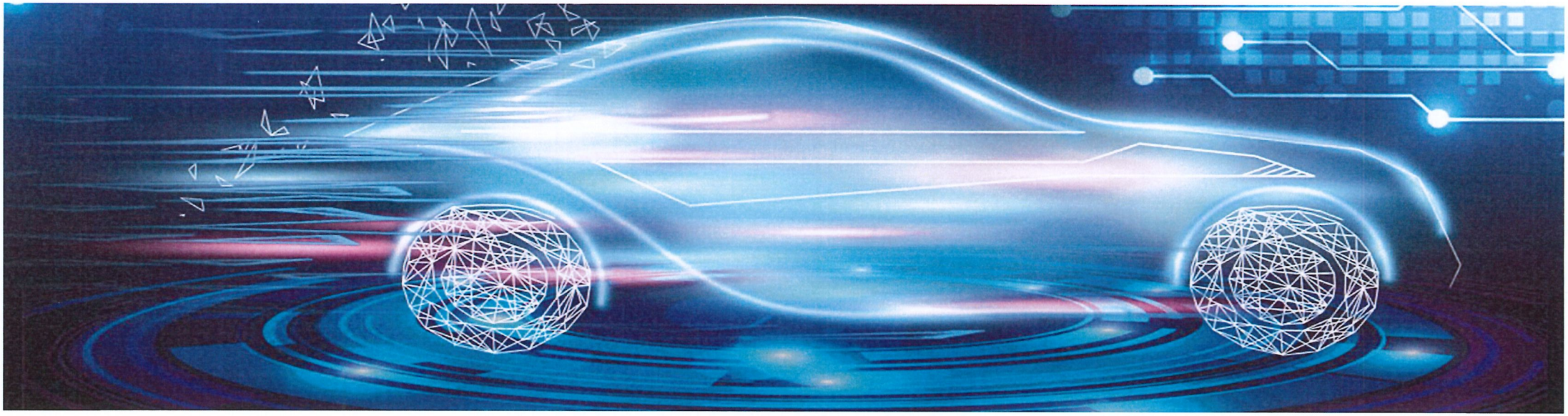

China Insights Consultancy

Industry Report of China's Capacitor Film Industry

Date: November 20, 2025

For and on behalf of China Insights Industry Consultancy Limited

Julia Zhu

Title: Partner

Name: Julia Zhu

CIC introduction, methodologies and assumptions

China Insights Consultancy is commissioned to conduct research and analysis of, and to produce a report on Global and China's capacitor film industry at a fee of RMB400,000. The report commissioned has been prepared by China Insights Consultancy independent of the influence of the Company and other interested parties.

China Insights Consultancy's primary services include industry consulting, commercial due diligence, and strategic consulting to both institutional investors and corporations. Its consulting team has been tracking the latest market trends in the fields of chemicals, healthcare, consumer goods, environment, industry, energy, transportation, agriculture, e-commerce, finance, etc., and has the most relevant and insightful market intelligence in the above-mentioned industries.

China Insights Consultancy conducted both primary and secondary research using a variety of resources in the completion of this report. Primary research involved interviewing key industry experts and leading industry participants. Secondary research involved analyzing data from various publicly available data sources, such as National Bureau of Statistics of China, World Bank, Energy & Climate Intelligence Unit, International Energy Agency, company reports, independent research reports and the internal database of China Insights Consultancy.

The market projections in the commissioned report are based on the following key assumptions: (i) the overall global social, economic, and political environment is expected to maintain a stable trend during the forecast period; (ii) the key industry drivers are likely to continue to drive the growth in each market during the forecast period, and (iii) there is no extreme force majeure or unforeseen industry regulations in which the market may be affected either dramatically or fundamentally during the forecast period.

All statistics are reliable and based on information available as of the date of this report. Other sources of information, including those from the government, industry associations, or market participants, may have provided some of the information on which the analysis or its data is based.

All the information regarding the Company has been sourced from the Company's audited report or management interviews. The information concerning and provided by the Company has not been independently verified by China Insights Consultancy.

Terms and abbreviations

CAGR	Compound annual growth rate
etc.	Et cetera
ESG	Environmental, social, and governance
GDP	Gross domestic product
RMB	Renminbi
PP	Polypropylene
BOPP	Biaxially oriented polypropylene
PET	Polyethylene Terephthalate
PEN	Polyethylene Naphthalate
PPS	Polyphenylene Sulfide
EV	Electric Vehicle
NEV	New Energy Vehicle
PV	Passenger Vehicle
GW	Gigawatt

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Major global economies have established clear targets in laws or policy documents to achieve carbon neutrality or net-zero emissions by around 2050

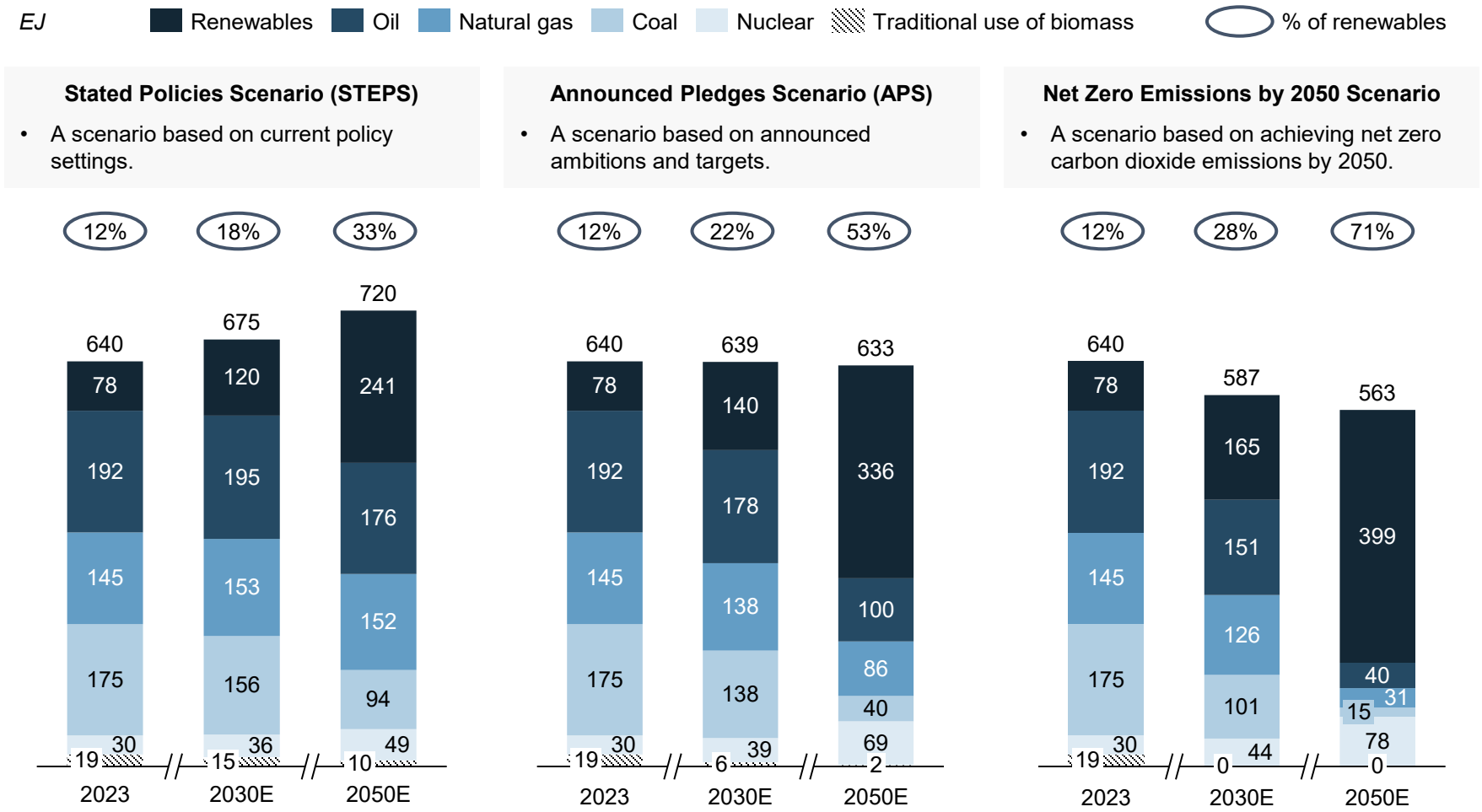
Carbon neutrality or net-zero emissions targets of major global economies

Countries and regions	GDP, 2024 *USD billion*	Target year	Target status	Target details
The United States	27,361	2050	In policy document	• The United States aims to achieve net-zero greenhouse gas emissions by 2050. This target aligns with the country's re-engagement in global climate efforts, including *the Paris Agreement*, and underscores federal initiatives to transition toward renewable energy, improve energy efficiency, and foster innovation in low-carbon technologies.
European Union	18,349	2050	In law	• The European Union aims to achieve climate neutrality by 2050, targeting net-zero greenhouse gas emissions. Central to *the European Green Deal*, this goal is legally binding under *the European Climate Law*, ensuring accountability and reinforcing the EU's commitment to leading global efforts against climate change and fostering a sustainable economy.
China	17,795	2060	In policy document	• China has committed to achieving carbon neutrality by 2060, with a peak in greenhouse gas emissions before 2030. This target reflects China's commitment to *the Paris Agreement* and its plans to accelerate the transition to renewable energy, enhance energy efficiency, and innovate in clean technologies.
Japan	4,213	2050	In law	• Japan targets carbon neutrality by 2050, established in *the Basic Act on Climate Change Countermeasures*. This legally binding framework emphasizes renewable energy expansion, green innovation, and carbon recycling technologies. The government prioritizes hydrogen energy and offshore wind power, aiming to reduce emissions by 46% by 2030 compared to 2013 levels.
The United Kingdom	3,340	2050	In law	• The UK enshrined its net-zero emissions goal for 2050 in *the Climate Change Act 2008.* It mandates progressive carbon budgets and sectoral decarbonization plans. The UK focuses on renewable energy, electric vehicles, and carbon capture. Emissions were reduced by 78% by 2035, compared to 1990 levels, highlighting its ambitious intermediate targets
Canada	2,140	2050	In law	• Canada's *Net-Zero Emissions Accountability Act* commits to achieving net-zero emissions by 2050. The legislation mandates milestone targets every five years and robust reporting requirements. The plan emphasizes clean energy investments, phasing out coal, and developing carbon capture. It also aims to cut greenhouse gas emissions by 40-45% below 2005 levels by 2030.
Australia	1,724	2050	In law	• Australia formalized its net-zero target by 2050 under *the Climate Change Act 2022*. The legislation ensures regular progress reviews and transparent reporting. Renewable energy investments, hydrogen production, and carbon sequestration form its core strategies. The 2030 target seeks to reduce emissions by 43% compared to 2005 levels, reflecting a significant climate ambition shift.

Source: World Bank, Energy & Climate Intelligence Unit, China Insights Consultancy

Carbon neutrality and net-zero targets are poised to significantly reshape the global energy supply by accelerating the transition from fossil fuels, such as oil, coal, and natural gas, to renewable energy sources, such as solar and wind power.

Global energy supply by scenario, 2024-2050



Stated Policies Scenario (STEPS)

- A scenario based on current policy settings.

Announced Pledges Scenario (APS)

- A scenario based on announced ambitions and targets.

Net Zero Emissions by 2050 Scenario

- A scenario based on achieving net zero carbon dioxide emissions by 2050.

Key Analysis

- Carbon neutrality and net-zero targets are poised to significantly reshape the global energy supply by accelerating the transition from fossil fuels, such as oil, coal, and natural gas, to renewable energy sources, such as solar and wind power. Resultingly, electricity will play an increasingly important role in global energy. The electrification process will continuously stimulate the demand of NEV and new energy electricity system, as well as electronic systems for industrial and household uses

Source: IEA, China Insights Consultancy

Capacitors are critical for NEV, new energy electricity system, industrial equipment, home appliances, and so on due to their ability to stabilize and enhance the performance of these systems

Functionality of capacitors in major renewable energy sources

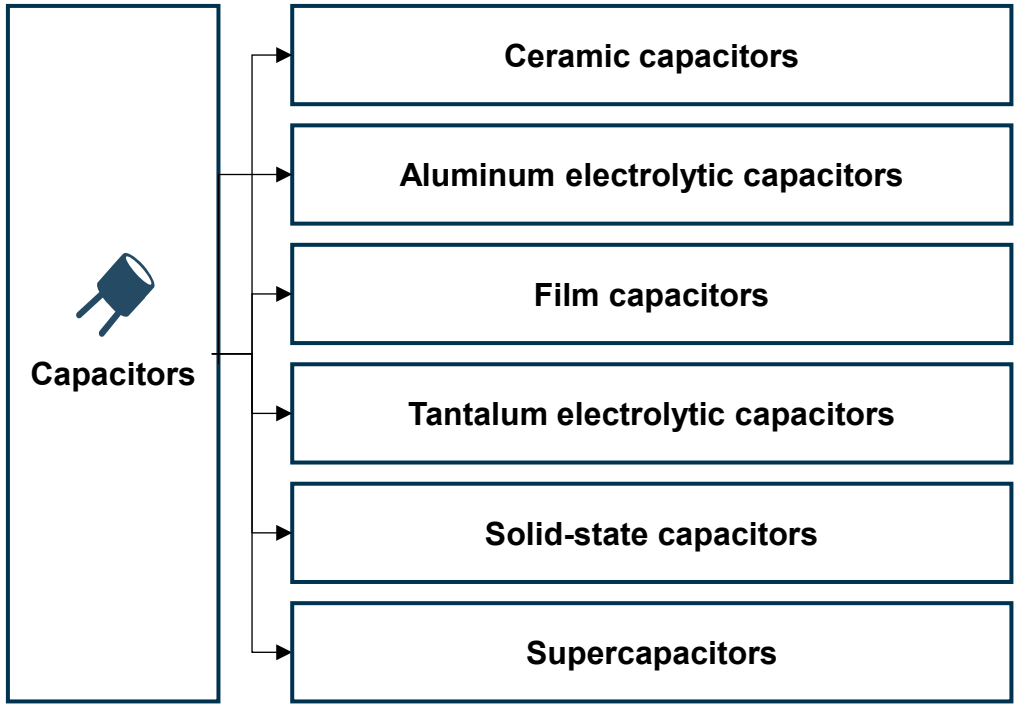
Major renewable energy sources	Major functionalities				
	Voltage stabilization	Reactive power compensation	Power factor correction	Energy storage and load balancing	Smoothing intermittency
1 ***Solar power***	• Solar output fluctuates with cloud cover and time of day. Capacitors smooth these variations by stabilizing voltage levels in the system, ensuring consistent power delivery.	• Renewable energy sources, particularly wind and solar, often generate less reactive power than conventional generators. Capacitors compensate for this by providing the reactive power needed to maintain grid voltage stability, preventing blackouts and enhancing system reliability	• Many renewable energy systems, such as wind turbines, can introduce reactive components into the grid, lowering the power factor. Capacitors improve the power factor, reducing energy losses and ensuring more efficient power transmission.	• Capacitors can store small amounts of energy and release it quickly, bridging short-term gaps in energy supply and demand. This is particularly useful for managing transient imbalances in solar and wind power output.	• During partial shading or sudden weather changes, capacitors help smooth output by managing rapid changes in power generation
2 ***Wind power***	• Wind speeds are unpredictable, leading to variable output. Capacitors regulate voltage fluctuations caused by changing wind conditions.				• Turbulence in wind speed causes power fluctuations. Capacitors help mitigate these effects by balancing output to the grid.
3 ***Energy storage***					
4 ***Hydro power***	• While hydro is generally more stable, sudden load changes in the grid can cause voltage swings. Capacitors help dampen these effects.				• Capacitors are used in systems with pumped storage to manage fast energy transitions and ensure stable grid interaction.

Source: China Insights Consultancy

Definition and categorization of the capacitor industry

Definition and categorization

- Capacitors are electronic components that store electrical energy by accumulating electric charges on two closely spaced surfaces that are insulated from each other. Capacitors serve multiple functions such as energy storage, filtering and smoothing, signal coupling and decoupling, resonance and frequency tuning, power factor correction, and pulse power applications, making them indispensable components in electrical product. Capacitors can be further categorized into ceramic capacitors, aluminium electrolytic capacitors and Film capacitors.



- Ceramic capacitors use a ceramic material as the dielectric. They are widely used in low-power and low-frequency circuits due to their small size, low cost, and good stability. Common types include monolithic and multilayer ceramic capacitors (MLCC).
- These capacitors use aluminum foil as the anode and an electrolyte as the cathode. They offer high capacitance values and are commonly used in power supply filters, energy storage, and applications requiring large capacitance.
- Film capacitors are capacitors with a plastic film as the dielectric. The dielectric films are drawn to a thin thickness and then coated with metallized aluminium or zinc, or a metallic foil. These conductive layers are wound into a cylinder or stacked in layers to form the capacitor body, often flattened to save space on printed circuit boards.
- Road bicycles are lightweight bicycles designed for speed and efficiency on paved surfaces, featuring narrow tires and drop handlebars to minimize wind resistance for long-distance and high-speed riding.
- Solid-state capacitors use a solid electrolyte instead of a liquid electrolyte, providing longer life and higher reliability. They are commonly used in high-frequency and high-temperature environments.
- Supercapacitors, also known as ultracapacitors, use materials like activated carbon and a liquid electrolyte to provide extremely high capacitance values. They are used in applications that require rapid charge and discharge cycles, such as energy storage systems and backup power.

Source: China Insights Consultancy

Comparison of different capacitors and advantage analysis of film capacitors

➢ ***Film capacitors are gaining market share, rising from 8.4% in 2019 to 13.4% in 2024, due to their outstanding voltage resistance, high-frequency stability, and long lifespan, which align well with the increasing demands of the new energy sector.***

Comparison dimension	Voltage resistance	High-frequency stability	lifespan
Film capacitor	● Excellent, 2000V or higher, meets high-voltage needs in new energy	● Excellent for frequent modulation and filtering	● Long, 10,000 to 1000,000 hours
Ceramic capacitor	◔ Low	○ Not suitable	◕ Medium, a few thousand to tens of thousands of hours
Aluminium electrolytic capacitor	◑ Limited, around 650-670V	◔ Poor	◔ Short, 1,000 to 10,000 hours (up to 20,000 for industrial-grade)

Key Analysis

- Film capacitors are widely used in various applications, including NEV, primarily including motor inverter, on board charger (OBC) and direct current to direct current (DC-DC) converter; new energy electricity system, primarily including (a) solar power, which consists of inverters, input and output filters, and high-voltage static var generator equipment; (b) wind power, which includes direct current (DC) support, input and output filters, electromagnetic interference (EMI) filters, and flexible DC transmission system; (c) energy storage, which comprises power conversion system (PCS), inverters, and welders; (d) charging station, which incorporate charging module; and (e) electric grid, which includes smart meters; industrial equipment, primarily including high-Voltage frequency converter, uninterruptible power supply (UPS) and EMI filters; and home appliance, primarily including drive motor, filter and induction motor.

Note：advantage ● →disadvantage ○

Source: China Insights Consultancy

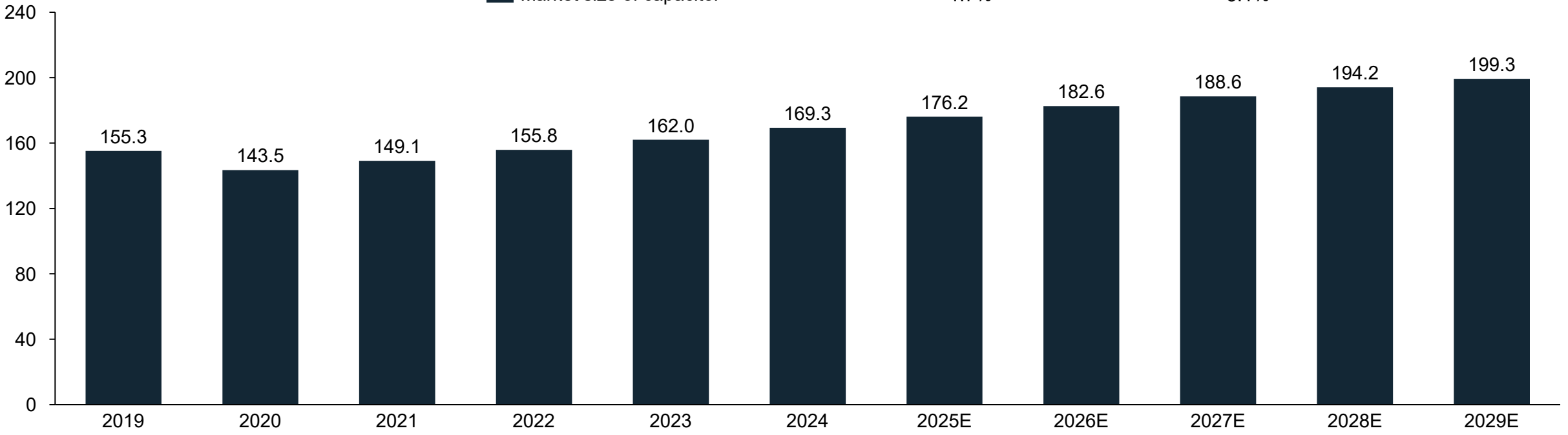
Analysis of development opportunities for film capacitors, highlighting the company's strategy and competitive advantages

Fragmented industry landscape with untapped consolidation potential	• The film capacitor industry is currently in a fragmented competition phase, lacking a dominant player with significant scale advantages. Most manufacturers are small-scale, with limited production lines, presenting immense potential for market consolidation. For companies with funding, technology, and resource advantages, this is an excellent opportunity to enter the market and establish a leading position.
Dependency on imported equipment, long lead times, high costs, and apparent advantages of domestic substitution	• Industry Pain Points：Most players in the market still rely on imported equipment from suppliers like Germany's Brückner. These machines have long procurement and delivery cycles (up to five years) and high costs (approximately 400 million RMB), with restricted operational flexibility for upgrades and maintenance. Such heavy dependence poses supply chain risks, particularly in a complex international environment.
Dependency on imported raw materials, high costs, and cost reduction potential of domestic polypropylene	• Raw Material Status and Pain Points: The core raw material for film capacitor production—electrical-grade polypropylene—is predominantly imported from suppliers like South Korea's Daelim and Belgium's Borealis, with significant price volatility (e.g., European materials cost up to 15,000 RMB/ton, and high-temperature grades reach nearly 20,000 RMB/ton). Although domestic materials offer cost advantages (7,000-8,000 RMB/ton), they need further improvements in quality consistency and market acceptance.
Limited Collaboration with Downstream Partners and Insufficient Terminal Partnerships	• Industry Characteristics and Constraints: In the film capacitor value chain, manufacturers primarily serve coating and capacitor producers, with indirect terminal client relationships limiting precise demand feedback and innovation responsiveness.

Source: China Insights Consultancy

The market size of global capacitor market has increased from RMB155.3 billion in 2019 to RMB169.3 billion in 2024, and is expected to reach RMB199.3 billion in 2029

Market size of capacitor, Global, 2019-2029E



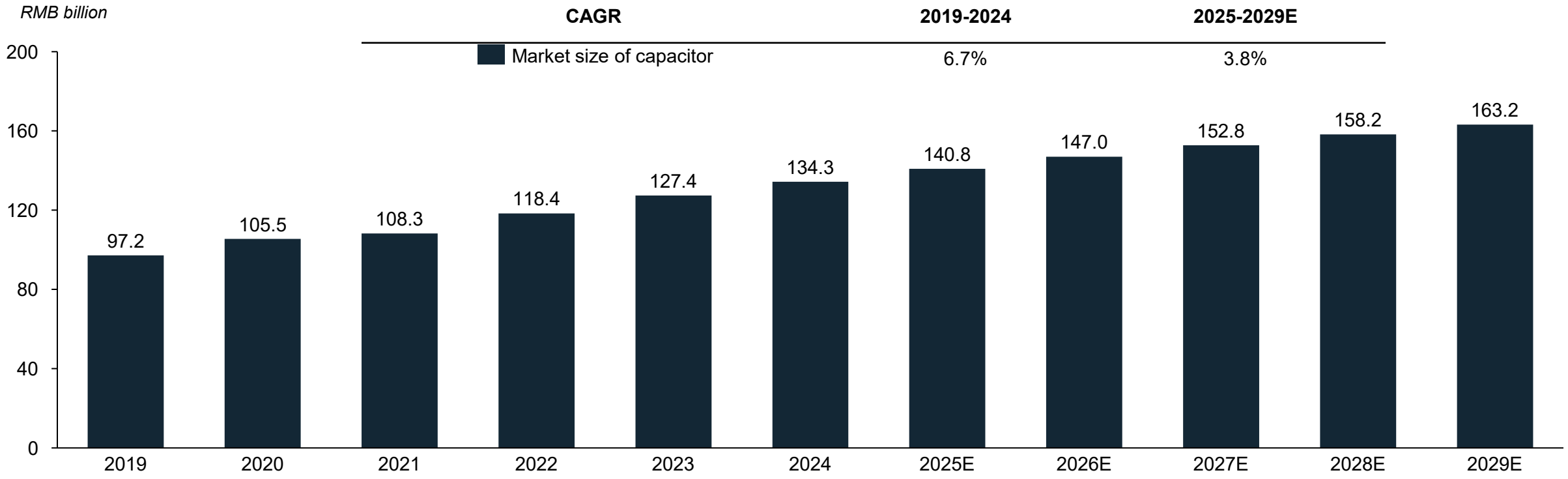
Key analysis

- The market size of global capacitor market has increased from RMB155.3 billion in 2019 to RMB169.3 billion in 2024, with a CAGR of 1.7%. With the ongoing development of global capacitor market, the market size of global capacitor industry is expected to maintain steady growth . It is anticipated to reach RMB199.3 billion in 2029, with a CAGR of 3.1%.

Source: China Insights Consultancy

China is the largest capacitor market in the world. The market size of capacitor in China increased from RMB97.2 billion in 2019 to RMB134.3 billion in 2024

Market size of capacitor, China, 2019-2029E



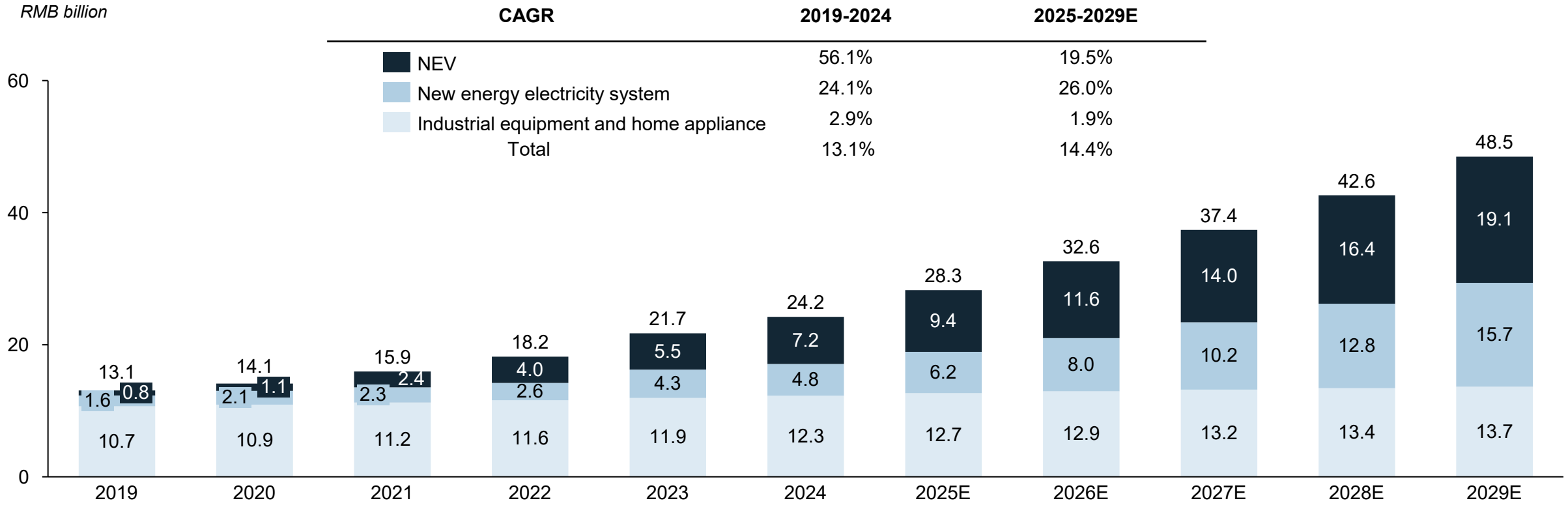
Key analysis

- China is the largest capacitor market in the world. The market size of capacitor in China increased from RMB97.2 billion in 2019 to RMB134.3 billion in 2024, with a CAGR of 6.7%. In the future, the capacitor market in China will continue to grow, and by 2029, the market size is expected to reach RMB163.2 billion, representing a CAGR of 3.8%.

Source: China Insights Consultancy

Global film capacitor market is experiencing strong growth across the fields of NEV and new energy electricity system

Market size of film capacitor, Global, 2019-2029E



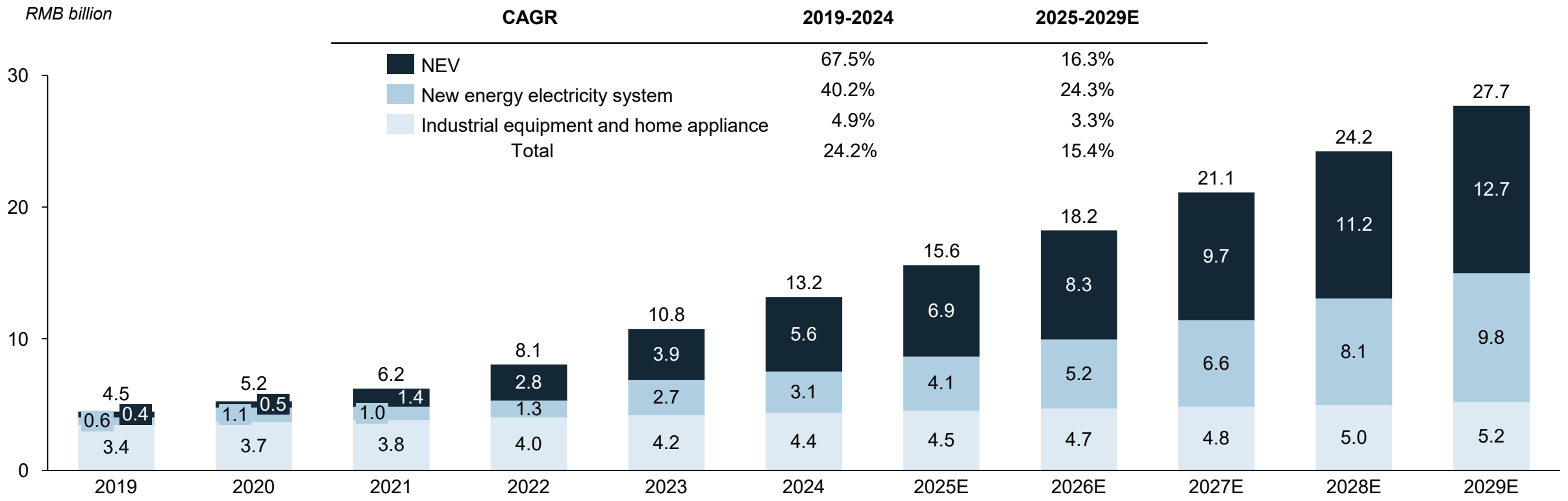
Key analysis

- Global film capacitor market is experiencing strong growth across the fields of NEV and new energy electricity system. The market size of global film capacitor market increased from RMB13.1 billion in 2019 to RMB24.2 billion in 2024, representing a CAGR of 13.1%. Both the wide spread adoption of NEV and the growth of solar and wind power have boosted the demand for film capacitors. It is expected that the market size of global film capacitor will reach RMB48.5 billion in 2029.

Source: China Insights Consultancy

The market size of China’s film capacitor market increased from RMB 4.5 billion in 2019 to RMB13.2 billion in 2024, representing a CAGR of 24.2%, and is expected to reach RMB27.7 billion in 2029

Market size of film capacitor, China, 2019-2029E



Key analysis

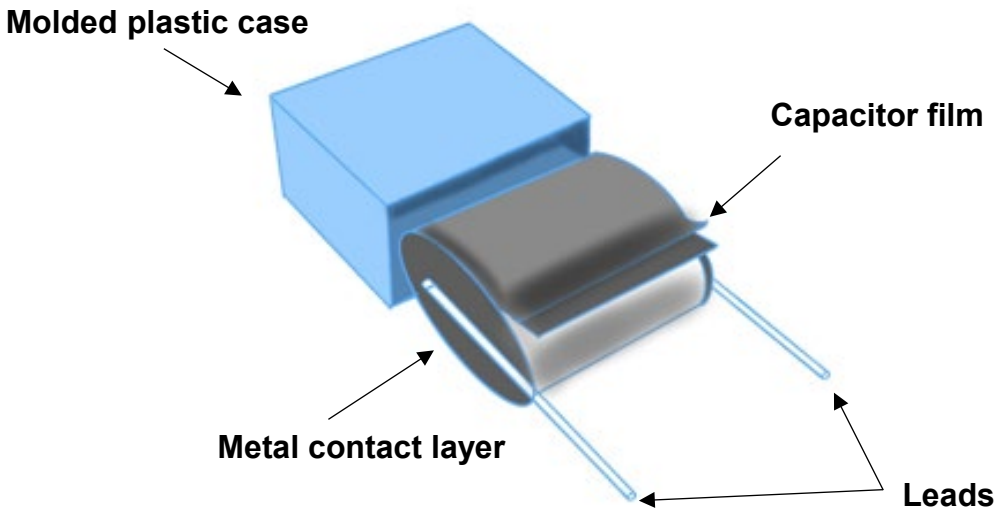
- With the rapid development of China’s NEV market, the demand for film capacitors in battery management systems (BMS), charging stations, and electric drive systems is increasing. In new energy electricity systems, China's strong push for solar and wind energy projects has also driven demand for film capacitors, particularly in energy storage and power conversion equipment. The market size of China’s film capacitor market increased from RMB 4.5 billion in 2019 to RMB13.2 billion in 2024, representing a CAGR of 24.2%, and is expected to reach RMB27.7 billion in 2029.

Source: China Insights Consultancy

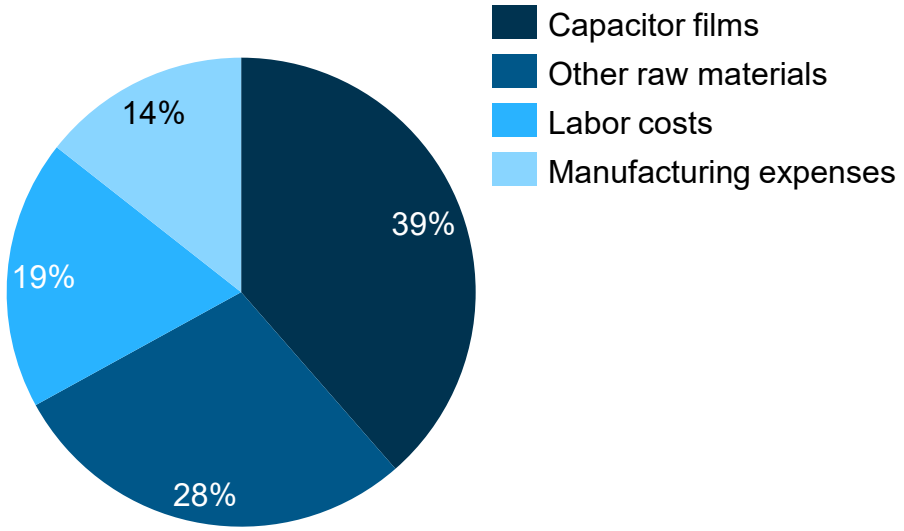
Structure and cost breakdown of film capacitors

➢ ***Among the cost breakdown of film capacitors, capacitor films represent the largest expense, accounting for 39% of the total production cost, and approximately 60% of the raw material cost.***

Structure of film capacitors



Cost breakdown of film capacitors



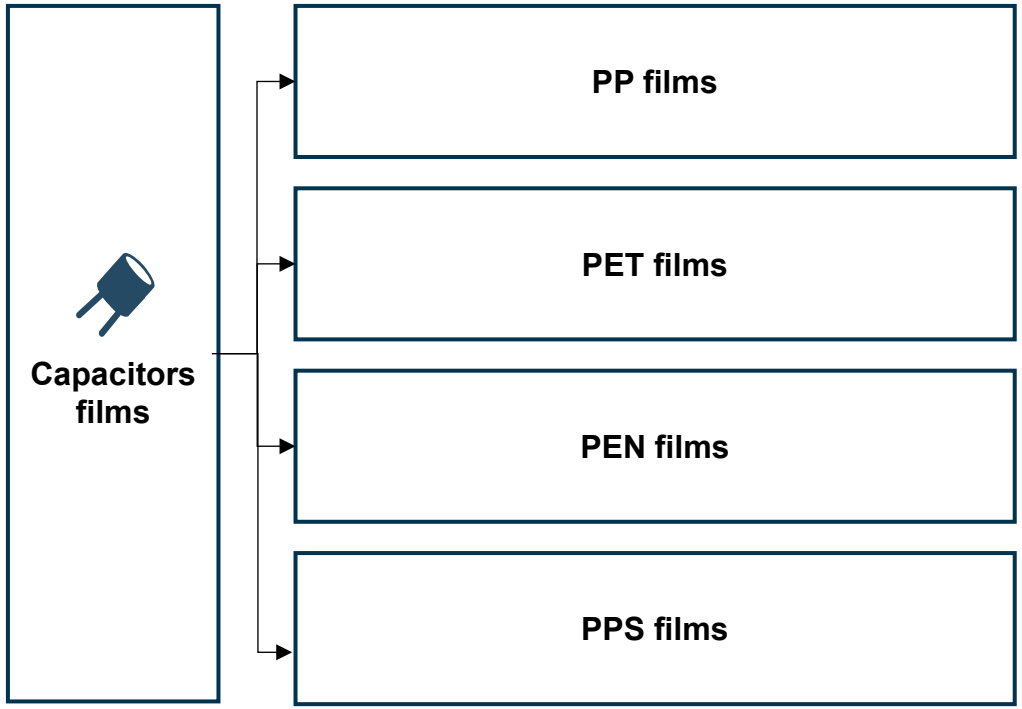
Film capacitors are widely used in various applications, including NEV, new energy electricity system, industrial equipment, and home appliances.

- ***NEV:*** Film capacitors are used in essential equipment in NEV such as motor inverter, on board charger (OBC) and direct current to direct current (DC-DC) converter, etc.
- ***New energy electricity system:*** Film capacitors are used in essential equipment in (a) solar power, which consists of inverters, input and output filters and high-voltage static var generator equipment; (b) wind power, which includes direct current (DC) support, input and output filters, electromagnetic interference (EMI) filters and flexible direct current transmission system; (c) energy storage, which comprises power conversion system (PCS), inverters and welders; (d) charging station, which incorporates charging modules; and (e) electric grid, which includes smart meters.
- ***Industrial equipment:*** Film capacitors are used in essential equipment in industrial equipment such as high-voltage frequency converter, uninterruptible power supply (UPS) and EMI filters. EMI and UPS are both indispensable industrial equipment for data centers.
- ***Home appliance:*** Film capacitors are used in essential equipment in home appliance such as drive motor, filter and induction motor.

Definition and categorization of the capacitor film industry

Definition and categorization

- Capacitor films are thin polymer-based dielectric materials widely used in the production of film capacitors for electrical insulation and energy storage in electronic circuits, which is the core material in film capacitors and plays a crucial role in determining the capacitor's performance and durability. Capacitor films can be primarily categorized into four types based on the polymer material used: polypropylene (PP), polyester (PET), polyethylene naphthalate (PEN), and polyphenylene sulfide (PPS). Currently, PP capacitor film stands as the most predominant type within the capacitor film category, accounting for over 90% of the market share.



- Polypropylene film capacitors are the most widely used in industrial and power applications due to their excellent high voltage resistance (up to 2000V), low dielectric absorption, and minimal temperature and frequency dependency. They are particularly suited for high-frequency and pulse applications such as IGBT circuits, snubber circuits, and EMI suppression. However, their maximum operating temperature of 105° C limits their use in high-temperature environments.
- Polyester film capacitors are low-cost, compact, and feature relatively high capacitance values due to their higher permittivity (3.3). They are widely used in general-purpose DC applications and semi-critical circuits, particularly in low-cost electronics. While PET capacitors can operate at temperatures up to 125° C, their higher temperature and frequency dependence, as well as higher dielectric absorption, make them less suitable for precision and high-frequency applications.
- PEN film capacitors offer better high-temperature performance than PET, with an operating range up to 175° C. They are commonly used in applications requiring higher thermal stability and are suitable for SMD (surface-mount device) packaging. Despite their larger physical size and slightly lower electrical performance compared to PP capacitors, they are preferred in environments where continuous high temperatures are present.
- PPS film capacitors are known for their exceptional stability, with very low temperature and frequency dependency of capacitance (±1.5%) and low dielectric absorption. They are highly resistant to heat, capable of withstanding temperatures up to 270° C, making them ideal for high-temperature and precision frequency-determining circuits. They are commonly used as replacements for polycarbonate capacitors, which are no longer widely produced, and are well-suited for SMD applications in high-temperature environments.

Functional analysis of capacitor films

➢ ***Capacitor films are the core component in film capacitors and play a crucial role in determining the film capacitor's performance and durability. They are widely used in film capacitors for electrical insulation and energy storage in electronic circuits. Specifically:***

Capacitor base films

- Capacitor base films determine the performance of the film capacitors. They serve as the dielectric medium of film capacitors. Capacitor base films primarily (i) assist film capacitors in achieving rapid energy storage and (ii) enable stable operation of the capacitors. The capacitor base films separate the capacitors' electrodes to form an electric field, thus allowing the capacitors to store electrical energy. By maintaining high insulation resistance, the films help minimize current leakage, thus helping reserve the energy stored within the capacitors and ensure long-term stability. By providing high dielectric strength and thermal stability, the base films enable the capacitors to endure high voltage and high temperature without degrading their properties, thus maintaining stable operation. The properties of base films, primarily including their voltage endurance, thermal shrinkage resistance, uniformity, surface roughness and tensile strength, are essential to the functionality of the films, thus in turn determining the performance of capacitors.

Metallized films

- Metallized films are made by coating a thin metallized layer, typically aluminum and zinc, onto one side of the surface of capacitor base films. The metallized layer acts as electrodes of film capacitors. Furthermore, the metal coating process strengthens the insulation resistance capability of the films. If the base films are damaged by high voltage or other reasons, the metallized layer will undergo immediate oxidation. This allows the films to restore insulation resistance without significant performance degradation. From a manufacturing perspective, metallization is an essential step in producing film capacitors. Compared with the more complex production of capacitor base films, the metallization process is relatively standardized and easier to implement. Nevertheless, the cost of metallization remains relatively high due to the use of metal raw materials, while the vacuum deposition process involved in metallization adds limited incremental value compared with the production of base films. Consequently, metallized films generally exhibit lower gross profit margin than capacitor base films.
- Most of the products from capacitor film manufacturers are delivered in the form of capacitor base films. The metallization of capacitor base films is typically performed by capacitor manufacturers, primarily because it allows for better integration into their specific production processes. However, film capacitor manufacturers may procure metallized films from external suppliers, primarily because film capacitor manufacturers may face limitations in their production capacity of metallized films from time to time. In such cases, capacitor film manufacturers with production capabilities for metallized films gain a competitive advantage, as they can flexibly meet downstream demand, further utilize production capacity and offer integrated solutions to enhance market competitiveness.
- On average, each ton of capacitor base films typically produces approximately 1.3 tons of metallized films.

Key Analysis

In the capacitor film industry, the market size of capacitor base film is widely used to represent the market size of capacitor film products. It is because most of the products from capacitor film manufacturers are delivered in the form of capacitor base films. The metallization of capacitor base films is typically performed by capacitor manufacturers, primarily because it allows for better integration into their specific production processes, primarily because it allows for better integration into their specific production processes, as the metallization parameters (such as sheet resistance and metallized-layer thickness) can be tailored to match the electrical performance requirements of different capacitor types. Such integration helps to ensure consistent film quality, improve yield rate, and enhance production efficiency in downstream capacitor manufacturing. However, film capacitor manufacturers may procure metallized films from external suppliers, primarily because film capacitor manufacturers may face limitations in their production capacity of metallized films from time to time. In such cases, capacitor film manufacturers with production capabilities for metallized films gain a competitive advantage, as they can flexibly meet downstream demand, further utilize production capacity and offer integrated solutions to enhance market competitiveness.

Comparison of different films and advantages of PP film

- ***Among the various film materials, PP film capacitors stand out for their excellent frequency stability, low dielectric absorption, and high voltage resistance, making them ideal for high-frequency and high-power applications.***
- ***Although PPS film exhibits comparable performance to PP film in technical parameters, its adoption within the capacitor film category remains limited. This is primarily due to its significantly higher raw material cost and narrower processing window, which lead to higher manufacturing costs and greater production complexity. In contrast, PP film offers an optimal balance of performance and cost-effectiveness, making it more suitable for large-scale industrial application. Currently, PP capacitor film stands as the most predominant type within the capacitor film category, accounting for over 90% of the market share.***

	Voltage resistance	Dielectric absorption	Frequency stability	Moisture resistance	Temperature dependency	Frequency range	Stability
PP film	Very high (up to 2000V)	Very low	Excellent, ideal for high frequencies	Strong	Very low, linear temperature coefficient	Very broad, suitable for high-frequency and high-power applications	Very high, excellent long-term reliability
PET film	High	High	Moderate	Strong	High	Narrow	Low
PEN film	High	Low	Good	Moderate	Low	Broad	High
PPS film	High	Very low	Excellent	Strong	Very low	Very broad	Very high

Note：advantage ● →disadvantage ○

Source: China Insights Consultancy

Introduction of BOPP

Introduction to BOPP technology

- **BOPP (Biaxially Oriented Polypropylene) technology** involves stretching polypropylene film in both the machine direction (MD) and transverse direction (TD). This process significantly enhances the film's physical and electrical properties, making it suitable for a wide range of applications, including capacitors, packaging, insulation, and optics.

Core process of BOPP technology

1. Extrusion
- Polypropylene resin is melted and extruded into a sheet through an extrusion machine.

2. Machine direction stretching (MD)
- The film is stretched in the machine direction, typically by 4-6 times, improving its strength and transparency.

3. Transverse direction stretching (TD)
- The film is then stretched in the transverse direction, usually by 6-10 times, enhancing its strength and stability.

4. Heat setting
- The film is stabilized under high temperatures to ensure dimensional stability and relieve internal stresses.

5. Slitting and winding
- The film is cut to the desired size and wound into rolls for storage and distribution.

Key characteristics of BOPP films

1. Excellent electrical properties
- High Dielectric Strength suitable for high-voltage and high-frequency circuits.
- Low Dielectric Loss improves capacitor efficiency.

2. High Mechanical Strength
- Enhanced tensile strength and tear resistance due to biaxial stretching.

3. Thermal stability
- Maintains performance at elevated temperatures, making it suitable for long-term use.

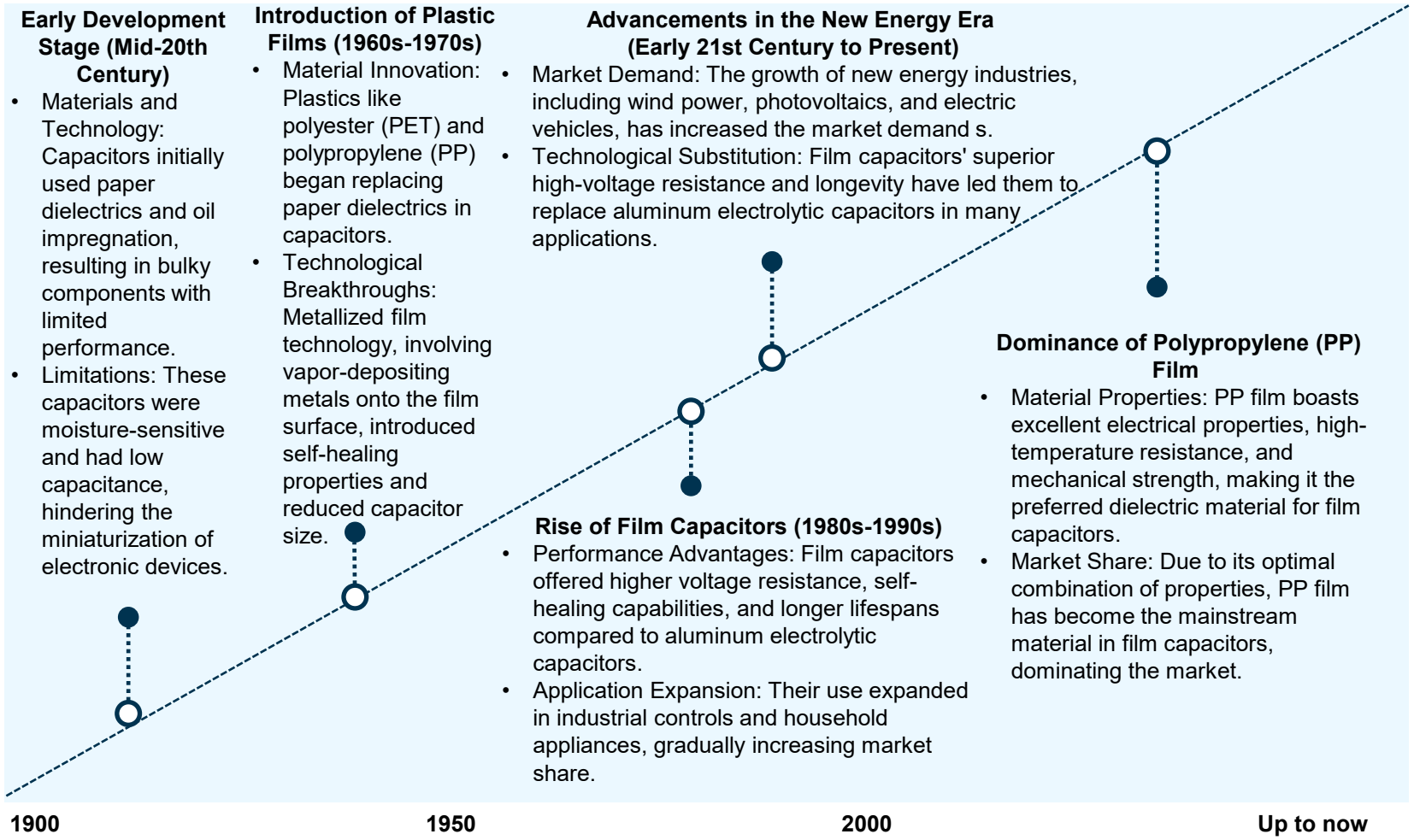
4. Chemical resistance
- Resists most chemicals, ensuring durability and longevity.

5. Self-healing
- In capacitor applications, the film can self-repair after localized breakdowns, enhancing reliability.

Source: China Insights Consultancy

Development history of the global capacitor film industry

- ***The global capacitor film industry has advanced through innovation and rising demand, with polypropylene (PP) film becoming the dominant material for high-performance applications.***

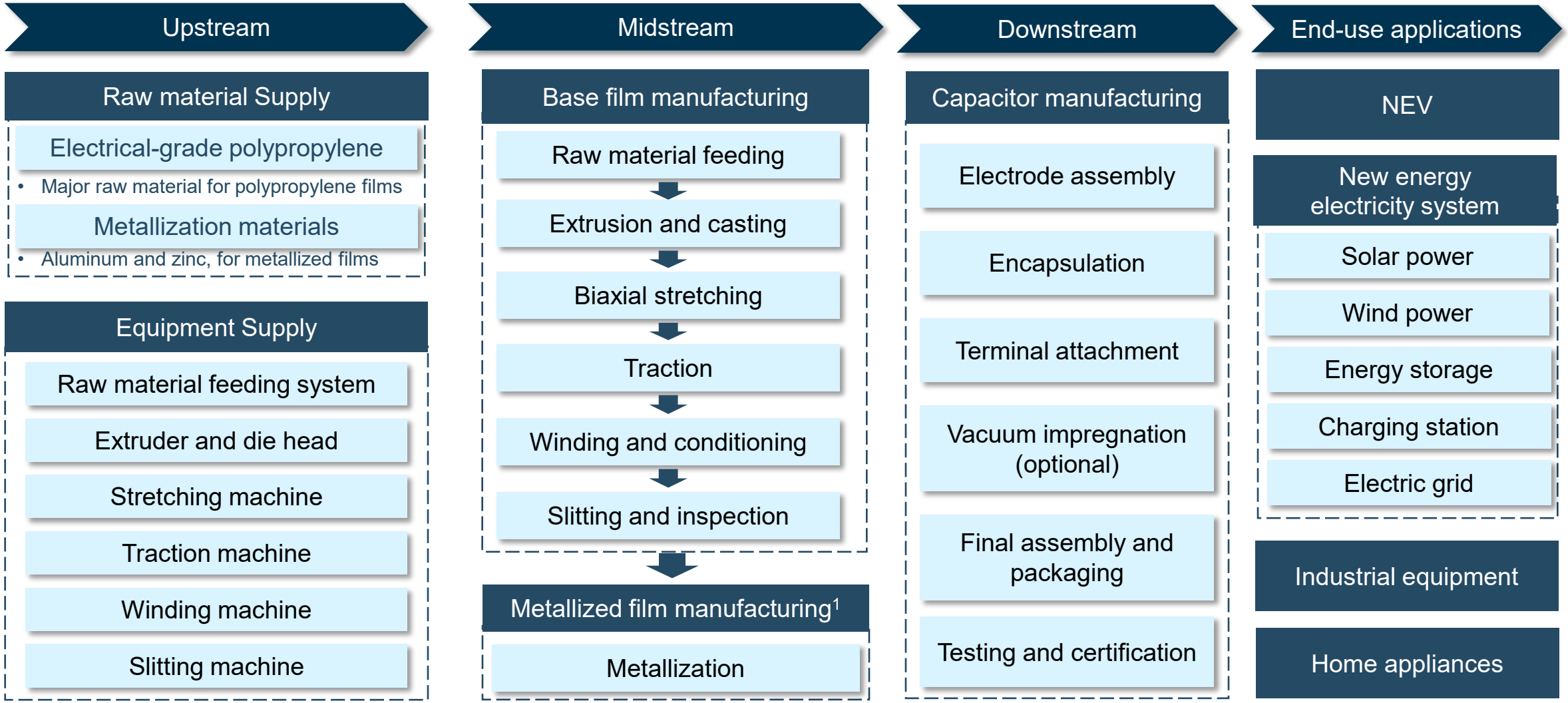


Key Analysis

- The film capacitor industry has evolved significantly, driven by technological advancements and shifting market demands. Notably, metallized polypropylene film capacitors have emerged as effective replacements for electrolytic capacitors in applications like DC link capacitors for inverter systems.
- However, transitioning to film capacitors requires careful consideration of factors such as capacitance, ripple current, voltage requirements, and cost, as they are not direct one-for-one replacements for aluminum electrolytic capacitors.
- Ongoing research focuses on further reducing the thickness of polypropylene films and enhancing metallization techniques to improve performance and reduce costs. These advancements are expected to expand the applicability of film capacitors across various industries, reinforcing their role in modern electronic systems.
- In summary, the film capacitor industry's evolution reflects a continuous pursuit of technological innovation to meet emerging market needs, with polypropylene film capacitors playing a central role in this progression.

Source: China Insights Consultancy

Value chain of the global capacitor film industry



Note: Metallized films are manufactured by capacitor film manufacturers, of film capacitor manufacturers.

Source: China Insights Consultancy

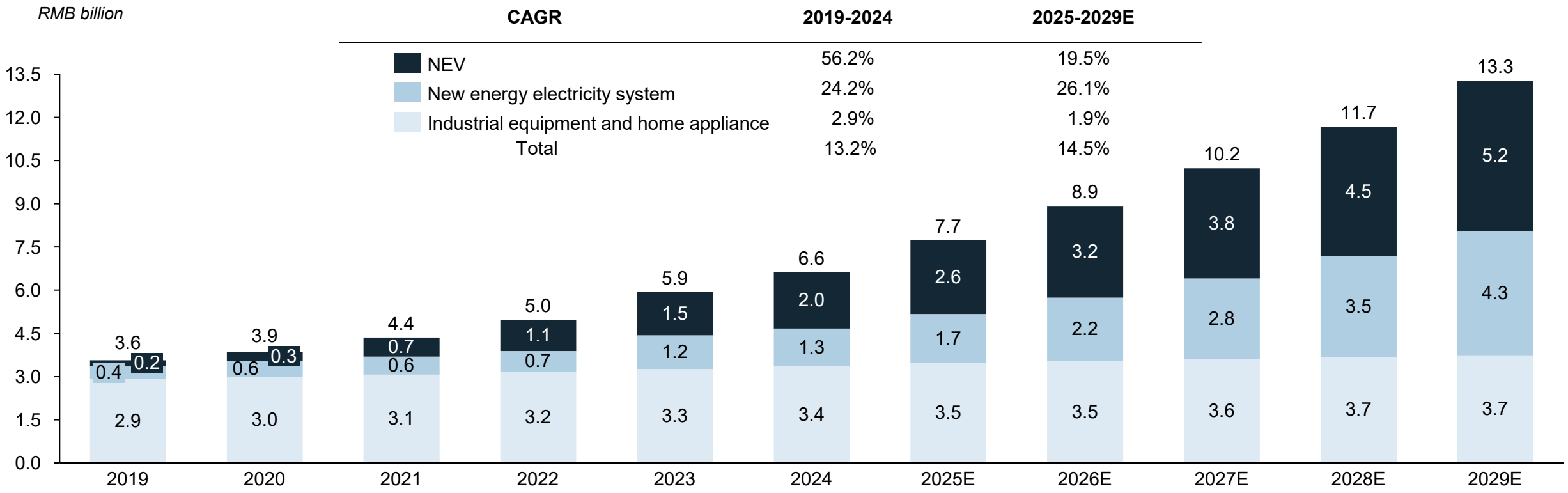
Value chain analysis

Key Analysis

- The value chain of the global capacitor film industry consists of upstream raw material and equipment supply, midstream film manufacturing, downstream film processing and capacitor manufacturing, and end-use applications. The vertical integration by new energy vehicle manufacturers such as BYD into the production of film capacitors reflects an emerging trend in the upstream integration of the NEV supply chain as the films can be directly tailored to match their equipment specifications and production flow. This results in improved consistency in product quality, reduced logistics and handling costs, and enhanced efficiency in the downstream capacitor manufacturing process. However, this trend has not yet substantively extended to the production of capacitor base films, which involves high technical barriers, significant capital expenditure, and specialized know-how. In addition, currently, with the exception of BYD, which produces film capacitors in-house, most NEV manufacturers typically procure film capacitors directly from third parties. As such, leading NEV manufacturers including BYD currently still rely primarily on external sourcing for capacitor base films. Accordingly, such trend is not expected to have a material impact on the Group’s business operations in the foreseeable future.

The market size of global capacitor base film market increased from RMB3.6 billion in 2019 to RMB6.6 billion in 2024, representing a CAGR of 11.5%, and is expected to reach RMB13.3 billion in 2029

Market size of capacitor base film, Global, 2019-2029E



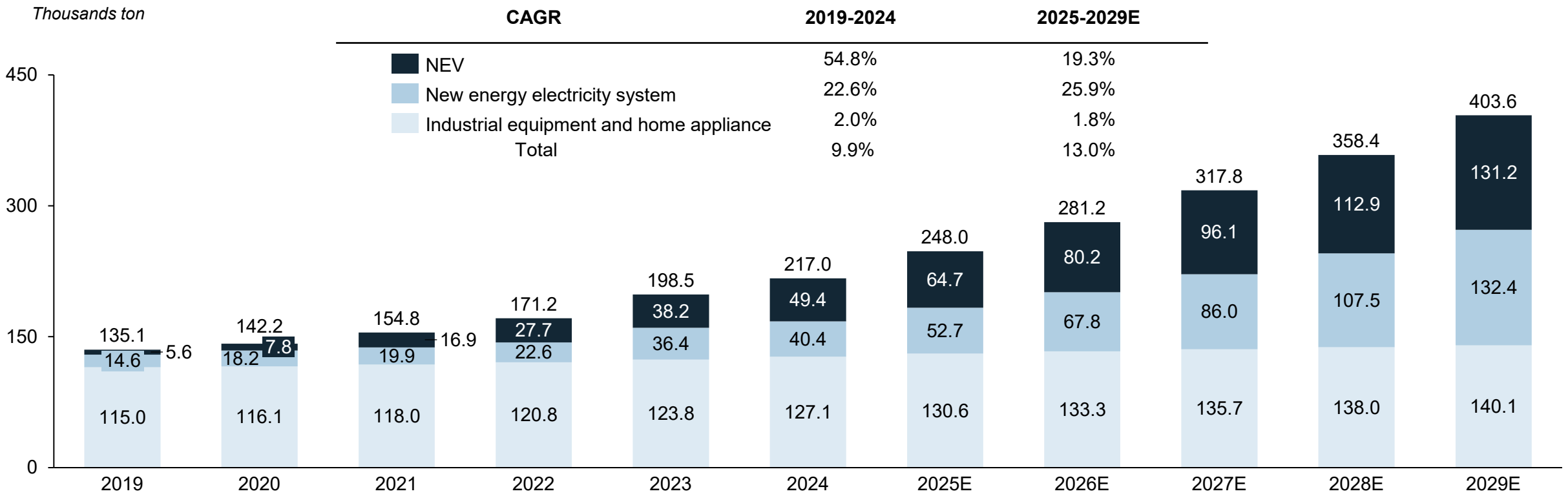
Key analysis

- Global capacitor base film market is experiencing strong growth. Both the wide spread adoption of NEV and the growth of solar and wind power have boosted the demand for film capacitors. The market size of global capacitor base film market increased from RMB3.6 billion in 2019 to RMB6.6 billion in 2024, representing a CAGR of 13.2%. It is expected that the market size of global film capacitor will reach RMB13.3 billion in 2029 with a CAGR of 14.5%.

Source: China Insights Consultancy

The market size of global capacitor base film market increased from 135.1 thousands ton in 2019 to 217.0 thousands tons in 2024, and is expected to reach 403.6 thousands ton in 2029

Market size of capacitor base film, Global, 2019-2029E



Note: The volume of capacitor base film is standardized by converting to 7 μm, which is in line with industry practice.

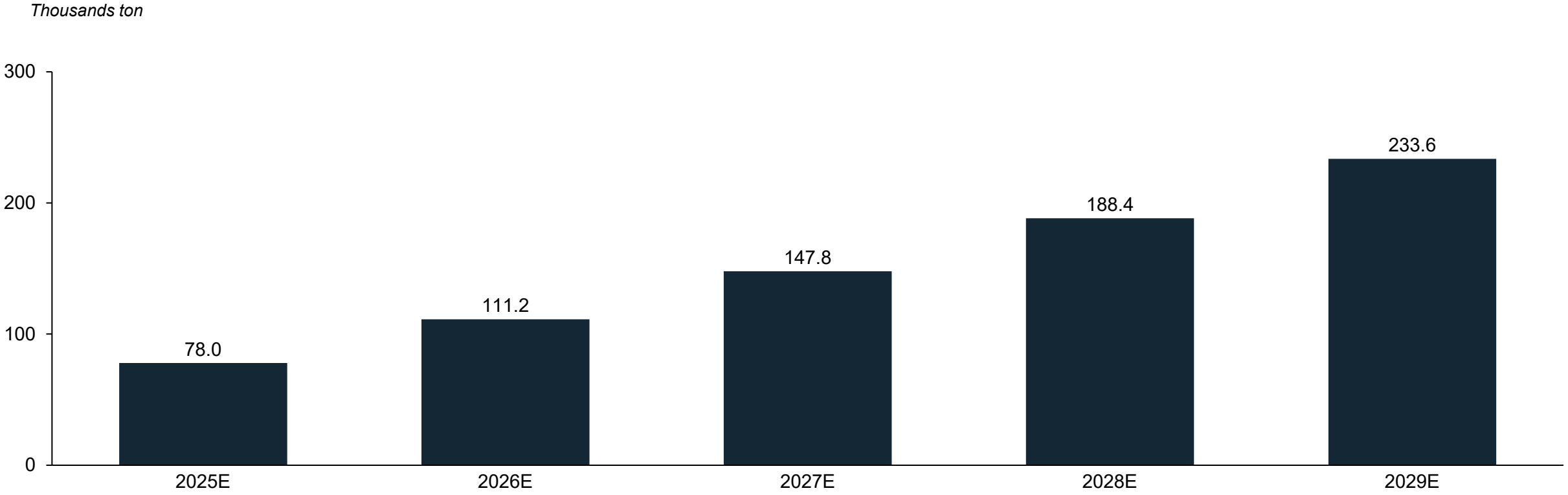
Key analysis

- The global capacitor base film market has experienced significant growth, with its volume increasing from 133.9 thousand tons in 2019 to 217.0 thousand tons in 2024, reflecting a CAGR of 9.9%. This growth is expected to continue, with the market projected to reach 403.6 thousand tons by 2029, representing a CAGR of 13.0%.

Source: China Insights Consultancy

With the rapid growth in demand driven by industries such as renewable energy, NEV, and consumer electronics, this capacity is expected to be stretched

Supply-demand gap of capacitor base film[1], Global, 2025E-2029E



Key analysis

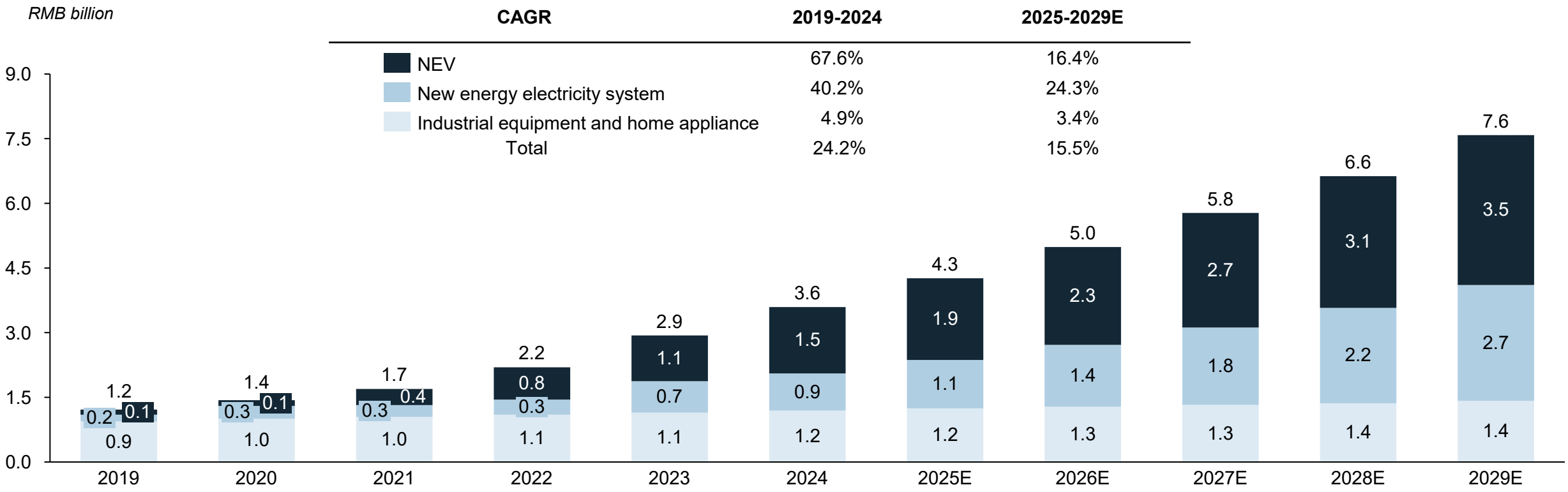
- Currently, the global production capacity of capacitor base films is approximately 170 thousand tons. However, with the rapid growth in, this capacity is expected to be stretched. As the demand for high-performance capacitor base films continues to rise, particularly for applications requiring efficient energy storage, voltage regulation, and fast-charging systems, it is anticipated that a significant supply-demand gap will persist. This gap creates opportunities for further investments in production capacity, innovations in manufacturing processes, and developments of new materials to meet the increasing needs of capacitor base film industry.

Note: Refers specifically to the gap between future demand forecasts and current production capacity.

Source: China Insights Consultancy

The market size of China's capacitor base film market increased from RMB1.2 billion in 2019 to RMB3.6 billion in 2024, representing a CAGR of 24.2%, and is expected to reach RMB7.6 billion in 2029

Market size of capacitor base film, China, 2019-2029E



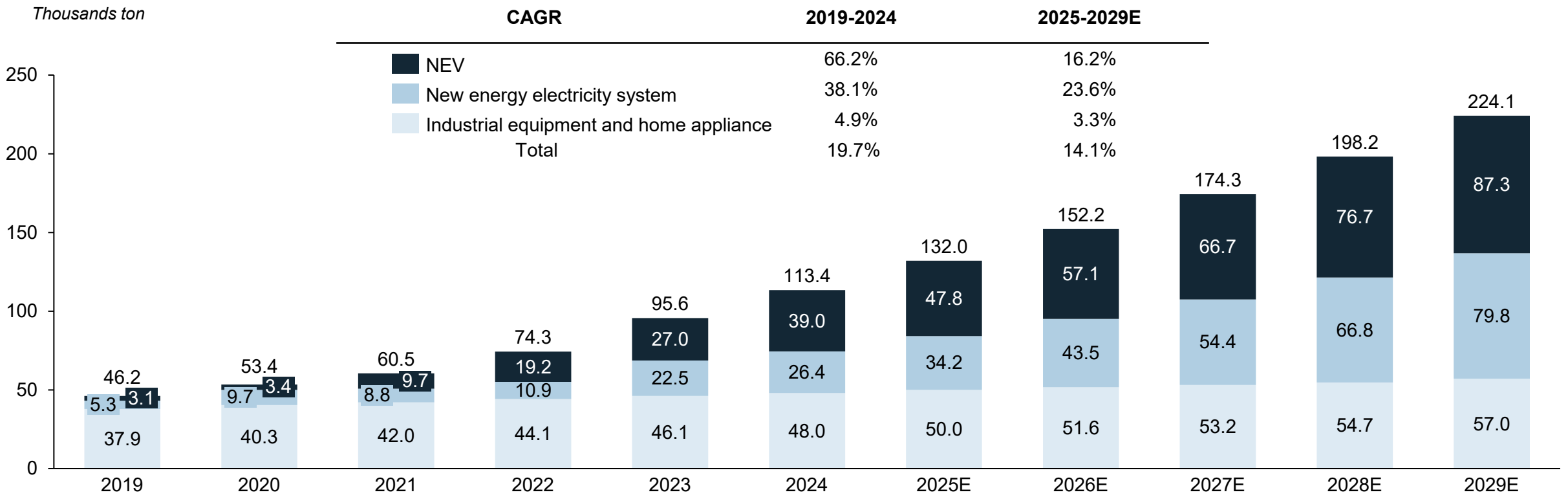
Key analysis

- With the rapid development of China' s NEV market, the demand for film capacitors in charging stations, and electric drive systems is increasing. In new energy electricity systems, China's strong push for solar power, wind power and energy storage adds to the demand for power conversion equipment, stimulating the demand for film capacitors. The market size of China's capacitor base film market increased from RMB1.2 billion in 2019 to RMB3.6 billion in 2024, representing a CAGR of 24.2%, and is expected to reach RMB7.6 billion in 2029.

Source: China Insights Consultancy

The market size of China’s capacitor base film market increased from 46.2 thousand tons in 2019 to 113.4 thousand tons in 2024, reflecting a CAGR of 19.7%

Market size of capacitor base film, China, 2019-2029E



Note: The volume of capacitor base film is standardized by converting to 7 μm, which is in line with industry practice.

Key analysis

- China’s capacitor base film market has experienced significant growth, with its volume increasing from 46.2 thousand tons in 2019 to 113.4 thousand tons in 2024, reflecting a CAGR of 19.7%. This growth is expected to continue, with the market projected to reach 224.1 thousand tons by 2029, representing a CAGR of 14.1%.

Source: China Insights Consultancy

Market drivers of the global and China’s capacitor film industry

Growth in renewable energy applications	• The growth in renewable energy applications has emerged as a significant driver for the global and China’s capacitor film industry. Renewable energy technologies, including solar panels, wind turbines, and energy storage systems, have seen rapid adoption worldwide, supported by commitments to carbon neutrality and reduced greenhouse gas emissions. Global newly installed solar power capacity reached 451.9 GW in 2024, increasing from 113.0 GW in 2019, and is expected to reach 1,663.6 GW in 2029. In 2024, global newly installed wind power capacity reached 121.6 GW, increasing from 60.8 GW in 2019, and is expected to reach 344.7 GW in 2029.As a result, the demand for advanced electronic systems that ensure efficient energy conversion and stability in renewable energy grids has surged, with capacitor films playing a critical role in these systems. With the growing importance of the renewable energy applications worldwide, the global and China’s capacitor film industry is expected to enjoy growth synergy and further grow in the future.
Increasing adoption of NEVs	• The global market size of the electric vehicles, in terms of sales volume, is expected to reach 45.5 million units in 2029 with a CAGR of 17.6% between 2025 and 2029. AAs an important material in the film capacitors, capacitor films play a critical role in energy storage and smooth out voltage fluctuations, thereby optimizing the performance of the battery and electric motor. Additionally, as the demand for fast-charging systems rises, capacitor films are crucial in supporting rapid refuelling needs, handling the quick charging cycles without compromising system efficiency. Consequently, the increasing adoption of NEVs globally induces more demand for higher quality capacitor films.
Advancement in industrial automation and data centers	• Advancement in industrial automation: As automation technologies advance—particularly in industrial robotics and high-speed control systems—they are driving unprecedented demands for precision electrical components. Capacitor films, critical for stabilizing energy flow and enhancing efficiency in these systems, are seeing surging market requirements. This growth trajectory is further propelled by the need to meet increasingly stringent performance benchmarks in modern industrial applications, from power management optimization to mart energy storage solutions. With the rapid development and expansion of data centers, their power demand is steadily increasing, expected to grow from 673 TWh in 2024 to 2,616 TWh in 2030. As a critical electronic component, capacitor films play an important role in stabilizing energy flow, improving system efficiency, and ensuring equipment reliability. Along with the continuous growth in data center scale and operational load, the demand for high-performance capacitor films is rising rapidly, becoming a key driver of market growth.
Rising demand for consumer electronics	• Capacitor films are essential for the efficient operation of a wide range of electronic devices, including smartphones, laptops, wearable devices, and home appliances like refrigerator and air conditioning. In consumer electronics, they play a key role in power management systems by stabilizing voltage, filtering noise, and smoothing out power fluctuations. As the adoption of these devices continues to grow, the demand for high-performance capacitor films is expected to increase, driven by the need for more reliable and efficient power management solutions.

Source: China Insights Consultancy

Future trends of the global and China's capacitor film industry

Substitution of aluminium electrolytic capacitors	• Film capacitors are gradually replacing aluminium electrolytic capacitors due to their superior voltage resistance, better high-frequency stability, and longer lifespan. Aluminium electrolytic capacitors face a voltage limit of 650-670V, while film capacitors can reach 2000V or higher, making them more suitable for high-voltage applications, especially in NEV and new energy electricity systems.
Trend towards ultra-thin and high-temperature-resistant films	• The capacitor film market is evolving towards ultra-thin and high-temperature-resistant products to meet the stringent demands of advanced applications. This shift is driven by technological advancements and the growing use of capacitor films in high-end markets such as automotive electronics and wind energy. Enhanced production techniques have enabled the development of thinner films with improved thermal stability, aligning with the industry's focus on miniaturization and reliability. Thinner capacitor base films allow film capacitors to achieve higher capacitance, lower equivalent series resistance and improved high-frequency performance, while offering a more compact and lightweight design. Such features are critical for NEVs and compact electronic devices devices such as smartphones, laptops and wearable devices.
High-voltage capacitor applications	• As industries pursure greater power and efficiency, there will be a growing need for capacitors that can withstand higher voltage ratings. Applications such as NEVs, renewable energy systems, industrial automation, and high-speed computing require capacitors capable of operating at higher voltages without compromising performance or safety. Capacitor films will evolve to meet these higher voltage demands, incorporating new materials, construction techniques, and advanced dielectric insulation technologies. High-voltage capacitor films will be critical in the development of next-generation power electronics, where voltage stability and energy efficiency are paramount.
The domestic substitution of imported capacitor films	• In recent years, China has focused on reducing its reliance on foreign technology and components, which has driven the need for domestic capacitor film production. The "Made in China 2025" initiative emphasizes self-sufficiency in critical technologies, which includes components like capacitor films used in high-tech applications. Chinese manufacturers are increasing their efforts to develop local solutions that meet both domestic and international standards. This push for self-reliance is creating new opportunities for capacitor film producers, both in terms of local market share and global exports.
The domestic substitution of imported capacitor films' raw materials	• As one of the world's largest producers and consumers of capacitor films, China is heavily reliant on high-quality raw materials like electrical grade polypropylene (PP) which are essential for manufacturing capacitor films. However, with growing demand for capacitors across industries such as NEVs, renewable energy, and consumer electronics, China is prioritizing the development of local supply chains to reduce dependence on imports. In addition, the "Guiding Catalogue for the First Batch Application of New Materials (2024 Edition)"and the "New Material Industry Development Guideline" both identify high-performance polymer and thin-film materials as priority areas for technological innovation and domestic production expansion. These policies collectively encourage investment in domestic high-end polymer materials, promote import substitution, and strengthen the local supply capacity for capacitor film manufacturers. As a result, capacitor film producers such as the Group are expected to benefit from an increasingly localized raw material supply chain, enabling them to procure core inputs domestically, reduce import dependence, and enhance cost efficiency and supply stability.

Source: China Insights Consultancy

Core equipment investment analysis: comparison of costs and delivery cycles between domestic production and overseas procurement

➢ ***In the capacitor film industry, core equipment investment and delivery cycles are critical factors influencing production efficiency and competitiveness. Overseas procurement, while offering advanced technology, is associated with high costs, long delivery cycles, and limited flexibility. In contrast, domestic production delivers significant advantages in cost efficiency, faster delivery, and higher adaptability, enabling companies to respond swiftly to market demands and achieve rapid expansion.***

Category	Investment cost per production line	Delivery cycle	Production success rate	Technology source	Equipment customization capability	Technical accumulation and iteration	Market response speed	Competitive advantage
Domestic equipment	Approx. 100-200 million RMB	Approx. 10 months	One-time successful trial run	Independently developed, strong customization	Highly customizable, flexible adjustment	Self-iteration, continuous optimization	Short expansion cycle, rapid market response	Low cost, short cycle, rapid expansion advantage
Foreign Procurement	Approx. 400+ million RMB	Approx. 5 years (total approx. 6 years)	Requires repeated debugging, long adaptation period	Dependent on foreign suppliers (e.g., Brückner)	Generalized equipment, low customization	Dependent on suppliers, long iteration cycles	Long expansion cycle, slow market response	High cost, long cycle, limited expansion

- **Domestic production offers significant advantages in cost efficiency, delivery speed, and adaptability, enabling rapid expansion and increased competitiveness.**

Source: China Insights Consultancy

Major material analysis: comparison of cost efficiency, delivery speed, and production adaptability between domestic and imported raw materials

➢ ***Balancing cost, supply security, and production flexibility is essential for long-term success in the capacitor film industry. While imported raw materials currently dominate due to customer preference and consistency, adopting domestic raw materials and in-house supply can mitigate risks, reduce costs, and enhance responsiveness to market demands. As the industry scales up and domestic material quality gains recognition, this shift will be crucial for maintaining competitiveness and ensuring sustainable growth.***

Category	cost	supply chain security	customization and flexibility	delivery cycle	technical advantage	market acceptance
Domestic raw materials	approx. 7,000-8,000 RMB per ton; potential 30%-40% cost reduction with scale	Reduces dependency on foreign sources; mitigates geopolitical risks	Customizable production processes (e.g., for copper foil membranes)	Shorter lead time, approx. **10 months**	Supports continuous innovation and self-optimization	Currently low acceptance but has growth potential
Imported raw materials	Korean: 12,000-13,000 RMB per ton; european: 15,000-19,000 RMB per ton	Vulnerable to geopolitical disruptions and trade restrictions	Standardized production, limited flexibility	Long lead time, new orders take 5+ years	Dependent on foreign supplier technology, slower iteration	High customer preference due to consistent quality

- **By adopting domestic raw materials and in-house supply, companies can enhance cost efficiency, supply chain resilience, and production adaptability, positioning themselves for sustainable growth and competitive advantage.**

Source: China Insights Consultancy

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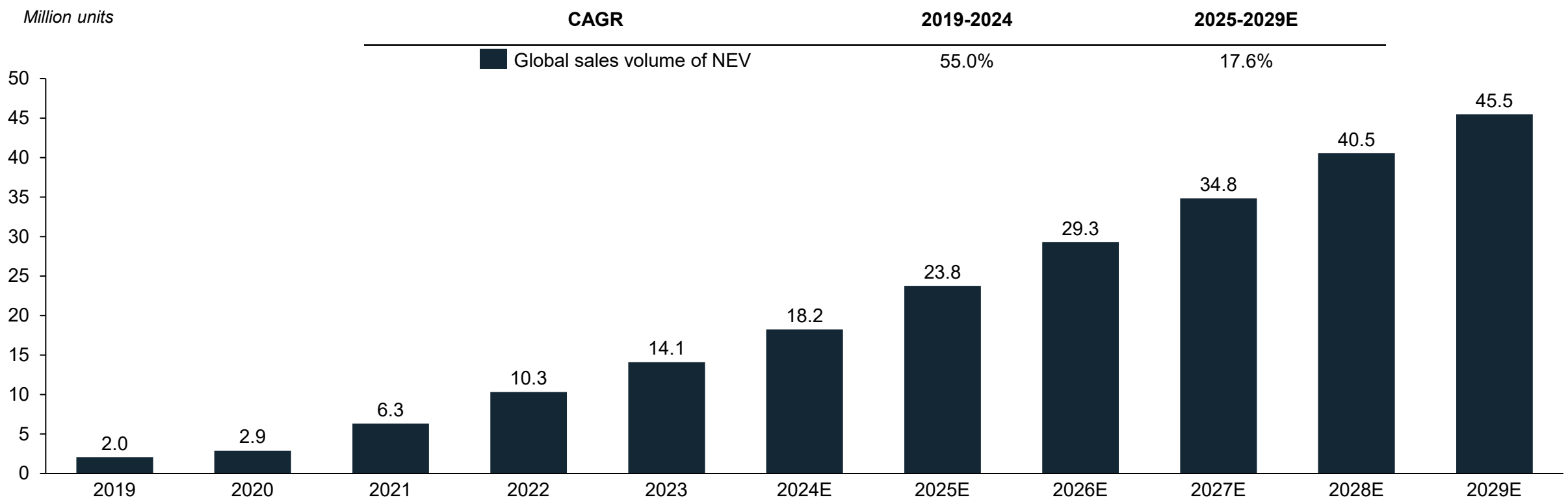
Application analysis of capacitive film in various new energy industries

New energy vehicle	Charging pile	Wind power	Solar power	Energy storage
• In new energy vehicles, thin film capacitors are mainly used in electronic control systems (inverters), DCDC modules and OBC modules, and are the components second only to power devices in terms of value in inverters. In some high-end models of new energy vehicles or parts with high performance requirements, high-performance and miniaturized capacitors are needed. Capacitors made of 2-to-3-micron thick capacitor films can meet high power density requirements while adapting to small installation spaces, and can be quickly charged and discharged to meet complex circuit requirements.	• The film capacitor can be applied to the charging pile inverter and other components, if it involves the relevant power conversion and other circuit parts, the film capacitor may also play such as filtering and other similar functions in other power equipment. Capacitors made of 3–4-micron thick capacitor films can be used in key components such as inverters of charging piles to achieve functions such as input/output filtering and DC support. With the continuous advancement of global charging pile infrastructure construction, the demand for such capacitors is also growing steadily.	• Film capacitors are widely used in key links such as frequency converter, reactive power compensation and generator end in the field of wind power, mainly for DC link filtering, reactive power compensation and harmonic suppression, to meet the long-term operation needs of wind power equipment in harsh environments.	• Film capacitors in photovoltaic systems are mainly used in key links such as inverters, maximum power point tracking circuits and energy storage systems, for DC link filtering, voltage stability and power regulation, with its low loss, high stability and fast response characteristics, to improve the conversion efficiency, power quality and energy storage performance of photovoltaic systems, to meet the demand for high efficiency and reliability of photovoltaic power generation. In photovoltaic inverters, the thickness of the capacitor film used in the part of the circuit that requires higher conversion efficiency may be 2-3 microns.	• In the field of energy storage, capacitor film is mainly used in supercapacitors and hybrid energy storage systems, as a key isolation layer and electrolyte carrier, with its excellent insulation, ion permeability and fast response characteristics, to meet the needs of fast charging and discharging and power regulation applications. • In small household energy storage systems, such as some portable energy storage devices, the thickness of the capacitor film used in the energy conversion circuit may be 2-3 microns to achieve miniaturization and high efficiency of the device.

Source: China Insights Consultancy

Driven by the global demand for low-carbon and emission reduction, NEV market has become a pivot focus of the global automobile industry

Global sales volume of NEV, 2019-2029E



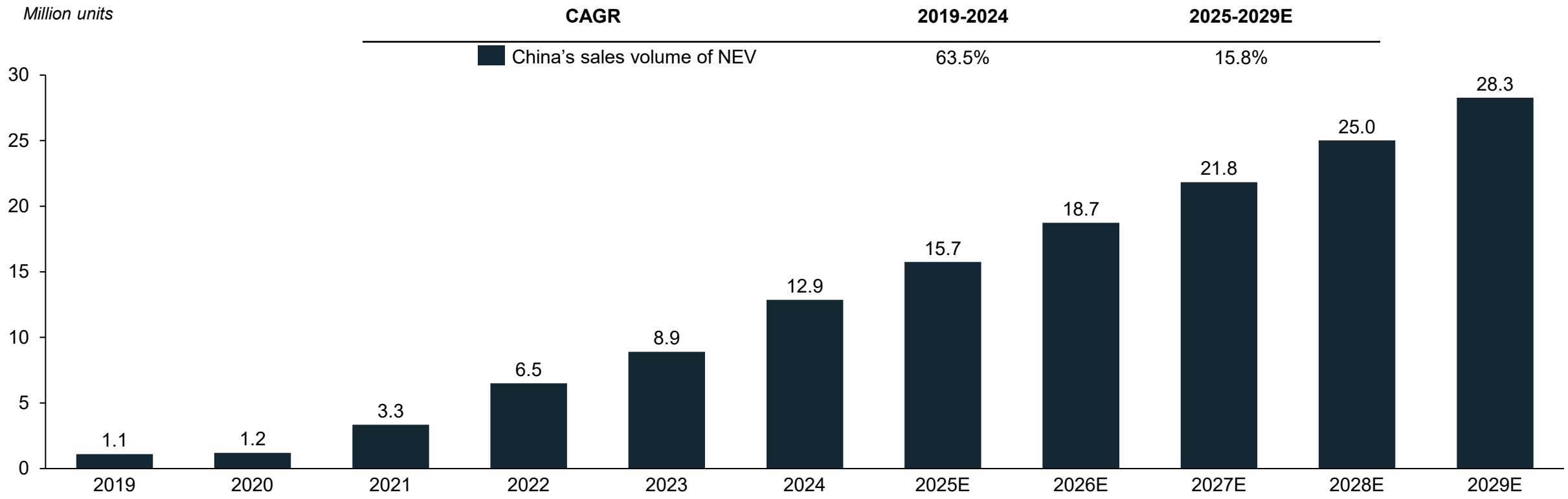
Key analysis

- In recent years, driven by the global demand for low-carbon and emission reduction, NEV market has become a pivot focus of the global automobile industry. As more countries introduce favorable policies, the global market is expected to expand rapidly. Global NEV sales volume reached 18.2 million units in 2024. It is estimated that from 2025 to 2029, global sales volume of NEVs will grow rapidly at a CAGR of 17.6%, reaching 45.5 million units in 2029. It is estimated that the global penetration rate of NEVs will increase from 18.6% in 2024 to 50.0% in 2029

Source: China Insights Consultancy

Driven by China's dual-carbon goals and continuous government policy support, the NEV market in China has experienced robust growth in recent years

China’s sales volume of NEV, 2019-2029E



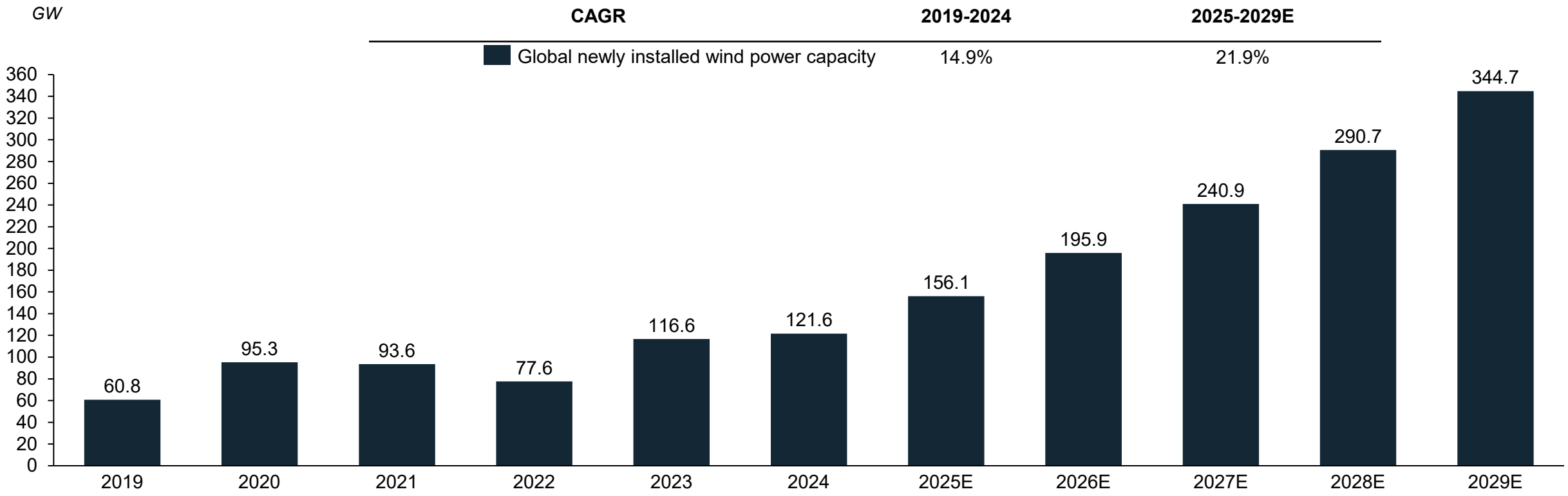
Key analysis

- Driven by China's dual-carbon goals and continuous government policy support, the NEV market in China has experienced robust growth in recent years. China's NEV sales reached 12.9 million units in 2024 with a CAGR of 63.5% during 2019-2024 period. Over the same period, the penetration rate of NEVs surged to 33.7%, showcasing significant strides toward electrification. From 2025 to 2029, China's NEV market is expected to maintain rapid growth, with strong momentum fueled by technological advancements and increased consumer adoption. By 2029, the penetration rate of NEVs in China is projected to surpass 80% and is expect to reach 28.3 million units.

Source: China Insights Consultancy

Global newly installed wind power capacity is estimated to reach 344.7 GW, driven by advancements in wind power technology and increasing global commitments to renewable energy

Global newly installed wind power capacity, 2019-2029E



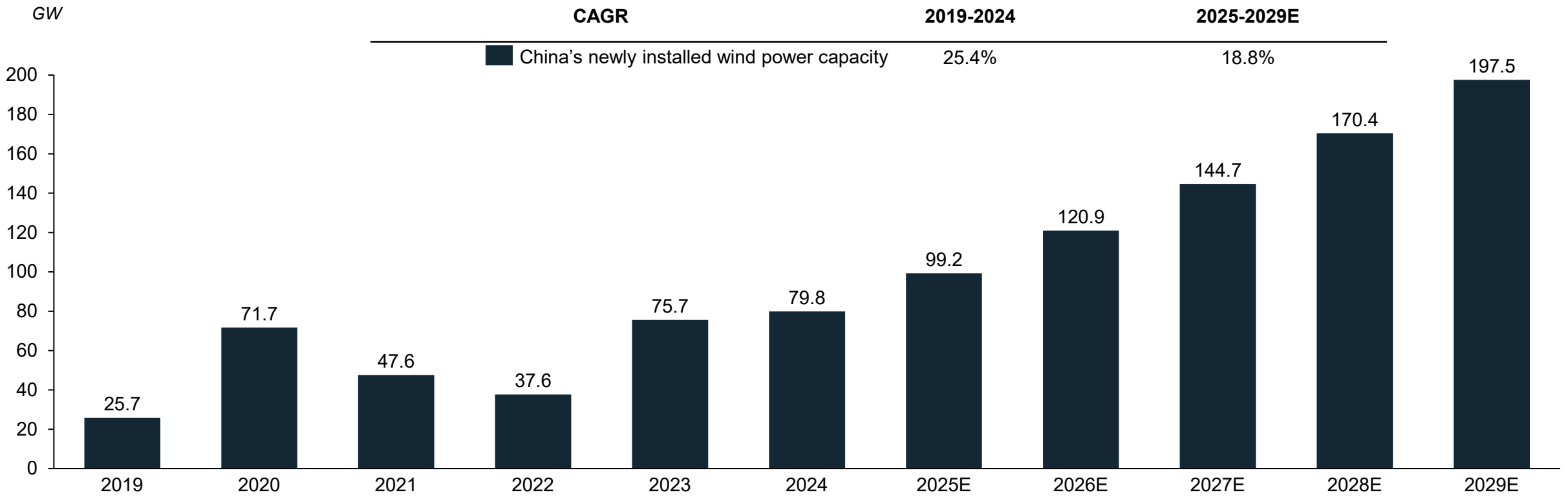
Key analysis

- From 2019 to 2024, the global newly installed wind power capacity experienced rapid growth, with a CAGR of 14.9%. In 2024, the newly installed capacity reached 121.6 GW, increasing from 60.8 GW in 2019. The market is expected to maintain strong growth momentum, with a projected CAGR of 21.9% from 2025 to 2029. By 2029, the global newly installed wind power capacity is estimated to reach 344.7 GW, driven by advancements in wind power technology and increasing global commitments to renewable energy.

Source: China Insights Consultancy

With increased policy support and continuous technological advancements, China's wind power market is expected to maintain strong growth momentum, reaching 197.5 GW of newly installed capacity by 2029

China's newly installed wind power capacity, 2019-2029E



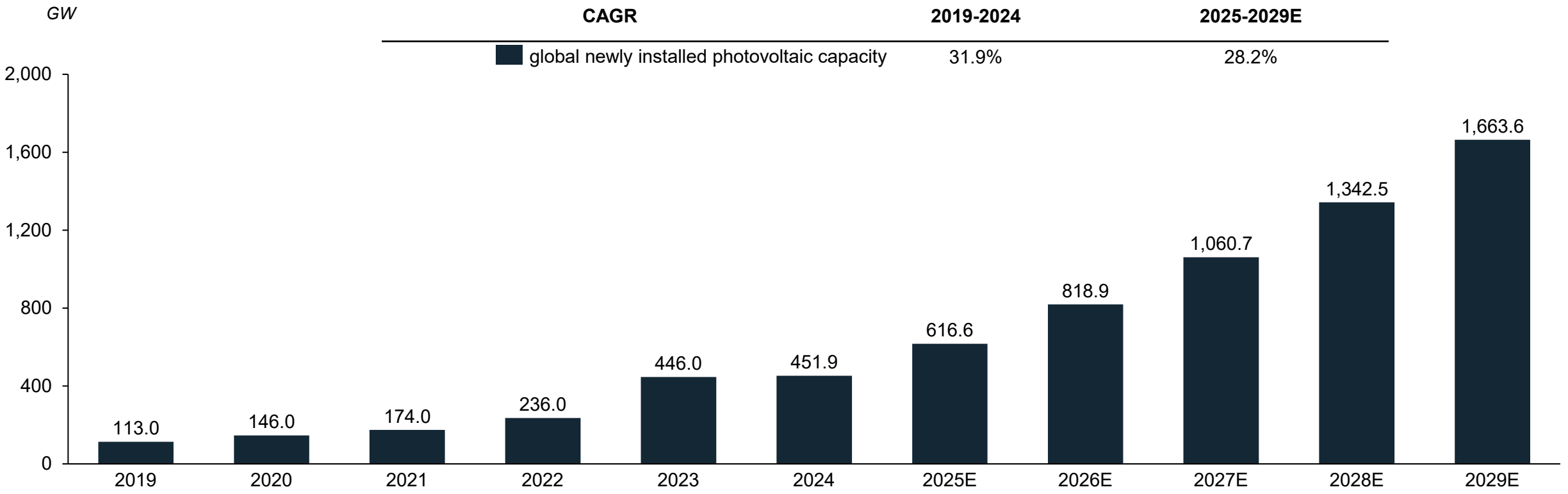
Key analysis

- In recent years, China's newly installed wind power capacity has continued to grow, becoming a major driving force in the global wind power market. In 2024, China's newly installed wind power capacity reached 79.8 GW, a significant increase from 25.7 GW in 2019, with a CAGR of 25.4%. With increased policy support and continuous technological advancements, China's wind power market is expected to maintain strong growth momentum, reaching 197.5 GW of newly installed capacity by 2029, providing significant support for achieving carbon neutrality goals.

Source: China Insights Consultancy

Global newly installed photovoltaic capacity has grown rapidly, driven by increasing commitments to renewable energy and advancements in solar technology

Global newly installed photovoltaic capacity, 2019-2029E



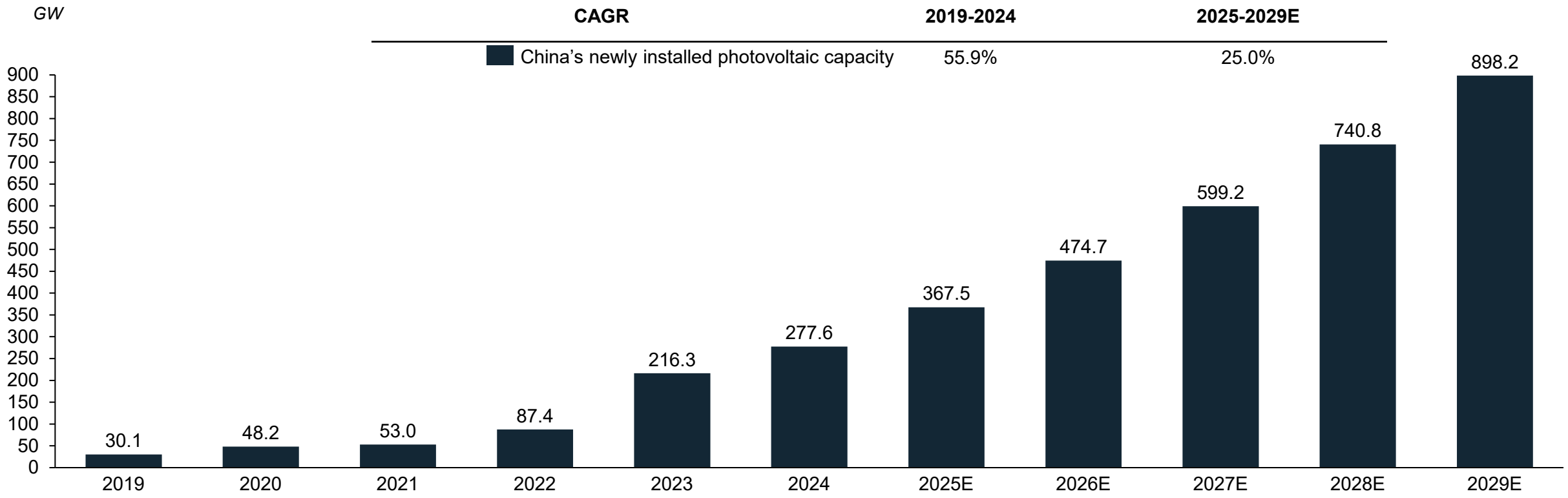
Key analysis

- Global newly installed photovoltaic capacity has grown rapidly, driven by increasing commitments to renewable energy and advancements in solar technology. By 2024, the global newly installed PV capacity reached significant levels, reflecting the industry's robust expansion. In the future , with stronger policy support and declining costs of solar installations, the PV market is expected to maintain steady growth. By 2029, global PV capacity additions are projected to further accelerate, contributing significantly to the global energy transition and the achievement of climate goals.

Source: China Insights Consultancy

China's newly installed photovoltaic capacity has grown rapidly from 30.1 GW in 2019 to 277.6 GW in 2024, with projections to reach 898.2 GW by 2029

China's newly installed photovoltaic capacity, 2019-2029E



Key analysis

- China's newly installed photovoltaic (PV) capacity increased from 30.1 GW in 2019 to 277.6 GW in 2024, with a CAGR of 55.9%. It is expected to reach 898.2 GW in 2029 with a CAGR of 25.0%. This rapid expansion, driven by policy support, technological advancements, and cost reductions, highlights China's strong commitment to renewable energy and carbon emission reduction, with a promising future for the PV industry.

Source: China Insights Consultancy

Market drivers of the global new energy industry

Environmental and climate policies	• Environmental and climate policies are key driving forces behind the global new energy industry. Governments around the world are increasingly implementing stricter regulations and offering incentives to promote the transition towards renewable energy sources, reduce carbon emissions, and combat climate change. These policies include subsidies for renewable energy projects, carbon taxes, emission reduction targets, and mandates for energy efficiency, which stimulate investment in clean technologies such as solar, wind, and energy storage.
Technological advancements	• Innovations in renewable energy technologies, such as solar panels, wind turbines, energy storage systems, and electric vehicles, have significantly increased efficiency, reduced costs, and improved performance. The development of smart grids, artificial intelligence, and energy management systems is optimizing energy distribution and consumption. As these technologies continue to evolve, they unlock new possibilities for scaling up renewable energy deployment, improving energy security, and achieving sustainability goals. Technological progress thus plays a pivotal role in accelerating the global transition to clean energy and reducing the reliance on fossil fuels.
Public awareness and consumer demand	• Public awareness and growing consumer demand for sustainability are also driving forces in the global new energy sector. As climate change and environmental degradation become more urgent issues, there is a significant shift in consumer behavior towards environmentally conscious choices. Individuals and businesses are increasingly seeking energy solutions that are not only affordable but also sustainable. This shift is reflected in the rising popularity of electric vehicles, energy-efficient appliances, and the desire for green building certifications. As public support for renewable energy grows, governments and private sectors are incentivized to accelerate investments in clean energy infrastructure.

Source: World Bank, China Insights Consultancy

Future trends of the global new energy industry

Continued technological innovation	• As renewable energy technologies evolve, advances in solar, wind, energy storage, and grid management systems will make these solutions more affordable and accessible. Innovations in materials, manufacturing processes, and energy conversion methods will lead to significant cost reductions, making renewable energy increasingly competitive with traditional fossil fuels. Additionally, the development of more efficient energy storage systems and smarter grids will enhance energy utilization, allowing for better integration of renewable sources into existing infrastructure.
The widespread adoption of clean energy	• As countries and companies strive to meet ambitious climate goals, the demand for renewable energy sources such as solar, wind, and hydropower continues to rise. Clean energy technologies are becoming more cost-competitive, and their integration into national grids is accelerating. This shift is driven by the urgent need to reduce carbon emissions, decrease reliance on fossil fuels, and mitigate the impacts of climate change.
International cooperation in new - energy	• There will be more extensive and in - depth international cooperation in the new - energy field. As the impact of climate change is a global issue, countries recognize the need to work together. Developed countries can assist in the transfer of solar and wind energy technologies, helping developing countries build their own manufacturing capabilities for renewable energy components. International cooperation can also take the form of joint research projects. Scientists from different countries can collaborate to develop more efficient and sustainable new - energy solutions.

Source: China Insights Consultancy

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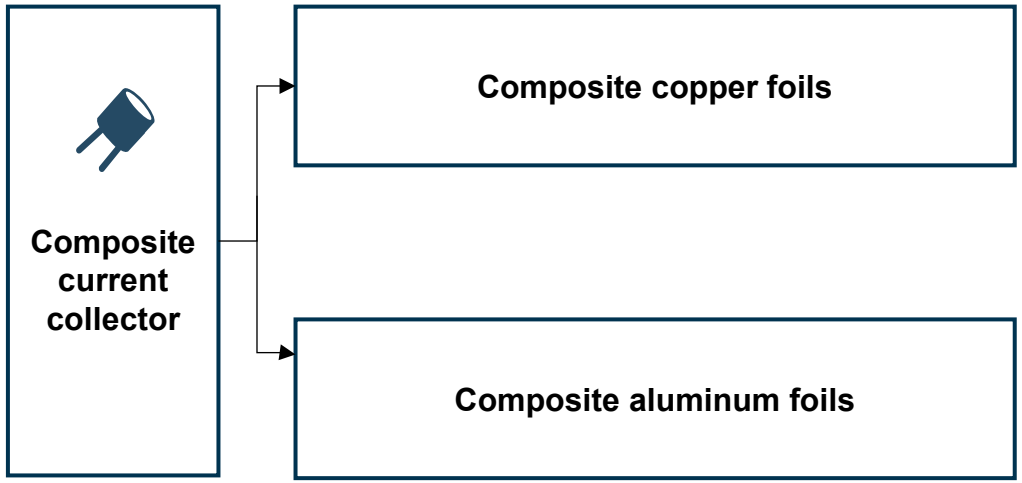
Definition and categorization of the global composite current collector industry

Definition and categorization

- A composite current collector is a critical component in batteries, designed to efficiently collect and transmit electric current between the active material and the external circuit. Unlike traditional single-metal collectors, composite current collectors integrate multiple materials or layers to enhance electrical conductivity, mechanical stability, corrosion resistance, and weight efficiency. These improvements are essential for optimizing battery performance in terms of capacity, safety, and longevity. The primary types of composite current collectors can be categorized based on the base metal and the structural enhancements applied. Understanding the distinctions between composite copper foils and composite aluminum foils helps in identifying their specific applications in lithium-ion batteries, from high-power outputs to long-cycle-life energy storage solutions. The composite current collector replaces part of the traditional metal materials with insulating polymer materials that have lower density and cost, which holds significant importance for enhancing the energy density, improving safety, and reducing the cost of lithium-ion batteries. It is poised to become the core technology for the battery anodes and cathodes.
- Composite current collectors are classified into composite copper foil and composite aluminum foil, differing mainly in material composition and application. Composite copper foil, using copper as the conductive layer, is typically applied to the battery's anode due to its high conductivity and corrosion resistance. Composite aluminum foil, with aluminum as the conductive layer, is mainly used for the cathode, offering advantages such as lower weight, lower cost, and high voltage resistance. Composite copper foil has achieved a higher level of commercialization and is already in mass production, while composite aluminum foil is still in the validation and promotion stage.



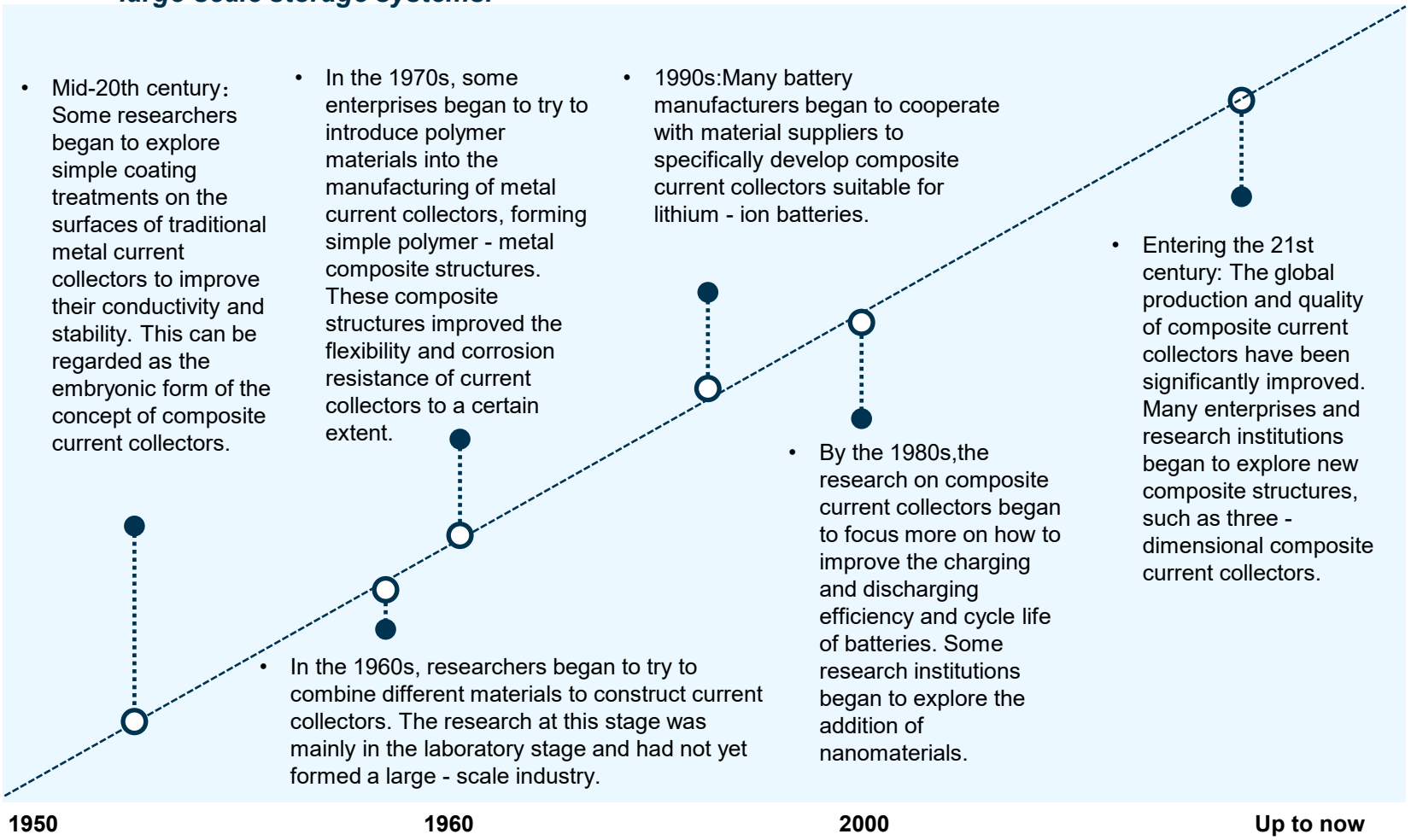
- Composite copper foils use copper as the base material and incorporate conductive or protective coatings such as carbon, graphene, or nickel layers. These foils are designed for use in lithium-ion battery anodes due to their excellent electrical conductivity, mechanical strength, and thermal stability. The additional coatings enhance adhesion with active materials, reduce interface resistance, and improve cycling performance by mitigating copper corrosion. Composite copper foils are widely used in applications that demand high power and efficiency, such as electric vehicles, portable electronics, and power tools.

- Composite aluminum foils use aluminum as the base material, combined with conductive coatings like carbon-based layers or protective nano-coatings. These foils are primarily used in lithium-ion battery cathodes due to their lightweight properties, excellent corrosion resistance, and high stability. The coatings improve electrical conductivity, enhance adhesion with active materials, and prevent oxidation during battery cycling. Composite aluminum foils are commonly found in energy storage systems, consumer electronics, and electric vehicles, where high-capacity and long-cycle-life performance are critical.

Source: China Insights Consultancy

Development history of the global composite current collector industry

- ***The global composite current collector industry has progressed through material innovations and structural advancements, enhancing performance and enabling applications in new energy and large-scale storage systems.***

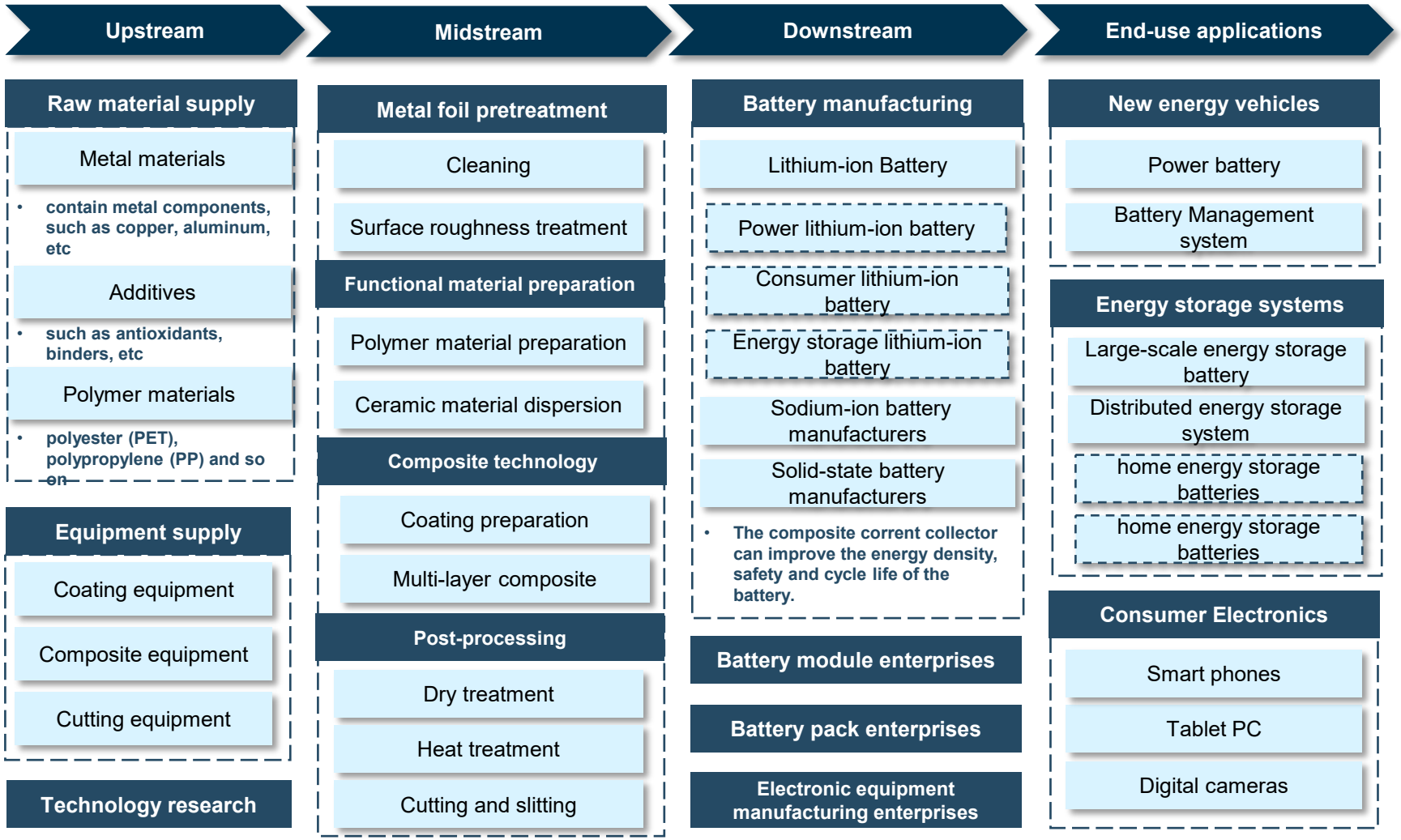


Key Analysis

- The composite current collector industry started in the early 20th century. In the early days, the technological foundation was weak, and the current collector only fulfilled the basic function of current conduction. Subsequently, it went through the stage of preliminary exploration of composite structures. From simple coating treatments to the introduction of multiple materials to construct composite structures, most of these were still at the laboratory stage.
- Currently, the composite current collector industry has diverse technological innovations. Structurally, innovative structures such as three - dimensional composite current collectors have improved the current collection efficiency. In terms of materials, it is moving towards green manufacturing and renewable materials, and the concept of intelligent composite current collectors has emerged.
- In the future, the composite current collector industry is expected to continue to make breakthroughs in technology. With the further expansion of markets such as new - energy vehicles and large - scale energy storage systems, the market scale of composite current collectors will keep growing. Moreover, it will meet higher standards in terms of safety and environmental protection and play an important role in more emerging fields.

Source: China Insights Consultancy

Value chain of the global composite current collector industry



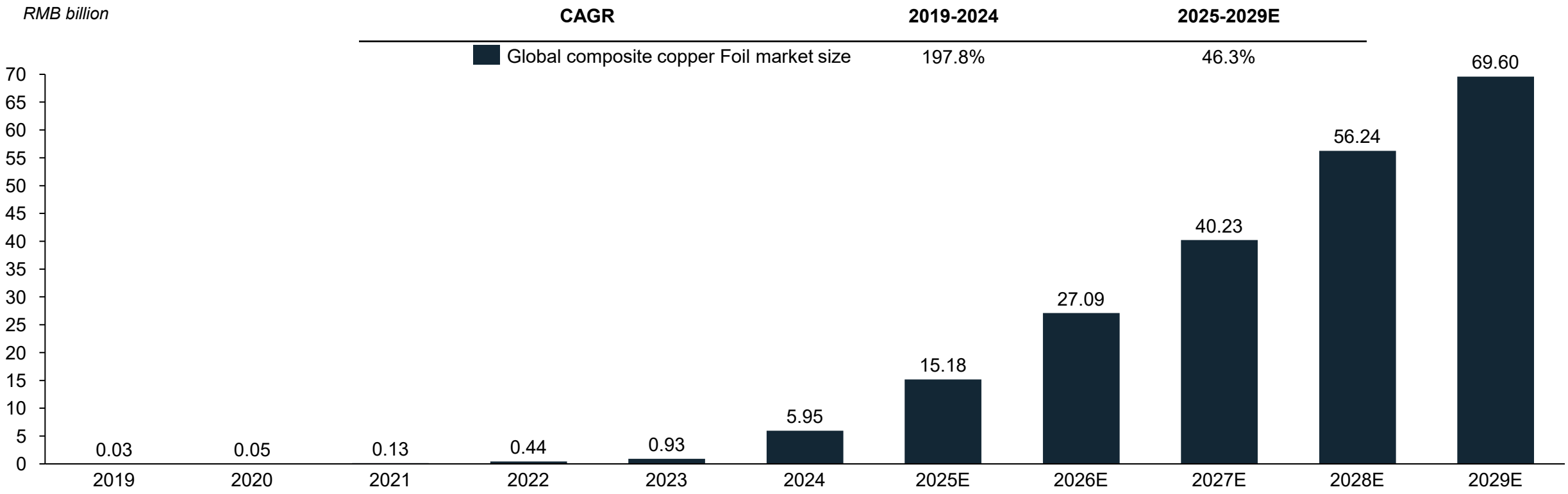
Key Analysis

- The industrial chain of the global composite fluid collection industry shows the characteristics of close correlation and mutual influence. In the upstream raw material supply link, the product quality and supply stability of metal, polymer and ceramic materials suppliers are crucial, and their technology research and development capabilities and resource control directly affect the quality and cost of raw materials, and then spread to the entire industrial chain; As the core of midstream production and manufacturing, the production process is complex and has high requirements on technology and equipment. Enterprises need to have advanced technology and strict quality control system to ensure product performance. The downstream battery manufacturing and module PACK enterprises have strict requirements for the performance and quality of composite fluid collection, and the scale and structural changes in the market demand will be reverse transmitted to the upstream of the industrial chain, promoting the continuous optimization and upgrading of all links, and the coordinated development of the overall industrial chain is of key significance for the continuous progress of the industry and the improvement of market competitiveness.

Source: China Insights Consultancy

Global composite copper foil market has shown explosive growth between 2019 and 2029, with market size rising rapidly from RMB5.95 billion in 2024 to RMB69.60 billion in 2029

Global composite copper Foil market size, 2019-2029E



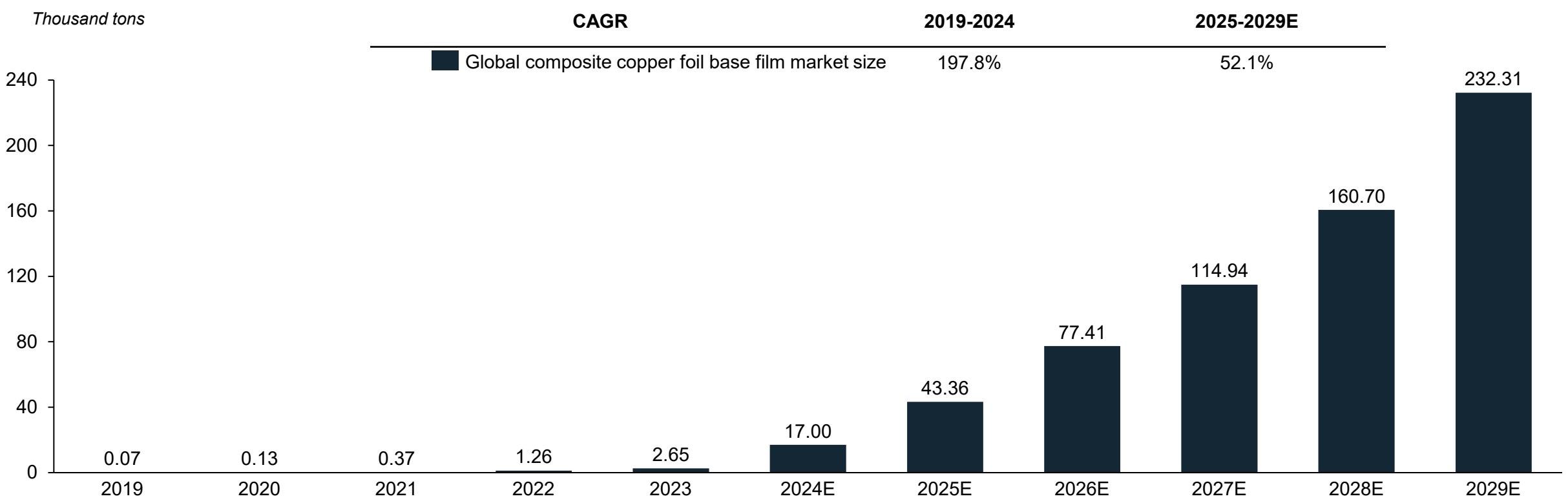
Key analysis

- The global composite copper foil market has shown explosive growth between 2019 and 2029, with market size rising rapidly from RMB5.95 billion in 2024 to RMB69.60 billion in 2029, achieving a CAGR of 197.8% from 2019 to 2024 and 46.3% from 2025 to 2029. Starting from 2024, the market began to expand significantly, driven primarily by the rapid development of the new energy sector. Additionally, advancements in technology and cost reductions have further facilitated market commercialization. Over the next five years, the composite copper foil market is expected to maintain rapid growth, presenting immense potential for development.

Source: China Insights Consultancy

Global composite copper foil base film market has experienced rapid growth from 2019 to 2029, with the market size increasing from 17.00 thousand tons in 2024 to 232.31 thousand tons in 2029

Global composite copper foil base film market size, 2019-2029E



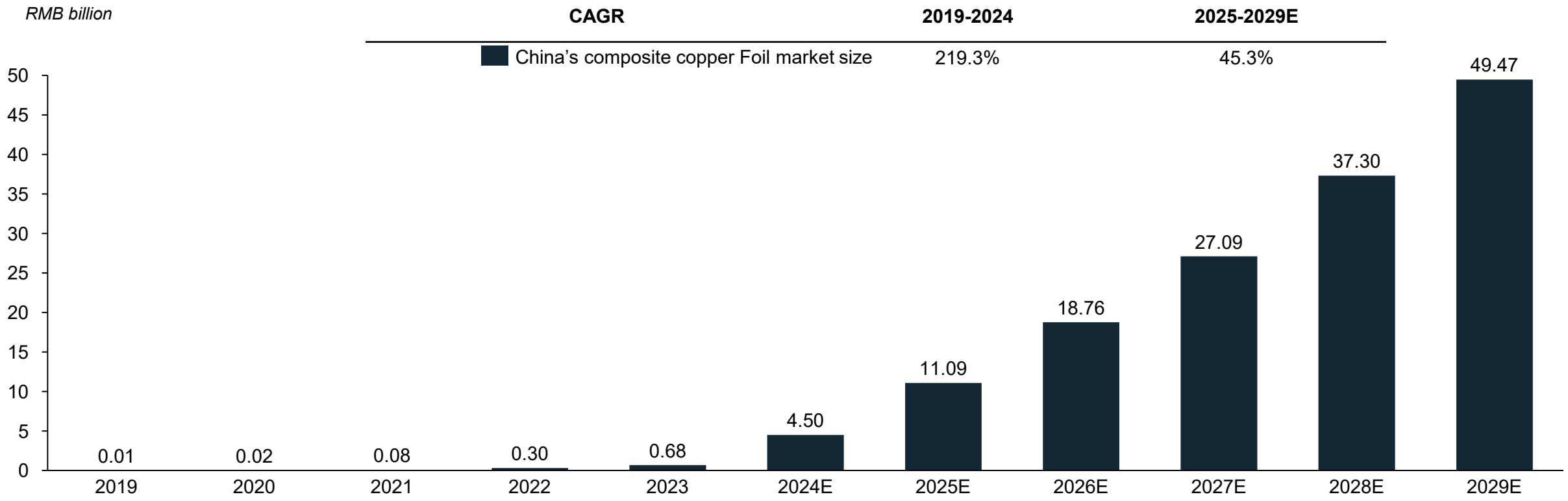
Key analysis

- The global composite copper foil base film market has experienced rapid growth from 2019 to 2029, with the market size increasing from 17.00 thousand tons in 2024 to 232.31 thousand tons in 2029. The CAGR reached 197.8% from 2019 to 2024 and 52.1% from 2025 to 2029. With the advancement of global energy transitions and climate goals, the demand for composite copper foil base films is expected to continue rising, offering significant opportunities for the renewable energy sector.

Source: China Insights Consultancy

China’s composite copper foil market has shown explosive growth between 2019 and 2029, increased from RMB0.01 billion in 2019 to RMB0.68 billion in 2024, and is expected to reach RMB49.47 billion in 2029

China’s composite copper Foil market size, 2019-2029E



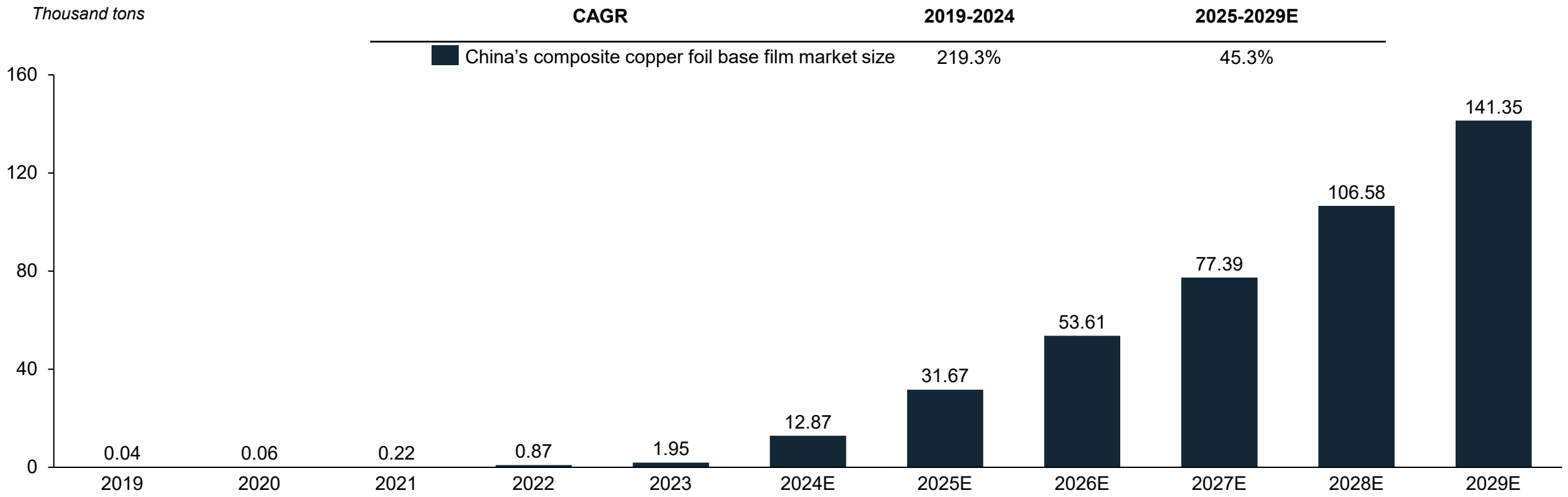
Key analysis

- Based on the growth trend of the global composite copper foil base film market, China, as the world's largest market for NEV and new energy electricity system, holds significant market potential. China’s composite copper foil market has shown explosive growth between 2019 and 2029, increased from RMB0.01 billion in 2019 to RMB4.50 billion in 2024, and is expected to reach RMB49.47 billion in 2029.

Source: China Insights Consultancy

China’s composite copper foil market has shown rapid growth in recent years, driven by the increasing demand in sectors such as new energy vehicles, 5G communications, electronic devices, and energy storage

China’s composite copper foil base film market size, 2019-2029E



Key analysis

- Chinese composite copper foil market has shown rapid growth in recent years, driven by the increasing demand in sectors such as new energy vehicles, 5G communications, electronic devices, and energy storage. With advancements in technologies like lithium batteries and supercapacitors, composite copper foil has become mainstream in battery applications, especially in the manufacturing of power and energy storage batteries. The market size increased from 12.87 thousand tons in 2024 to 141.35 thousand tons in 2029.

Source: China Insights Consultancy

Market drivers of the global composite current collector industry

Miniaturization and performance enhancement of electronic Devices	• As the demand for smaller, lighter, and more efficient electronic devices grows, manufacturers are pushing the boundaries of materials science to meet these demands. Composite current collectors are integral to this evolution because they provide enhanced conductivity, lighter weight, and greater flexibility compared to traditional metals. These properties are crucial in applications in new energy sector, where battery efficiency and size constraints are critical. The ability of composite materials to deliver high performance in these increasingly compact devices is driving their adoption, allowing the industry to grow and meet the increasingly stringent requirements of modern electronic components.
Advancements in new energy technologies	• The global push for clean energy solutions has led to significant advancements in renewable energy technologies, particularly in energy storage systems and electric vehicles (EVs). Composite current collectors are vital in improving the performance of lithium-ion batteries, which are at the heart of energy storage systems and EVs. Their high electrical conductivity ensures efficient power transfer, while their stability improves the overall longevity and cycling performance of batteries. Moreover, their light weight contributes to reducing the overall mass of electric vehicles, helping to increase their range. As renewable energy technologies continue to scale up, the composite current collector industry is positioned to benefit from the expanding market for EVs, energy storage systems, and other sustainable energy applications, presenting a long-term growth trajectory.
Growing market demand	• The growing market demand for high-performance electronic products, energy-efficient systems, and eco-friendly technologies is providing continuous momentum for the industry. As consumer and industrial demand for products like electric vehicles, renewable energy systems, and high-performance electronics rise, the need for advanced materials such as composite current collectors becomes even more critical, further fueling industry growth.

Source: World Bank, China Insights Consultancy

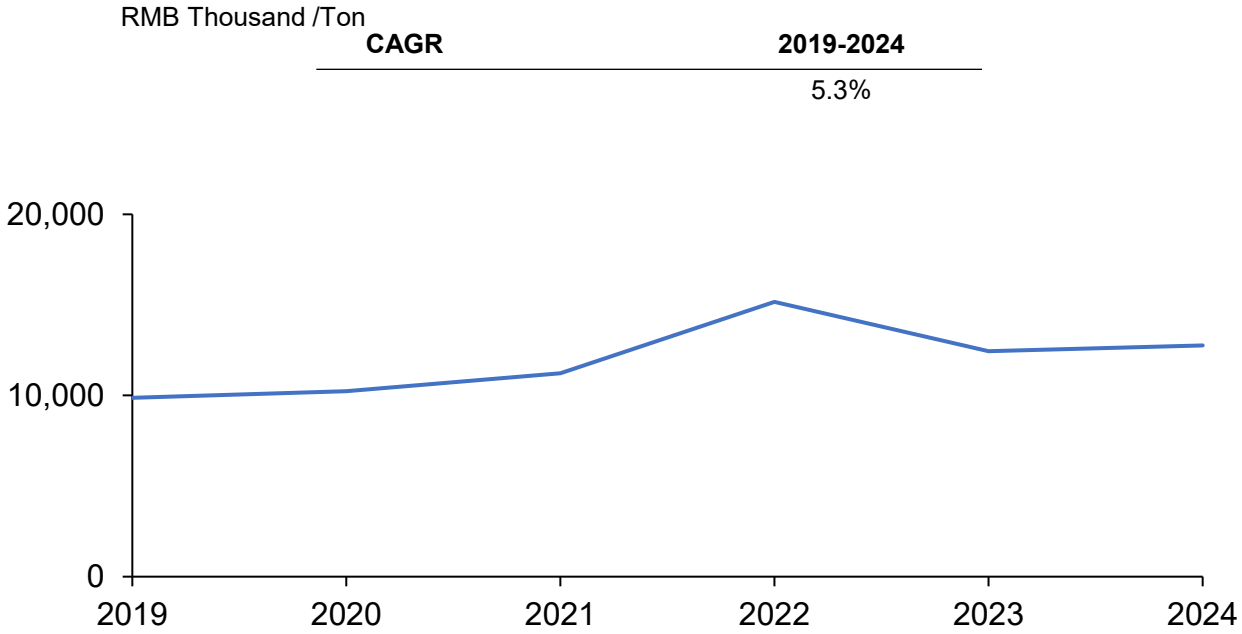
Future trends of the global composite current collector industry

Material Innovation and Performance Enhancement	• With continuous technological advancements, the performance of composite current collector materials is constantly improving. The industry is increasingly focused on using high-performance composite materials to enhance conductivity, cycling stability, and mechanical strength. These innovations not only help improve battery efficiency but also extend battery lifespan, meeting the growing demands of electric vehicles and energy storage systems for high performance and long-cycle usage. Additionally, the emphasis on material lightweighting and sustainability is becoming a key direction for research, driving the industry toward more environmentally friendly and efficient solutions.
Diversification of Market Applications	• s the demand for electric vehicles, energy storage systems, and consumer electronics continues to grow, the market applications of composite current collectors are diversifying. In addition to traditional battery applications, composite current collectors are increasingly being used in broader renewable energy fields, including wind energy, solar energy storage systems, and autonomous driving technologies. The electric vehicle market, in particular, is a key driver for the growth of the composite current collector industry. With advancements in battery technology, the demand for composite current collectors will significantly increase.
Advancements in Automation and Production Technology	• To meet the growing market demand, the production process of composite current collectors is shifting toward automation and smart manufacturing. The application of new manufacturing technologies such as 3D printing, nanotechnology, and precision manufacturing is greatly improving the efficiency and precision of composite current collector production. At the same time, reduced production costs offer greater profit potential for companies. As production technologies continue to advance, composite current collectors will become more widely used, and product quality will become more stable, further driving the sustained growth of the industry.

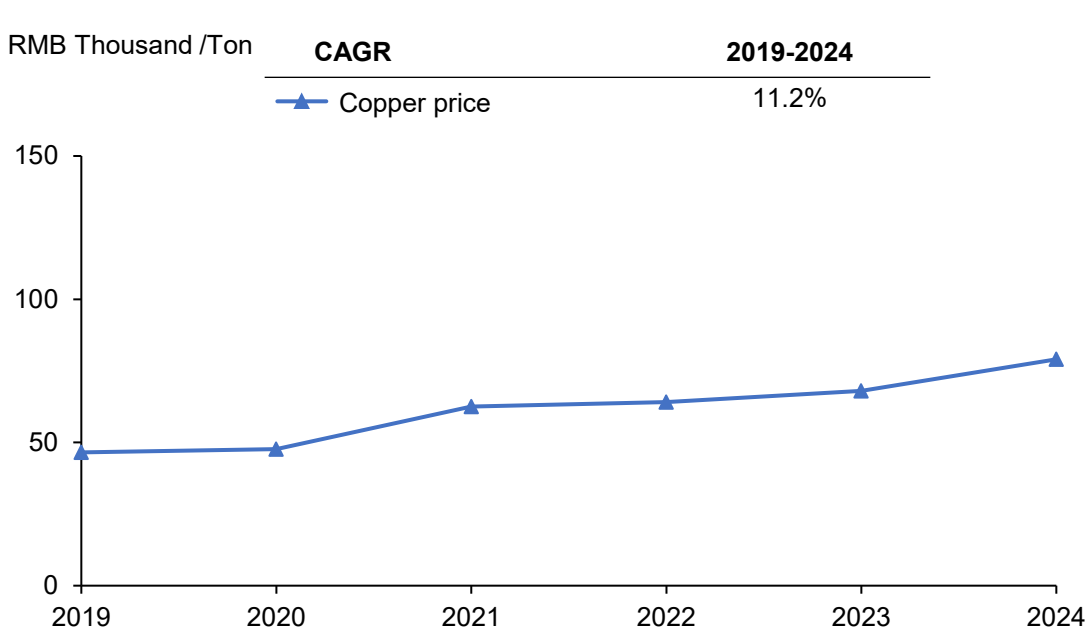
Source: China Insights Consultancy

Cost analysis of major raw material for composite current collector industry

Annual average price of electrical-grade PP, China, 2019-2024



Annual average price of copper price, China, 2019-2024



Key Analysis

- The annual average price of electrical-grade PP showed fluctuations from 2019 to 2024, with a compound annual growth rate (CAGR) of 5.3%. The fluctuation was primarily driven by the fluctuation in the price of crude oil, a key raw material for the production of electrical grade polypropylene. Crude oil price experienced a significant increase in 2022 due to the Russia-Ukraine war, and then declined and remained relatively stable in 2024.
- Copper prices saw a significant increase during the same period, with a CAGR of 11.2%. After remaining relatively stable between 2019 and 2020, copper prices surged sharply in 2021 and continued their upward trend through 2024, reflecting strong demand, supply constraints, and market volatility. Given the importance of copper in the composite current collector industry, the rising prices directly impact production costs and profitability, emphasizing the need for effective supply chain management and cost-control strategies.

Source: China Insights Consultancy

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Competitive landscape of China’s capacitor film industry

The top five capacitor film suppliers, China, in terms of capacitor base film sales volume, 2024

Ranking	Company	Sales volume, 2024, thousand tons	Market share,2024	Listing status
1	Hubei Longchen Technical Joint-Stock Co.,Ltd.	17.1	15.1%	Non-Listed
2	The Company	16.2	14.2%	Non-listed
3	Zhejiang Great Southeast Co.,Ltd	13.5	11.9%	Listed
4	Anhui Tongfeng Electronics Co., Ltd	11.7	10.3%	Listed
5	Quanzhou Jiadeli Electronic Materials Co.,Ltd	11.4	10.1%	Non-listed
	CR5	69.9	61.6%	
	Total	113.4	100.0%	

Note：Refers to the sales volume of capacitor base films in 2024, including sales volume of metallized films converted back to base film. The volume of capacitor base film is standardized by converting to 7 μm, which is in line with industry practice.

Key Analysis

- The competitive landscape of mainland China‘s capacitor film industry is highly competitive and concentrated, with the top five companies capturing 61.6% of the market share in 2024 in terms of capacitor base film sales volume, a concentration ratio projected to intensify. The leading players, particularly those that have localized the production of core manufacturing equipment, can rapidly expand capacity to meet growing market demand while maintaining and increasing their market share.
- In terms of capacitor base film sales volume, the Company is the second largest capacitor film supplier in mainland China’s market, achieving a sales volume of 16.2 thousand tons, representing 14.2% of the market share in 2024. While the company ranked second in China’s capacitor film market by sales volume in 2024, the market shares of other top players were closely comparable, reflecting a highly concentrated yet competitive industry landscape.

Introduction of the top participants in China's capacitor film industry

Introduction of top participants

Company	Established time	Location	Description
The company (Hebei Haiwei Electronic New Material Technology Co., Ltd.)	2006	Hebei, China	• A leading capacitor film manufacturer in China. Our products mainly include (i) capacitor base films and (ii) metallized films, which are the key components of film capacitors. Our products have a wide range of end-use application scenarios, primarily covering both new energy industries, including (i) NEV and (ii) new energy electricity system, and traditional industries, including (iii) industrial equipment and (iv) home appliances.
Zhejiang Great Southeast Co.,Ltd	2000	Zhejiang, China	• Established in 2000 in Zhejiang, Entity A is a listed company on the Shenzhen Stock Exchange, specializing in the design, manufacture and distribution of plastic films, including BOPET, CPP, BOPP capacitor base films, and metallized films. The company utilizes imported production lines .
Hubei Longchen Technical Joint-Stock Co.,Ltd.	2003	Hubei, China	• Established in 2003 in Hubei, Hubei Longchen is a non-listed company specializing in the research, development, production and sales of PP films for capacitors, including capacitor base films and metallized films. The company utilizes imported production lines .
Anhui Tongfeng Electronics Co., Ltd	1996	Anhui, China	• Established in 1996 in Anhui, Tongfeng Electronics is a listed company on the Shanghai Stock Exchange , engaging in the research, development, manufacture and sale of film capacitors and capacitor films. Tongfeng Electronics also produces metallized films amd utilizes imported production lines .
Quanzhou Jiadeli Electronic Materials Co.,Ltd	2002	Fujian, China	• Established in 2002 in Fujian, Quanzhou Jiadeli is a non-listed company engaging in the research, development, manufacture and sale of capacitor films, including capacitor base films and metallized films. The company utilizes imported production lines .

Source: China Insights Consultancy

Analysis of competitive advantage of the company(1/2)

Integration with proprietary upstream raw materials supplier	• The company's parent group, Anhui Ningguo Haiwei Electronic Co., Ltd., is the sole domestic producer of electrical-grade polypropylene, a key raw material for BOPP and capacitor films. This unique vertical integration ensures unmatched control over raw material quality and supply. Anhui Ningguo Haiwei Electronic Co., Ltd.'s ability to produce 720 types of polypropylene, including the patented electrical-grade polypropylene, provides unparalleled flexibility in adjusting production parameters, a capability not available from third-party suppliers. This reduces the reliance on foreign raw material providers like Borealis and LG Chem and offers a strategic advantage, particularly in scenarios of geopolitical instability.
Domestication of equipment localization and rapid capacity expansion	• Since its inception, the company has successfully transitioned from utilizing fully imported production equipment to achieving complete domestic manufacturing of production lines. Starting in 2006 with a German Brückner production line and Japanese Fuji Iron Works splitting equipment, the company steadily increased its domestic equipment ratio. By the fifth production line, the company achieved 100% self-designed and domestically manufactured equipment. This shift reduced equipment costs from over 400 million RMB per line for imported models to approximately 100-200 million RMB per line. Additionally, the company's localized equipment development allows for significantly faster production line setup—delivering operational lines within a year compared to competitors' 5-6 year timelines. This capability ensures rapid response to market demands, enhanced profitability, and reduced reliance on foreign equipment suppliers.
R&D capability and product innovation	• A robust investment in research and development ensures the company remains a leader in technological advancements. The company has cultivated a dedicated team comprising senior researchers with expertise in equipment design and younger talents focused on material innovation. These efforts have enabled breakthroughs such as producing ultra-thin films down to 2.6 microns, with ongoing refinements targeting 2 microns. Advanced multifunctional production lines capable of producing biaxially oriented capacitor films and synchronous stretched composite copper foil films further highlight the company's innovative edge. These developments ensure adaptability to evolving industry trends and consumer demands.

Source: China Insights Consultancy

Analysis of competitive advantage of the company(2/2)

Scale and operational efficiency	• By optimizing operations and leveraging economies of scale, the company achieves substantial cost savings and operational excellence. Currently, the company operates five production lines on 110 acres of land, with plans to expand to 260 acres to accommodate up to 10 capacitor film lines and 20 coating lines. The company's ability to design and implement wider film widths (up to 7 meters) and thinner film thicknesses ensures enhanced production efficiency, cost advantages, and superior product quality. The operational efficiencies gained through domesticated equipment and experience-driven refinements further enhance the company's market competitiveness.
Government support and policy alignment	• The company benefits from proactive government policies and incentives aimed at strengthening domestic production and technological capabilities. Recent recognition as a national "Specialized and Innovative Little Giant" enterprise underscores its industry leadership and innovation. Additionally, the company actively pursues equipment localization subsidies from the National Development and Reform Commission, reinforcing its alignment with strategic policy objectives. This support positions the company favorably for sustainable long-term growth and resilience in a competitive global landscape.
Rapid scalability through land acquisition and modular production capabilities	• The company's forward-looking approach to land acquisition and modular production design positions it for sustained growth. With 260 acres of land under development, the company plans to deploy up to 30 additional production lines, including multifunctional film lines and advanced coating lines. This modular approach not only accelerates construction and deployment but also allows the company to scale production in alignment with market demand. The ability to rapidly expand capacity while maintaining operational efficiency ensures the company's long-term competitiveness and responsiveness to industry trends.

Source: China Insights Consultancy

Features of the company's capacitor base film products

- **Voltage endurance:** the company's capacitor base film products are manufactured using biaxially oriented electrical grade polypropylene, which typically possesses a dense material structure. Given such nature, their capacitor base film products can endure high voltage. With high voltage endurance, our capacitor base films can effectively disperse electric field stress, mitigating the risk of dielectric breakdown and ensuring reliable performance under high voltage conditions. In addition, the high voltage endurance of our capacitor base films enhances their insulation resistance, thereby minimizing current leakage. This contributes to efficient energy storage in capacitors while reducing energy loss, ensuring consistent and reliable operation across diverse applications. the voltage endurance of the company's capacitor base film products is at the top level in the industry in China. Specifically, the average voltage endurance of their ultra-thin base films, thin base films and medium-thick base films is approximately 450 V/μm, 500 V/μm and 550 V/μm, respectively. By comparison, the mean voltage endurance of ultra-thin base films specified under China's national industry standard, GB-T 13542.3-2006 (the "National Industry Standard"), is approximately 120 V/μm, the mean voltage endurance of thin base films ranges from approximately 150 V/μm to 190 V/μm, and that of medium-thick base films ranges from approximately 230 V/μm to 320 V/μm.

- **Thermal shrinkage resistance:** the company's capacitor base film products demonstrate minimal thermal shrinkage, ensuring dimensional stability under high-temperature operating conditions. This property minimizes deformation, allowing the film to maintain its electrical performance and mechanical strength in demanding environments. Low thermal shrinkage reduces the risk of internal stress caused by temperature fluctuations during manufacturing and operation, supporting consistent performance and enhancing the reliability and lifespan of capacitors. The thermal shrinkage resistance of the company's capacitor base film products is above the industry average in China. Specifically, the thermal shrinkage resistance of the company's capacitor base film products typically reach a thermal shrinkage resistance of 4.5%, as compared to the industry average of approximately 5.0% in China.

- **Surface roughness:** the company's capacitor base film undergoes the precise biaxial stretching and traction process to optimize surface roughness. Optimal surface roughness helps strengthen adhesion between the film and its metal coating, ensuring a stable and durable bond. Stronger adhesion helps reduce the risk of delamination, blistering or other similar issues during the operation of capacitors, thus enhancing product reliability and durability. The surface roughness of the company's capacitor base film products is at the top level in the industry in China. Specifically, the surface roughness of our capacitor base film products typically range from 0.06 μm to 0.12 μm, which is significantly lower than the surface roughness range of 0.2 μm to 0.6 μm specified under the National Industry Standard.

- **Tensile strength:** the company's capacitor base film products exhibit high tensile strength. This enhances the films' dielectric strength by improving the stability of the films, effectively mitigating the risk of short-circuit failure. Furthermore, it helps capacitors maintain consistent voltage resistance and insulation performance under varying environmental and operating conditions. The tensile strength of the company's capacitor base film products is at the top level in the industry in China. Specifically, the average longitudinal tensile strength of the company's ultra-thin base films, thin base films and medium-thick base films is approximately 160 MPa, 150 MPa and 130 MPa, respectively, while the average transverse tensile strength is approximately 280 MPa, 260 MPa and 240 MPa, respectively. By comparison, the tensile strength in either longitudinal or transverse orientation specified under the National Industry Standard is set at a minimum of 140 MPa. The company has also implemented environmental temperature control measures in the biaxial stretching process, which help improve the tensile strength and overall performance of such ultra-thin capacitor base films.

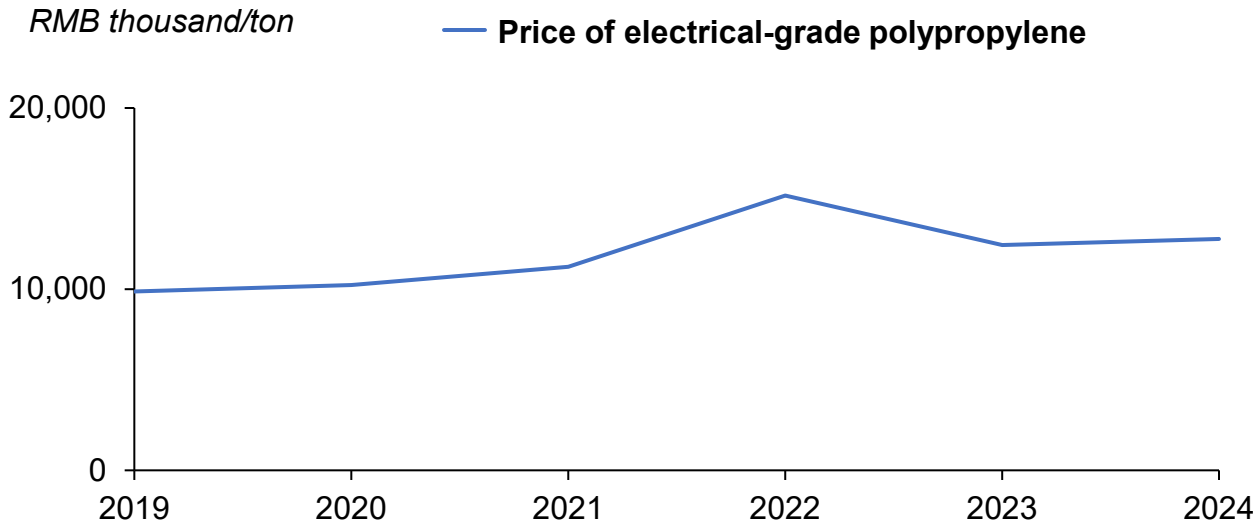
Entry barrier and key success factors for the industry

Rapid expansion capability	• The ability to quickly expand production capacity is a critical competitive advantage in the capacitor film industry. Most competitors rely on expensive imported equipment with long lead times, typically 3-5 years. In contrast, companies that have pioneered the localization of production equipment can reduce delivery times to as little as 8-12 months. This significantly accelerates capacity expansion, enabling these firms to respond swiftly to market demand and gain a decisive edge over competitors.
High capital investment	• Establishing a foothold in the capacitor film industry requires significant financial resources. Building a single production line entails an investment of several hundred million RMB, covering equipment, land, and infrastructure costs. This creates a substantial barrier for small companies or new entrants who lack the necessary capital. The high upfront costs also mean that achieving profitability requires considerable scale and operational efficiency, which is not feasible for companies with limited production capacity.
Technical expertise and intellectual property	• The development of advanced production lines, particularly those utilizing domestically manufactured equipment, demands years of research and development. Existing industry leaders have accumulated proprietary technologies and secured patents, making it difficult for new players to replicate their success. The complex engineering and manufacturing processes for high-performance capacitor films require specialized expertise, further increasing the barriers to entry.
Integrated supply chain	• Controlling the supply chain through vertical integration provides a significant competitive edge. New entrants face significant challenges in establishing similar supply chain capabilities, as it requires not only capital but also long-term strategic alignment with raw material producers. This integration ensures cost control, quality assurance, and supply stability—advantages that are hard to replicate.
Scale and operational efficiency	• The ability to scale operations is critical in the capacitor film industry. Larger manufacturers benefit from economies of scale, allowing them to reduce costs through specialization and optimized production processes. For example, companies with multiple production lines can dedicate each line to specific film thicknesses and specifications, reducing waste and enhancing product quality. Smaller competitors struggle to achieve similar efficiencies, leaving them at a cost disadvantage.
Customer relationships and approval	• In this standardized and highly competitive industry characterized by product homogeneity, the 2-3 year process of obtaining customer approval presents a significant barrier to entry for new entrants. Established companies with long-standing customer relationships and proven records of securing client trust hold a substantial competitive advantage.
Geopolitical risks and localization requirements	• The increasing emphasis on reducing dependency on foreign imports has heightened the importance of localized production. Companies capable of manufacturing production equipment and sourcing raw materials domestically are better positioned to navigate geopolitical uncertainties. Firms reliant on imported machinery or raw materials face risks such as supply chain disruptions or price volatility, placing them at a competitive disadvantage.

Source: China Insights Consultancy

Price analysis of major raw material

Annual average price major raw material, China, 2019-2024



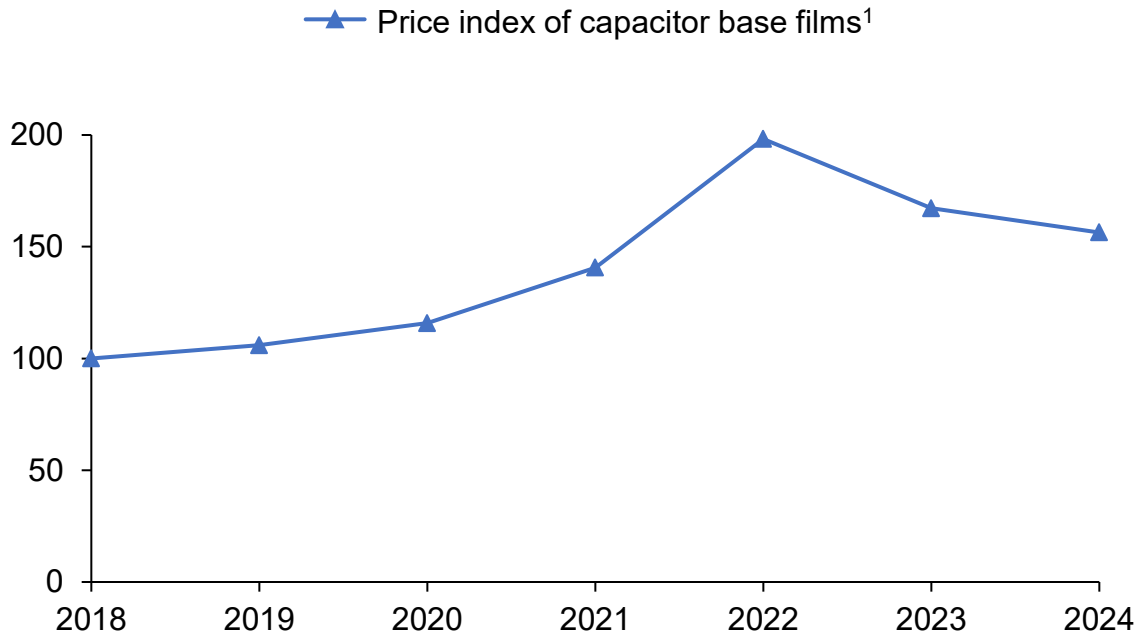
Key Analysis

- The major raw material for the capacitor film industry is electrical grade polypropylene. The annual average price of electrical-grade polypropylene showed fluctuations from 2018 to September 30, 2024. The fluctuation was primarily driven by the fluctuation in the price of crude oil, a key raw material for the production of electrical-grade polypropylene. Crude oil price experienced a significant increase in 2022 due to the Russia-Ukraine conflict, and then declined and remained relatively stable.

Source: China Insights Consultancy

Price analysis of capacitor film

Price index of capacitor base films, China, 2019-2024



Note：The Price Index for capacitor base films uses 2019 as the base year (index = 100, average price = RMB21.6 thousand per ton)

Key Analysis

- The price index of capacitor base film in China showed an upward trend from 2019 to2022, but began to gradually decline after 2022. The fluctuation was primarily driven by (i) the fluctuation in the price of crude oil, a key raw material for the production of electrical grade polypropylene, as a result of the Russia-Ukraine conflict, and (ii) robust downstream demand, which reflects the growing application of capacitor films in various industries.

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Verification material (1/5)

- The application of capacitor base films across different application scenarios primarily varies in accordance with their thickness.
- It is a common practice in capacitor film industry to divide capacitor base film products into three categories based on their thickness, including ultra-thin base films with thickness ranging from 2.0 μm to 3.9 μm, thin base films with thickness ranging from 4.0 μm to 6.9 μm and medium-thick base films with thickness ranging from 7.0 μm to 13.9 μm.
- Thin base films exhibit the strongest market demand compared to ultra-thin and medium-thick base films. This is mainly due to thin base films' broader range of end-use application scenarios, spanning (i) NEV, (ii) new energy electricity systems, (iii) industrial equipment and (iv) home appliances.
- Capacitor film manufacturers, especially the top players are are researching and developing the manufacturing techniques of capacitor base films with relatively thinner thickness. This is in response to the industry trend of capacitor base films becoming thinner, which is driven by the need to further reduce the size of film capacitors.
- The applications of metallized films are primarily determined by the thickness of their respective capacitor base films.
- Metallized films are usually produced by capacitor base film customers by performing the coating process on the capacitor base films we provide. This practice is primarily due to (i) the need of film capacitor manufacturers to ensure the stable supply and quality of metallized films, and (ii) the relatively low investment cost required for the manufacturing equipment used in the production of metallized films.
- Certain film capacitor manufacturers procure metallized films from external suppliers, primarily because film capacitor manufacturers may face limitations in their production capacity for metallized films from time to time. As such, film capacitor manufacturers will purchase metallized films from external suppliers to meet demand when their in-house production capacity for metalized films is insufficient.
- Composite copper foils are a major type of composite current collectors, which are a crucial component in batteries. Composite copper foil are designed to collect the current of the batteries, enabling the stable and efficient output of energy. Composite copper foils have significant advantages in safety, raw material cost and battery energy density. Composite copper foil films consist of a copper-coated composite base film. They utilize advanced material compounding techniques, combining copper foil as the conductive layer with the base films. This design enhances conductivity, mechanical strength, and heat resistance while maintaining excellent flexibility and lightweight characteristics, making it particularly suitable for high-performance electronic devices.
- Recycled granules are produced during the capacitor base film manufacturing process by reclaiming waste edges, which are crushed and reintroduced into the production line through extrusion to form polypropylene granules. These recycled particles are primarily used in applications such as packaging and injection molding. Recycled particles are colorless and transparent, they may contain internal bubbles and have a less smooth surface compared to new granules.
- The company's return policy is generally in line with industry norms.
- The company's pricing for capacitor film products generally aligns with current market trends.
- The company's recycled granules typically have a one-year storage period, which in in line with the industry practice.
- The company's electronic anti-theft tag films are the specialized film products manufactured with electrical grade polypropylene using proprietary processes, designed for use in the production of electronic anti-theft tags. These tags are primarily applied in areas such as supermarkets, logistics and warehousing. Their production line employs a unique process featuring low chill roll temperatures, high draw ratios, and low-speed operation. This results in films with low surface roughness, high rigidity, and exceptional properties such as easy adhesion and easy winding, significantly facilitating the subsequent production of electronic tags.
- In 2011, the Group started the operation of the first domestic capacitor film production line in China.
- In 2014, the first domestic ultra-thin capacitor film production line in China commenced operation in the Group.

Source: China Insights Consultancy

Verification material (2/5)

- The company is a leading capacitor film manufacturer in China.
- The company is the largest capacitor film manufacturer in China in 2024 in terms of sales volume. The company have established a leading position in the capacitor film industry in China, by leveraging their industry experience and technological capabilities.
- China's capacitor film manufacturers generally rely on overseas suppliers in Germany and France to import entire production lines for capacitor base films, primarily due to the intricate manufacturing techniques and processes involved in the production of capacitor films. For China's capacitor film manufacturers, the average delivery time for capacitor base films' production lines is approximately three to five years. For China's capacitor film manufacturers, the investment cost of production lines for China's capacitor film manufacturers is generally high, primarily due to the stringent demands for accuracy, stability and reliability of production lines in the capacitor film industries. The investment cost for each imported production line for capacitor base films reaches approximately RMB200.0 million to RMB300.0 million and hence, the depreciation cost of the fixed-asset for Chinese capacitor film manufacturers typically accounts for approximately 15% to 20% of cost of sales.
- The company is the only capacitor film manufacturer in China with the capability to independently design and develop capacitor base films' production lines. The company's ability to design and develop production lines for capacitor base films is one of their core strengths. As of the Latest Practicable Date, all of their existing five production lines for capacitor base films were independently designed, developed and assembled by them. As a result, the delivery time of the manufacturing equipment for our production lines is approximately eight months, which is significantly lower than the industry average of three to five years. Such strength also helps them incur lower cost of sales. Specifically, they are able to procure manufacturing equipment on the production lines from domestic suppliers, thereby significantly reducing the investment cost of their production lines. Such lower investment cost is in turn a factor in reducing their cost of sales. Accordingly, their gross profit margin for capacitor base films was 48.6%, 36.1% and 29.7% in 2022, 2023 and 2024, respectively, which was higher than the industry average gross profit margin of approximately 30.0%.
- The market of the company's products is growing. On the demand side, the rapid growth of the NEV and the new energy electricity system industry present significant opportunities for us. With China's "dual-carbon" goals and the implementation of carbon-neutral measures globally, the industry of NEV and the industry of new energy electricity system are expected to experience a steady and sustainable growth. China's capacitor film market size in terms of sales volume grew from 45,000 tons in 2019 to 95,600 tons in 2024, representing a CAGR of 16.3%, and is expected to reach 232,800 tons in 2029, representing a CAGR of 16.0% from 2024 to 2029. Within the capacitor film market in China, the market size for capacitor films used in NEV in terms of sales volume is expected to grow from 27,000 tons in 2024 to 79,200 tons in 2029, representing a CAGR of 19.7% from 2024 to 2029. Meanwhile, the market size for capacitor films used in new energy electricity system in China in terms of sales volume is expected to grow from 22,500 tons in 2024 to 96,600 tons in 2029, representing a CAGR of 27.4% from 2024 to 2029.
- The delivery time for the company's independently designed and developed production lines for capacitor base films is approximately eight months, which is significantly shorter than the industry average of three to five years for imported production lines.
- The investment cost of for the company's newly-constructed production lines for capacitor base films is approximately RMB120.0 million, which is significantly lower than the industry average in China. Such lower investment cost is a factor in reducing our cost of sales. The company's gross profit margin for capacitor base films was 48.6%, 36.1%, 34.7% and 37.2% in 2022 and 2024, and the nine months ended September 30, 2024 and 2024, respectively, which was higher than the industry average gross profit margin of approximately 30.0% during the same periods.
- There is an industry trend of capacitor base films becoming thinner, which helps further reduce the size of film capacitors. However, it is technically challenging to maintain sufficient tensile strength and high voltage endurance of thinner capacitor base films, especially those with thickness below 2.5 μm.

Verification material (3/5)

- Composite copper foils are a major type of composite current collectors, which are a crucial component in batteries. Composite copper foils are designed to collect the current of the batteries, enabling the stable and efficient output of energy. Composite copper foils have significant advantages in safety, raw material cost and battery energy density. Similar to the structure of capacitor films, composite copper foils consist of (i) composite copper foil base films and (ii) a metal layer coated on both sides of the composite copper foil base films. The company's production lines for capacitor base films can manufacture composite copper foil base films with generally equivalent production capacity. Therefore, the company's advantage in production capacity of capacitor base films would support our expansion of composite copper foil base film business in due course. Driven by the growth of the NEV industry and the new energy electricity systems industry, the composite copper foil market is expected to exhibit rapid growth. The market size for composite copper foils in China in terms of revenue is expected to grow from RMB0.7 billion in 2024 to RMB57.3 billion in 2029, representing a CAGR of 109.3%.
- While currently capacitor base films with thickness ranging from 4.0 μm to 6.9 μm exhibit the strongest market demand among all capacitor base films, capacitor base films are trending toward being thinner, which helps further reduce the size of film capacitors.
- The company expect that the addition of new capacity will bring us significant economies of scale and cost advantages. By independently developing production lines and optimizing process designs, they expect to reduce construction costs by approximately 50.0% compared to the industry average during their construction of new production lines.
- The market size of film capacitors in China has grown significantly in recent years. The market size of film capacitors in China in terms of revenue grew from approximately RMB4.3 billion in 2019 to approximately RMB10.8 billion in 2024, representing a CAGR of 20.1%, and is expected to reach RMB28.7 billion in 2029, representing a CAGR of 17.8% from 2024 to 2029. The growth of film capacitors market in China has been primarily driven by the rapid expansion of the NEV industry and the new energy electricity system industry. Customer demand for film capacitors in China has been driven by multiple favorable factors, primarily including government policies promoting the development of the NEV industry and the new energy electricity system industry, and technical advantages of film capacitors compared to other types of capacitors used in these industries.
- The market size of capacitor films in China increases in tandem with the growth of the film capacitor market in China. The market size of capacitor films in China in terms of revenue grew from approximately RMB1.2 billion in 2019 to approximately RMB2.9 billion in 2024, representing a CAGR of 20.1%, and is expected to reach approximately RMB7.9 billion in 2029, representing a CAGR of 17.8% from 2024 to 2029. Within the capacitor film market in China, the market size for capacitor films used in NEV in terms of revenue grew from approximately RMB0.1 billion in 2019 to approximately RMB1.1 billion in 2024, representing a CAGR of 58.4%, and is expected to reach approximately RMB3.2 billion in 2029, representing a CAGR of 19.9% from 2024 to 2029. Meanwhile, the market size for capacitor films used in new energy electricity system in China in terms of revenue grew from approximately RMB0.2 billion in 2019 to approximately RMB0.7 billion in 2024, representing a CAGR of 36.2%, and is expected to reach approximately RMB3.3 billion in 2029, representing a CAGR of 28.4% from 2024 to 2029.
- There has been a significant supply-demand gap of capacitor films recently, and the gap is expected to persist.
- The price of electrical grade polypropylene fluctuated during the Track Record Period. According to CIC, the average selling price of electrical grade polypropylene was approximately RMB15,000 per ton, RMB12,500 per ton and RMB13,000 per ton in 2022 and 2024 and the nine months ended September 30, 2024. According to CIC, the fluctuation was primarily driven by the fluctuation in the price of crude oil, a key raw material for the production of electrical grade polypropylene. Crude oil price experienced a significant increase in 2022 due to the Russia-Ukraine conflict, and then declined and remained relatively stable in 2024 and 2024.
- The average selling price of capacitor base film shows an overall downward trend during the Track Record and has stabilized in 2025. Such decrease was primarily due to companies' price adjustment in response to the request of their customers. Such customer request was primarily attributable to the price reduction in the downstream industries of capacitor base films. Therefore, the Company decided to adjust their product selling price, primarily to strengthen our long-term relationship with customers. Such reduction in selling price was in line with the industry practice.

Verification material (4/5)

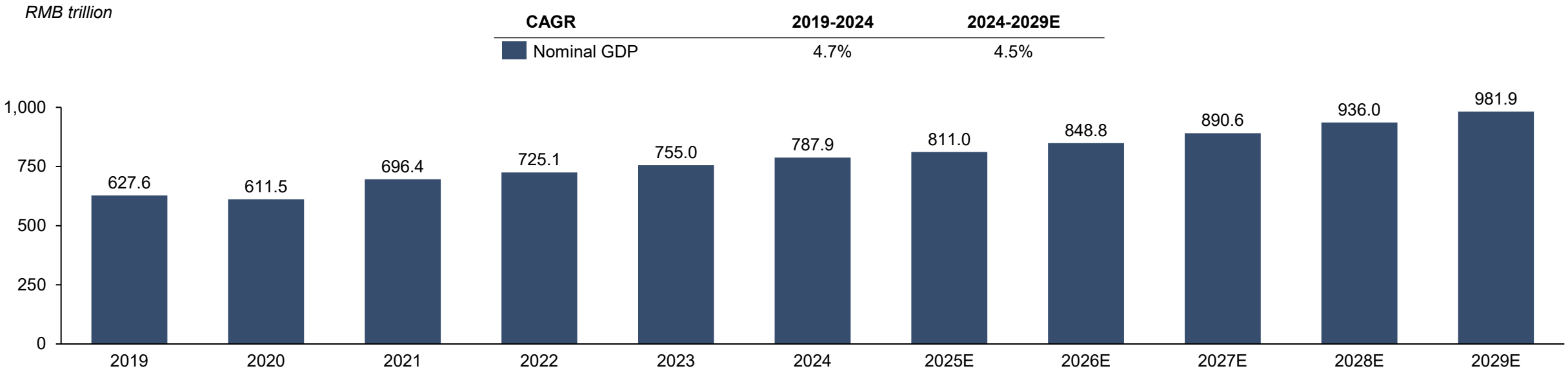
- In the capacitor film industry, the market size of capacitor base films is widely used to represent the market size of capacitor film products.
- Among major capacitor film manufacturers in China, the Company is the only company with the capability to independently design and develop capacitor base films' production lines.
- The delivery time for the Company's independently designed and developed production lines for capacitor base films is approximately eight months, which is significantly shorter than the industry average of three to five years for imported production lines; and the investment cost of their newly-constructed production lines for capacitor base films is expected to be approximately RMB120.0 million, which is significantly lower than the industry average in China.
- There's an industry trend of capacitor base films to become thinner, which is driven by the need to further reduce the size of film capacitors.
- There's a market trend in the capacitor film industry that capacitor film manufactures tend to adjust downward their prices of metallized films sold to BYD to maintain their competitiveness in the bidding process.
- In 2024, the Company's market share in terms of revenue from capacitor base films was 10.9%.
- Among major capacitor film manufacturers in China, the Company was the only company with the capability to independently design and develop capacitor base films' production lines as of the Latest Practical Date.
- The calculation of production capacity is standardized by converting to the equivalent production volume of 7.0 μm capacitor base films, which is in line with industry practice. Such calculating method is widely adopted in the capacitor film industry in China, primarily because 7.0 μm is recognized as a representative industry benchmark that facilitates standardization, enhances data comparability across different film thicknesses, and supports consistent capacity reporting.
- The vertical integration by new energy vehicle manufacturers such as BYD into the production of film capacitors reflects an emerging trend in the upstream integration of the NEV supply chain. However, this trend has not yet substantively extended to the production of capacitor base films, which involves high technical barriers, significant capital expenditure, and specialized know-how. As such, leading NEV manufacturers including BYD currently still rely primarily on external sourcing for capacitor base films. Accordingly, such trend is not expected to have a material impact on the Group's business operations in the foreseeable future.
- Capacitor film manufacturers in China primarily rely on overseas suppliers for electrical grade polypropylene, primarily because the electrical grade polypropylene industry in China is still growing, with only a few domestic suppliers available. The Group procure electrical grade polypropylene from overseas suppliers in the United Arab Emirates and Korea, which is in line with the industry practice in China.
- Declining end-use capacitor base-film prices prompted customer requests for lower selling prices, and this downward pricing trend similarly affected other capacitor-film producers in China during the Track Record Period.
- Capacitor film manufacturers averaged about 90 days of trade receivables turnover days during the Track Record Period.
- The group achieve lower cost of the production lines, led by the Group's self-design and development of production lines. The investment cost of the Group's newly-constructed production lines for capacitor films, which are integrated from domestically sourced manufacturing equipment, is approximately RMB120.0 million per line. In contrast, according to CIC, the average investment cost per production line is 200.0 million RMB for Tongfeng Electronics, and 267.0 million RMB for Em Technology5, averaged at 233.5 million RMB per production line. Hence, the investment cost of The Group's production lines is approximately 55% below the industry peers average, which accounts for the Group's higher gross profit margin by approximately 5%.
- The investment cost for peers' production lines are calculated based on a standard capacity of 2,000 tons per production line. The fixed asset depreciation in the industry is usually around 10% of production costs, and in that case, assuming identical cost structures where all non-depreciation costs are equal, the Group's unit product cost is around 5.5% lower than that of industry peers, causing the Company's gross margin to be higher than comparable peers by around 5%.

Verification material (5/5)

- In the capacitor film industry, the market size of capacitor base film is widely used to represent the market size of capacitor film products. It is because most of the products from capacitor film manufacturers are delivered in the form of capacitor base films. The metallization of capacitor base films is typically performed by capacitor manufacturers, primarily because it allows for better integration into their specific production processes, as the films can be directly tailored to match their equipment specifications and production flow. This results in improved consistency in product quality, reduced logistics and handling costs, and enhanced efficiency in the downstream capacitor manufacturing process. However, film capacitor manufacturers may procure metallized films from external suppliers, primarily because film capacitor manufacturers may face limitations in their production capacity of metallized films from time to time. In such cases, capacitor film manufacturers with production capabilities for metallized films gain a competitive advantage, as they can flexibly meet downstream demand, further utilize production capacity and offer integrated solutions to enhance market competitiveness.
- The proportion of export to U.S. of the new energy electricity system, the industrial equipment and the home appliances from China only accounted for 0.7%, 13.6% and 16.3%, respectively, of total export in terms of trade value in 2024.
- The decline in the average selling price of film capacitors used in the NEV industry by approximately 16.7% from 2022 to 2023 was mainly driven by intensified market competition and automakers' increasing focus on cost reduction amid slower growth in terminal demand. As capacitor base films are a key upstream material, downstream customers adjusted procurement prices accordingly, leading to price pressure on ultra-thin base film suppliers across the industry.
- The average gross profit margin of capacitor base film industry was 25% during the Track Record.
- The proportion of export to U.S. of the new energy electricity system, the industrial equipment and the home appliances from China only accounted for 0.7%, 13.6% and 16.3%, respectively, of total export in terms of trade value in 2024.
- The price of the electrical grade polypropylene procured by Haiwei Petrochemical and the Company was in line with the price procured by other peers within the industry.
- The price of the customized color steel plates sold by Haiwei Petrochemical to the Company was in line with the price procured by other peers within the industry.
- In the capacitor film industry, it is a general return policy that companies accept sales returns for verified product defects for which they are responsible.
- It is not uncommon in the capacitor film industry for companies to operate without maintaining product liability insurance.
- There's an industry trend that film capacitor manufacturers increasingly produce metallized films in-house using capacitor base purchased externally since 2025.
- The gross profit margin of metallized films is generally lower than capacitor base films. This is because: (i) the cost of metallization is relatively high due to the use of metal raw materials; and (ii) compared with the more complex production of capacitor base films, the metallization process is relatively standardized and easier to implement, and therefore, adding limited incremental value.

Global nominal GDP has increased from RMB 627.6 trillion in 2019 to RMB 787.9 trillion in 2024. With sustained economic growth, global nominal GDP is expected to reach RMB 981.9 trillion by 2028.

Nominal GDP, Global, 2019-2029E



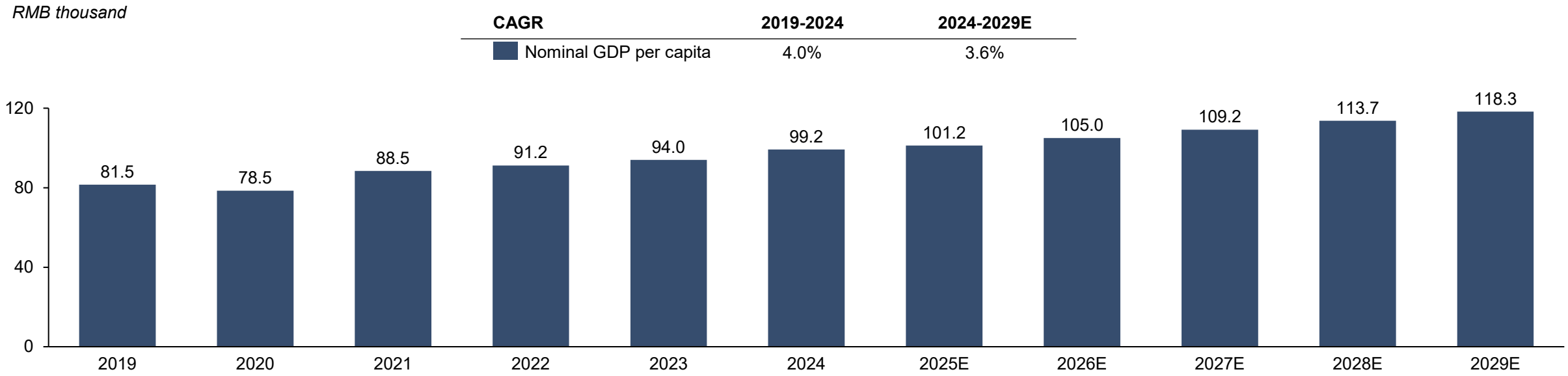
Key Analysis

- The global nominal GDP has demonstrated a steady increase from RMB 627.6 trillion in 2019 to RMB 787.9 trillion in 2024, achieving a CAGR of 4.7% over this period. Looking forward, global GDP growth is projected to continue, with an estimated CAGR of 4.5% from 2024 to 2029. By 2029, the global nominal GDP is expected to reach RMB 981.9 trillion. This upward trend reflects the sustained economic expansion across regions, driven by factors such as technological advancements, increased global trade, and economic recovery in various sectors. The following graph provides a detailed view of the historical and projected GDP figures for the specified periods.

Source: NBS, IMF, China Insights Consultancy

Global per capita nominal GDP has increased from RMB 81.5 thousand in 2019 to RMB 99.2 thousand in 2024. With continued economic growth, global per capita nominal GDP is expected to reach RMB 118.3 thousand by 2029.

Per capita nominal GDP, Global, 2019-2029E



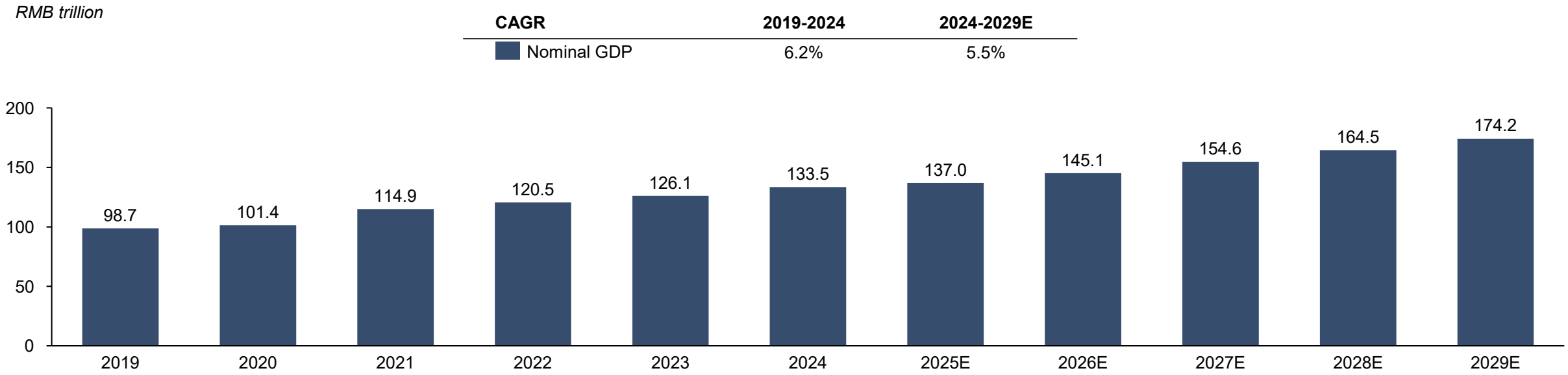
Key Analysis

- The global per capita nominal GDP has shown steady growth, increasing from RMB 81.5 thousand in 2019 to RMB 99.2 thousand in 2024, with CAGR of 4.0% over this period. Projections indicate that this growth will continue at an accelerated rate, with an estimated CAGR of 3.6% from 2024 to 2029, reaching RMB 118.3 thousand by 2029. This trend reflects improvements in average income levels globally, supported by economic expansion across various regions. The graph illustrates the historical and projected values for per capita nominal GDP, providing insights into expected growth patterns.

Source: NBS, IMF, China Insights Consultancy

China’s nominal GDP has increased from RMB98.7 trillion in 2019 to RMB133.5 trillion in 2024. With the continued development of China’s economy, China’s nominal GDP is expected to reach RMB174.2 trillion by 2029

Nominal GDP, China, 2019-2029E



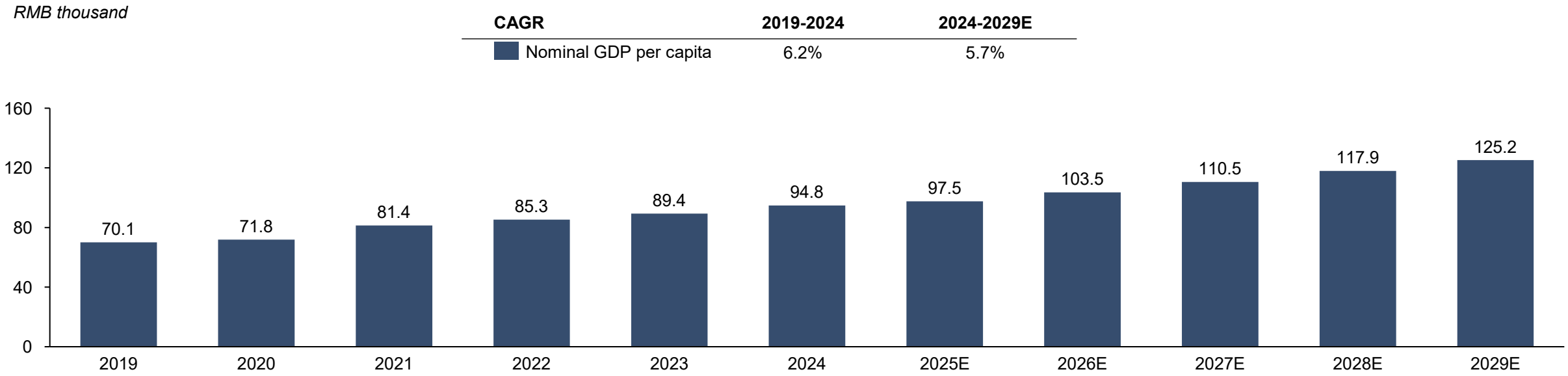
Key Analysis

- China’s economy has experienced growth over the past several years, with its nominal GDP increasing from RMB98.7 trillion in 2019 to RMB133.5 trillion in 2024. With the continued development of China’s economy, China’s nominal GDP is expected to maintain this growth momentum in the near future to reach RMB174.2 trillion by 2029.
- China’s economy is in the process of slowly transitioning from a state-led investment model to a consumption-driven model. This transition process has contributed to a partial reduction in the growth rate of the economy in recent years in order to optimize the economic structure for high-quality growth in the future.In the future, with growing domestic consumption demand and with the Chinese government continuing to adhere to its opening-up policy, China’s economy is expected to grow at a stable and sustainable pace over the long run.

Source: NBS, IMF, China Insights Consultancy

China’s per capita nominal GDP has increased from RMB70.1 thousand in 2019 to RMB94.8 thousand in 2024. In the next five years, China’s per capita nominal GDP is expected to reach RMB125.2 thousand by 2029

Per capita nominal GDP, China, 2019-2029E



Key Analysis

- China’s economy has undergone significant growth over the past years, with its per capita nominal GDP increasing from RMB70.1 thousand in 2019 to RMB94.8 thousand in 2024. Supported by growing consumption, ongoing urbanization progress, and maturity of economic restructuring, China’s per capita nominal GDP is expected to reach RMB125.2 thousand by 2029.

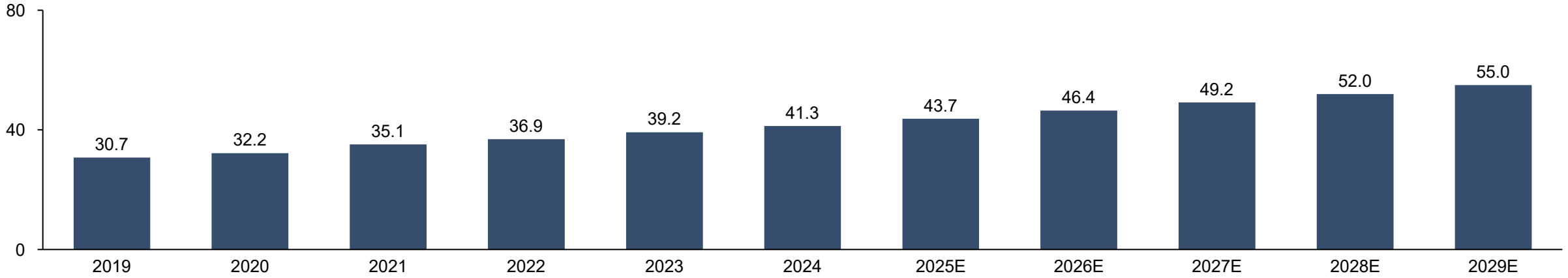
Source: NBS, IMF, China Insights Consultancy

China’s per capita disposable income has increased from RMB30.7 thousand in 2019 to RMB41.3 thousand in 2024. In the next five years, China’s per capita disposable income is expected to reach RMB55.0 thousand by 2029

Per capita nominal GDP, China, 2019-2029E

RMB thousand

CAGR	2019-2024	2024-2029E
Per capita disposable income	6.1%	5.9%



Key Analysis

- China’s per capita disposable income has shown steady growth over the past five years, increasing from RMB30.7 thousand in 2019 to RMB41.3 thousand in 2024, with a compound annual growth rate (CAGR) of 6.8%.This growth is driven by rising household earnings, government policies aimed at improving living standards, and continued economic development. Over the next five years, per capita disposable income is expected to continue growing, reaching RMB55.0 thousand by 2029, supported by ongoing urbanization, economic restructuring, and efforts to boost domestic consumption. The projected CAGR of 5.9% for 2024-2029 reflects a stable economic environment and potential for further income growth, enhancing the spending power of Chinese consumers.

Source: NBS, IMF, China Insights Consultancy

Thank you!