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China Insights Consultancy

Industry Report on the Global and China's SiC Power Semiconductor Device and Epitaxial Wafer Market

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CIC Introduction, Methodologies, and Assumptions

China Insights Consultancy is commissioned to conduct an analysis and report of the global and China's SiC power semiconductor device industries and epitaxial wafer industries market. The report commissioned has been prepared by China Insights Consultancy independent of the influence of the Company or any other interested party.

China Insights Consultancy, originally established in Hong Kong, is a Shanghai-based investment consulting company whose services include industry consulting services, commercial due diligence, strategic consulting, and so on. CIC's consultant team has been tracking the latest market trends in sectors such as finance and service, agriculture, chemicals, consumer goods, marketing and advertising, culture and entertainment, energy and industry, healthcare, TMT, transportation, etc., and has the most relevant and insightful market intelligence in the mentioned industries.

The information and data collected by CIC have been analyzed, assessed, and validated using CIC's in-house analysis models and techniques. Primary research was conducted via interviews with key industry experts and leading industry participants. Secondary research involved analyzing data from various publicly available data sources.

The market forecasts in the CIC Report are based on the following key assumptions: (1) the overall social, economic and political environment in China is expected to remain stable during the forecast period; (2) related key industry-driving factors are likely to continue to drive the growth of the global and China's SiC power semiconductor device industries and epitaxial wafer industries market, such as technological advancements, supporting policies and increasing downstream demand, during the forecast period and (3) there will be no extreme force majeure or unforeseen industry regulations during the forecast period, which may have a drastic or fundamental impact on the market.

All statistics are reliable and based on information available as of the date of this report. Other sources of information, such as governments, industry associations, or marketplace participants, may have provided some of the information on which data or its analysis is based. Certain amounts and percentage figures included in this report have been subject to rounding adjustments.

All the information about the Company is sourced from the Company's own audited report or management interviews. China Insights Consultancy is not responsible for verifying the information obtained from the Company.

Term Abbreviations

Commercial Energy Storage	Large-scale systems using semiconductor-enabled power electronics (e.g., inverters, battery management ICs) to store and manage electrical energy for grid stability, renewable integration, or industrial applications
Consign	A business model where semiconductor materials or components are retained in a supplier's inventory but allocated to a specific customer, with payment occurring only upon usage or delivery.
Die	A small, individual piece of semiconductor material containing a functional integrated circuit, ready for packaging into a final chip.
Epitaxial wafer	a semiconductor substrate with a thin, single-crystalline grown on its surface, maintaining the substrate's crystal structure, to optimize electrical or optical performance for advanced electronic or photonic devices
ESS	energy storage system, a device that uses electricity to charge an energy storage system or device, which is discharged to supply (generate) electricity when needed at desired levels and quality
EV	electric vehicles
eVTOL	an electric-powered aircraft capable of vertical takeoff and landing, relying on advanced semiconductor-based for energy efficiency, flight stability, and autonomous operation
IDM	a semiconductor company that designs, manufactures, and sells its own integrated circuits
Substrate	the base layer of material used in the manufacturing process of semiconductor devices and integrated circuits

SiC	silicon carbide, one of the mainstream semiconductor materials
Turnkey	A complete, ready-to-use manufacturing solution provided by a vendor, covering design, process integration, equipment, and software, enabling clients to begin production without additional development.

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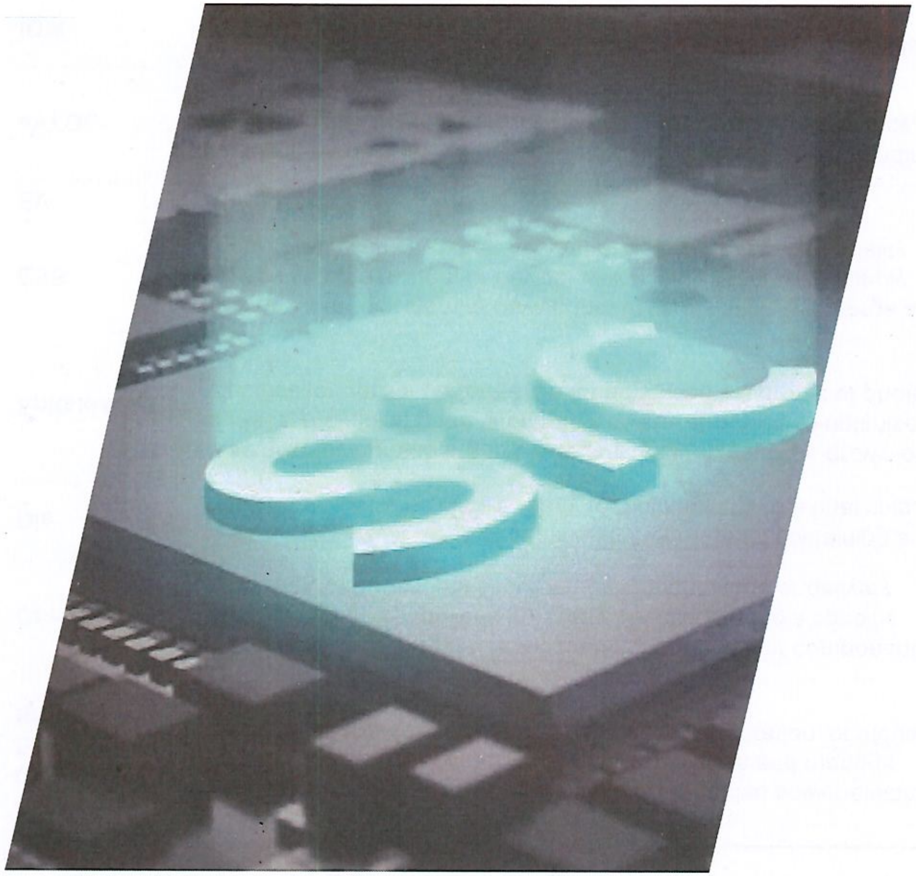


Overview of SiC Power Semiconductors

Definition

- Power semiconductors, also known as power electronic devices, are essential components in electronic systems for electrical energy conversion and circuit control. They enable precise voltage and frequency modulation, as well as efficient conversion between AC and DC power. By regulating energy flow and ensuring system stability through inversion, conversion, power amplification, power switching, and circuit protection, these devices serve as the "heart" of power electronics.

Comparative Analysis of Semiconductor Materials

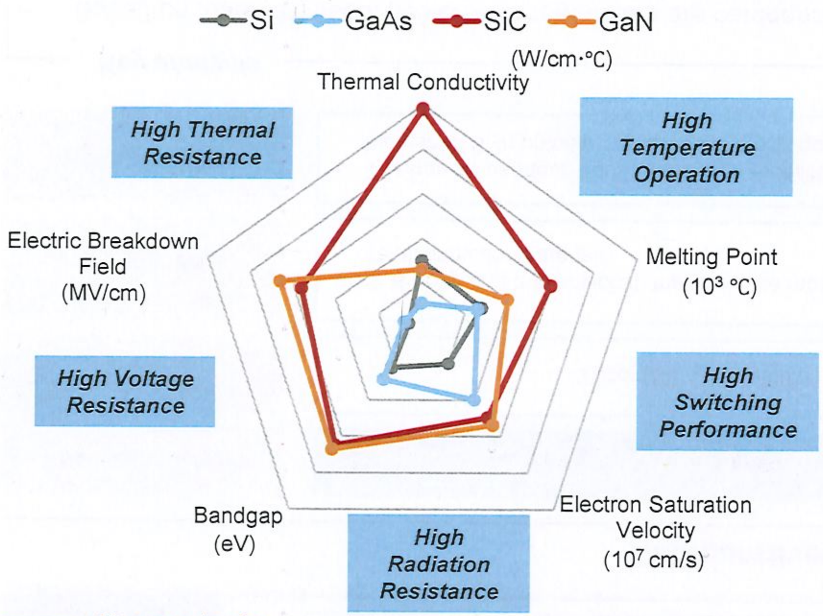
Semiconductor	Traditional silicon semiconductors	Wide-bandgap semiconductors
Materials	Silicon(Si), Germanium (Ge)	Compound semiconductors: Silicon Carbide (SiC), Gallium Nitride (GaN)
Advantages	• Si is abundant and low-cost, making it the most widely used semiconductor materials	• High breakdown voltage, high thermal conductivity, high electron saturation velocity and high radiation resistance • Energy-efficient and eco-friendly
Disadvantages	• The narrow bandgap and low electron mobility and breakdown field limit the use of Si in optoelectronics and high frequency, high-power devices	• Relatively complex and costly fabrication processes

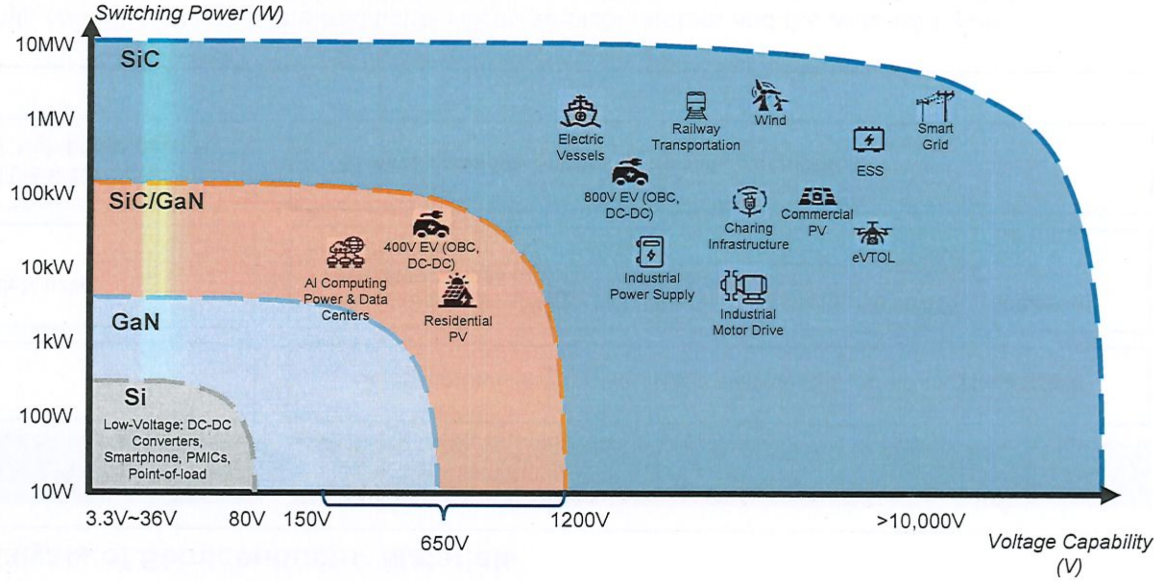
Key analysis

- Based on materials used, power semiconductors are categorized into two primary types, the traditional silicon semiconductors and the wide-bandgap semiconductors. The former includes semiconductors formed by elements such as silicon (Si), while the latter consists of compounds like SiC and GaN. Traditional silicon semiconductor devices face inherent physical limitations that prevent them from meeting the high-performance requirements of emerging applications such as AI computing power and data centers, smart grids, and energy storage systems. In contrast, wide-bandgap semiconductors, represented by SiC and GaN, exhibit significant performance advantages from the material to the device level.

Comparative Analysis of Major Semiconductor Materials and Application Scenarios of SiC

Comparative Analysis of Major Semiconductor Materials and Application Scenarios of SiC Power Semiconductors



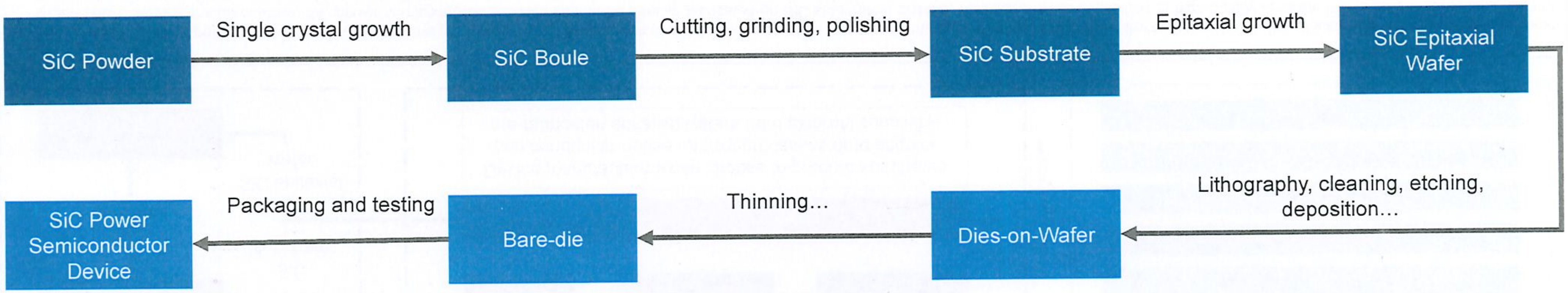


Key analysis

- Silicon (Si) dominates low-voltage applications like DC-DC converters, smartphones, PMICs, and point-of-load systems due to its cost-effectiveness and reliability. It efficiently manages power conversion in consumer electronics and mobile devices. Gallium Nitride (GaN), with its high electron mobility, is increasingly used in AI computing, data centers, and 400V EVs, offering enhanced efficiency and performance in high-frequency, power-conversion applications. Silicon Carbide (SiC) is key to high-power, high-efficiency applications such as 800V EVs, industrial power supplies, charging infrastructure, industrial motor drives, and electric vessels. SiC's superior thermal and electrical properties also make it ideal for smart grids, which require high voltage handling and high switching power to manage complex energy flows, integrate renewable sources, and improve grid resilience. Its usage extends to sectors like railway transportation, wind energy, commercial PV, eVTOL, ESS, and more, where high voltage and thermal stability are critical.

Production Process of SiC Power Semiconductor Device

Production Process from SiC Raw Materials to SiC Power Semiconductor Device

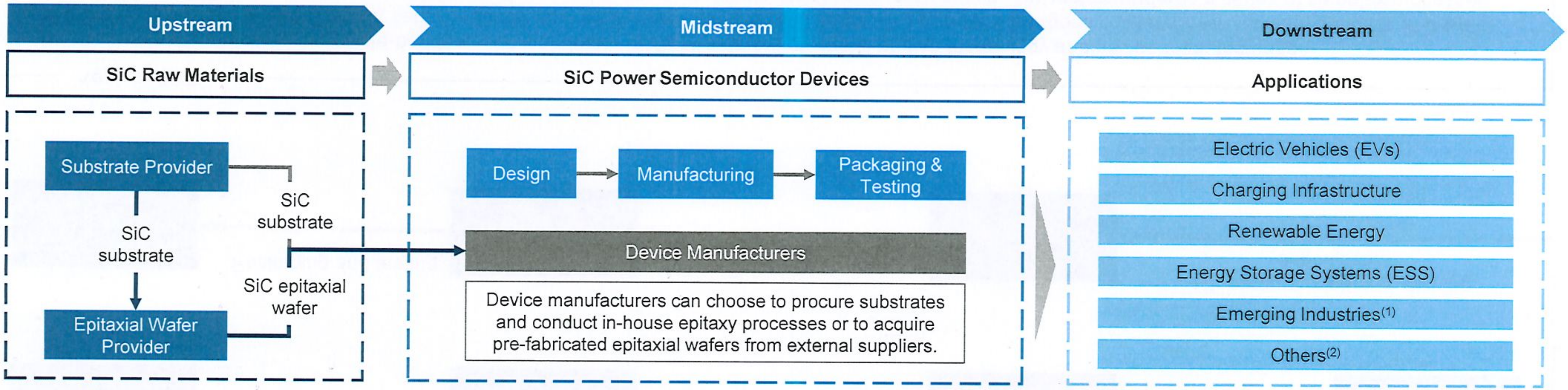


Key analysis

- SiC is currently the most mature wide-bandgap semiconductor material in terms of crystal growth technology and device manufacturing.
- The production process of SiC power semiconductor devices involves the following steps. SiC powder undergoes crystal growth, cutting, grinding, and wafer polishing to produce SiC substrates, on which single-crystal epitaxial materials are subsequently grown. The wafers undergo a series of complex processes, including lithography, cleaning, etching, deposition, thinning, packaging, and testing, to eventually form SiC power semiconductor devices.

Value Chian Analysis of SiC Power Semiconductor Device Industry

Industry Chain of of SiC Power Semiconductor Device Industry

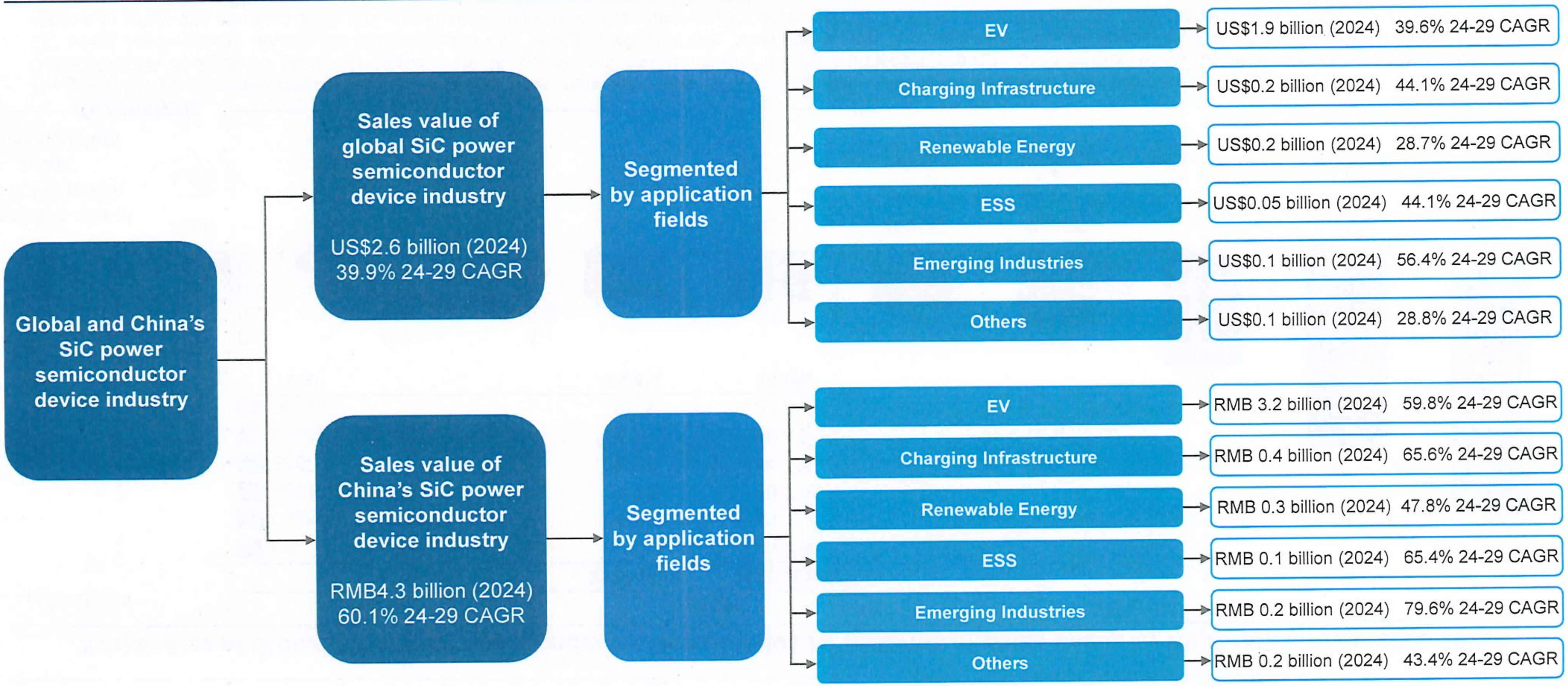


Key analysis

- The upstream segment of the industry chain involves the preparation of SiC substrates and SiC epitaxial wafers. As the key material in the industry chain, the quality of SiC epitaxial wafers is crucial. Unlike traditional silicon power semiconductor devices, SiC power semiconductor devices cannot be directly fabricated on SiC substrates; instead, they require the deposition of high-quality epitaxial layers on the substrates. Due to the high technical barriers in producing high-quality SiC epitaxial wafers, their supply is relatively limited. With global demand for SiC power semiconductor devices continues to grow, high-quality epitaxial wafers will play an increasingly important role in the industry chain.
- The midstream segment consists of SiC power semiconductor devices' design, manufacturing, packaging, and testing. SiC power semiconductor device manufacturers use SiC epitaxial wafers as the base material to fabricate SiC semiconductor devices through a complex manufacturing process. Device manufacturers are generally divided into three types: IDM, fabless, and foundry. IDM integrates the design, manufacturing, packaging and testing of SiC power semiconductors and other industrial chains. Fabless is only responsible for the design and sales of SiC power semiconductors, while foundry is only responsible for manufacturing, packaging and testing. Chinese power device manufacturers are closing the technology gap through continuous R&D investments, and obtain increasing market share in the global SiC power semiconductor device industry in recent years, gradually forming a self-sufficient supply pattern in the future and well-positioned for global growth even if the U.S. tariff on Chinese exports to the U.S. normalizes.
- The downstream segment involves applications such as EVs, charging infrastructure, renewable energy, ESS, as well as emerging industries such as home appliances, AI computing power and data centers, smart grids, eVTOL.

Note: (1) Emerging industries include home appliances, AI computing power and data centers, smart grids and eVTOL. (2) Others include industrial power supply, UPS, railway transportation, etc.

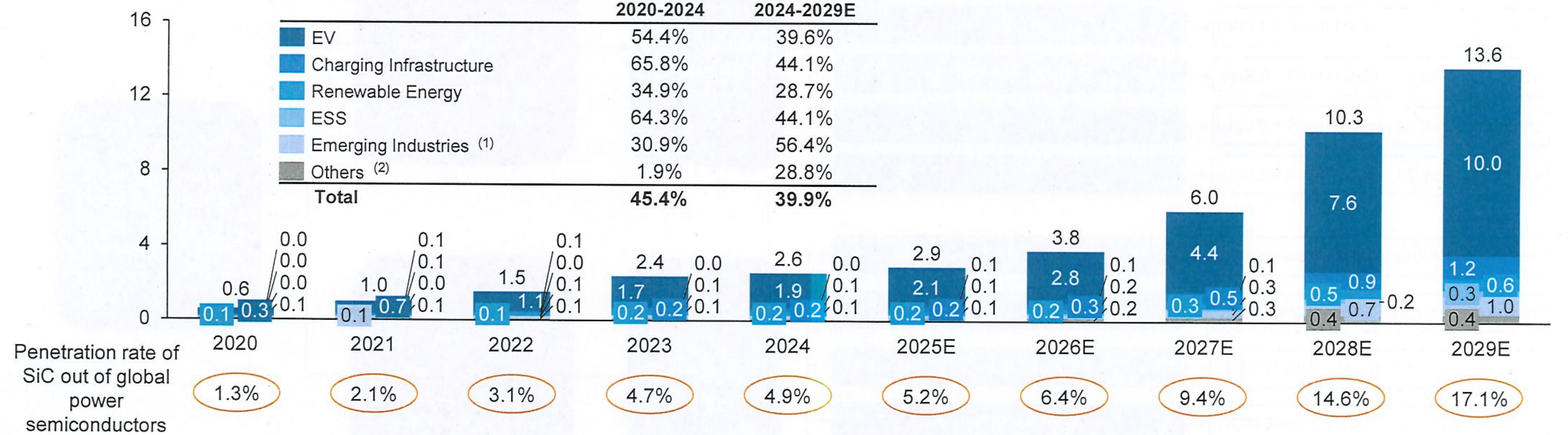
Summary for Global and China's SiC Power Semiconductor Device Industry



Source: WSTS, Omdia, Yole, CIC

Sales Value of Global SiC Power Semiconductor Device Industry

Market Size of Global SiC Power Semiconductor Device Industry, in Terms of Sales Value, by Application Area, 2020-2029E



	CAGR 2020-2024	CAGR 2024-2029E
EV	54.4%	39.6%
Charging Infrastructure	65.8%	44.1%
Renewable Energy	34.9%	28.7%
ESS	64.3%	44.1%
Emerging Industries (1)	30.9%	56.4%
Others (2)	1.9%	28.8%
Total	**45.4%**	**39.9%**

Key analysis

- The global SiC power semiconductor device market has grown remarkably from 2020 to 2024, with sales value increasing from US$0.6 billion in 2020 to US$2.6 billion in 2024 at a CAGR of 45.4%. By 2029, the global sales value of the SiC power semiconductor device industry is projected to reach US$13.6 billion, with a CAGR of 39.9% from 2024 to 2029.
- SiC power semiconductor devices are widely used in EVs, charging infrastructure, renewable energy, ESS and emerging industries. The EVs sector represents the most extensive application within this group. In 2024, SiC power semiconductor devices used in EVs accounted for 74.4% of the global market. The charging infrastructure sector followed, with a market share of 7.8% in 2024. The renewable energy and ESS sectors also show growth momentum, with expected CAGRs of 28.7% and 44.1% between 2024 and 2029, respectively. Emerging industries are expected to grow SiC power semiconductor device value at a CAGR of 56.4% from 2024 to 2029.

Note: (1)Emerging Industries include home appliances, AI computing power and data centers, smart grids, and eVTOL. (2)Others include industrial power supply, UPS, railway transportation, etc.

Source: MarkLines, CAAM, CCPA, CPIA, BNEF, InfoLink, Omdia, Yole, CIC

Market Drivers of Global SiC Power Semiconductor Device Industry

1 Application in Electric Vehicles (EVs)	✓ With increasing battery capacity, driving range, declining costs, maturation and convenience of charging infrastructure, and growing consumer environmental awareness, the penetration rate of EVs is expected to continue rising. Global EV sales are projected to reach 48.1 million by 2029, with a CAGR of 21.2% from 2024 to 2029. Compared to silicon power semiconductor devices, SiC power semiconductor devices offer significant advantages, including lower conduction resistance, smaller chip size, higher operating frequency, and superior high-temperature tolerance. For example, SiC MOSFET and Si MOSFET of the same specifications show that the former reduces the conduction resistance to 1/100 of the latter, decreases the size to 1/10, and extends the driving range of electric vehicles by 5-10%. As a result, they are widely used in key components such as power converters, main drive inverters, onboard chargers, battery chargers, bidirectional DC/DC converters (high voltage), and motor drives.
2 Application in Charging Infrastructure	✓ With the accelerated advancement of global charging infrastructure, particularly the widespread adoption and upgrading of fast and ultra-fast chargers, the penetration rate of SiC power semiconductor devices in the charging sector is expected to continue rising. As EV electrical systems transition from 400V to 800V architectures, the power level and power density of power modules of chargers are also increasing to 40kW/50kW and above to meet the demands of higher-voltage EVs. Compared to traditional silicon power semiconductor devices, SiC power semiconductor devices can enhance the output power of chargers by nearly 30% and reduce power losses by approximately 50%. Additionally, the significantly lower on-resistance of SiC materials ensures that chargers can provide a wider and higher output voltage range, catering to the charging needs of various EV battery types. With anticipated cost reductions, the global penetration rate of SiC in the charging infrastructure sector is projected to reach over 35% by 2029.
3 Application in Renewable Energy	✓ SiC power semiconductor devices are used in photovoltaic system components such as microinverters and DC/DC converters, significantly improving system performance by enhancing energy conversion efficiency and reducing energy loss. Global photovoltaic newly installed capacity is expected to grow at a CAGR of 15.4% from 2024 to 2029. This will drive the sales value of SiC power semiconductor devices in this sector to grow at a CAGR of 29.8% from 2024 to 2029.
4 Application in Energy Storage Systems (ESS)	✓ SiC technology has led the advancement of energy storage converters toward higher capacity and modular designs. With the rising global demand for ESS from industrial, commercial, and residential users, energy storage batteries have become one of the most vital components of power systems. New installed capacity for global electrochemical energy storage is projected to grow at a CAGR of 33.4% from 2024 to 2029, propelling the expansion of the SiC power semiconductor device market
5 Application in Emerging Industries	✓ In AI computing power and data centers, SiC power semiconductor devices have higher energy conversion efficiency than traditional silicon power semiconductor devices under the same output power conditions, allowing data center to reduce the number of power modules and lowering operational costs. From 2024 to 2029, the global computing power capacity is expected to grow at a CAGR of 65.0%, and global electricity consumption of data centers is projected to exceed 2,676 TWh by 2029. In smart grids, SiC technology is essential for advancing solid-state transformers and flexible AC/DC transmission systems, due to its superior thermal management and electronic properties enhancing grid efficiency and stability. It is projected that from 2024 to 2029, the sales value of SiC power semiconductor devices in the smart grid sector will grow at a CAGR of 52.3%. SiC power semiconductor devices also hold significant potential in home appliances. The high efficiency and compact size of these devices enable energy savings and improved performance in home appliances, aligning with global trends toward energy efficiency and sustainability. In the case of eVTOL, SiC's high thermal stability and power density support lightweight, reliable powertrains and extended flight durations.

Source: CIC

Market Trends of Global SiC Power Semiconductor Device Industry

Increasing Penetration in Existing Fields and Expansion into Emerging Applications

- With advancements in manufacturing technology and cost reductions, the global demand for SiC power semiconductor devices continues to grow, and their application scenario is expanding rapidly. On one hand, SiC power semiconductor devices are accelerating their penetration into application scenarios such as EVs, charging infrastructure, renewable energy, and ESS. In the EVs sector, SiC devices significantly enhance the efficiency of motor drive systems, extend vehicle mileage range, and reduce charging time. In the renewable energy and ESS sector, the high energy conversion efficiency of SiC devices reduces system losses and improves the overall efficiency of photovoltaic power generation and energy storage systems. On the other hand, as the cost of SiC power semiconductor devices decreases and the performance improves, SiC power semiconductor devices also hold immense potential in emerging applications such as home appliances, AI computing power and data centers, smart grids, and low-altitude economy applications

Technological Advancements Broaden the Voltage Range of Applications.

- SiC power semiconductor devices have been used in the medium-low voltage (600V to 1,700V) fields and some low voltage applications, such as home appliances, as well. In the future, with the improvement of cost-effectiveness and the advancement of SiC material technology, SiC power semiconductors are expected to realize widespread use in low-voltage applications and expand to medium-high voltage and ultra-high voltage applications. For example, traditional power grids are transitioning toward smart grids. Power electronic transformers (PET), as core components of smart grids, also demand ultra-high voltage and high-power devices.

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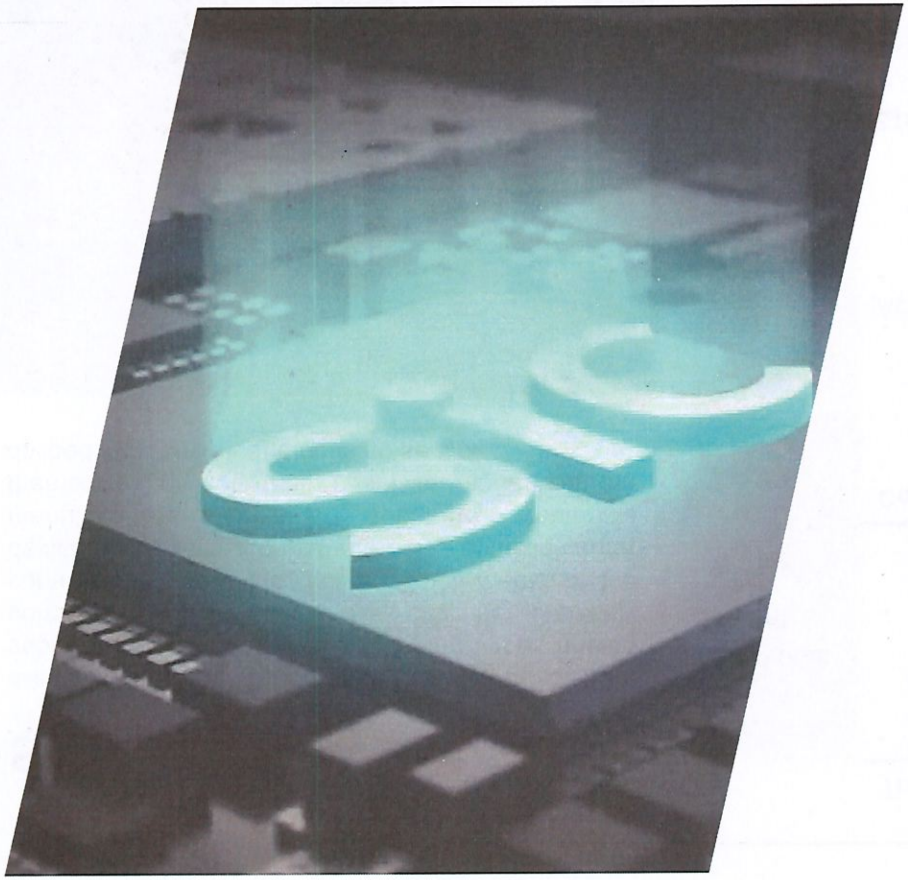
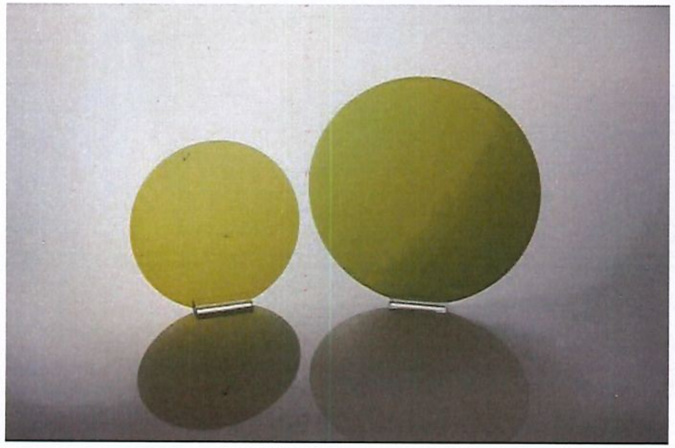


Definition of SiC Epitaxial Wafer and Business Model

SiC Epitaxial Wafer

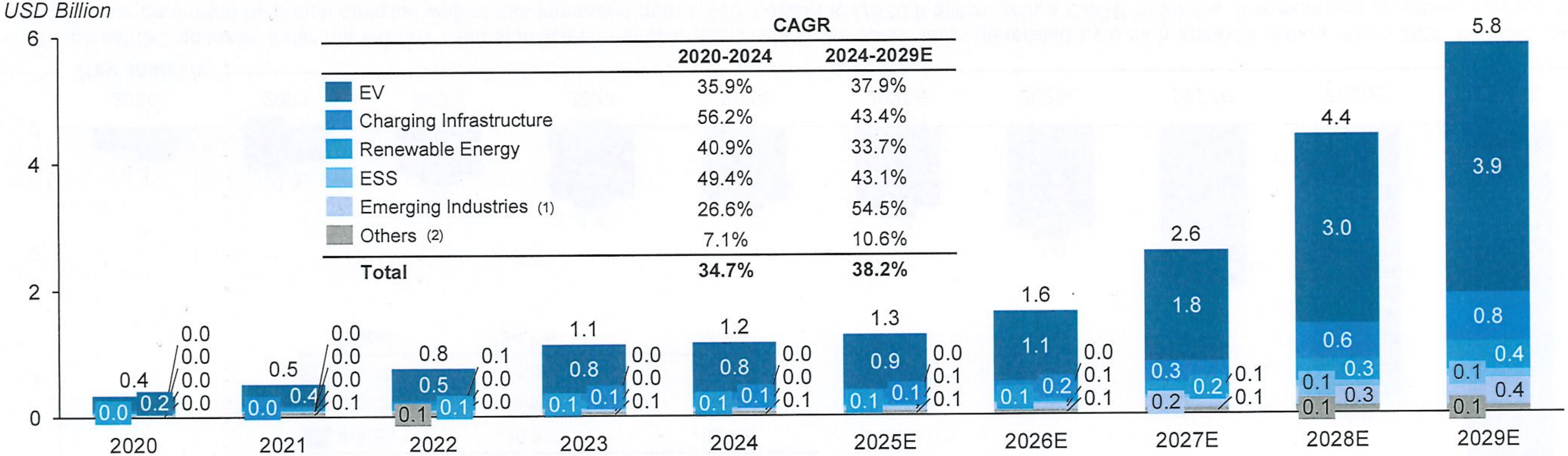
are single-crystal SiC thin films grown on the substrate surface, with their doping type, doping concentration, and thickness can be precisely controlled to meet the design requirements of the devices. Depending on whether SiC epitaxial wafer manufacturers procure substrate materials themselves or not, their business model can be divided into turnkey and consign service.



	Turnkey	Consign
Business Model	• SiC epitaxial wafer manufacturers purchase substrates based on customer order requirements, create the product, and deliver epitaxial wafer products. The price and payment settlement are determined based on the full cost, including substrates and other raw materials.	• The customer provides the substrate materials, while the SiC epitaxial wafer manufacturers procure other auxiliary materials. After completing production and delivering the products, the manufacturers charge the customer for epitaxial wafer foundry services.
Key Features	**Convenient** • The supplier handles both substrate procurement and epitaxial growth, saving you from managing a complex upstream supply chain. **Accountable** • The foundry takes full responsibility for the final wafer quality and yield, eliminating the risk of substrate-epitaxy mismatches. **Efficient** • It removes the logistical steps of purchasing and shipping substrates to the foundry, resulting in a faster overall delivery cycle.	**Flexible** • Can freely specify and supply SiC substrates from preferred brands based on your technical requirements or strategic partnerships. **Economical** • Only pay the foundry for the pure epitaxial processing fee, avoiding the comprehensive procurement markup that a foundry might charge. **Controllable** • Maintain complete control over the source and initial quality of the core raw material, preventing the foundry from switching substrate suppliers to cut costs

Sales Value of Global SiC Epitaxial Wafer Industry

Market Size of Global SiC Epitaxial Wafer Industry, in Terms of Sales Value, by Application Area, 2020-2029E



	CAGR 2020-2024	CAGR 2024-2029E
EV	35.9%	37.9%
Charging Infrastructure	56.2%	43.4%
Renewable Energy	40.9%	33.7%
ESS	49.4%	43.1%
Emerging Industries (1)	26.6%	54.5%
Others (2)	7.1%	10.6%
Total	**34.7%**	**38.2%**

Key analysis

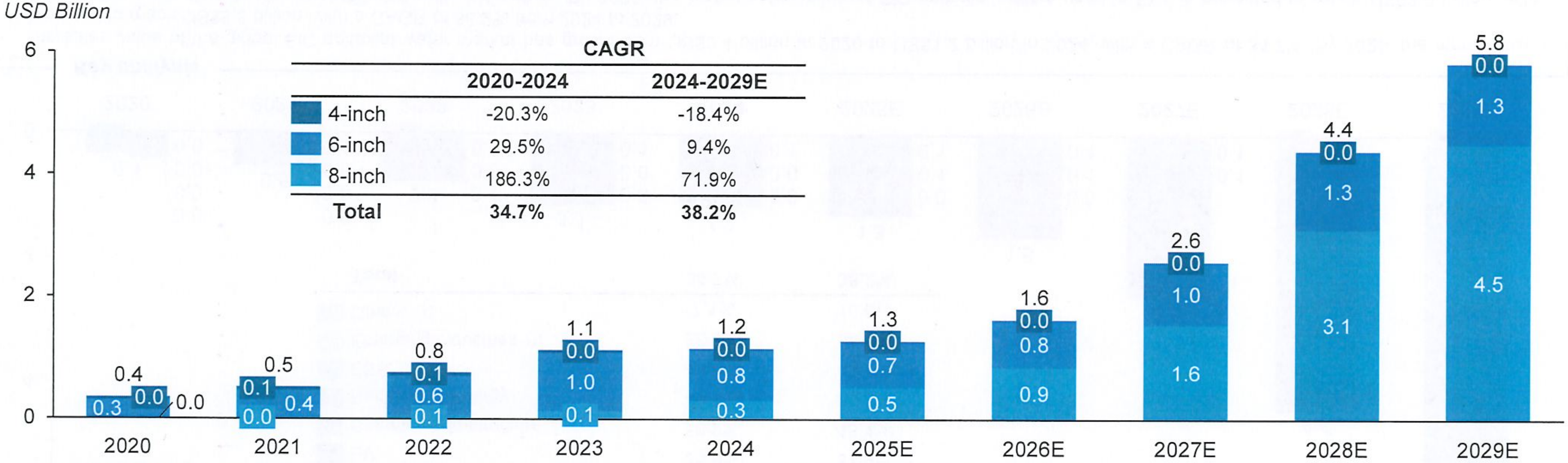
- The sales value of the global SiC epitaxial wafer market has grown from US$0.4 billion in 2020 to US$1.2 billion in 2024, with a CAGR of 34.7%. By 2029, the market size is expected to reach US$5.8 billion, with a CAGR of 38.2% from 2024 to 2029.
- EVs are the largest application area for SiC epitaxial wafers. By 2029, the global sales value of SiC epitaxial wafers used in EVs is projected to reach US$3.9 billion, with a CAGR of 37.9% from 2024 to 2029. Charging infrastructure is expected to grow at a CAGR of 43.4% from 2024 to 2029 in terms of SiC power semiconductor device sales value. The renewable energy and ESS sectors also show strong momentum, with CAGRs in the forecasted period reaching 33.7% and 43.1%, respectively. Emerging industries have high growth potential, and global sales value from SiC epitaxial wafers for them is expected to grow at a CAGR of 54.5%.

Note: (1)Emerging Industries include home appliances, AI computing power and data centers, smart grids, and eVTOL. (2)Others include industrial power supply, UPS, railway transportation, etc.

Source: MarkLines, CAAM, CCPA, CPIA, BNEF, InfoLink, Omdia, Yole, CIC

Sales Value of Global SiC Epitaxial Wafer Industry

Market Size of Global SiC Epitaxial Wafer Industry, in Terms of Sales Value, by Wafer Size, 2020-2029E



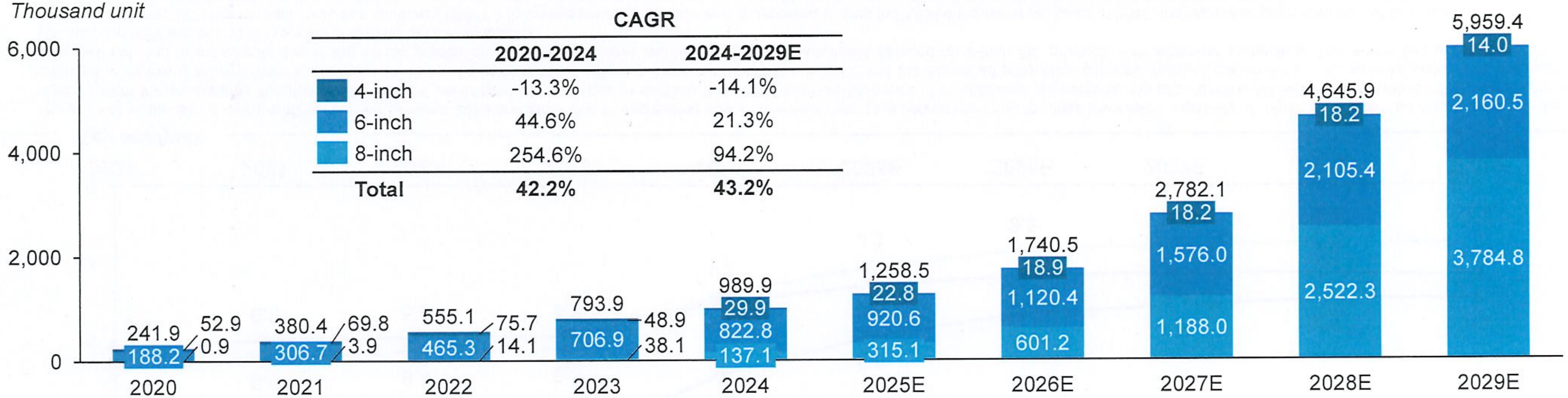
CAGR	2020-2024	2024-2029E
4-inch	-20.3%	-18.4%
6-inch	29.5%	9.4%
8-inch	186.3%	71.9%
Total	**34.7%**	**38.2%**

Key analysis

- The global SiC epitaxial wafer market has seen significant changes, especially in the sales value generated by 6-inch epitaxial wafers. From 2020 to 2024, the sales value generated by 6-inch epitaxial wafers has increased from US$0.3 billion to US$0.8 billion, with a CAGR of 29.5%. It is expected to further increase to US$1.3 billion by 2029, with a CAGR of 9.4% from 2024 to 2029. Conversely, the sales value generated by 4-inch epitaxial wafers has experienced a decline with the popularity of 6-inch epitaxial wafers, decreasing from US$49.6 million in 2020 to US$20.0 million in 2024 and further to an expected US$7.2 million by 2029.
- With the maturation of technology and continuous cost reductions, the penetration rate of 8-inch SiC epitaxial wafer will increase substantially. By 2029, the sales value generated by 8-inch epitaxial wafers is expected to reach US$4.5 billion, with a CAGR of 71.9% from 2024 to 2029.

Sales Volume of Global SiC Epitaxial Wafer Industry

Market Size of Global SiC Epitaxial Wafer Industry, in Terms of Sales Volume, by Wafer Size, 2020-2029E



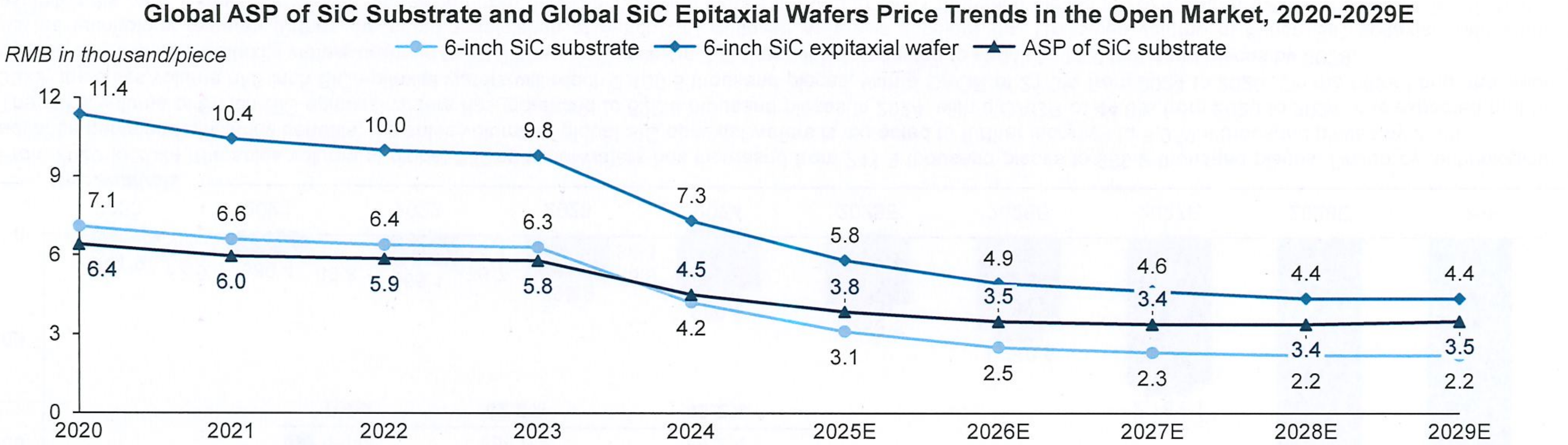
CAGR	2020-2024	2024-2029E
4-inch	-13.3%	-14.1%
6-inch	44.6%	21.3%
8-inch	254.6%	94.2%
Total	**42.2%**	**43.2%**

Key analysis

- From 2020 to 2024, the sales volume of global SiC epitaxial wafers has increased from 241.9 thousand pieces to 989.9 thousand pieces. Driven by technological advancements and efficiency benefits, the sales volume of global SiC epitaxial wafers is expected to further increase to 5,959.4 thousand pieces by 2029.
- The sales volume of 6-inch SiC epitaxial wafers has increased to 822.8 thousand pieces in 2024, with a CAGR of 44.6% from 2020 to 2024. It is expected that by 2029, the sales volume of 6-inch SiC epitaxial wafers will reach 2,160.5 thousand pieces, with a CAGR of 21.3% from 2024 to 2029. On the other hand, the sales volume of 4-inch SiC epitaxial wafers dropped to 29.9 thousand pieces in 2024, and it is forecasted to shrink to 14.0 thousand pieces by 2029.
- As the technology matures further, the commercialization of 8-inch SiC epitaxial wafers is accelerating. The sales volume of 8-inch SiC epitaxial wafers has exhibited the most remarkable growth, increasing from only 0.9 thousand pieces in 2020 to 137.1 thousand pieces in 2024, with a CAGR of 254.6%. By 2029, it is expected to increase to 3,784.8 thousand pieces, with a CAGR of 94.2%. Although 6-inch wafers currently dominate the market and is expected to grow continously, the market size for 8-inch SiC wafers is projected to expand significantly.

Source: Omdia, Yole, CIC

Price Trend of Global SiC Epitaxial Wafer Industry



Key analysis

- The price of global SiC epitaxial wafers declined between 2020 and 2024 due to decreasing cost of raw materials, cost optimization due to mass production capability of 6-inch SiC wafer and expanded production capacity. With the accelerated iteration of SiC epitaxial wafer products and rises in demand due to the swift development of downstream applications, the price decline for SiC epitaxial wafers of the same size is expected to narrow gradually. More specifically, the price of 6-inch epitaxial wafers is expected to stabilize in 2026 and the expanded production capacity mainly focus on 8-inch SiC epitaxial wafer in recent years, which will not lead to oversupply due to the limited production capacity at present and the increasing downstream demand for 8-inch SiC products with advanced technology. The 8-inch SiC products were first introduced in NEV sector and is expected to expand to other industries.
- The price of 6-inch SiC epitaxial wafer was approximately RMB7.3 thousand per piece in 2024 and is expected to drop to RMB4.4 thousand per piece in 2029, mainly due to price reduction of SiC substrate.
- With the ongoing advancements in the substrate supply chain, domestic manufacturers are now capable of providing alternatives to imported substrates. The increased supply, cost advantages of domestically manufactured substrates and technological developments in producing more cost-effective substrates have collectively contributed to a decline in raw material prices. The global average selling price of SiC substrates has shown a consistent decline from RMB6.4 thousand in 2020 to RMB4.5 thousand in 2024, reflecting improved production efficiencies and increasing market competition. The downward trend is expected to continue in the future with the initial application of 8-inch SiC wafer. The average selling price of SiC substrate is expected to have a slight increase due to the substrate iteration from 6-inch to 8-inch. To mitigate the decline in the price of SiC epitaxial wafers across the industry, our Company intends to upgrade our capacity, maintain and stabilize our price level by providing high-quality epitaxial wafers to high-end industry applications. Furthermore, leveraging our large production scale, we are able to maintain our costs at a competitive level and flexibly adjust our pricing strategy to grow our market share.

Market Drivers of Global SiC Epitaxial Wafer Industry

1 **Increasing Downstream Application Demands**

- With the global push towards renewable energy and electrification, SiC power semiconductor devices are becoming crucial for enabling high-efficiency systems due to their superior thermal performance, high breakdown voltages, low energy consumption during switching, and ability to boost overall system efficiency. Key industries such as EVs, renewable energy and ESS are increasingly adopting SiC power semiconductor devices to meet higher demands for performance and energy efficiency, where China plays a significant role, accounting for over 70% of global EV unit sales and charging infrastructure shipments, and over 90% of photovoltaic production capacity in the global market in 2024. Such strong vertical market presence inherently buffers Chinese SiC epitaxial suppliers against global tariff fluctuations. Furthermore, the expansion into emerging application areas, such as home appliances, AI arithmetic and data centers, smart grids, and eVTOL, is driving the growth of the SiC power semiconductor devices market. The global SiC power semiconductor devices market is expected to continue growing rapidly at a CAGR of 39.4% from 2024 to 2029. SiC epitaxial wafers, as core materials, will see their demand grow in direct response to the increasing market demand for high-performance SiC power semiconductor devices.

2 **Technological Advancements and Manufacturing Expansion**

- Innovations in epitaxial growth techniques, defect reduction, and uniformity improvement are improving the quality and yield of SiC epitaxial wafers, making them more cost-effective and reliable. With the maturation of 6-inch SiC epitaxial wafer manufacturing processes and the reduction in production costs, along with breakthroughs in 8-inch SiC epitaxial wafer mass production and the acceleration of their commercialization, the market size of SiC epitaxial wafers is experiencing rapid growth.

3 **Supportive Government Policies**

- Favorable policies, laws and regulations supporting the development of the SiC epitaxial wafer industry have been continuously issued by governments worldwide. In July and August 2023, the Ministry of Industry and Information Technology issued the *Implementation Opinions on Reliability Improvement of Manufacturing Industry and Action Program for Stable Growth in the Electronic Information Manufacturing Industry for 2023-2024*, which emphasized the need to establish industry standards and enhance the reliability of wide-bandgap power semiconductor devices, including SiC power semiconductor devices. In February 2023, the State Council of the People's Republic of China released the *Outline for Building a Quality-Strong Country*, explicitly advocating for the development of domestic material quality, stability, and applicability through technological research and development. SiC epitaxial wafers, as the key material of broadband semiconductors, fall under national industry policy and receive funding to support their development in key areas. In September 2023, the European Union enacted the *European Chips Act*, investing over 43 billion euros to boost the European semiconductor industry.

Market Trends of Global SiC Epitaxial Wafer Industry

1 Enhanced Specialization in Epitaxial Wafer Manufacturing

- The SiC epitaxial wafer market is seeing a growing number of foundries focusing exclusively on epitaxial wafer manufacturing. This trend is driven by the need for high-quality, application-specific wafers tailored to the requirements of downstream industries. Chinese suppliers hold a significant 30% market share of the global SiC substrate market, with other major SiC substrate suppliers located in Korea and the U.S. This diversified upstream supply chain effectively protects the epitaxial market from potential tariff fluctuations. Specialized foundries are investing in advanced equipment and expertise to meet the diverse needs of customers

2 The Development of 8-inch SiC Epitaxial Technology is Accelerating

- For chips of the same specifications, larger wafers reduce the proportion of edge chips and increase the number of bare dies produced per wafer, significantly improving wafer utilization and lowering the unit cost of chips. Taking a die with a size of 32 square millimeters as an example, expanding the SiC epitaxial wafer from 6-inch to 8-inch can increase the wafer area by 1.8 times, reduce the edge die ratio from 14% to 7%, and boost the number of bare dies by 90%. Due to the mature production processes and lower costs, 6-inch SiC epitaxial wafers will continue to hold an important position in a medium-to-long period. As the manufacturing processes for 8-inch SiC epitaxial wafers mature and quality improve, their adoption is expected to accelerate.

3 Expanding to Medium-High and Ultra-High Voltage Applications

- With the increasing demand for high-power, high-voltage SiC power semiconductor devices in fields such as smart grids, rail transportation, and large-scale energy storage systems, the application scenarios for SiC epitaxial wafers are expanding into medium-high voltage and ultra-high voltage domains. In the future, SiC epitaxial wafers will increasingly focus on meeting the requirements of these devices, driving their adoption in higher voltage applications.

4 Rapid Development of Multi-Layer Epitaxy and Trench Epitaxial Refill Technologies

- Multi-layer epitaxy technology involves growing multiple epitaxial layers with precise doping profiles and thicknesses, enabling higher voltage tolerance and lower on-resistance, making it particularly suitable for higher voltage applications. Trench epitaxial refill technology, on the other hand, is a critical manufacturing process for super junction devices. This technique involves etching trenches into the SiC epitaxial wafer and refilling them with epitaxially grown SiC layers, significantly improving the voltage tolerance, power density, and thermal management performance of super junction devices. .

5 Declining Unit Production Costs

- The unit production cost of SiC epitaxial wafers is steadily dropping, driven by technological advancements, economies of scale, and greater integration across the industry chain. Innovations in epitaxial growth techniques and process optimization are enhancing production efficiency and yields. Additionally, expanding production capacities and the establishment of vertically integrated supply chains are lowering costs further.

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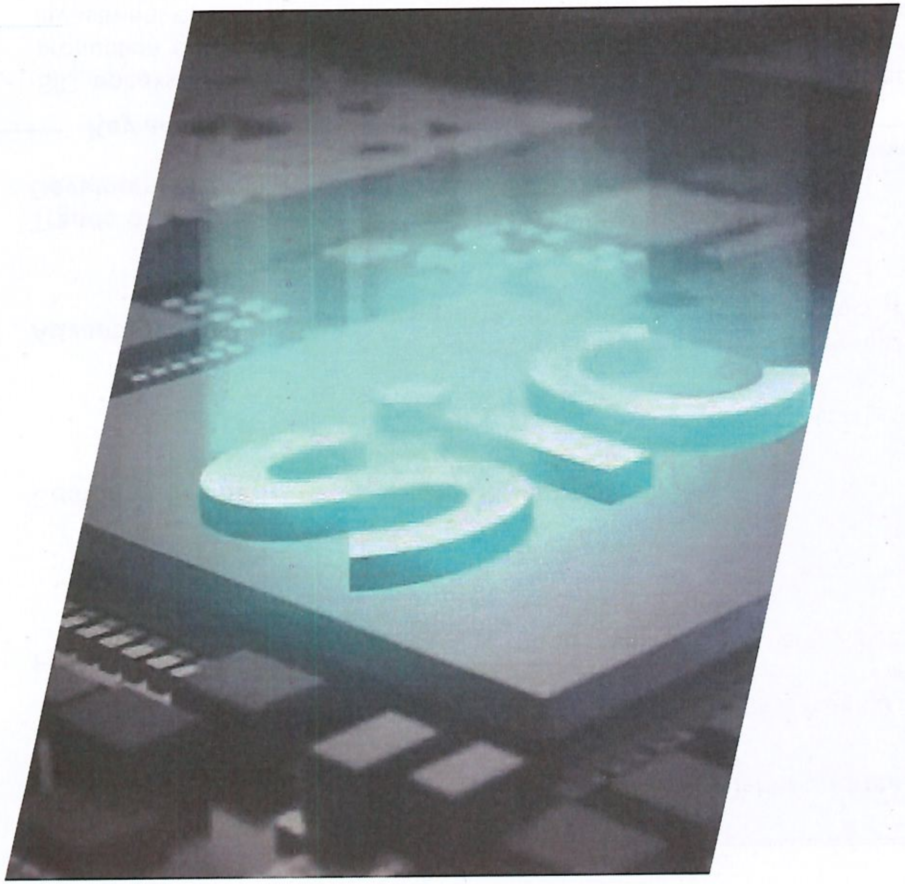


Competitive Landscape

	SiC Epitaxial Foundries	SiC Device Manufacturers with In-house SiC Epitaxy Production Capability
Features	• Focus on SiC epiwafer (substrate may be included) manufacturing • Possess strong manufacturing capabilities and complete know-how on process control	• Operations cover SiC wafer manufacturing to power device production and sales • Require huge amount of investments
Customer Profile	• SiC power device manufacturers • Standardized requirements • Dominated by large clients	• End customers such as automobile OEMs, energy storage PCS manufacturers, etc. • SiC power device manufacturers • Customized requirements
Advantages	• Focus on SiC epiwafer field and accumulate large amount of know-how on manufacturing high-grade SiC epiwafer	• Covering the entire production process of SiC power devices, which is independently controllable • Unified supply chain management, significant long-term economic benefits
Trends of Development	• Mainly focus on the key clients • Focus on technological innovation	• Focus on expanding client base • Focus on product development

Key analysis

- SiC epitaxial wafer providers in the open market can be categorized into two groups, epitaxial foundries and device manufacturers with in-house epitaxy production capability. Epitaxial foundries focus on providing SiC epitaxial wafer and are not involved in SiC power device manufacturing, having more capital investment on SiC epitaxial wafer and accounting for 72.7% of the SiC epitaxial wafer open market. While device manufacturers with in-house epitaxy production capability are able to manufacture both wafers and devices. Both epitaxial foundries and device manufacturers with in-house epitaxy production capability in the SiC industry should continuously engage in research and innovation and accumulate extensive know-how to meet the diverse demands of downstream customers.

Business Profile

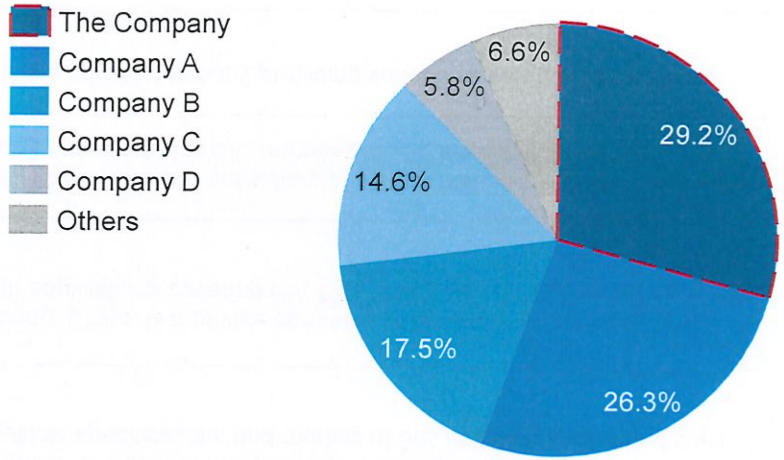
Company	Profile
Company A	• Established in 1939, headquartered in Tokyo, Japan and listed on the Tokyo Stock Exchange (TYO: 4004), specializes in advanced semiconductor materials, electronic components, and high-performance chemicals.
Company B	• Established in 2000, headquartered in Hebei, China, is a private company specializing in research and production of SiC epitaxial wafers, with products covering multiple specifications and models of SiC epitaxial wafers and GaN epitaxial wafers.
Company C	• Established in 2009, headquartered in Guangdong, China, is a private company specializing in the R&D, and production of SiC semiconductor materials, with applications covering PV, EVs, charging stations, energy storage, and rail transit.
Company D	• Established in 2019, headquartered in Zhejiang, China, is a sub-subsidiary of a state-owned company which holds 19 listed subsidiaries, specializing in developing and manufacturing SiC materials and GaN epitaxial wafers.
Company E	• established in 2019, headquartered in Jiangsu, is a private company providing various semiconductor epitaxial foundry services.

Source: Annual Reports, Expert Interviews, CIC

Ranking of Top Five Global SiC Epitaxial Foundries

Ranking of Top 5 Global SiC Epitaxial Foundries, in terms of revenues, 2024

Ranking	Company Name	SiC Epiwafer Revenue (in billions of RMB)	Market Share (%)
1	The Company	1.0	29.2%
2	Company A	0.9	26.3%
3	Company B	0.6	17.5%
4	Company C	0.5	14.6%
5	Company D	0.2	5.8%
	Sum of Top Five	3.2	93.4%
	Others	0.2	6.6%
	Market Total	3.4	100.0%



Notes:
(1)The market total of the ranking is the sum of the sales revenues of SiC epitaxial foundries.
(2)The revenue of SiC epitaxial wafer includes both turnkey(销售) and consign(代工).
(3)Any discrepancies between the totals shown in the table above and the sums of the amounts listed are due to rounding and figures shown as totals may not be the arithmetic sum of the figures preceding them.

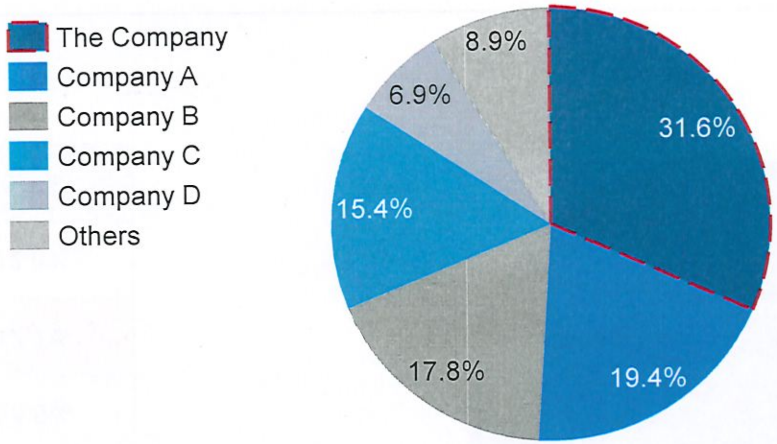
Key analysis

- SiC epitaxial wafer providers can be categorized into two groups, epitaxial foundries and device manufacturers with in-house epitaxy production capability. Epitaxial foundries focus on providing SiC epitaxial wafer and are not involved in SiC power device manufacturing, having more capital investment on SiC epitaxial wafer and accounting for 72.7% of the SiC epitaxial wafer open market. While device manufacturers with in-house epitaxy production capability are able to manufacture both wafers and devices. Both epitaxial foundries and device manufacturers with in-house epitaxy production capability in the SiC industry should continuously engage in research and innovation and accumulate extensive know-how to meet the diverse demands of downstream customers.

Ranking of Top Five Global SiC Epitaxial Foundries

Ranking of Top Five Global SiC Epitaxial Foundries, in Terms of Sales Volume in open market, 2024

Ranking	Company Name	SiC Epitaxial Wafer Sales Volume (6-inch equivalent, in thousand)	Market Share (%)
1	The Company	170	31.6%
2	Company A	105	19.4%
3	Company B	96	17.8%
4	Company C	83	15.4%
5	Company D	37	6.9%
	Sum of Top Five	491	91.1%
	Others	49	8.9%
	Market Total	540	100.0%



Notes:
(1)The market total of the ranking is the sum of the sales volume of SiC epitaxial foundries.
(2)The sales volume of SiC epitaxial wafer includes both turnkey(销售) and consign(代工), and has been converted to 6-inch equivalent.
(3)Any discrepancies between the totals shown in the table above and the sums of the amounts listed are due to rounding and figures shown as totals may not be the arithmetic sum of the figures preceding them.

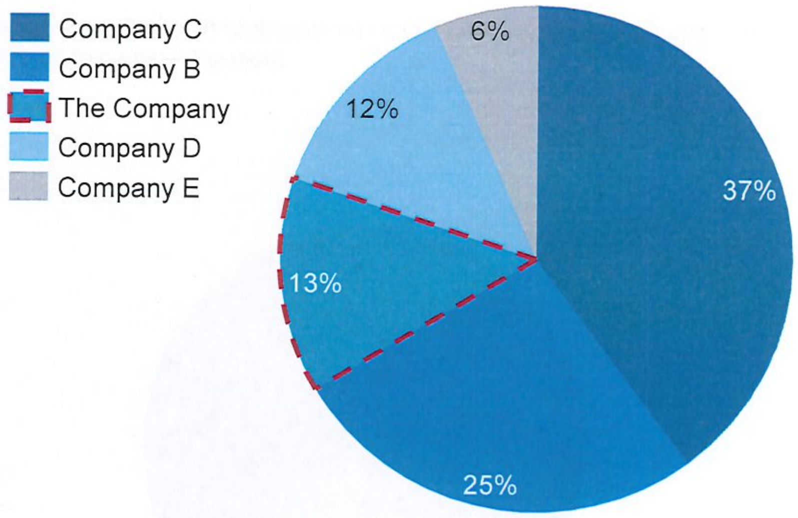
Key analysis

- The Company is a global leader among SiC epitaxial foundries and has established a strong footprint in the global market (including China), where the company obtained 31.6% and 29.2% of the global market share in terms of sales volume and revenue, respectively, ranking first worldwide in 2024, according to CIC.

Ranking of Top 5 Global SiC Epi Foundries

Ranking of Top 5 Global SiC Epi Foundries, in terms of revenues in China, 2024

Ranking	Company Name	SiC Epiwafer Revenue (in billion RMB)	Market Share (%)
1	Company A	0.6	36.8%
2	Company B	0.4	24.5%
3	**The Company**	**0.2**	**12.7%**
4	Company D	0.2	12.3%
5	Company E	0.1	6.1%



Key analysis

- Meanwhile, the Company's sales in the China domestic market amounted to revenue of RMB0.2 billion in 2024, ranking third in terms of SiC epitaxial wafer revenues generated in China, according to CIC.

Entry Barriers and Key Success Factors in Global SiC Epitaxial Wafer Industry

Advanced Technological Capabilities	• Companies in the global SiC epitaxial wafer industry must possess advanced technological expertise, including defect control technology, uniformity control technology, etc., which enables them to produce innovative products to meet various demand of downstream applications. For new entrants, achieving such a level of technological proficiency requires substantial and continuous investment in research and development, thereby forming a significant technological barrier to entry.
Advantages in Large-Size and Mass Production Capacity	• Producing in large sizes and large-scale helps secure economies of scale, improve production efficiencies, and lower per-unit costs. This robust production capacity creates a formidable barrier to entry for new market entrants, as it demands stringent production control and substantial investment in manufacturing infrastructure.
Extensive Industry Experience and Knowledge Accumulation	• SiC epitaxial wafer manufacturing is a technology-intensive process, requiring long-term R&D and experimentation to obtain industry know-how. Deep-rooted industry experience enables companies to foresee market trends, optimize production processes, and mitigate risks effectively. This expertise is invaluable for driving continuous improvement and innovation.
Solid Customer Base and Collaborative Supply Chain	• Through long-term cooperation with leading global customers, SiC epitaxial foundries can accumulate rich industry experience and deep insight into future trends in downstream industries, satisfying the differentiated needs. The high cost to switch suppliers, including product evaluation, testing and certification, has created a strong customer stickiness. Especially for application areas with strict requirements, such as EV, etc., the verification process may take several years, forming an invisible customer barrier as well.
Assurance of High-quality Products	• Achieving high-quality and high-consistency products helps companies obtain a competitive edge, especially for automotive-grade wafers. To ensure consistent high-quality SiC epitaxial wafer products, businesses must obtain industry know-how and strictly enforce quality management processes.
Significant Capital Investment in Production and R&D	• The SiC epitaxial wafer industry is capital-intensive, demanding substantial upfront investments for large-scale production facility construction. To achieve cost advantages and enhance market competitiveness, companies must allocate significant capital for upgrading production lines from 6-inch to 8-inch wafers. Meanwhile, continuous R&D investment is essential to advance epitaxial growth technologies, such as reducing defect densities and improving uniformity

Source: CIC

Appendix (1/2)

1. The Company was the first company in China to develop trench filling epitaxy technology for superjunction applications, achieving in 2022.
2. Since 2023, the Company has been the world's largest SiC epitaxial foundry by annual sales volume, with a market share exceeding 30% in 2024.
3. SiC power devices fabricated using our epitaxial wafers exhibit stable performance in high-temperature and high-power use.
4. The Company's products lead the industry in key performance metrics for SiC epitaxial products, including epitaxial thickness, doping concentration, epitaxial defect and yield rates.
5. In 2024, the Company's revenue, adjusted net profit (Non-IFRS measure) and operating cash flow reached RMB974.3 million, RMB323.5 million and RMB640.6 million, respectively, ranking among the highest in the industry.
6. Amid the global wave of energy revolution, electricity is rapidly replacing traditional fossil fuels, emerging as the driver for electrification and growth in industrial automotive and renewable energy sectors. In this transformative shift, SiC power devices serve as the "intelligent heart" of various power systems utilizing electricity.
7. The extensive global market of semiconductors is concentrated, with top 10 providers obtaining over 70% of the market share. Currently, traditional silicon materials still dominate while emerging materials such as SiC gradually earning their market presence. As an enterprise focus on the next-generation materials, the Company obtained approximately 0.1% of the total semiconductor market share in 2024.
8. The production of SiC epitaxial wafers is still facing several hurdles: (i) defect control, (ii) uniformity and consistency, and (iii) high costs.
9. The Company also have a significant first-mover advantage as the first company in the world to mass-produce and commercially supply 8-inch SiC epitaxial wafers in the open market.
10. From 2023 to 2025, the semiconductor industry witnessed a sequential inventory adjustment across its downstream applications. This process started in the consumer electronics segment in 2022 before impacting semiconductors power devices, particularly in automotive, in 2023.
11. Semiconductor inventory cycles, typically lasting three to four years, are primarily driven by shifts in downstream demand, capacity expansion cycles, and macroeconomic factors. The current adjustment is anticipated to end in the second half of 2026 and is seen as a cyclical correction during the semiconductor industry cycle instead of a structural market deterioration.
12. The recent cyclical fluctuations have been driven primarily by adjustments in downstream supply and demand as well the impact from the transition from 4-inch to 6-inch and 8-inch wafers.
13. Facilitating transactions through channel partners are widely adopted and are industry norm in the relevant regions.
14. The supplier certification cycle in the automotive industry generally exceeds two years.
15. The Company's product yield rate reaches over 99%, outperforming industry peers.
16. Similarly to the traditional Si industry, which has formed clear division of labour after years of consolidation, the trend towards a highly specialized division of labor for the SiC industry is inevitable.
17. The Company was the first company in China to develop trench filling epitaxy technology for superjunction applications.
18. The Company was the first in the world to achieve large-scale commercial supply of 8-inch SiC epitaxial wafers and the first in China to commercialize and mass produce 3-inch, 4-inch, 6-inch, and 8-inch SiC epitaxial wafers.

Appendix (2/2)

1. The Company held the largest SiC epitaxial wafers production capacity worldwide.
2. Given the stringent technical requirements and the critical need for supply chain stability across the downstream semiconductor sectors, power device industry are dominated by limited leading players, which constitute the majority of our customer base.
3. The downstream semiconductor industry demands a rigorous validation cycle of at least one to two years for new suppliers, meaning any attempt to switch would result in prohibitive time-to-market delays and substantial validation costs that effectively lock in our partnership.
4. It is common industry practice for governments to provide similar grants to other companies in the SiC or SiC epitaxial wafer industry.
5. The Company's customers cover four of the world's top five SiC power device providers and seven of the top ten power device providers, by volume in 2024.
6. The production of SiC epitaxial wafers is still facing several hurdles. 1) Defect Control: The epitaxial growth process generates critical defects such as triangular defects and particle-induced defects. Additionally, existing defects in the substrate can propagate into the epitaxial layer, if not properly controlled or eliminated, reducing device yield. 2) Uniformity and Consistency: Controlling the thickness and doping uniformity of large-diameter wafers is difficult, leading to inconsistencies in device performance. 3) High Costs: Epitaxial growth requires expensive equipment, costly consumables and complex processes, making it one of the most costly segments in the value chain and a key bottleneck for cost reduction.
7. The Company has a significant first-mover advantage as the first company in China to mass produce and commercially supply 8-inch SiC epitaxial wafers. Although 6-inch wafers currently dominate the market and is expected to grow continuously, the market size for 8-inch SiC wafers is projected to expand significantly.

Source: Expert Interviews, CIC

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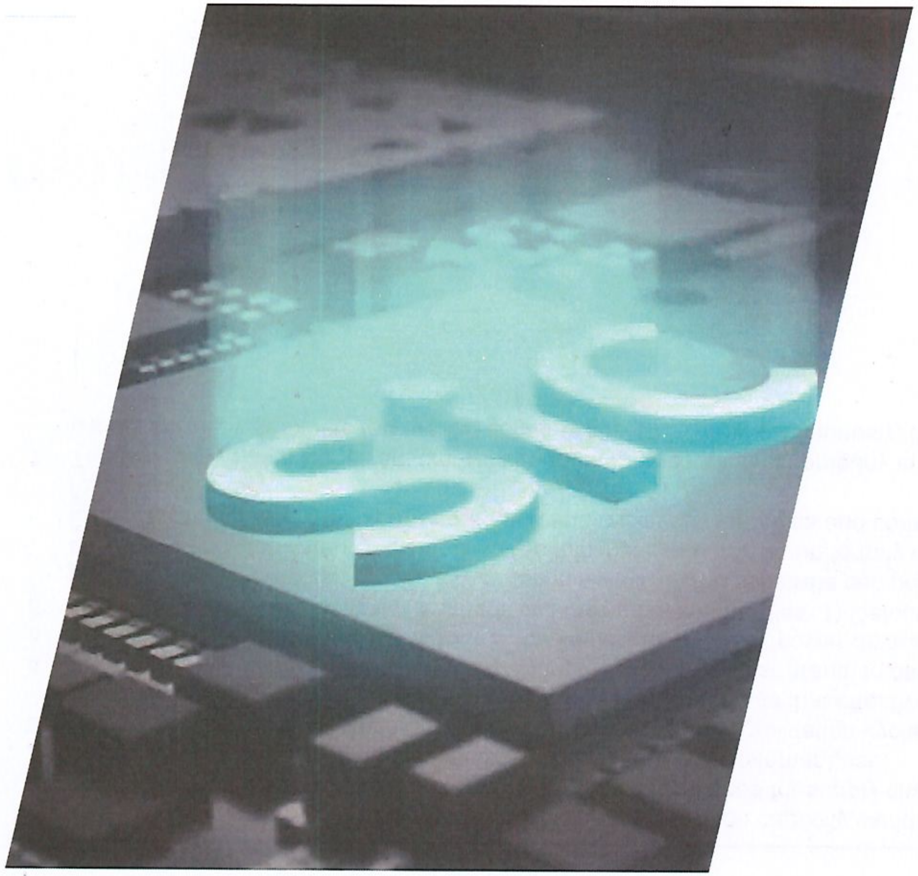
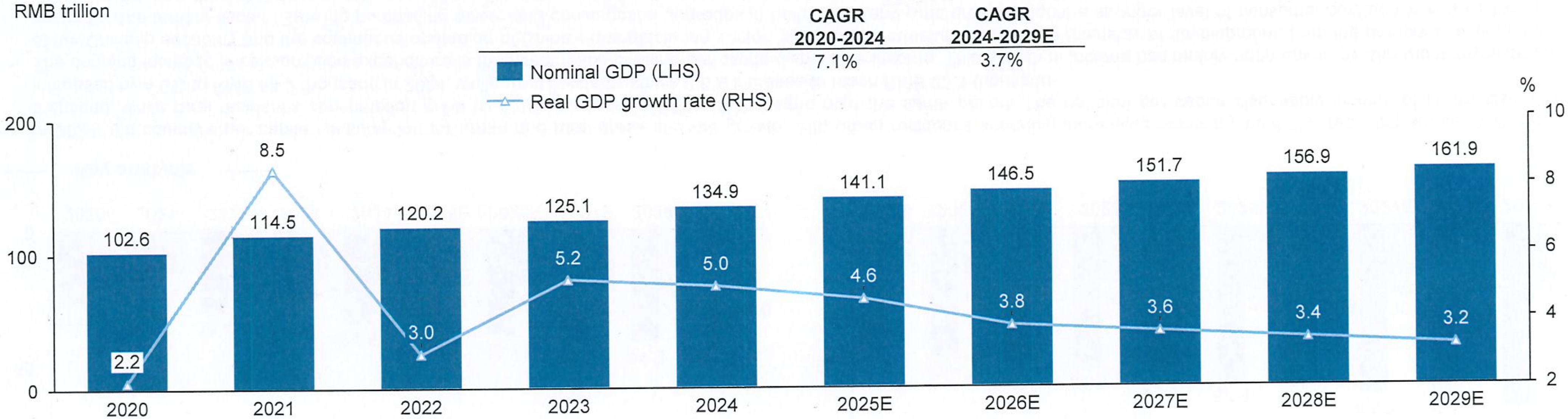


China's real GDP growth rate witnessed a sharp decline in 2020 and 2022, however, it is expected to stabilize in the future, fueled by increasing consumer demand and an opening-up policy.

Nominal GDP and Real GDP growth rates, China, 2020-2029E



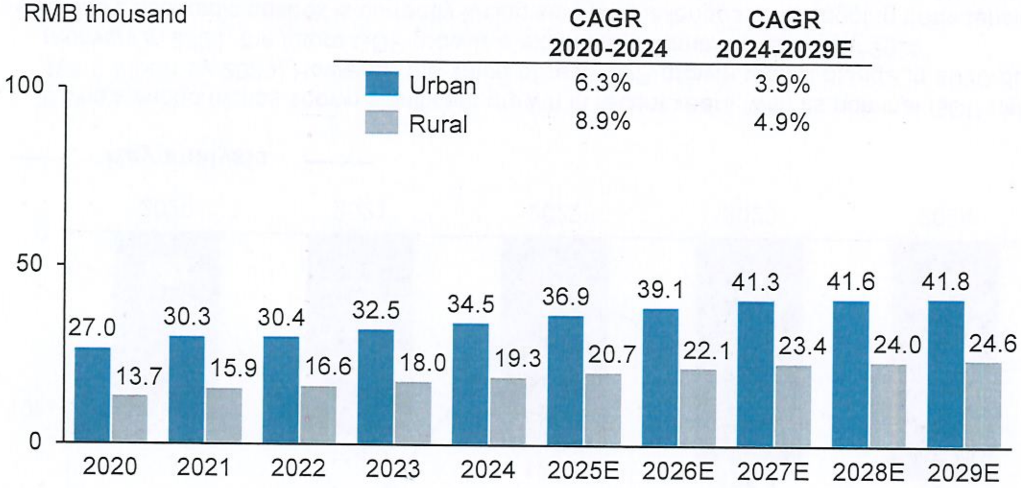
Key analysis

- China's economy has shown significant growth in recent years, with its nominal GDP rising from RMB 99.1 trillion in 2019 to RMB 134.9 trillion in 2024 and is projected to reach RMB 161.9 trillion by 2029. However, the value of real GDP growth took a plunge in 2020 due to the covid-19. Although there was a one-time increase in real GDP during the economic recovery in 2021, the future GDP growth is expected to remain stable after 2023.
- China's economic outlook is currently facing several challenges. The ongoing trade tensions with the United States have led to uncertainty and a potential slowdown in economic growth. In addition, China's aging population is putting pressure on its labor force and social security system. Despite these challenges, China continues to invest heavily in infrastructure and technology, which could drive future economic growth. The government's commitment to economic reform and opening up to foreign investment also presents opportunities for sustained growth.

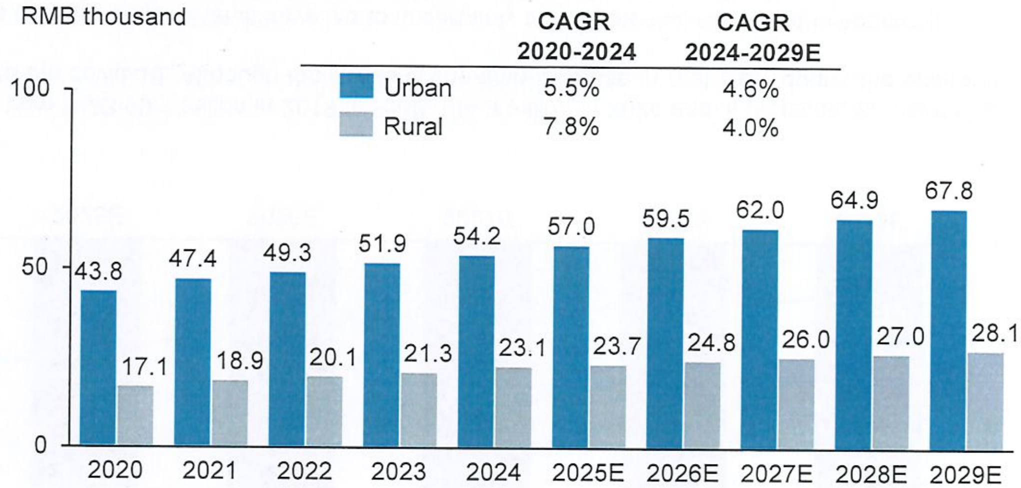
Source: NBS, CIC

Urban and rural per capita consumption rose; despite urbanization shifts, higher incomes drive increased consumer spending.

Per capita consumption expenditures in China, urban and rural, 2020-2029E



Per capita disposable income in China, urban and rural, 2020-2029E



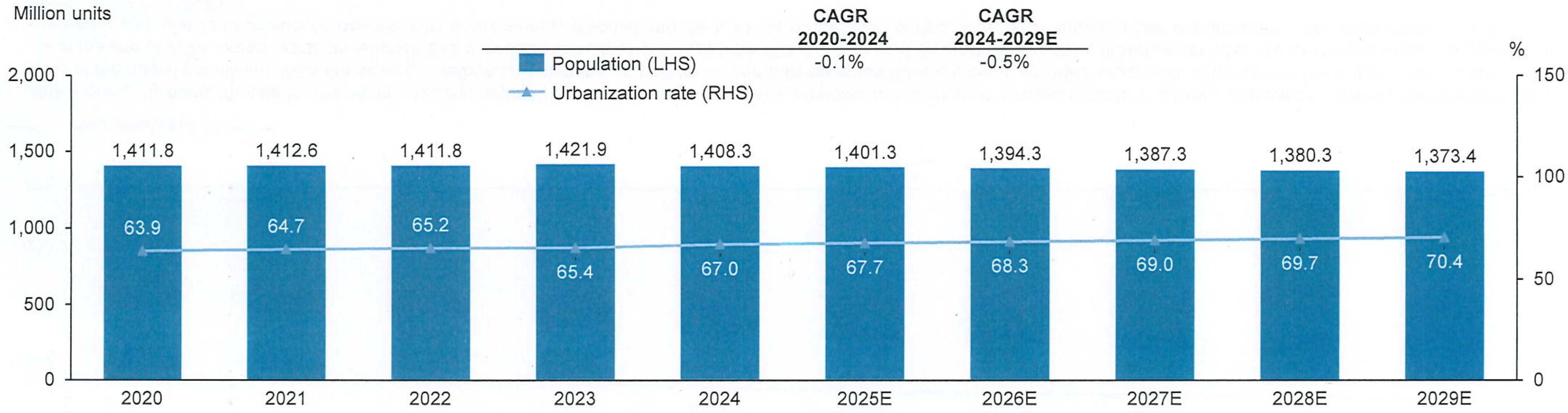
Key analysis

- In 2024, the country's per capita consumption for urban and rural areas showed growth, with urban resident's spending increasing nominally by 4.7%, reaching around RMB 34.5 thousand, while rural resident's consumption grew by 6.1%, surpassing RMB 19 thousand over the same period. The national per capita disposable income of urban residents increased by 4.6% to RMB 54.2 thousand in 2024, while rural residents saw a 6.6% increase to reach RMB 23.1 thousand.
- The ongoing increase in consumption expenditure is the direct result of rising per capita disposable income. This growth in income has mainly been driven by the rapid development of the Chinese economy and the continuous upgrading of China's manufacturing sector, along with a structural shift in the mainstay of development, from the primary and secondary sectors to the tertiary sector. Growing purchasing power and consumption upgrades in both urban and rural areas suggest a stronger level of consumer confidence and sustainable internal circulation, thus giving rise to the new retail and logistics industry. It provides tremendous development potential for China's consumer and FMCG industries.
- The compound annual growth rates of per capita disposable income and consumption expenditure in the urban area is expected to decline in the future due to lower birth rates and an ageing population. Despite this, disposable income and expenditure levels will still grow steadily, driven by the globalization of trade, productivity gains and the internationalization of the Renminbi.

Source: NBS, CIC

Despite the low population growth due to the one-child policy, China's population size remains globally significant.

Population and Urbanization, China, 2020-2029E



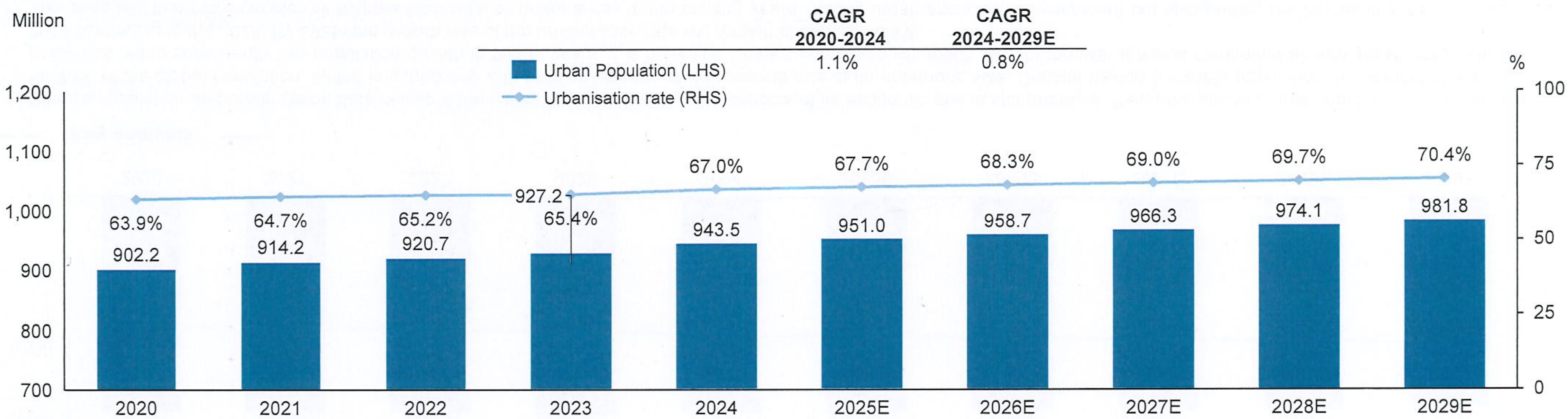
Key analysis

- China's population and urbanization data highlight the intricate nature and diverse aspects of its economic and social progress. Being the second most populous country, accounting for 20% of the global population, China is confronted with both challenges and prospects due to its enormous size. Despite having a sizable population, the impact of the one-child policy has led to consistently low population growth in recent years. It is projected China's population will reach 1.37 billion with a minus compound annual growth rate from 2020 to 2024 continuing to the 2029. By 2029, the growth rate of the urbanization rate will remain at around 70.4%.
- This suggests that more people will migrate from rural to urban areas in the coming years, fueling urban economic development but also posing challenges in areas such as urban planning, infrastructure development and social security. China's population and urbanization figures have far-reaching implications for economic and social development. As population growth continues and urbanization accelerates, the demand for resources will increase, as will the pressure on the environment.

Source: NBS, CIC

The urbanization rate has steadily increased, creating a substantial market for industries including digital retail.

Urban population and urbanization rate, China, 2020-2029E



Key analysis

- China presently holds the title for the world's second largest population, and this figure is expected to maintain an upward trajectory. China's population currently constitutes roughly 20% of the global population. With the advent of reform and opening up policies, urban built-up areas have experienced rapid expansion, aligning with the nation's swift urbanization. As of the end of 2024, urban residents reached 943.5 million, marking an increase from 902.2 million in 2020. At the same time, urbanization rates are expanding rapidly, regarding the narrowing gap relative to developed nations. China has already stepped into the post-industrialization period, with its urbanization rate of permanent population standing at 67.0% in 2024, up 3.1 from 2020.
- This increasing urbanization is driven by various factors, including economic opportunities in urban areas, improved infrastructure, and government policies aimed at promoting urban development. As more people migrate to cities, it presents both opportunities and challenges for China, including the need for sustainable urban planning, infrastructure development, and social welfare systems to support the growing urban population.

Source: NBS, CIC

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