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ALTERNATIVE THINKING ABOUT INVESTMENTS

New China Perspectives



Welcome to the latest issue of Morgan Creek's **New China Perspectives**. This issue is comprised of research from Morgan Creek's China-based investment team together with curated articles of interest. In addition to timely political and economic news covering greater China, Morgan Creek's China team seeks to provide in-depth perspectives on investing in the technology, consumer and healthcare sectors in the region. Our research leverages the "on the ground" insights of our team together with

Morgan Creek's decades-long experience in covering the region. To learn more about our team and investment offerings, please email chinateam@morgancreekcip.com.

Best Regards,

Handwritten signature of Mark W. Yusko in black ink.

Mark W. Yusko
CEO & CIO

NOTES FROM THE BUND¹

This is the second installment of a five-part series exploring China's dual circulation model. The prior newsletter introduced the overall mechanism of the model. In this newsletter, we will dive deeper into China's endeavors in supply chain safety through the lens of energy transformation for renewables and minimizing the technological gap with advanced nations.

China is a leader in global trade, contributing over 60%² of the total global imports. Globalization in supply chains once underpinned China's rapid export-led growth, but also shifted its import structure to be highly concentrated in integrated circuits ("IC"s) and oil, at 16% and 10% of total imports respectively.³ A shift to the 'dual circulation' growth strategy now urges the country to look for supply chain safety. Energy transformation and technological independence now have become two key strategic pillars for future sustainable growth.

Energy Transformation

Energy transformation involves renewable energy generation, storage and consumption. As the No.1 oil importer globally, China's efforts in energy transformation traces back to 2000, when it devoted itself to developing photovoltaic ("PV")⁴ technology. China invested billions of RMB⁵ to insert itself into the center of the global PV supply chain. Today it controls roughly 80%⁶ of the value chain, from polysilicon materials to solar modules, and provides 40%⁷ of solar panel installments worldwide. In 2019, China achieved grid parity at a national level. Two years later in 2021⁸, China saw its crude oil imports drop for the first time in the past two decades. In 2022⁹, China's percentage of clean energy in electrical generation increased to 31.9%, compared to 26.3% in 2015. China continues to invest heavily in the space and accounted for nearly half of the global investments in clean energy in 2022.¹⁰ This is further shown as Chinese companies are one of the leaders in the innovation to create more accessibility to renewable energy.

China's newly installed energy storage capacity has grown at a 5-year compound annual growth rate of 57% and has helped reduce energy wastage from 10% to 2% in solar power and from 17% to 3% in wind. China now also shows impressive competitiveness in the field of electrochemical energy storage, which is mostly represented by lithium-ion batteries.

On the consumption side, the transition to electric vehicles (“EVs”) has also paid off. Continuous subsidies, including the removal of license plate quotas and cash rewards for owners that replace ICE¹¹ cars with EVs¹², have made China the world's largest EV-consuming market. The wide adoption of EVs by the world's largest population has enabled both rapid product iteration and economies of scale in production. China's EV export volume has grown at an unprecedented speed, 190% YoY in 2022, and has outpaced Germany to become the world's second largest vehicle exporter.¹³ China's determination in encouraging EV sales continues. The recent National People's Congress proposed further guidelines (i.e. China VII Standard) to reduce diesel emissions. The standard sets baselines for vehicle emissions on CO, HC, NMHC, NOx, PM, NH3 and smoke.¹⁴ The country has become more and more aggressive in introducing a tighter baseline for each standard released. It used to take an average of 3.5 years to execute the next-level rules and it the taking only 2 years per level.¹⁵ The current China VI b Standard has already been one of the most restricted standards to date. This is another sign of support for EV adoption in the nation by further exacerbating pressure on gasoline automakers.

A microcosm of successful domestic circulation has already started to form in this specific area.

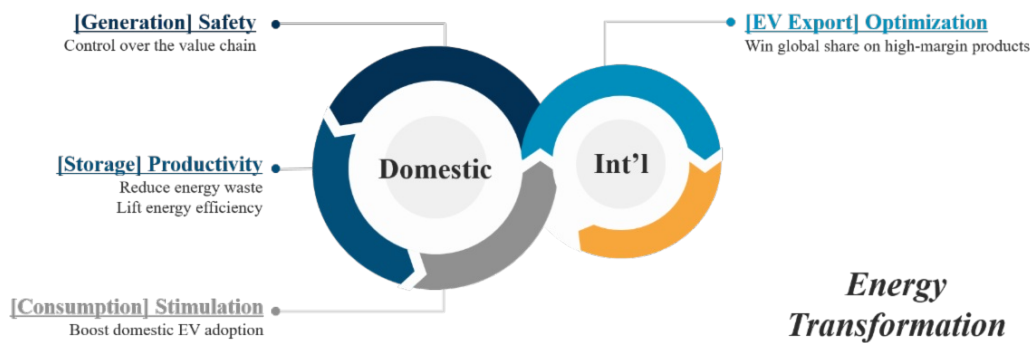


Figure 1: China's example of domestic circulation in energy transformation

Technological gap minimization

To adapt to the fast-changing demands of the global consumer market, China adopted an ‘import, localize’ approach to technology, which is utilized to manufacture and assemble products for export. However, this now plays as a double-edged sword, leaving the second largest economy with a vacuum of indigenous technology at home. The high-level of dependence was brought to the government's attention as early as 2015 when the “Made in China” policy launched. The back-end IC market of both manufacturing and fabless design has doubled since then.¹⁶ While some progress has been made, the road to self-sufficiency remains long. As illustrated in the diagram below, China's global market share throughout the semiconductor supply chain remains weak. China only accounts for 1% of global higher-end microprocessors.¹⁷

| Design | | Manufacture | | | Manufacturing Inputs | |
|--------|-----------|-------------|-----|------|----------------------|-----------|
| EDA | IC Design | Foundry | IDM | OAST | Equipment | Materials |
| <15% | <5% | <15% | <5% | 20% | <15% | <15% |

Figure 2: China's market share of the global semiconductor supply chain¹⁸

Recent geopolitical conflict among major economies has fostered an accelerated trend toward self-sufficiency in this critical, \$700 billion¹⁹ market.

Current platform technology has reached a ceiling, giving China some respite. Moore's law was once the foundation for the rapid rise of integrated circuits, and stated that the number of transistors

on a microchip doubles approximately every two years. However, due to physical limitations, further improvement has become marginal. As a result, the growth of processor performance has slowed from 52% a year between 1986 and 2003, to 23% a year between 2003 and 2011, to less than 4% between 2015 and 2018.²⁰ This allows additional time for China to catch up on chip design and foundry where it remains far behind. Recently, attempts to further push chip performance have focused on other areas, including new materials and outsourced semiconductor assembly and test, and in these areas, China is at relatively the same technological starting point as its peers.

China's recent record of accomplishment in semiconductors has been robust. Within only three years, the country has witnessed noticeable progress across the semiconductor value chain, with the aim to realize the national target of 70% self-sufficiency by 2025.²¹

























| Sectors | Self-Sufficiency Rate | | Representative Company |
|-------------|--|--|---|
| | 2018 | 2021 | |
| FPGA |  0% |  10% |  |
| Analog |  <1% |  15% |  |
| Power |  5% |  20-30% |  |
| Equipment |  0.4% |  10-15% |  |
| Materials |  16% |  20% |  |
| Fabrication |  10% |  20-30% |  |
| OSAT |  30% |  40% |  |
| EDA |  1% |  10% |  |

Figure 3: China's self-sufficiency rate in several sectors²²

Despite SMIC, China's largest foundry, suffering external supply interruptions since 2020, it has managed to ramp up its production to 28nm²³ chips and posted record revenue²⁴ in 2022. The company has also achieved mass production in 14nm chips in 2022, at a rate of 35,000 pieces of 14-nm wafers per month.²⁵ This production allows China to realize self-sufficiency in lower-end 3C²⁶ products and home appliances, which account for approximately 26%²⁷ of China's total exports. In addition, China has been chasing innovation. JECT Group, for example, has risen to the global No. 4 spot with 11% of the market share on the back of its new, advanced packaging technology²⁸, which enables higher performance for the same process nodes in one single package. This could potentially mitigate China's current lack of higher-end node manufacturing.

Economics prevails over the long term

China's demand for integrated circuits is expected to reach \$223 billion (28% of global demand) by 2025, remaining the single largest semiconductor market in the world.²⁹ This demand is driven by the massive downstream applications for chips in China in particular the manufacturing of consumer electronics and automotive. China continues to remain attractive to most suppliers. Sixty-three percent of Qualcomm's revenue³⁰ is in China. The company is the global leader in networking and communication chips and was one of the earliest prohibited from selling its 5G chipset to Huawei, who has been placed on the US's Restricted Trade Entity list since 2019. However, in Feb'23, Qualcomm announced partnerships on its newly developed satellite communication technology, embedded in its 5G modem-RF system, with three major Chinese smartphone makers, including Honor (a Huawei cellphone manufacturer spin-off), Oppo and Xiaomi. In another example, NVIDIA, the world's largest GPU³¹ designer, witnessed its China revenue jump 82% YoY in 2022.³² NVIDIA was asked to halt sales of its two top computing chips (generally used in supercomputers, AI and high-performing data centers) to China in Aug'22 but within two months, unveiled a tailored GPU product specifically for Chinese customers.

In the end, owing to increasing uncertainty due to technological decoupling, domestic vendors now actively employ, and even co-develop, homegrown chips as a hedge. Specifically, China's leading AI chip-making companies have been heavily focusing on ASICs³³, a type of chip that is being designed for a specific task, rather than GPUs, which are designed for various applications. This is because custom chips fit each customer's immediate need, support rapid iteration, and are relatively easier to produce and design. This, however, comes at a cost of omitting functions that could support use that is more comprehensive. Chinese chipmakers are leveraging the scale of the domestic market and the opportunity presented by a decoupling market to move up the technological ladder.

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CHINA NEWS SPOTLIGHT

China and Brazil Reset Ties with Tech, Environment Accords, Agree on Ukraine: Brazil reset its diplomatic ties with China, its largest trading partner, with a state visit on Friday where they agreed to boost investments and cooperation on technology and sustainable development, while urging peace talks in Ukraine. Brazilian President Luiz Inacio Lula da Silva and several of his ministers signed the accords with President Xi Jinping and other Chinese officials in Beijing. [Read More.](#)

Oil Steady as Market Awaits China GDP Data: Oil prices turned lower on Monday as the U.S. dollar strengthened and as investors mulled over a possible May interest rate hike by the U.S. Federal Reserve, which could dampen economic recovery hopes. Brent crude futures fell \$1.55, or 1.8%, to settle at \$84.76 a barrel, while U.S. West Texas Intermediate crude dropped \$1.69, or 2.1%, at \$80.83 a barrel. [Read More.](#)

Chinese Ride-hailing Giant DiDi Developing Own Driverless Taxis, Plans to Roll Them out in 2025: DiDi Global on Thursday said it is developing its own self-driving taxis alongside Chinese carmakers and it plans to roll them out in 2025 on its ride-hailing service. The Chinese giant's autonomous driving unit also showed off a concept robotaxi, or driverless taxi, called the DiDi Neuron. It includes a robotic arm in the back that can pick up luggage or wake passengers up if they've fallen asleep. [Read More.](#)

XPeng Presents New EV Architecture that will Debut in G6 SUV: Chinese electric vehicle manufacturer XPeng Motors revealed its latest EV architecture on April 16. The company aims to achieve a balance between cost, efficiency, experience, and globalization with the new SEPA 2.0 platform that will reduce XPeng's future development cycle for new vehicles by 20% and enable up to 80% interchangeability of common components across different models. [Read More.](#)

CATL's Sodium-ion Batteries to be used in Chery Vehicles: On April 16, CATL, a prominent battery company, announced that Chery vehicles will be equipped with its sodium-ion batteries. Additionally, the state-owned automobile manufacturer and CATL will collaborate to launch a new battery brand named "ENER-Q". This partnership aims to develop various types of batteries including sodium-ion batteries, lithium iron phosphate batteries, M3P batteries and more. [Read More.](#)

J&J, Legend tap Novartis to help make CAR-T drug Carvykti as they Work Through Supply Constraints: Struggling to meet demand for CAR-T med Caryvkti, Johnson & Johnson and Legend Biotech have reached out to another cell therapy expert for help manufacturing their multiple myeloma treatment. Novartis has signed a three-year contract to manufacture Carvykti, also known as cilta-cel, Legend said in a securities filing Friday. In a statement to Fierce Pharma, Novartis confirmed that it will supply Caryvkti from its cell therapy site in Morris Plains, New Jersey, which is about 20 miles from J&J and Legend's CAR-T facility in Raritan, New Jersey. [Read More.](#)

Biosyngen Received China NMPA IND Approval for its T-cell Redirection Therapy Targeting EBV-positive Lymphoma: Biosyngen Pte Ltd (hereinafter as "Biosyngen") was granted IND approval by China NMPA for the company's first-in-class T-cell redirection therapy, it is an

autologous T cell therapy for EBV-positive lymphoma. The principle of autologous T cell therapy is to genetically modify patients' own T cells to express additional receptors for Epstein-Barr virus (EBV) antigen recognition and T cell activation upon EBV+ tumor cell engagement, targeting cancer indications. [Read More.](#)

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¹ The Bund is a historic waterfront area in central Shanghai, where Morgan Creek’s office is located. From the 1860s to the 1930s, it was the rich and powerful center of the foreign establishment in Shanghai, operating as a legally protected treaty port. The picture above is part of the historical waterfront.

² Source: World Bank

³ Source: TrendEconomy

⁴ Note: For more details, please refer to China’s corporate debt series.

⁵ Source: International Energy Agency (IEA)

⁶ Source: China Photovoltaic Industry Association (CPIA)

⁷ Source: International Renewable Energy Agent (IRENA)

⁸ Source: China’s oil dependence on imports sees drop; <https://english.www.gov.cn/>; Feb 24th, 2022

⁹ Source: Ember data

¹⁰ Source: China Invests \$546 Billion in Clean Energy, Far Surpassing the U.S. <https://www.scientificamerican.com/>; Jan 30th, 2023

¹¹ Note: ICE stands for Internal combustion engine

¹² Note: China’s Provinces Offer EV Sweeteners as National Subsidies Fade <https://www.bloomberg.com/>; Mar 7th, 2023

¹³ Source: The export of new energy vehicles increased by 190% year-on-year, and the automobile industry ushered in new opportunities for development; <http://www.cinic.org.cn/>; Mar 15th, 2023

¹⁴ Note: CO stands for carbon monoxide, HC stands for hydrocarbon, NMHC stands for non-methane hydrocarbons, NOx stands for nitrogen oxides, PM stands for particulate matter, NH3 stands for ammonia

¹⁵ Source: <https://dieselnet.com/standards/cn/ld.php>

¹⁶ Source: Lagging but motivated: The state of China’s semiconductor industry <https://www.brookings.edu/>; Jan 7th, 2021

¹⁷ Notes: Wafer manufacturing at 10nm and below for Foundry and IDM as of 2021; Source: Massive Fab Expansion to Change Geographical Mix of Supply; <https://www.counterpointresearch.com/>; May 13th, 2021

¹⁸ Source: China Semiconductor Industry Association (CSIA); EDA stands for Electronic design automation. IDM stands for Integrated device manufacturer.

¹⁹ Notes: By 2025; Source: WT microelectronics

²⁰ Source: Tech Progress Is Slowing Down; <https://www.wsj.com/>; Feb 16th, 2023

²¹ Source: China Semiconductor Industry Association (CSIA)

²² Source: ACHI 2022 AGM material

²³ Note: As the node gets smaller, the chip enables more feature-rich and less power-hungry devices.

²⁴ Note: Revenue increase 34% YoY.

²⁵ Source: SMIC spending \$9 bn to build China’s most-advanced wafer plant <https://www.asiafinancial.com/>; Feb 9th, 2021

²⁶ Note: 3C products mean computer, communication and consumer electronic products

²⁷ Source: TrendEconomy

²⁸ Note: The new technology is called system-in-package (SiP), SiP is a form of advanced packaging to accommodate more I/Os in finer pitches that allow higher performance; Source: SiPs: the best things in small packages; <https://www.volegroup.com/>; Oct 28th, 2022

²⁹ Source: IC insight; May 2022

³⁰ Note: As of 2022. Source: QCOM 2022 10-K

³¹ Note: GPU stands for graphics processing unit

³² Note: As of 2022. Source: NVDA 2022 10-K

³³ Note: ASIC stands for Application-specific integrated circuit

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