide adoption of electric vehicles by adding up to 145,000 additional charging points each year.

The UK planned to invest 1.6 billion pounds to increase the number of EV charging stations tenfold to 300,000 by 2030.

Austria

The country provided a subsidy of 600 euros for private charging stations, 1,800 euros for public charging facilities in apartment buildings, and up to 30,000 euros for public fast charging stations.

Sweden

Investment in public and private charging stations is granted up to 50% of the funds, and private charging stations are subsidized up to 10,000 Krona each.

569 million Swedish Krona (\$63.9 million) is provided for HDV charging infrastructure along the main transport corridors.

Sweden planned to expand the national charging infrastructure by 400 million Swedish Krona through the Klimalivet (Climate Life Plan) in 2023.

The country planned to invest 300 million euros over the next 10 years for the construction of charging facilities: it is estimated that by 2024, there will be 8,000 charging stations throughout Paris.

France also invested 100 million euros in charging stations on the national highway network, subsidizing an average of 30%, with special cases subsidized at 40%.

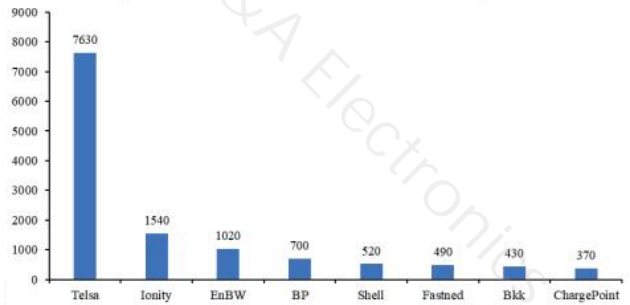
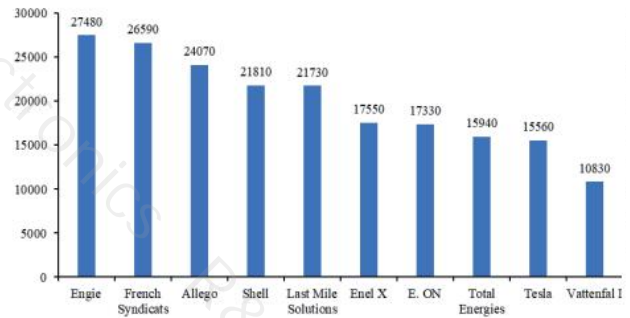
Each company in France must have four fast charging stations, including at least two stations with a charging power of 150kw.

Netherlands

Subsidy policies are mainly aimed at the construction of public charging stations, which are the environmental investment tax exemption and the environmental investment random depreciation.

Approximately 53.27 million USD is provided as subsidies for investment in the construction of charging stations.

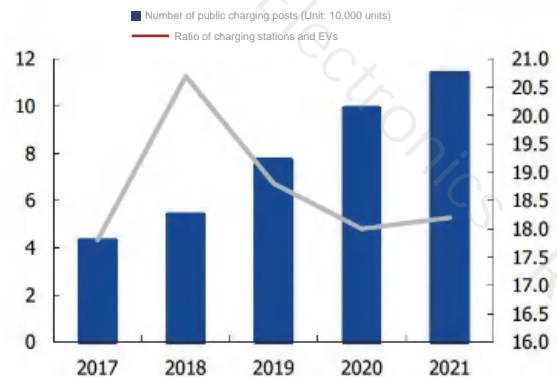
There are mainly two types of participants (manufacturers and operators) in the European charging station industry. In terms of manufacturing, companies such as ABB and Schneider Electric have taken the lead with advanced technologies. ABB introduced the world's fastest EV charging station in 2021, capable of charging for 100 kilometers in 3 minutes. In terms of operators, they are mainly traditional energy companies including ENGIE, Shell, Total Energies and third-party operators like Allego. Energy companies have been actively integrating resources, for example, Shell acquired Ubitricity, the largest charging infrastructure operator in the UK, and Engie acquired charging station company EV Box. The aforementioned operators primarily invest in AC charging stations, while in the fast-charging field, Tesla has occupied a considerable market share by virtue of its brand influence and product capabilities.



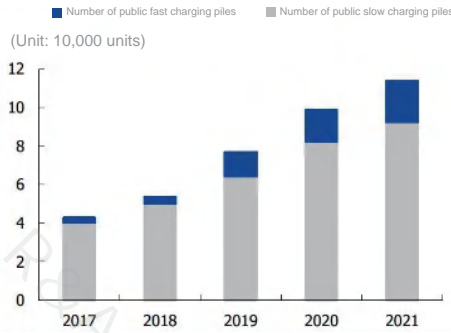
U.S.: Incentive policies ramp up the establishment of charging piles

EVs account for less than 10% of new car in the U.S., far below China and Europe. Although the penetration rate is low, global demand for new EVs is still on a long-term upward trend. With the decrease in battery prices, improvement in driving range, and upgrade of charging infrastructure, the U.S. new EV market is expected to become a highlight.

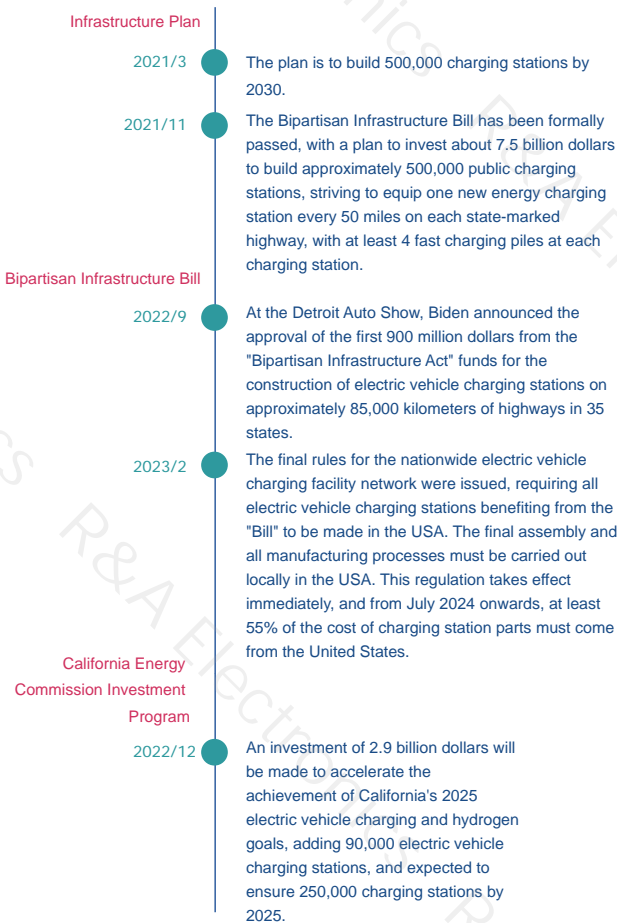
According to IEA data, the number of public charging stations in the US was 128,000 in 2022, with a vehicle-to-pile ratio as high as 23:1, indicating a significant gap in charging station availability.



the top market share there. Electrify America, a subsidiary of Volkswagen, ranked second place with only 14.1% market share.

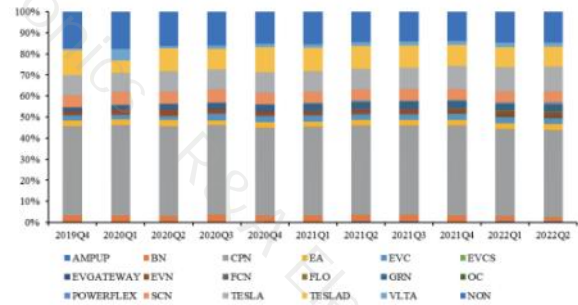


The U.S. government's policies are increasingly leaning towards electric vehicles, which will accelerate the production of new energy vehicles and the deployment of charging stations.

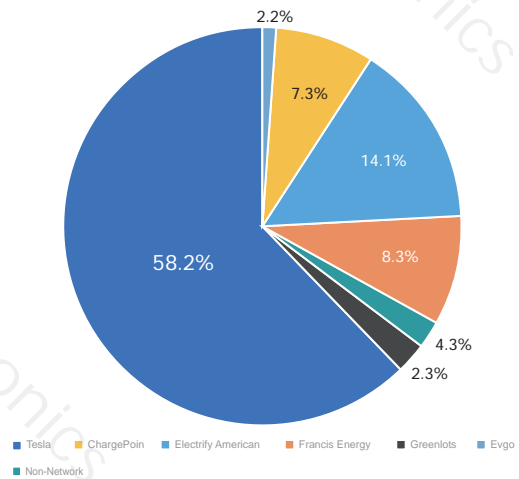


In the United States, there is a pattern of "one super powerful force with several sub-powerful forces" among public charging station operators. ChargePoint is the leader operator, with a market share of 41% as of 2Q22. In the field of public fast-charging stations, as of 2Q22, Tesla Superchargers dominate with a market share of 58.2%, and its fast chargers are also exported to Europe, holding

State of the Market for Public Chargers in the US

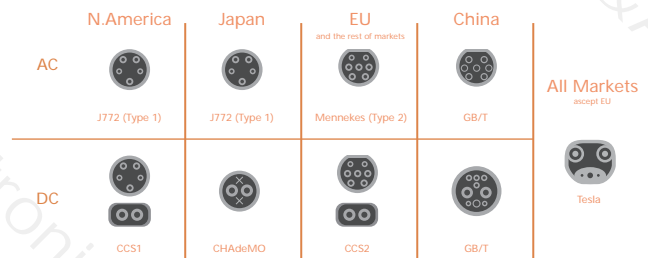


State of the Market for Public Fast Chargers in the US



04 Five charging standards are launched, Tesla's NACS charging standard dominates North America

Although charging stations are beginning to enter a period of accelerated construction in various countries, there are significant differences in safety standards and detailed requirements between countries. Currently, there are five main charging station interface standards internationally: China's national standard GB/T, CCS1 (combo/Type1) for the U.S., CCS2 (combo/Type 2) for Europe, Japan's CHAdeMO standard, and Tesla's own separate charging interface standard.



The 5 international charging standards

In China, there is only the GB/T standard for charging. In the initial pilot charging stations opened in mainland China, including 10 Supercharging Stations and 120 Destination Charging Stations, they can support up to 37 models of vehicles, including popular models like BYD, NIO, XPeng and LI.

In Europe, charging station standards specify three main types of connectors: European, American, and Japanese. Currently, the Type 2 connector has become the most popular in the European region.

In the US, federal funding of \$7.5 billion was allocated to promote the CCS standard, and currently more than 50 passenger car models are equipped with CCS charging interfaces. However, the three largest American automakers, Tesla, Ford, and General Motors, all adopt Tesla's NACS connector.

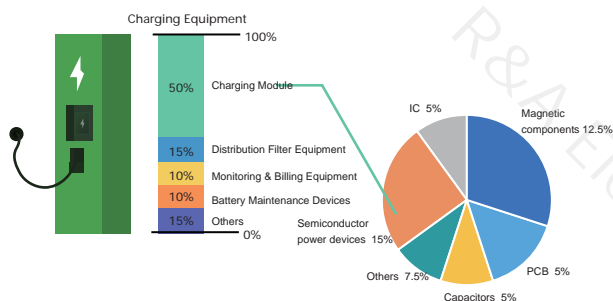
According to statements from Ford and General Motors, they will stop manufacturing electric vehicles with CCS ports and instead use Tesla's NACS charging port from 2025. This will gradually marginalize the CCS charging standard in North America.

05 Charger module: SiC is highly emphasized in the future

Charging stations can be divided into AC charging stations and DC charging stations based on the type of current output. AC charging stations have lower power and slower charging speeds. In the future, with the popularity of electric vehicles and the increasing demand for fast charging from users, DC charging stations will continue to develop.

In DC charging stations, the charging module is the core component that plays a crucial role in charging safety and efficiency. Currently, charging modules in China are in a transition phase from the second-generation 15/20 kW to the third-generation 30/40 kW.

Schematic diagram of the cost of each module of the charging pile



The charging module includes a large number of parts such as chips, PCBs and power devices, and the most critical component being the IGBT mainly dependent on imports. However, compared to IGBTs, SiC modules can help charging stations increase output power by nearly 30%, reduce losses by around 50%, enhance stability, and lower the overall application cost of the charging station system. Leading power semiconductor manufacturers such as Infineon, ON Semiconductor, ROHM, Sanan Optoelectronics, CR Micro, and Global Power Technology have already introduced SiC chips or devices for the charging station field. In the future, the application of SiC modules in the charging station market is expected to be further promoted.

06 In spite of huge demand, overseas markets embrace opportunities and challenges.

With the accelerated construction of charging stations overseas, particularly the enormous demand gap for charging stations in Europe and America, and the high production costs of local charging station companies, Chinese companies are expected to break into the European and American markets with high cost-performance products, achieving rapid development in the charging station business.

Since 2022, major charging station companies in China have been accelerating their overseas standard certification to tap into foreign markets. For example, in 2022, Shenghong Shareholding Co., Ltd. partnered with British Petroleum (BP), becoming one of the first charging station manufacturers to enter BP's list of Chinese suppliers. Sunrise Technology's charging station products, developed for the European and American markets, have passed CE and ETL standard certifications and provide supporting power modules for overseas manufacturers through OEM. Gresgying Digital Technology has some products that have passed the CE certification, and it has received small batch orders from the European market in 2022.

The construction of public charging stations in the European market benefits from various subsidy policies, and there is no requirement for localization. Chinese charging station companies are expected to enter the market as replacements by leveraging their technological and cost advantages. They can provide contract manufacturing services for companies like ABB, Siemens, and Schneider Electric, and charging module suppliers also have the potential to supply overseas.

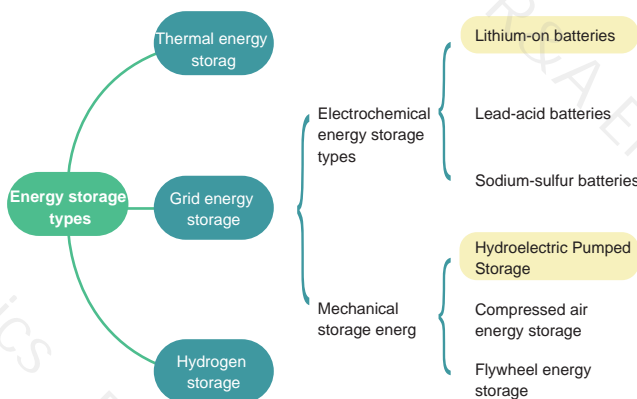


Energy storage revolution

Grace

Categories and Advantages of Energy Storage

Energy storage, according to different forms of energy preservation, can be broadly divided into three types: electrical energy storage, thermal energy storage, and hydrogen energy storage. To be specific, based on differing principles electrical energy storage that is the predominant means involves two technological types: electrochemical energy storage and mechanical energy storage. Electrochemical energy storage refers to a variety of secondary battery storage, primarily encompassing lithium-ion batteries, lead-acid batteries, and sodium-sulfur batteries. Mechanical energy storage mainly includes hydroelectric pumped storage, compressed air energy storage(CAES), and flywheel energy storage. Energy storage can facilitate stable and quick electricity regulation, balance power distribution, and serve as a backup.



The Current Development of Two Main Energy Storage types: Hydroelectric Pumped Storage

Hydroelectric pumped storage occupying mainstream position owns largest installed capacity in the market. China Energy Storage Alliance(CNESA) reported that the total installed capacity of global energy storage in 2021 accomplished 205 GW, of which hydroelectric pumped storage accounted for 86%, reaching 177 GW. Despite pumped hydro storage being the most advanced power storage technology nowadays, its boom is restricted from geography conditions.

Among different types for energy storage, pumped hydro storage, compressed air energy storage, flywheel energy storage, flow

batteries, and lead-acid batteries expose visible and insurmountable drawbacks when it comes to geographical conditions, configurational flexibility and portability, construction period and costs. At the other end of spectrum, Lithium-ion battery energy storage has a distinct advantage in commercial applications—it can be flexibly utilized in all aspects of power systems and various other scenarios. However, lithium resource is too insufficient to maintain a long-term growth. Therefore, sodium-ion batteries have been gaining attention and are expected to become an important alternative solution. In spite of that, lithium-ion batteries held 86.8% of the global installed emerging energy storage in 2022, with sodium-ion batteries only constituting 1.3%, in light of statistical data from the China Industrial Association of Power Sources.

In the electrochemical energy storage market, lithium-ion battery energy storage has the fastest growth rate, leading the way. In 2022, its cumulative installed capacity in new energy storage increased by 3.5 percentage points compared to the same period in 2021. The Ministry of Industry and Information Technology of PRC stated that China's lithium-ion battery production reached 750 GW, a year-on-year increase of over 130%, and the total industry output value exceeded 1.2 trillion RMB(\$168.12 billion) in 2022.

The Market size for Pumped Hydro Storage

Pumped Hydro Storage equipped with rapid and responsive power-on-and-off performance, with their swift and flexible operation characteristics, serve six fundamental roles in the power system: energy storage, peak and valley filling, frequency regulation, phase modulation, emergency backup, and black start.

By 2021, China was the global leader in both individual pumped hydro storage station installed capacity and national total installed capacity. In the first three quarters of 2022, China installed new 6.1 GW of pumped hydro storage, surpassing the full-year total of 5.2 GW in 2021, which brought the cumulative installed capacity to 43.1 GW. The latest information reveals that China is vigorously promoting the construction of hydro energy storage, expecting that the installed capacity of China's pumped hydro storage stations will carry out 62 million kW by 2025, while the figure will jump to 120 million kW by 2030.

Major Application Scenarios & Market for Lithium-ion Battery Storage

The high efficiency, energy density, and flexible applicability of lithium-ion battery storage play crucial roles in fields like consumer and industrial, power, and energy storage systems. Here are some primary application scenarios:

Consumer Market: Digital electronics (such as smartphones, tablets, laptops, digital cameras, electric toys, power banks), medical equipment, car keys, high beam flashlights, built-in lithium lamps, etc.

Power market: Electric vehicles, electric scooters, charging stations, etc.

Energy Storage: Mainly applied in base stations, server room power sources, clean energy storage, grid power storage, household light storage systems, etc.

Global Lithium-ion Battery Market Overview for the first half of 2023:

Battery prices remain high in the short term: the prices of related battery raw materials have fallen from their highs, a sign of relief in tense raw material supply, easing cost pressure for battery enterprises.

Localization of battery cell supply chain: Due to the requirements of the IRA Act and the upcoming carbon tax in the EU, manufacturing capacities of raw materials and batteries that concentrate in China gradually spreading to a certain proportion in the U.S., Europe, and other regions. These countries, although, increasingly set up a battery supply chain, short supply chain is still haunting them. On the horizon, the tense metal raw material supply is persisting.

The revolution of raw materials supply chain leads to vertical integration in the industry: The limitations of a single business are stimulating the integration of the industry chain as a viral trend. Top-tier battery companies have begun to actively integrate upstream and downstream of the industry chain into recycling partnerships. Additionally, the increasingly demanding technical requirements from downstream clients like electric vehicles, energy

storage systems, etc., are making it increasingly challenging for start-ups to the industry.

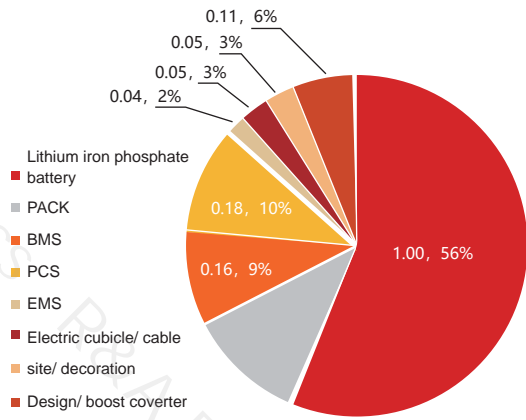
TOP 10 companies of the largest energy storage shipments in the world

Rankings	Company
1	CATL
2	BYD
3	REPT
4	EVE
5	GREAT POWER
6	HITHIUM
7	GanfengLiEnergy
8	Samsung SDI
9	GOTION HIGH-TECH
10	PYLONTECH

The global lithium battery market is spreading rapidly. SMM a research firm expects global demand for lithium-ion batteries skyrocketing to 1319 GWh in 2023, a year-on-year jump of 39%. In the next decade, the lithium-ion battery market is forecast to continue its rapid growth with an annual compound growth rate of about 30%.

Energy Storage System: Power Conversion System

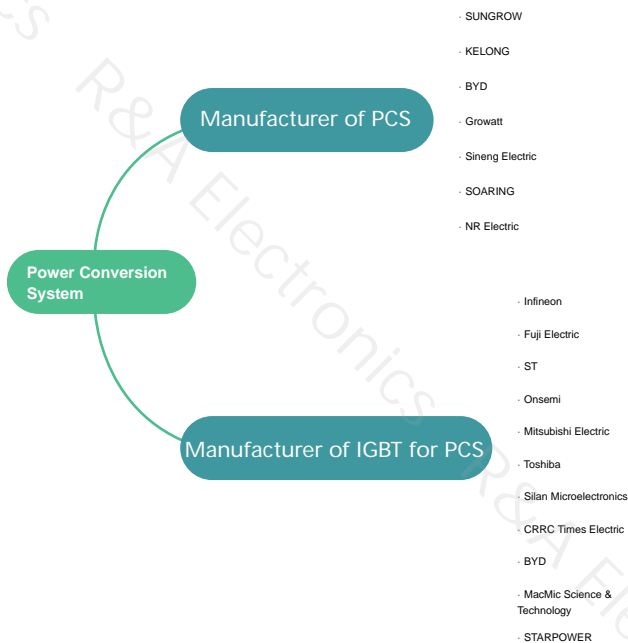
The structure of electrochemical energy storage systems primarily consists of batteries, power conversion system (PCS), battery management systems (BMS), energy management systems (EMS). A PCS, also known as a bidirectional energy storage inverter, inverts the DC power from batteries into AC for grid supply or AC load utilization. Furthermore, it rectifies the AC power from the grid into DC power for battery charging. Thus, PCS play a crucial role as the control and information exchange center connecting the grid, battery, and domestic loads, but accounts for only 10% of the energy storage system cost.



sources: BJX energy storage research, Changjiang securities

PCS is the heart for energy storage systems to facilitate bidirectional power flow with the grid or microgrid. It is widely used in power systems, rail transportation, military, petroleum machinery, new energy vehicles, wind power, solar photovoltaics, etc. It enables energy bidirectional flow for grid peak and valley filling, smoothing new energy fluctuations, energy recycling. Besides, PCS actively supports grid voltage frequency, thereby improving the quality of power supply.

PCS shares its technological roots and structure with photovoltaic inverters, with the similar components that are the inverter power module and secondary control circuit.



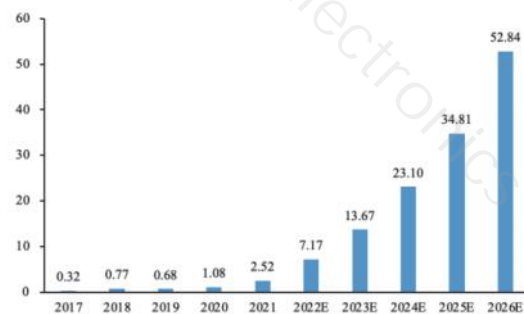
The long-term surge of energy storage business underpins the promising prospects of PCS, along with expansive global energy storage market. HIS Markit predicts the global scale of new grid-connected photovoltaic storage inverters to be 10.6GW by 2025. The energy storage inverter industry will proceed to boom.

Development Trends in the Energy Storage Industry

In recent years, with the decrease in energy storage costs and advances in energy storage technology, the importance of energy storage has been evidently recognized across the world, pushing the hike of installed capacity. Countries around the world have sequentially introduced energy storage-related policies to ramp up the energy storage industry chain. The U.S. government shores up the support for energy storage technology and has positioned it as a strategic technology boosting the rise of new energy. Japan's "Energy and Environment Innovation Strategy for 2030" proposes guidelines for energy security, environment, economic benefits, and safety as well as the promotion of new energy storage technology.

Wood Mackenzie anticipates that China may well become the largest energy storage market in the Asia-Pacific region by 2024, with cumulative energy storage capacity expected to grow from 489MW/843MWh in 2017 (maximum charging/discharging power is 489MW when energy storage capacity is 843MWh) to 12.5GW/32.1 GWh in 2024 (maximum charging/discharging power is 12.5GW when energy storage capacity is 32.1GWh).

Global Energy Storage Market Size and Forecast by New Installed Capacity, 2017-2023 (Unit: 10,000 MW)





Chinese battery market raises and rises in 2023

Tom

The global lithium battery industry remains highly prosperous, with power lithium batteries being the main factor driving industry growth in the face of the global trend of carbon neutrality and the rapid growth of new energy vehicle penetration.



According to data from the China Automotive Power Battery Industry Innovation Alliance, China's cumulative power battery capacity was 294.6 GWh in 2022, a cumulative year-on-year increase of 90.7%. The improvement of the new energy vehicle industry is beneficial for China to resolve energy environmental constraints. Besides, pushed by the "dual carbon" policy, China's new energy vehicle industry has grown by leaps and bounds with large scale, leading the endless rise in global new energy vehicle sales. The explosive growth of new energy vehicles constantly promote the upsurge in power battery installation.

In the long run, the electrification of vehicles is inevitably demanded by reduction of the petrol consumption and the emission of pollutants and greenhouse gases, and promotion of the global energy structure. The growth of the power battery complements the progress of the new energy vehicle. A rising popularity of electric vehicles is mainly spurred by the optimization of power battery technical indicators and the reduction of costs constantly. On the flip side, the endless innovations that make their way into the battery technique are burst out of consumers' requirements for new energy vehicle performance indicators and comprehensive cost-effectiveness.

From a technical perspective, the government standardized and clarified the most valuable technical parameter—power battery system energy density—between 2017 and 2022. This parameter is reflected in the national subsidies for new energy vehicles and has played a positive role in leading the healthy development of the market. At the same time, the energy density of power batteries for mainstream electric vehicles has raised from 105Wh/kg to 160 Wh/kg, and the range of electric vehicles has also mounted from 250km to 500km+. The technical level of power batteries is closely related to the performance of new energy vehicles and mainstream market demand.

The technological iteration of power batteries can be divided into material and structural systems, and packaging.

Regarding materials, there are two major cathodes rising: lithium iron phosphate and ternary materials. Over the past few years, the Chinese subsidy policy fostered a spurt of progress in ternary lithium batteries. In a wake of fading subsidies and the upgrade of lithium iron phosphate performance, since July 2021, the domestic installation volume of lithium iron phosphate batteries has overtaken ternary batteries, with a substantial increase in share. High nickel content, high voltage, and monocrystallization are viral trends of ternary materials at present, while research and development towards Lithium ferromanganese phosphate is an crucial direction in coming years. The multiple applications of sodium-ion batteries are also gradually making its way into electric vehicle market as CATL stated that it is striving to industrialize sodium-ion batteries in 2023. The anode is in a breakthrough period: synthetic graphite takes a crown in the market. Besides, composite silicon-carbon anodes are researched and developed

continuously. Speaking of the electrolyte, adds favour the popularity of solid-state batteries eventually and the decline of the liquid batteries. This brings many companies to actively work on in the field of solid-state batteries, including Gotion High-Tech, Farasis Energy, and Solid Power.

Data shows that in March of this year, China's power battery installation volume was 27.8 GWh, a year-on-year increase of 29.7%, and a month-on-month rise of 26.7%. Precisely, the installations of ternary batteries gained 8.7 GWh, accounting for 31.4% of the total power battery installations, inching up 6.3% YOY and 29.8% MOM. the applications of lithium iron phosphate batteries was 19.0 GWh, a proportion of 68.5% of the total installations, surging by 44.4% year on year and 25.3% month on month.

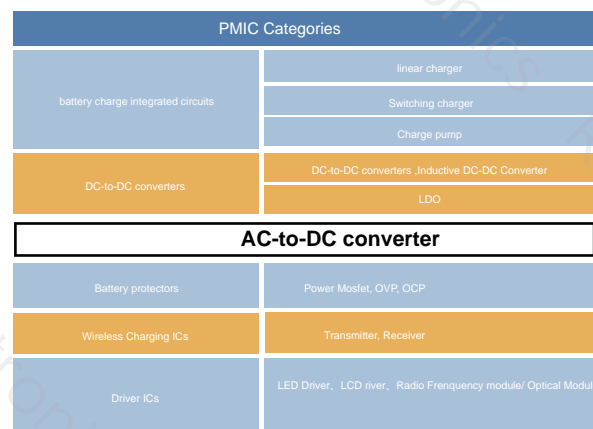
As a major supplement to lithium batteries, sodium batteries have gradually matured in recent years, but the cycle life and energy density of them are lower than those of lithium batteries, which puts them at a disadvantage in the field of power batteries. Furthermore, the cathode, anode, and electrolyte required for sodium-ion batteries have not yet been mass-produced. The cost is high, and there is a large difference in product performance and price. Therefore, it is expected that it will take 2-3 years for sodium-ion batteries to be widely used. Otherwise, it is in the cards that they can replace lead-acid and lithium batteries quickly in the two-wheel vehicle area due to their higher cost-effectiveness.

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Viewed in a packaging technology, it mainly includes cylindrical, pouch, and prismatic batteries. Comparing the histories in market

shares of different types of batteries in China, it can be seen that prismatic batteries have long dominated in China. Prismatic batteries held by 93.2% of the market share in 2022. The market increasingly appeals for pouch and cylindrical batteries, but there is no improvement in their sales.

Based on the battery form and integration degree, the evolution of battery structure should cover three stages: module standardization, CTP (cell to pack), and CTC (cell to chassis). The concepts of CTP and CTC are quite viral, but strictly speaking, the entire industry is currently accelerating the process from standardized modules to CTP.



The Battery Management System (BMS) is a critical component within the battery pack, requiring the use of a microcontroller (MCU) and specific integrated circuits (ICs). The essential functions of the BMS embrace charging and discharging management, state monitoring, temperature control, and data recording, all of which are achieved through microcontrollers and other electronic components.

The MCU is the heart of the BMS, responsible for receiving and processing various data, as well as implementing relevant control algorithms. These control algorithms may involve battery charging and discharging strategies, assessment of battery state (such as remaining power, health status, etc.), and safety policy.

Therefore, the nature and stability of the MCU have a direct link with the property of the BMS. On the top of that, specific ICs are necessary to accomplish particular functions in the BMS.

Specifically, battery monitoring chips are used to monitor battery parameters such as voltage, current, and temperature. Battery protection chips serve to prevent battery damage under abnormal conditions like overcharging, over-discharging, and overheating. Power management chips control the charging and discharging of the battery.



Market Size:

In 2022, China yielded 239.28 billion lithium-ion batteries, imported 1.109 billion ones, and exported 3.773 billion units. Therefore, China's demand for lithium-ion batteries achieved 212.64 billion units. China's lithium batteries that are mostly export-oriented had a mounting value of exports in recent years with US\$50.919 billion of the amount of exports in 2022, a simultaneous extension of 7 9.03% YOY; the import amount was 2.984 billion U.S. dollars, a slide of 22.42%.

China's lithium-ion batteries are generally shipped to the United States and Germany based on the export destination. In 2022, China exported lithium-ion batteries to the United States amounting to US\$10.123 billion, sharing 19.88% of the total export amount; China's lithium-ion batteries worth US\$7.724 billion were delivered to Germany, taking 15.17% of the total export value.

The needs for batteries in electric vehicles are blowing up. It follows that the global and Chinese power battery markets are showing up strong growth, with the expectation of robust upward course continuing in the short term. The compound annual growth rate from 2022 to 2026 is foreseen to be 39.1%. Concerning the production and sales of power battery in China, both of them have been on the rise in recent years. The growth rate of China's electric

car sales in 2023 is likely to dwindle, so there may be a structural glut of power batteries.

Global Power Battery Installed Capacity Forecast Trend 2016-2023



• Development Opportunities

The power battery industry deemed as an important part of the green industry, has unprecedented development opportunities beneficial from "carbon peak and carbon neutrality".

The propulsion of various policies, the surge in consumer demand for new energy vehicles, and the cut in the costs of power batteries have all paved the way for new energy vehicles to replace fuel vehicles as the star of cars. Additionally, to integrate the broad prospects of renewable energy power generation, power battery-related enterprises have also ushered in broader cooperation chances in digital transformation and management of the full lifecycle of power batteries.

• Consumer Market

China has gradually been home of the world's largest production and consumption for lithium-ion batteries. The application of China's lithium-ion battery market in the field of traditional consumer electronics products has matured, such as laptops, tablets, and smartphones. The market size remains stable, while it is expanding of the market of emerging products represented by smart wearable devices and drones.

Energy Tension and Environmental Requirements Accelerate the Industry ahead: Promoting the new energy vehicle industry based on low pollution and emissions is an vital way to fulfil sustainable economic growth. The rapid vehicle electrification has brought about enormous market demand.

• Huge Potential in Energy Storage Market

A report in light of market scale disclosed by SPIR shows that in 2022, the global shipment of lithium batteries was 948.1GWh, a year-on-year surge of 66.7%. To be specific, the shipment of energy storage batteries in 2022 reached 153.5GWh. The figure is forecast to be 520GWh in 2025.

The energy storage -- an emerging area of lithium-ion battery application -- is highly attracting attention. Lithium-ion batteries are remarkably superior to lead-acid batteries in terms of cycle life, fast charging and discharging energy efficiency, and specific energy. They are comparable to lead-acid batteries in regard to safety performance. As a new type of green and environmentally friendly battery, it will form a large-scale replacement for lead-acid batteries and can work better in the energy storage field.

Fixed grid energy storage market for battery is only about one-tenth of the electric vehicle battery market. However, as there is a mounting number of renewable energy devices installed, power storage is enjoying a rising popularity. Lithium-ion batteries are not suitable for fixed storage, although they are often used for such applications today.

Sodium-ion batteries have huge application potential in the energy storage scenario. It is projected that a complement of sodium and lithium batteries is on the horizon. Stumbled by the low energy density and limited room for improvement, sodium-ion batteries are currently predicted to largely serve as alternative in the new energy subdivision industry. It is expected to be a substitution of lithium batteries in the field of energy storage, low-speed transportation tools and some low-cruising passenger vehicles that require low energy density and strong cost sensitivity. By contrast, sodium-ion batteries have a relatively limited impact on the mid-to-high-end passenger car market.

• Broad Prospects for Battery Recycling

Lithium battery recycling involves two major links: echelon use and resource recycling. At present, the recovery of resources has formed an advanced process called "wet method".

The exact market scale of power battery recycling in China is about 14.6 billion RMB(roughly US\$2 billion), and it is theoretically estimated to accomplish 59.5 billion RMB(nearly US\$8.27 billion) in 2025 and 140.6 billion RMB(around US\$19.5 billion) in 2030; the overall market volume of lithium battery recycling is projected to be 31.4 billion RMB(about US\$4.4 billion) in 2022, and 126.4 billion RMB(approximately US\$17.6 billion) in 2025, and theoretically 235.1 billion RMB(almost \$32.7 billion) in 2030.

• Recycling and Rebuilding of Lithium Resources

The disposable recycling chain of lithium resource of power batteries involves: lithium mining--lithium salt manufacturing--precursor manufacturing--battery design--battery making--new energy vehicle production--vehicle consumption--waste battery collection--battery transportation and evaluation--battery echelon use--scrap recycling.

The secondary (multiple) recovery chain of lithium resource of power batteries involves: scrap battery recycling--lithium salt re-manufacturing--precursor re-manufacturing--cell re-manufacturing--cell reuse (cars, energy storage, etc.)--waste battery collection--battery transportation, evaluation--echelon use--recycling again.

Photovoltaic inverter market is heating up

Jade



As things go, the global photovoltaic demand is on the rise as a whole. On the global vision, it is projected that European photovoltaic will maintain a high growth rate of 40% this year as the rise in the prices of European energy has led to the rapid growth of household photovoltaic demand.

Distributed photovoltaic (DPV) which is easy to install and experiences a short approval time, is heating up in the Asian market (except India). New installation of PV in the United States surged 47% in the first quarter of this year, as a result of the mounting imports of photovoltaic modules to break the ice, in terms of an industry report published by third-party research firm Wood Mackenzie.

The new installation of PV in the United States was 6.1 gigawatts (GW) in the first quarter, hitting a new record. That's enough to power more than 1 million households.

The world's top 10 countries in terms of annual new PV installed capacity in 2022		
Ranking	Country	New installed capacity (GW)
1	China	106
(2)	EU	38.7
2	US	18.6
3	India	18.1
4	Brazil	9.9
5	Spanish	8.1
6	German	7.5
7	Japan	6.5
8	Poland	4.9
9	Australia	3.9
10	Netherlands	3.9

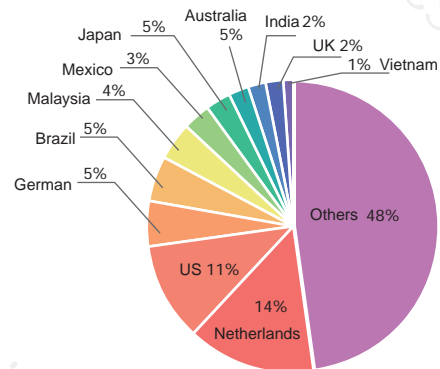
Sources: IEA-PVPS, SMM

Italy jumped into the top 10 countries of the largest cumulative installed capacity of solar PV with 25GW. Viewed in the ranking, there is still a staggering gap between the top five and the bottom five; Australia, Spain, Italy, South Korea and Brazil generated solar PV's cumulative installed capacity of between 20GW and 30GW for each, which is less than half that of Germany ranking fifth place.

The upstream polysilicon price of the industrial chain has been plummeting since the beginning of 2023, which foster demand for the photovoltaic terminal industry. The price of silicon has fallen below the essential threshold of 100,000 yuan/ton (US\$13950 per ton), 80,000 yuan/ton (US\$11,160/ton). The decline in silicon prices is partly because photovoltaic industry is gradually entering the

China has been ahead of the game in the photovoltaic market. By the end of April, 2023, China's photovoltaic cumulative installed capacity has overwhelmed hydropower to become the second largest power supply in the country. It is expected that the new installed PV capacity across the world will be about 350GW this year; In 2027, photovoltaic will edge out the coal to be the largest energy source around the world.

Photovoltaic inverters deemed as a vital element of the photovoltaic system is of ceaselessly inflating market. From January to December 2022, China's exports of inverters accumulated nearly 50 million units, up 16.21% YOY, according to a China's research firm SMM. The second half of year has been the peak season for inverter shipments, with 29.62 million deliveries amid July and December 2022, holding 58% of the total shipments of the year.



Distribution of iPV inverter exporters in 2022
Sources: SMM

Customs data show that China witnessed the export volume of 4,927,400 inverters in April 2023, a hike of 30.3% YOY and a decrease of 16.7% from the previous month. Imports were 181,700, down 7.3% year-on-year and 4.9% month-on-month. From January to April 2023, the exports summed up around 1,9.85 million inverters, an increase of 52.13% over the same period last year. The shipments of inverters ascended to a climax in December,

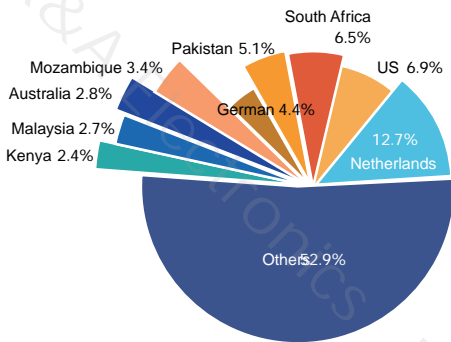
Inverters made in China were exported to 174 countries and regions in April 2023 in the view of the countries who imported inverters from China. To be specific, Europe imported approximately 1.25 million inverters, accounting for 25.4% of total exports of China's inverters. It is worth noting that the export volume to the African market is also increasingly expanding, aggregating 129.22 million inverters, taking 26.22%. The top ten countries purchased

The top five countries that imported PV inverters from China covers the Netherlands, the United States, South Africa, Pakistan and Germany.

IC THE WORLD

In April, the Netherlands bought 625,300 inverters from China, lowering by 12.9% from the previous month, spiking by 109.3% YOY. The United States imported 342,200 inverters, a decrease of 15.9% compared with the previous month and an increase of 10.5% from the same period last year. 322,500 inverters were shipped into South Africa, an expansion of 41.6% month-on-month, a spike of 436.5% year-on-year; 251,000 inverters were delivered to Pakistan, up 34.5% month-on-month, jumping by 113.9% year-on-year; Germany traded 219,000 inverters, a decrease of 20.8% from the previous month, an increase of 108.6%.

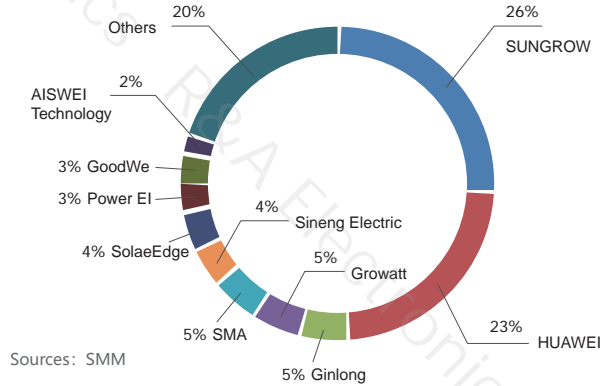
The demand for PV inverters still maintains flourishing in Europe. The Netherlands and Germany are still the main export trading countries of inverters. Overseas distributed PV installation has slowed down, reducing the month-on-month exports of China. The demand for photovoltaic and energy storage in the Africa has exploded because of the lack of electricity as five African countries take places in the top ten countries that imported PV inverters from China. Not only is the demand driven by a long-term serious lack of electricity, but the incentive of policies plays a role in the growth of installed demand. In particular, since South Africa has introduced rebate schemes for rooftop photovoltaic, users can apply for a tax rebate of up to 25% of the cost of photovoltaic modules. Additionally, the government also intends to cut off the approval process for a number of solar and energy storage projects, for a sake of pushing the installation of photovoltaic systems. Odds favor the major export markets of China's inverters including America, Africa and Latin America in the coming years.



Volume of trade share by country, April 2022
Sources: SMM

In terms of analysis released by SMM, the global shipment of photovoltaic inverters in 2022 has reached roughly 290GW, rising by 37.36% in contrast to that of 2021.

China's inverter enterprises are the workhorse of inverter shipment rising, contributing 235GW, an increase of 38% YOY. Precisely, the leading enterprises in shipments contain Sunshine power and Huawei, respectively, an increase of 60% and 23%.



Sources: SMM

Photovoltaic inverters play a critical role in photovoltaic power systems, typically used for converting power from high-capacity solar modules. Specifically, centralized inverters, due to their high efficiency, low cost, and suitability for large-scale facilities, are expected to meet increasing demand in the future. The Asia-Pacific region is forecast to be the fastest-growing market, with most of the demand coming from countries like China and India on the horizon. Besides, Southeast regions such as Malaysia own enormous potential market for photovoltaic inverter. This not only contributes to its vast potential in the field of renewable energy but also because of its innate geographical advantages -- abundant solar energy resources.

The main electronic components used in inverters include: power devices such as IGBT and MOSFET, main control chip, drive chip, capacitors, resistors, magnetic components such as inductors, current sensors, DC switches, AC connectors, DC connectors, heat sinks, ect. The key composition are power semiconductors mentioned above.

With the raise of third-generation semiconductors, many manufacturers have begun to adopt the related devices such as SiC and GaN. Nevertheless, in the short term of 3-5 years, IGBT is impossible to be widely replaced by SiC MOSFET. Nowadays, as the proportion of solar inverters using IGBT is increasing by leaps and bounds, the new energy market continuously advances the IGBT market. The shortage of IGBT is not ease until 2024.

According to the reports of SMM, Taiwan foundry giant Episl Technologies Inc. elevated the OEM price of its IGBT production line by 10% at the beginning of this year, grabbing a large number of orders from Infineon. However, currently, the lead time and price of major overseas IGBT suppliers such as Infineon and Onsemi are quite stable. The price of IGBT has been on an upward trend, but the price keeps stable recently. Its lead time lasts around 50 weeks all along. Thus, IGBT has a limited impact on the price and supply of inverters.

	2022 Q1	2022 Q2	2022 Q3	2022 Q4	2023 Q1
Infineon					
LT	39-50	39-50	39-50	39-50	39-50
Price Trends	upward	upward	upward	upward	keeps stable
onsemi					
LT	39-52	39-52	39-52	39-52	39-52
Price Trends	upward	upward	upward	upward	keeps stable

IGBT Lead Time and Price Trends
Sources: SMM

The production capacity of IGBT expands slowly and is restricted. Most 6-inch and 8-inch wafer fabs are depreciating. A little of 6-inch and 8-inch wafer fabs are enlarging their IGBT capacity. However, some of 12-inch wafer fabs have already begun to produce IGBT, such as the cooperation plan between Denso and United Microelectronics Corporation (USJC) to produce IGBT on 12-inch wafer fabs, which will start in the first half of 2023. Also, the 12-inch wafer fabs acquired by Infineon and Onsemi have made progress in IGBT production. quite stable. The price of IGBT has been on an upward trend, but the price keeps stable recently. Its lead time lasts around 50 weeks all along. Thus, IGBT has a limited impact on the price and supply of inverters.

These expansions still need some time. Reportedly, Infineon's new factory in Germany barely mass-produce until 2026. Apart from that, Onsemi's capacity for 2023 has already sold out, with some customers having basically confirmed their full-year supply for 2023 in the second half of 2022. Although the scale of demand for IGBT and orders is ballooning, it still takes time to adjust the capacity of downstream wafer foundries which is mainly concentrated on massive and stable consumer electronic products. In the short term, the short of IGBT is difficult to alleviate.



Given the lack of IGBT, diode factory -- PANJIT Semiconductor, OEM -- EMIS and Episl Technologies have seen their values rise along with the tide. Episl Technologies, which wins a large order from Infineon, raised the OEM price of the IGBT production line by about 10% at the beginning of this year. Against the trend of wafer foundry price cuts, Episl's price rise marks the market is going to be rock. PANJIT Semiconductor is more active in creating its own IGBT components in Taiwan, aiming at applications such as solar energy to catch the trend. The company is optimistic that its discrete component business has the chances to go up this year, especially components such as IGBT, SiC in high average selling price (ASP). For IGBT wafers, PANJIT is striving to approve the verification and mass-produce by the second quarter.

The demand for IGBT in China has reached 180 million per year, but the output may only be over 40 million per year. It is in the cards that Chinese semiconductor companies like Yangzhou Yangjie Electronic Technology Co., Ltd, Ncepower, MacMic Science & Technology Co., Ltd, and Starpower shift their capacity to photovoltaics and new energy vehicles, while capacity is supposed to further mount.

R&A Electronics : ESG Executive Oversight Committee and ISO14001

R&A Electronics : ESG Executive Oversight Committee and ISO14001

R&A Electronics has grown and matured over the past 8 years since it was founded in 2015. The company increasingly realizes that we focus on not only growth but responsibilities for the industry and society in this hugely uncertain era.

Build R&A Electronics' sustainably competitive advantage based on ESG

In recent years, the concept of environmental, social and governance (ESG) investment has drawn mounting attention at home and abroad. In terms of environment (E), ESG investment highlights climate change, resource consumption, waste, pollution and deforestation.

In general, the concept of ESG investment refers to that in the decision-making process, investors should consider the corporate and social value reflected by environmental, social and corporate governance, apart from the traditional corporate profits and revenue.

Therefore, R&A Electronics adheres to the corporate value of "being integrity, honesty and respect" all the time. Taking "ESG" as the guide, it struggles to establish itself in the industry and march the international market, regarding creating value for society as the bedrock of its development.

Besides, our company makes efforts to generate more social value for our country, the industry, environment and society with the concept of "co-building, co-learning, co-exploring, sharing, and co-excelling".

In April 2023, the R&A established an ESG Executive Oversight Committee within the company. Members of the committee across different departments, are responsible for the promotion and coordination of "employee's protection, human rights and health, green environment, public ethics and management system", to build R&A's ESG culture.

Hence, the company can comprehensively improve its social reputation and corporate image as well as build sustainable competitive advantages in the great changes of the century.



Added certificate ISO14001, R&A is committed to creating a new future.



In April 2023, R&A passed the supervision and audit of NQA, one of the six most famous certification institutions in the world, and successfully obtained the environmental management system certification ISO14001:2015.

ISO14001 is a standard issued by the International Organization for Standardization, which provides a framework for organizations to protect the environment, reduce waste, and save energy while their business continues to grow.

ISO14001 can also help organizations to be more innovative, improve management system processes, meet relevant regulatory requirements, and enhance corporate credibility among investors, customers and the public.

This new standard will help R&A keep pace with changes in the environment, ensuring the company stays ahead of the curve.

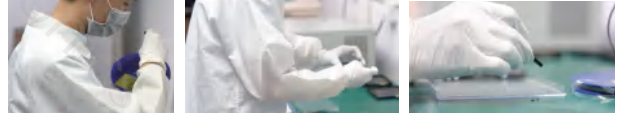
Since its inception, R&A has established a strict quality management system, adhering to the original intention of "Quality First". R&A constantly optimizes the company's management system and processes, making the service environment and product quality more standardized and professional.



AS6081 - The industry recognized as the most authoritative electronic components authenticity test standard

Documentation and packaging

- Matching of batch, date, lot, etc. on the package
- Grammar, spelling, changes, etc
- Compatibility between Barcode and readable part data
- Manufacturer's trade mark and label
- Compatibility between bar code and readable part data



General external visual inspection



- Mainly for consistency inspection of packaging and device packaging direction
- Appearance and size
- Leads, solder balls and others

Remarking and Resurfacing

- mineral alcohol and isopropanol test
- Acetone wipe
- 1-Methyl 2-Pyrrolidinone(CAS Registry Number:870-50-4)
- Dynasolve 750 immerse for 45min

X-RAY Inspection

- Consistency of internal structure



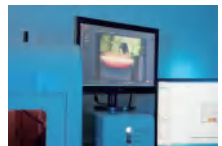
05 Lead finish evaluation

- XRF or EDS test, XRF is preferred



06 Delid/Decapsulation internal

- Internal appearance inspection, marking inspection

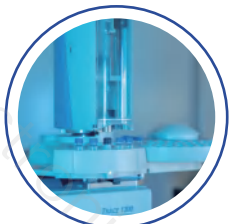


R&A Lab Plus



Electronic scanning microscope

KSI



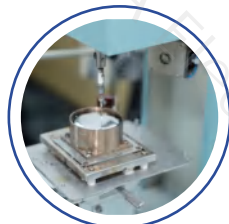
Gas chromatography mass spectrometry

Thermo Fisher



X-ray(3D)

GE



Solderability Tester

Malcom



Acoustic scanning microscope

KSI



FCL drop test machine

JH



Microscopic confocal Raman spectrometer

RENISHAW



Cold/thermal shock box

ESPEC



Constant temperature and humidity box

JH



Directional drop tester

JH

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