China in Transition

China's capacity - the imbalance, the inflections, and beyond cycles

A year ago our China team deconstructed China's supply chain amidst unprecedented changes to the outlook, to build a picture of resilience, opportunity and vulnerability. A year on and a year worse, we sample seven significant global manufacturing industries representing 22% of China's GDP growth. In five sectors, these industries have built more capacity than the entire global demand pool — imbalances that have left more than 50% of capacity running at zero or negative cash margins. As China's transition continues, we ask how cyclical are these imbalances, how much further can they go and how might we gauge inflection points ahead.

We conclude that Chinese manufacturers are responding to poor profitability and uncertainties around limitations to market access to the US and EU, pre-emptively adjusting the pace of future additions of capacity, in contrast to consensus narratives. We expect a rebalancing in supply versus demand, a restoration in profit, and sharp deceleration of Chinese supply to the world through 2028.

Our "Rule of Three" and "tipping point" frameworks suggest that: (1) solar and lithium batteries are the closest to reaching an inflection point in their supply/demand imbalances, with negative cash margins and reductions in Capex plans set against still solid demand growth; (2) electric vehicles and power semis are furthest from an inflection point, driven by both their balance sheets and profitability positioning; and (3) tipping points may be altered by supply side reforms, competitive industry structures, capacity expansion ex-China as well as demand destruction, if faced with a global economic slowdown.

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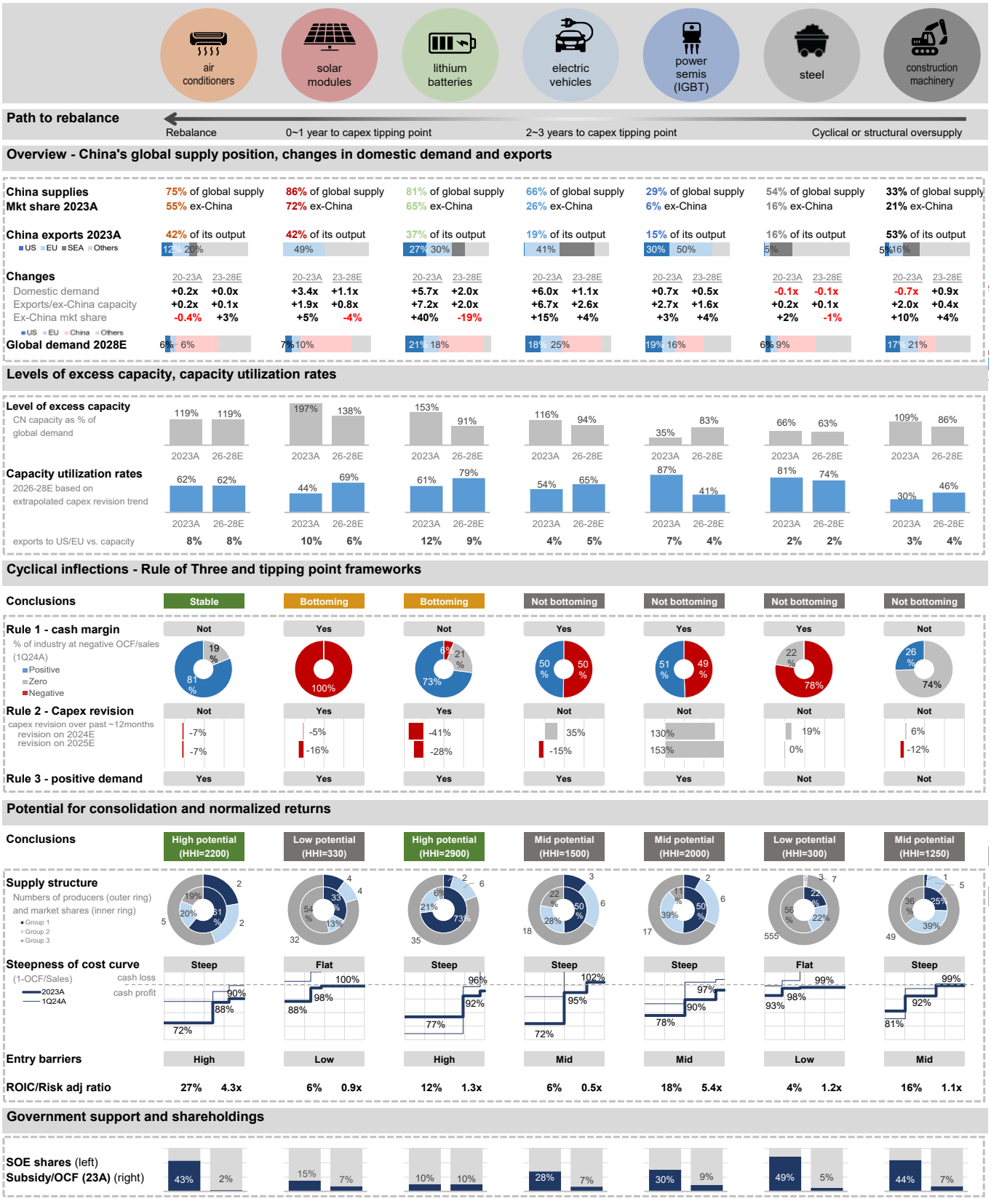
Exhibit 1: Sectors in one chart - global supply chain positions, supply/demand balances, cyclical inflections, and supply consolidation



Source: Company data, Goldman Sachs Global Investment Research

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Executive summary

Why we are writing this report

Surplus capacity in various sectors in China has been at the center of many debates in the context of intensifying tensions in global trade and other geopolitical issues, as well as the deep level of imbalances that have been breached. For example, in 1Q24A, Chinese capacity in solar modules and lithium batteries reached 150-200% of the global demand pool, while more than 50% of industry supply in solar, electric vehicles, steel, and construction machinery generated zero or negative cash margins. In this report, we focus on forward-looking factors that will lead to potential cyclical turns ahead. We believe the turn of the cycle, or changes in imbalances, rather than absolute excess supply, will predominantly drive both the path of industry pricing and margins, and the direction of travel of Chinese exports.

Cash margins drive the Capex cycle, and a potential rebalance of supply vs. demand

We conclude that Chinese manufacturers are responding to poor profitability and uncertainties around limitations to market access to the US and EU, pre-emptively adjusting the pace of future additions of capacity, in contrast to consensus narratives. We expect a rebalancing in supply versus demand, and a restoration in profit through 2028 - for early inflecting sectors we expect higher capacity utilization (from 54-55% to 69-79%) and expanding unit cash profit (from -Rmb0.04 to Rmb0.11/w for solar, and Rmb122 to Rmb137/kWh for batteries) over the period.

Ex-China market share of Chinese supply will decline or decelerate

As a result, the expanding share of Chinese supply to the world (i.e., the ex-China market), will decelerate sharply or decline in most sectors, including notable inflections taking place in new energy sectors. Specifically, we expect the market shares of Chinese supply, in terms of both Chinese exports and potential output from more ex-China capacity developed by Chinese producers, will become stagnant on average across our sample sectors, versus a 10% increase in 2020A-23A. Despite a much decelerated growth outlook, the trade-off between lower volumes and potentially higher pricing may still be enough to support a reasonably better outcome in terms of the contributions of these sectors to China's GDP/economy.

Which sectors are likely to rebalance first

On a sector level, we expect positive cyclical risks (of improving S/D balance) for solar modules and lithium batteries, but persistent/rising negative cyclical risks (of excess capacity) in electric vehicles and power semis (IGBT). We expect steel and construction machinery to remain in structural excess supply, and air conditioners to remain in balance. Despite non-market driven factors, we expect capital investments will no longer be supported imminently for solar modules and lithium batteries, but think it may take 2-3 years for power semis and electric vehicles to change course.

What makes our work different

What makes our work different: We believe basic economics, including cash margins and the Capex cycle, are dominant forces driving industry cycles in China. We utilize industry Capex revision trends, rather than absolute capital spending, to reflect incremental supply responses to market conditions, and gauge capacity expansion trends beyond 2024-25E. Our proprietary analysis utilizing (1) The "Rule of Three"; and (2) tipping points define the bottom of a cycle, and quantify the limitation of non-market driven supporting factors on capacity expansion in a downcycle.

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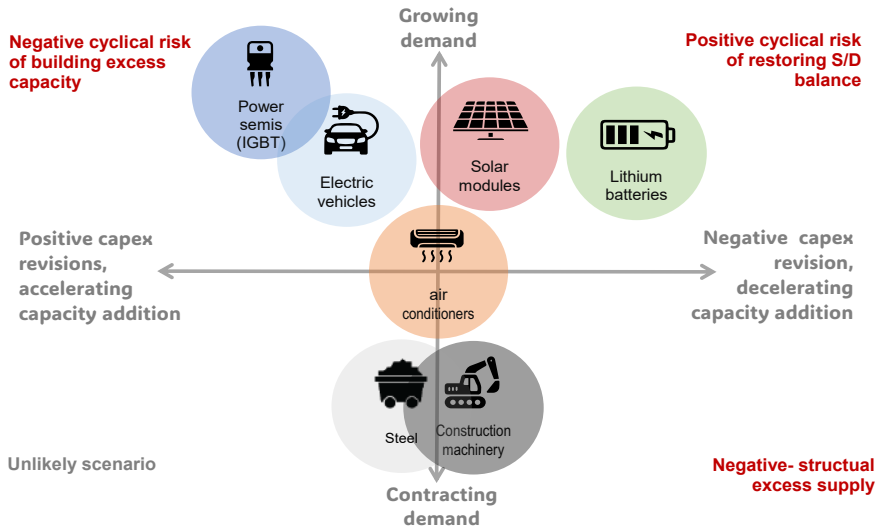
We selected seven sample sectors for our analysis as they represent a wide range of Chinese manufacturing sectors, all with excess capacity in the past or at present, and they reflect the growing presence of Chinese supply in the global market. On an aggregate basis, in 2023A these seven sectors contributed 6.6% of China's GDP and 21.9% of GDP growth, and they held an average 37% market share in the ex-China market for their respective products (versus 27% in 2020A).

Exhibit 2: Cyclical and structural risks of supply/demand imbalances - the outlook for seven select sectors in China



Source: Goldman Sachs Global Investment Research

The current imbalance - in a global context

Is there overcapacity in these sectors? Yes, in our view, based on numbers of indicators. As of 2023A, we estimate that Chinese capacity in five of these seven sectors is higher than the entire global demand pool for their respective products. In particular, Chinese solar modules capacity is equivalent to 200% of global demand, while lithium batteries equates to 150%. Capacity utilization rates of the seven sectors ranged from 30-87% as of 2023A, versus 41-95% in 2020-21A. Prices of respective products have declined by 10-55% (for most sectors) vs. early 2023, as a result of worsening supply and demand imbalances.

Potential inflections - cash margins and the Capex cycle

In 1Q24, more than 50% of industry supply generated zero or negative cash margins (in most of our sample sectors). There were notable revisions in producers' 2024-25E Capex plans - for example, an average cut of 28-41% for lithium batteries, but an upward revision of over 100% for power semis (IGBT), and mixed for electric vehicles.

Changing fundamentals are reshaping potential inflection points, both positively and negatively, taking industry capacity utilization rates to very different places versus where

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they are today. Extrapolating from Capex revision trends over the past 12 months to a potential capacity outlook in 2026-28E (a simplified scenario versus GSe base cases), we see capacity utilization rates potentially improving for solar modules and lithium batteries (from 54-55% to 69-79%). On the other hand, accelerating Capex in power semis (IGBT) and the mixed trend in electric vehicles suggest a deteriorating capacity utilization rate (from 78% to 41%), and poor visibility on any improvement, respectively.

We estimate the time to the tipping point (i.e., when Capex revisions become inevitable) as when both profitability and balance sheets fail to support access to capital and expansion. This looks imminent for solar modules and lithium batteries, but it could take 2-3 years before the course changes for electric vehicles and power semis.

Reasons behind the imbalances - large scale demand growth

The common factor in sectors that have experienced excess capacity has been the unique path of Chinese demand growth over the past few decades. Rather than cyclical swings, Chinese demand typically moves from a low base, then increases at an astonishing scale and pace - making it extremely challenging to estimate a potential market size, especially at the beginning of a cycle. Combined with a rapid supply response, the risk of imbalances in capacity and demand, on a large scale, is therefore elevated by nature.

Government support for both supply and demand can be meaningful and can exacerbate the mismatch between capacity and demand. However, we do not consider this to be a defining element that alters the basics of economics on a sustainable basis. As of 2023A, we estimate the average government subsidy/rebate accounted for only 2-10% of EBITDA (or operating cash flow).

Beyond cycles - it is about the strength of top players and entry barriers

Beyond the cycle, our assessment of industry structures and cost curves yield opportunities to invest in sectors with strong returns. We like sectors with: (1) a strong market position of top tier producers (in both market share and cost advantage); and (2) higher entry barriers that protect the state of consolidation.

Stock picks

We highlight 11 stocks that provide exposure to both cyclical inflections and/or structural stability. Please see our summary at the back of this report and refer to the below links for a detailed analysis.

China solar sector - closer to inflection

China electric vehicle sector - no turn yet

China lithium battery sector - inflection on the horizon

China power semis sector - heating up

China air conditioner sector -staying cool

China construction machinery sector - structural supply surplus here to stay

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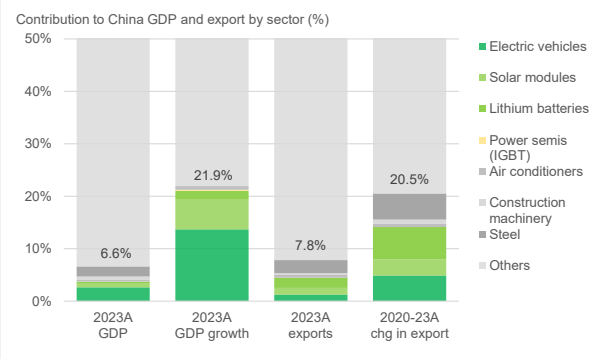
Defining excess capacity

In this report, we assess the degree of excess capacity by analyzing seven sectors: 1) solar modules, 2) electric vehicles, 3) lithium batteries, 4) power semis (IGBT chip sets[1]), 5) construction machinery, 6) air conditioners, and 7) steel.

For a more complete picture of China's self-sufficiency by industry, please refer to our August 2023 report China in Transition: At the crossroads of the supply chain.

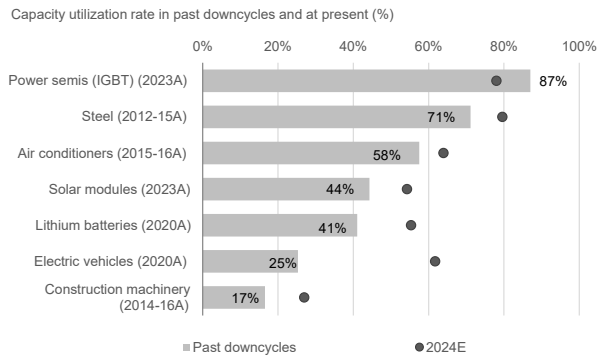
Our seven sample sectors

Exhibit 3: The contribution of our seven sample sectors to China GDP and exports - more than 20% for both GDP growth and change in exports



Source: NBS, China Customs, Wind, Goldman Sachs Global Investment Research

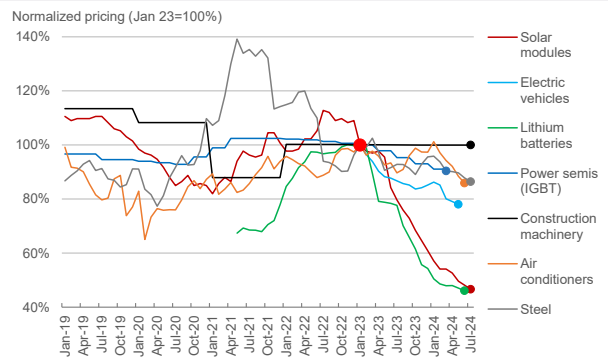
Exhibit 4: Capacity utilization rates in prior downcycles and at present (%) - not at the worst points, but still of deep concern



* IGBT data only started in 2019A with utilization ranging from 87%-98%

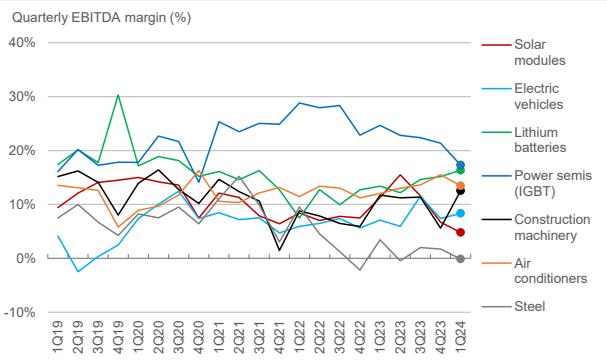
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 5: Domestic pricing for key products declined 10-55% vs. early 2023



Source: Wind, CEIC, Company data, Goldman Sachs Global Investment Research

Exhibit 6: Quarterly EBITDA margin (%, weighted industry average) - softened EBITDA margin in general, implies more profit contraction if combined with price decline



Source: Company data, Goldman Sachs Global Investment Research

[1] IGBT - insulated gate bipolar transistors, power semiconductor devices serving as electronic switches in power electronics applications.

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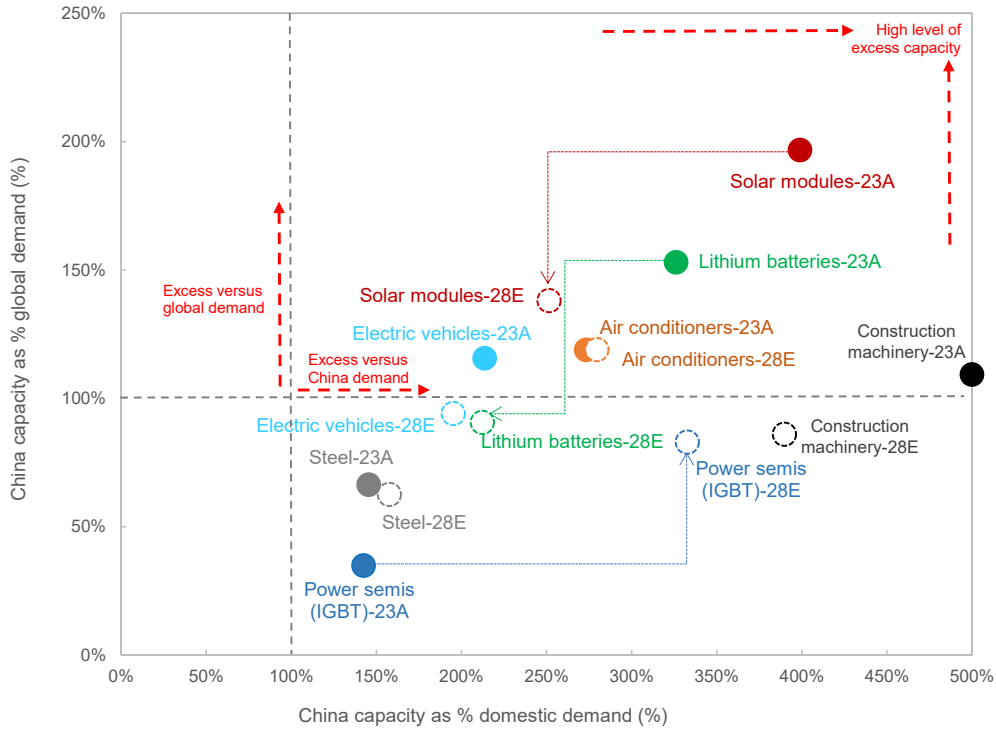
Is there overcapacity? Yes, in a global context

The textbook definition of excess capacity in an industry refers to non-utilized capacity that exceeds demand. Debates around the degree of overcapacity in China usually differ with respect to domestic demand, global demand, incremental exports, and/or the future demand outlook.

Is there overcapacity? Yes, on several indicators. We estimate that five out of our seven sample sectors have capacity that exceeds global demand by 10-100%. In particular, Chinese capacity of solar modules and lithium batteries is equivalent to 200% and 150% of the global demand pool, respectively - a higher level of excess capacity than other sectors. The best reflection on the balance of capacity versus demand is industry capacity utilization rate, defined as output as % of capacity. Five out of our seven sectors had capacity utilization of 30-60% in 2023A, well below 80% typically needed for a balanced market in capital intensive sectors.

Exhibit 7: Excess Chinese capacity in the context of global and China domestic demand (2023A and 2026-28E) - solar modules and lithium batteries are in high level of excess capacity at present



*2026-28E capacity is extrapolated based on Capex revisions over the past ~12 months

Source: Company data, Goldman Sachs Global Investment Research

Rise of exports, thus trade tension

From 2020-2023A, Chinese exports for five of the seven sectors increased by 190-720% (based on volume). Through direct exports, or indirectly in the form of finished goods, the market share of Chinese lithium battery exports increased by 40% in the ex-China market, 15% for electric vehicles, 5% for solar modules, and 3% for power semis (IGBT, combined with domestic substitution that is equivalent to 11% of the ex-China market),

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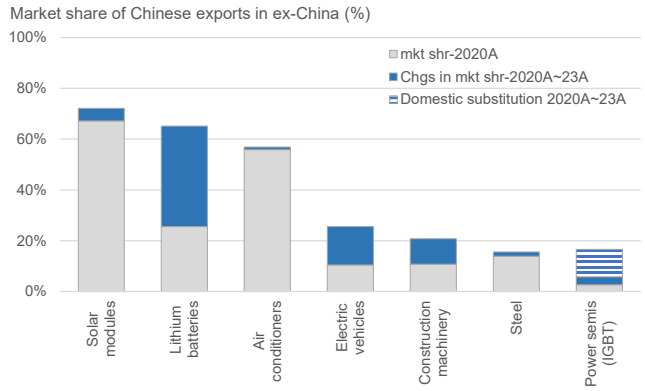
and 2-10% for construction machinery and steel.

The rise in Chinese exports is not necessarily the result of excess capacity. However, expanding excess capacity and worsening capacity utilization can still spill over its impact through higher exports and pricing pressure. Changes in market share, rather than the absolute market share, can be more sensitive in some regions if those exports impact sectors that are strategically important to local manufacturers and employment - we see higher tension in global trade, as evidenced by the recent changes in tariff and duties, and trade investigations and probes against Chinese exports for selected products. One example to the contrary is Chinese air conditioners - while maintaining a prevailing ex-China market share of 55% (~70% if based on unit sales), exports have not been subject to the same degree of push back in global trade, which we believe is due to the absence of large changes in its global market share.

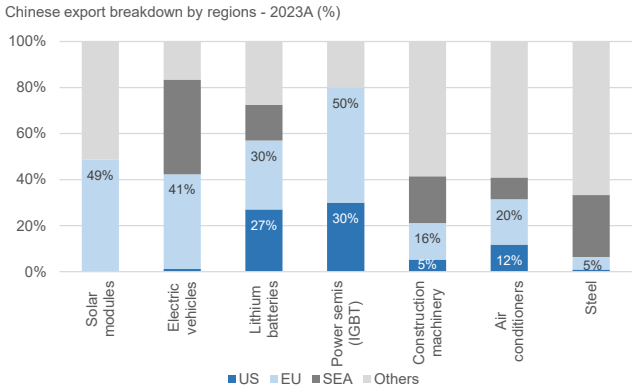
We estimate 40-60% of Chinese exports were designated for the US and EU in 2023A for solar modules, lithium batteries and electric vehicles sectors, where there is relatively higher uncertainty in continued market access.

Exhibit 8: Relative change in ex-China market share (for Chinese exports) - most key products hold a more dominant market share versus three years ago



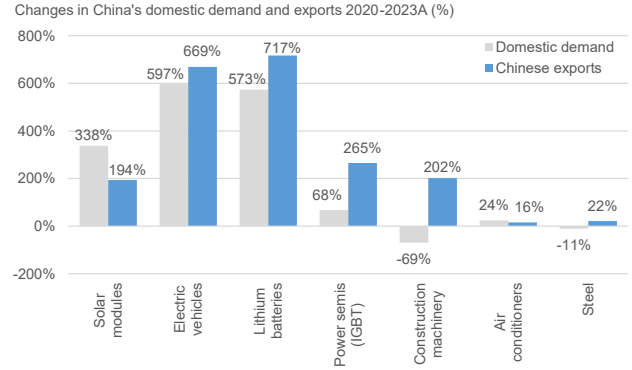
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 9: Chinese export breakdown by region - nearly half of Chinese exports of new energy sectors go to the US and EU



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 10: Changes in China's domestic demand and exports (2020-2023A; volumes) - strong exports and strong domestic demand



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 11: Current tariffs on selected Chinese products and recent changes imply more intensified trade tensions

Sector	Year	Export limitations/tariffs on Chinese imports
Solar modules	2024	Section 301: 10% tariff imposed by the US on a suite of PV products in 2018, revised up to 25% in 2019 and 50% in 2024.
Electric vehicles	2024	In May 24, the US announced an increase tariffs on EVs imported from China to 100% (from 25%), effective Aug24.
	2024	In Jun 24, the EU announced an increase tariffs on battery EVs imported from China (to 27.4%-48.1% from 10%) provisionally in Jul24; a final decision will be made in Nov24).
Lithium batteries	2024	In May 24 the US announced an increase in tariffs on imports of batteries and battery-related products from China (to 25% from 0-7.5%) in 2024-26.
Power semis (IGBT)	2024	In 2024, the US announced an increase in tariffs on semiconductors to 50% from 25% by 2025.
Construction machinery	2018-19	The US raised tariffs on construction machinery (excavators, concrete pumps, loaders and road machinery) to 25% from 10%.
Air conditioners	2018	In 2018, the US increased tariffs on split air conditioners imported from China to 25% from 2%.
Steel	2024	In 2024 the US increased tariffs on steel products imported from China to 25% from 0-7.5%. Vietnam is also discussing tariff hikes.

Source: Company data, Goldman Sachs Global Investment Research

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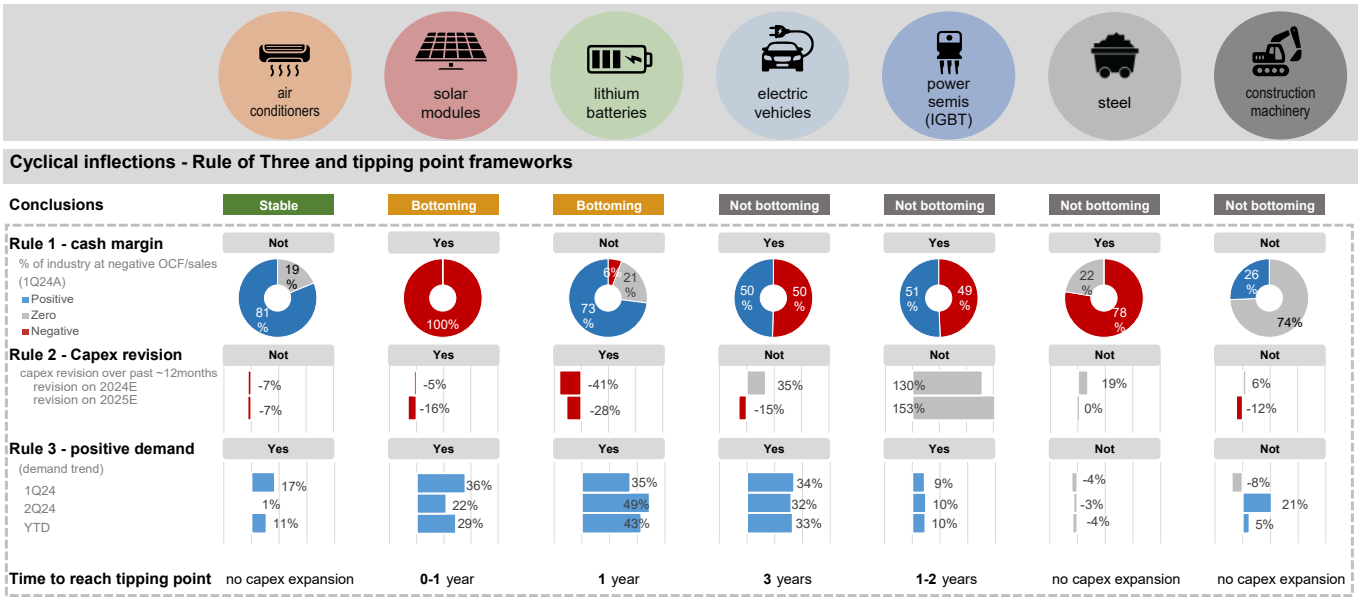
Cyclical inflections and structural traps

Most cases of excess supply are cyclical, in our view. We focus our work, including the "Rule of Three" and tipping point analysis, on industry trends of capacity additions, using profitability, Capex revisions, demand trends, as well as cash flow generation and balance sheet strength depletion, to gauge the inflection of capital investment for capacity additions, which provides a forward-looking picture on potential changes to imbalances and capacity utilization rates.

Exhibit 12: Using our Rule of Three and tipping point analysis to define the cyclical bottom and timing - solar modules and lithium batteries would be the first two sectors to inflect



Source: Company data, Goldman Sachs Global Investment Research

"Rule of Three" - to define the industry bottom

The below is quoted from Taking a pure cyclical approach by Jim Covello (Goldman Sachs global head of equity research and former long-time semiconductor equipment analyst) and Avi Nash (former Goldman Sachs chemicals analyst).

1. Are the majority of companies in the industry at or near breakeven EBITDA? Rule One asks whether or not the cash flows of the majority of companies in an industry have deteriorated to the point at which companies are no longer able to add any new capacity and/or have begun to take capacity off-line.

2. Has the industry reached "hara-kiri" stage? The point of Rule 2 is that industry executives must "throw in" the proverbial towel and give up anticipating when an industry is going to hit a cyclical upturn. Only after industry managements capitulate are supply/demand dynamics likely to come back into balance.

3. Is there a glimmer of hope for an upturn? An industry can stay at a cyclical bottom for some time. Rule Three helps us identify whether business conditions have started to improve and thus whether or not a cyclical upturn is imminent.

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Definition of groups

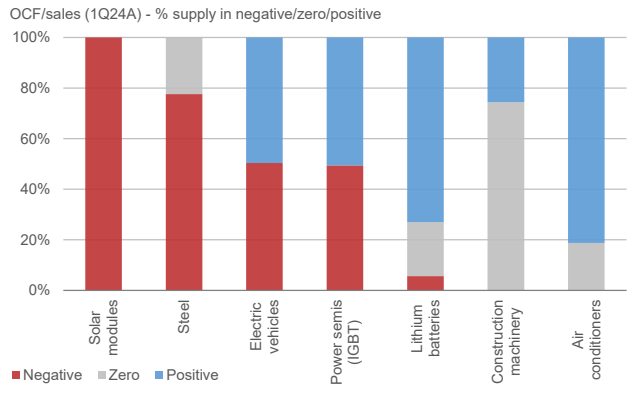
We categorize industry supply into three groups — 1, 2 and 3, representing producers with the lowest, average, and highest cash cost positions, with the total summing to 100% of the industry. Group 1 includes a limited numbers of top industry players, typically with lower cash costs and more meaningful market share. Groups 2 and 3 are divided based on cash costs, each with representative market shares. The total number of producers in each sector ranges from 9 to over 500. We analyze a selected sample of companies in each group to represent the overall performance of similar suppliers.

Using the "Rule of Three" to search for a cyclical inflection

The "Rule of Three" framework, a legacy of the Goldman Sachs US research team, helps the search for a cyclical bottom (but is also useful to assess the risk of a cyclical correction). The analysis centers on industry profitability, management expectations and Capex plans, and demand inflection.

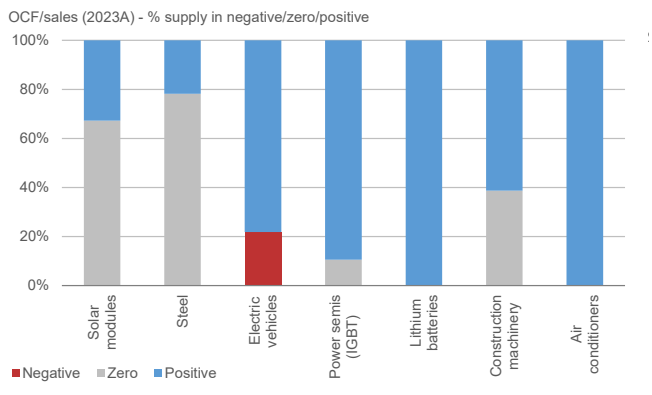
Rule Number 1: Are the majority of companies in the industry at or near breakeven EBITDA? We use the most recent OCF/sales as an indicator. As of 1Q24A, five out of our seven sample sectors saw 50-100% of their supply generate either zero or negative operating cash flow, a significant deterioration from 2023A (when only two out of the seven were in the same position). Solar and steel were the most negative sectors in 1Q24A, while air conditioners had the highest profitability.

Exhibit 13: Snapshot of industry cash profits (OCF/sales); in 1Q24A most sectors had more than 50% of supply generate negative cash margins



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 14: Snapshot of industry cash profits (OCF/sales); in 2023A most producers were in positive cash margins a year ago



Source: Company data, Goldman Sachs Global Investment Research

Rule Number 2: Has the industry reached the "hara-kiri" stage? We use the trend of Capex revisions as a better indicator of incremental changes in supply responses to market conditions. The second derivative of the Capex trend captures producers' plan in terms of adding or canceling expansion projects, versus changes in capital spending yoy.

Lithium batteries had the most negative Capex revisions in the past year, with current 2024 and 2025E Capex plans 41% and 28% lower than what was planned a year ago, mostly driven by Group 2-3 producers (i.e., non-top producers) as margins deteriorated. On the other hand, power semis (IGBT) saw the most robust upward revisions over the past year with current 2024E and 2025E Capex more than 100% higher than a year ago, reflecting accelerating plans for building new capacity.

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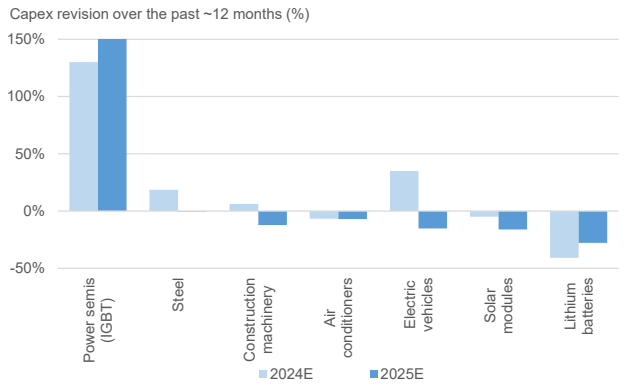
Exhibit 15: Capex revision trend over the past ~12 months - Capex in power semis revised up, but solar and lithium batteries cut



Source: Bloomberg, Company data, Goldman Sachs Global Investment Research

Exhibit 16: Industry Capex revisions, Capex yoy changes, and Capex/sales - negative Capex revisions despite high Capex/sales are a better reflection of supply additions turning cautious

Industry Capex trend	Revisions over the past ~12 months 2024E	Revisions over the past ~12 months 2025E	Capex YoY 2024E	Capex YoY 2025E	Capex/sales 2024E*
Power semis (IGBT)	130%	153%	51%	9%	68%
Steel	19%	0%	0%	0%	5%
Construction machinery	6%	-12%	-7%	-7%	4%
Air conditioners	-7%	-7%	4%	5%	3%
Electric vehicles	35%	-15%	-39%	-32%	13%
Solar modules	-5%	-16%	-20%	-40%	7%
Lithium batteries	-41%	-28%	-22%	-4%	13%

**post revision, weighted avg of samples*

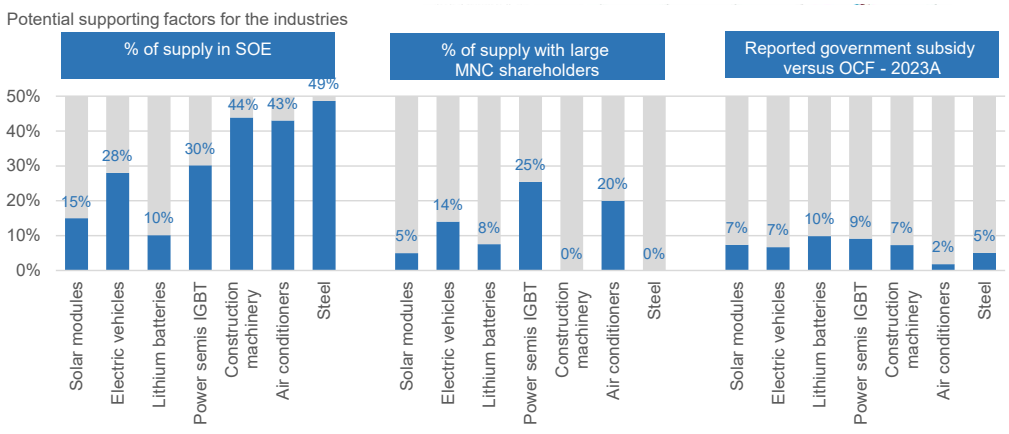
Source: Company data, Goldman Sachs Global Investment Research

Rule Number 3: Is there a glimmer of hope in the industry (for a demand upturn)? We use the most recent demand trends on the ground to make this assessment. YTD growth in demand for lithium batteries, EVs, solar installation and power semis (IGBT) ranged from 10-43%, however, steel and construction machinery continued to see negative/stagnant yoy trends in demand.

Tipping points - when Capex expansions are not supported

We recognize that potential non-market driven factors could extend the cycle beyond expectations, including SOE shareholdings, large MNC or industry shareholders, government subsidies (e.g., government rebates as % of Capex), or sometimes simply cash burn. While SOE ownership tends to be higher in traditional sectors, among growth sectors SOE ownership within electric vehicles is also relatively high. Government subsidies effectively accounted for 2-10% of cash profits in 2023A, based on the disclosures of listed companies. These factors could provide support, especially in downcycles, and add hurdles for weak producers to exit in theory.

Exhibit 17: Potential non-market factors (including suppliers with SOE or large MNC ownership and government subsidies) may add hurdles for weak producers to exit



Source: Company data, Goldman Sachs Global Investment Research

However, there are more limitations to support that can be provided to capital

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investment - regardless of the shareholders or rebates. In our view, the tipping point (for Capex revisions) becomes inevitable, when neither profitability nor the balance sheet can support capital for expansion. Assuming EBITDA margin for mid-level (Group 2) producers is zero, a scenario very close to 2024YTD for most of our seven sample sectors, our stress test analysis signals Capex tipping points - defined as when more than 50% of the industry comes to net debt (i.e., no more cash to burn), with EBITDA interest coverage less than 5x (i.e., an inability to service existing debt). On this basis we see imminent tipping points for solar modules and lithium batteries. On the other hand, it may take another 2-3 years before the industry Capex cycle for EVs and power semis (IGBT) will be forced to turn as balance sheets strength depletes. A deeper deterioration in cash profits could accelerate this process.

Exhibit 18: Tipping points for Capex - when balance sheets and profitability both fail to support Capex expansions

Sectors	2023A	2024E	2025E	2026E	2027E	2028E
Solar modules		Tipping point (current)				
Group 1 = 34%	-60%, net cash	-62%, net cash	-71%, net cash	-75%, net cash	-42%, net cash	-48%, net cash
Group 2 = 14%	67%, 12x	97%, 0x	680%, 0x	1847%, 0x	n.a.	n.a.
Group 3 = 52%*	57%, 2x	57%, 2x	57%, 2x	57%, 2x	57%, 2x	57%, 2x
Electric vehicles					Tipping point (3+ years)	
Group 1 = 50%	-51%, net cash	-42%, net cash	-45%, net cash	-42%, net cash	-38%, net cash	-36%, net cash
Group 2 = 28%	-16%, net cash	-5%, net cash	5%, 9x	13%, 10x	21%, 10x	27%, 10x
Group 3 = 22%	-51%, net cash	19%, -EBITDA	-290%, -EBITDA	-equity, -EBITDA	-equity, -EBITDA	-equity, -EBITDA
Lithium batteries			Tipping point (1 year)			
Group 1 = 73%	-67%, net cash	-70%, net cash	-67%, net cash	-72%, net cash	-69%, net cash	-70%, net cash
Group 2 = 21%	59%, 5x	117%, 0x	211%, 0x	299%, 0x	431%, -EBITDA	680%, -EBITDA
Group 3 = 6%	-81%, net cash	-47%, net cash	24%, -EBITDA	45%, -EBITDA	133%, -EBITDA	586%, -EBITDA
Power semis (IGBT)				Tipping point (1~2 years)		
Group 1 = 51%	-92%, net cash	-54%, net cash	7%, 52x	55%, 71x	155%, -EBITDA	255%, -EBITDA
Group 2 = 39%	-13%, net cash	-3%, net cash	43%, -EBITDA	63%, -EBITDA	163%, -EBITDA	263%, -EBITDA
Group 3 = 11%	1%, 5.2x	7%, -EBITDA	37%, -EBITDA	63%, -EBITDA	n.a.	n.a.
Construction machinery	no Capex expansion					
Group 1 = 26%	17%, 16x	19%, 5x	25%, 5x	29%, 6x	28%, 27x	n.a.
Group 2 = 34%*	35%, 9x	35%, 0x	35%, 0x	35%, -EBITDA	35%, 0x	35%, 0x
Group 3 = 40%	-27%, net cash	-22%, net cash	-24%, net cash	-17%, net cash	n.a.	n.a.
Air conditioners	no Capex expansion					
Group 1 = 60%	-32%, net cash	-31%, net cash	-32%, net cash	-33%, net cash	n.a.	n.a.
Group 2 = 21%	-25%, net cash	-28%, net cash	-33%, net cash	-37%, net cash	n.a.	n.a.
Group 3 = 19%	-12%, net cash	-25%, net cash	-35%, net cash	-44%, net cash	n.a.	n.a.
Steel	no Capex expansion					
Group 1 = 22%	11%, 35x	8%, 41x	3%, 60x	-1%, net cash	-4%, net cash	-6%, net cash
Group 2 = 22%	7%, -EBITDA	15%, -EBITDA	19%, -EBITDA	24%, -EBITDA	28%, 0x	34%, 0x
Group 3 = 56%	66%, 3x	74%, 5x	76%, 5x	78%, 2x	79%, 5x	81%, 11x

*Scenario analysis - assuming average producers (group 2) at zero cash margins. *not covered, based on 2023A financial data.*

How to read this chart

Tipping points for Capex: when >50% of supply is in net debt, EBITDA interest coverage is <5 and the gearing ratio is rapidly changing, thus has to suspend or cut capital for expansion

blue color represents net cash in balance sheet
light grey color represents net debt position, with ability to service debt (EBITDA interest coverage >5x)
dark grey color represents net debt position, with risk in servicing debt (EBITDA interest coverage <5x)

60%,4x
60% in net gearing ratio
4x in EBITDA interest coverage

Source: Company data, Goldman Sachs Global Investment Research

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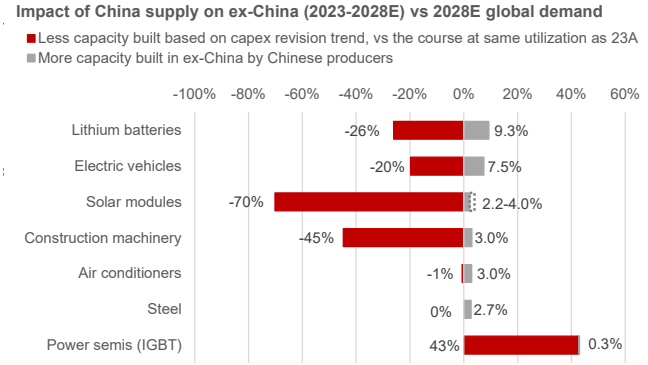
China+: building capacity outside China

A new trend is also clearly forming: Chinese producers are setting up new capacity outside of China to mitigate market access risk amidst rising trade tensions. By and large, such Chinese investment has been welcomed by ex-China regions. We estimate indicated capacity additions outside of China, in construction or planned, aggregate to 1-20% of 2023A China capacity (or 0-10% of 2026E-28E capacity), with lithium batteries and EVs being the most active sectors. The majority of new projects are located outside the US/EU, except lithium batteries (89% of ex-China projects are planned in the US/EU) and solar (30%).

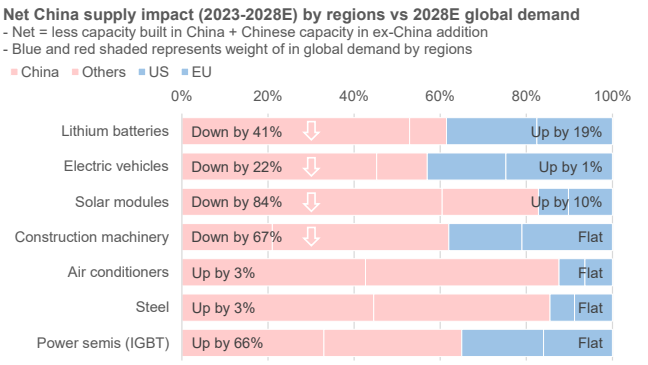
Ex-China capacity additions (still expanding at the current stage, while many have poor visibility) could partly set back a potential improvement in the supply outlook in the context of the overall global market. However, the magnitude of this incremental supply at this point is much smaller than the degree of deceleration in China-based capacity we are currently seeing. As a result, we expect effective China supply (both Chinese exports and potential supply from production located outside of China) to expand by 0.8x-2.6x in the coming years for growth sectors, and remain relatively stable for traditional sectors (steel, construction machinery and air conditioners). The market share of Chinese supply in the ex-China market could see 4-19% losses for lithium batteries and solar modules, and moderate gains of 3-4% for electric vehicles, air conditioners and power semis (IGBT), versus gains of 5-40% and 0-15%, respectively in 2020A-23A.

Exhibit 19: Impact of China supply on ex-China (2023-28E) vs. 2028E global demand - ex-China capacity additions are still small versus capacity trends in China



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 20: Net China supply impact (2023-2028E) vs. 2028E global demand - the trend implies less capacity for China+ regions, but flat to higher in the US/EU



Source: Company data, Goldman Sachs Global Investment Research

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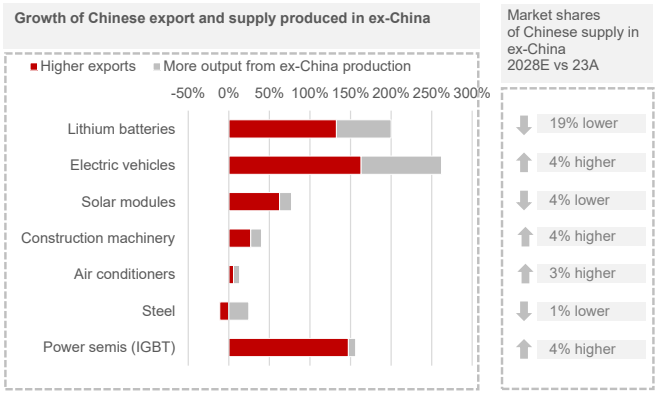
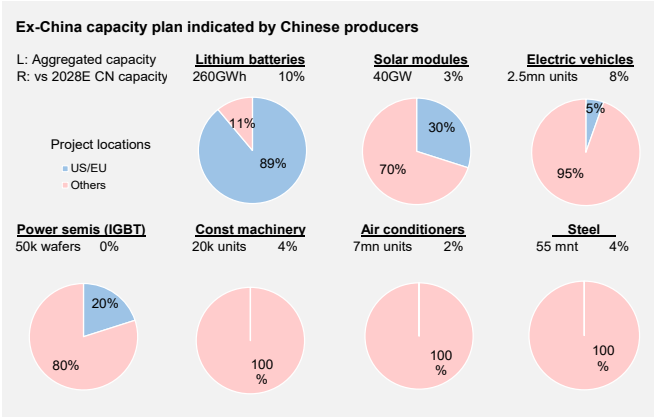
Exhibit 21: Growth of Chinese supply and changes to market share (2023-2028) - supply growth remains positive, but market share will decline or decelerate



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 22: Ex-China capacity plans indicated by Chinese producers - aggregated capacity to be 0-10% of domestic capacity, and mostly outside the US/EU

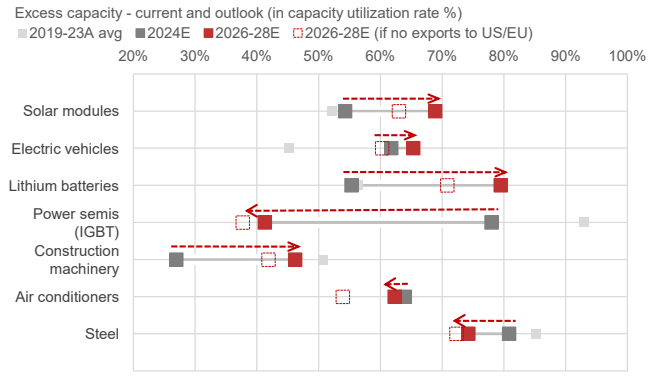


Source: Company data, Goldman Sachs Global Investment Research

Rebalancing ranked by sector

Overall, we see potential positive risks (improving balance between supply/demand and capacity utilization rates) for solar modules and lithium batteries, but negative risks (weaker S/D balance and capacity utilization rates) for electric vehicles and power semis (IGBT). We see limited changes to steel, construction machinery, and air conditioners. We estimate 2-9% downside risk to our estimated utilization rates if exports to the US/EU are impacted by global trade tensions (0-3% if the US only).

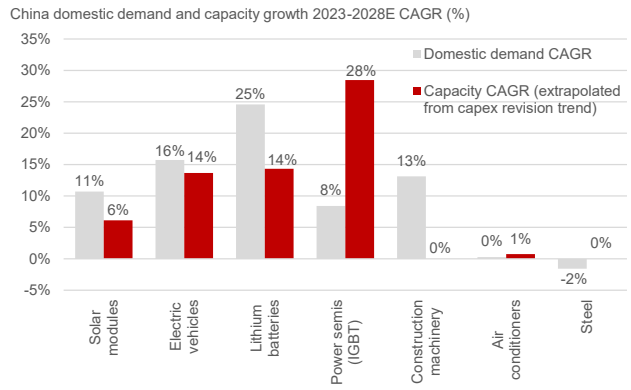
Exhibit 23: Sector capacity utilization - current, past and the next five years - improving trends for solar modules, electric vehicles, and lithium batteries, but meaningfully lower for power semis



*Capacity outlook is extrapolated from Capex revisions

Source: Company data, Goldman Sachs Global Investment Research

Exhibit 24: Domestic demand vs capacity CAGR by sectors 2023-2028E - capacity growth likely falls behind demand growth for solar, electric vehicles, and lithium batteries, but contrary for power semis



Source: Company data, Goldman Sachs Global Investment Research

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Past lessons

Over the past two decades, there have been several instances of excess capacity in different sectors in China, from aluminum, steel and cement to solar products, lithium batteries, and electric vehicles. Much of this, in our view, is the result of:

1. Large scale demand growth
2. Rapid supply responses
3. Government policies (on both demand and supply) can accelerate the pace of cycles and contribute to higher levels of volatility, however we do not view these as an underlying driver of excess capacity.

What's special about Chinese demand and supply

Most Chinese producers would comment that positive demand growth is usually the first reason behind an expansion project. Examples can be seen in the first aggressive expansion of Chinese aluminum capacity in 2002, steel capacity in 2004 (that took China from a net importer of steel to a net exporter by 2005) and the cement industry (which doubled capacity after a Rmb 4trillion infrastructure stimulus program in 2009-2010). Lithium batteries and electric vehicles have seen similar rapid expansion in recent years. Quantitatively, there are high correlations between China domestic demand growth and industry Capex growth, and the ratios in Capex/sales, based on the historical data of the seven sectors included in our work.

Forecasting demand from zero to mature can be particularly challenging - never make a call on the peak of Chinese demand - this was the very true before 2012 and is perhaps still the case for relatively newer sectors. The path of Chinese demand growth over the past few decades has been very different from the cyclical changes typical of mature demand. Demand typically moves from a low base and increases by an astonishing scale (3x to >10x) in a matter of 3-10 years. Behind this pattern, new demand segments have been built from zero to mature, such as housing and infrastructure, or those that are still evolving such as electric vehicles and renewables.

Supply responses, when a new market is being defined, can move at an even more astonishing speed in China, for many reasons. We estimate it only takes 6 months to build a new solar module plant, 1.5-2.5 years for electric vehicles and lithium battery capacity, and 2.5 years for a steel plant (less than one year before 2010).

The uncertainty of market size and pace of demand growth, combined with an aggressive supply response, probably implies a high margin of error for producers and industries to match capacity additions to future demand, especially at the beginning of the cycle. On the other hand, once demand growth decelerates, the adjustment in capacity investment soon follows. For example, Capex/sales for air conditioners has fallen to nearly zero in recent years due to stable demand, despite still attractive margins and returns.

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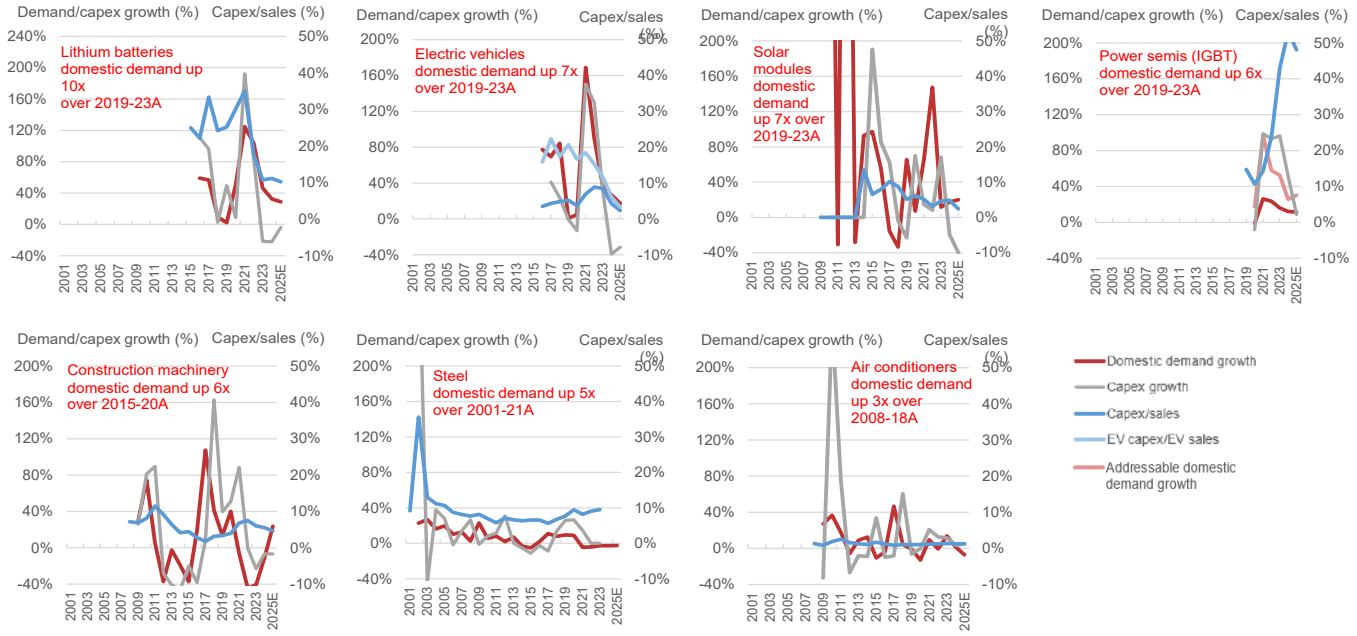
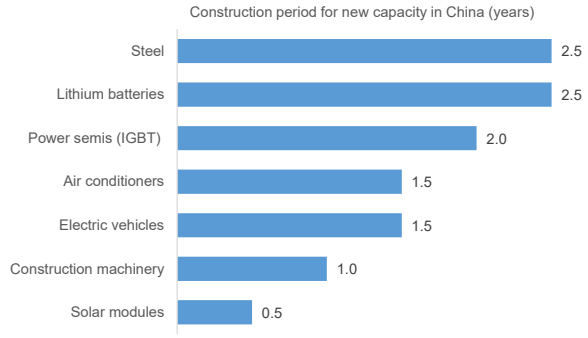
Exhibit 25: Capex expansion in China is driven by demand growth - a close correlation between industry Capex trend and changes in demand can be seen from historical data



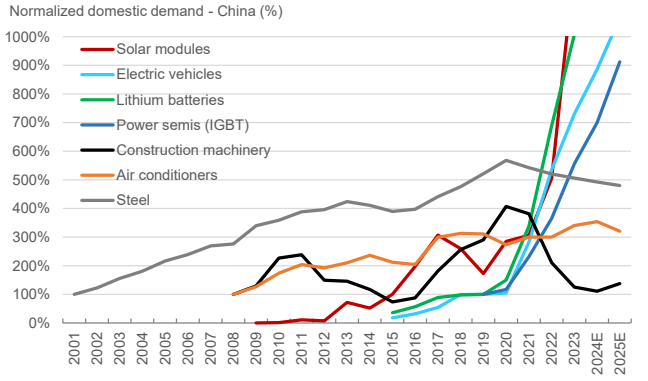
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 26: Construction time for new capacity in China by sector - 0.5-2.5 years implies short Capex cycle and rapid supply responses



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 27: Path of demand growth by key sectors - China, the scale of demand changes in China are much larger than the typical cyclical changes in mature demand



Source: Company data, Goldman Sachs Global Investment Research

What has previously worked - supply side reforms

In addition to cyclical forces that drive the consolidation of supply through cycles, there have been Chinese government policies in the past to effectively facilitate the rebalance of oversupplied sectors, given policymakers are in a unique position to regulate industry development policy and have the ability to manage aggregate capacity growth through project approval processes.

In 2015-2017, the Chinese central government implemented a successful supply-side reform of key overcapacity sectors including steel and coal, followed by aluminum. In 2012-2015, the slowdown in domestic demand exacerbated the level of excess capacity, taking utilization rates to 70%. With a fragmented supply structure, these industries had

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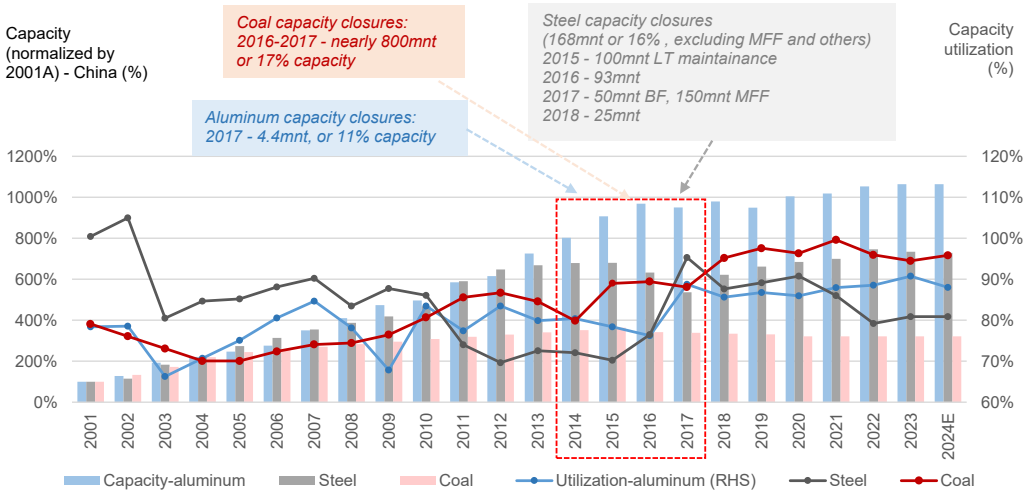
completely lost their pricing power and more than 50% of supply fell into negative cash margins and many producers were unable to service their debt. Starting in 2015, the central government implemented a capacity reduction plan for these industries, including Rmb100bn in central government funding to facilitate the severance of 1.8mn coal and steel workers. More than 10% of industry capacity was closed and new expansions have been strictly controlled since that time, leading to structurally better margins and pricing in coal, aluminum, and steel in subsequent years.

Exhibit 28: Supply side reforms in 2015-2017 - effective closures of capacity for Chinese steel, aluminum and coal led to improving capacity utilization in subsequent years



Source: Company data, Goldman Sachs Global Investment Research

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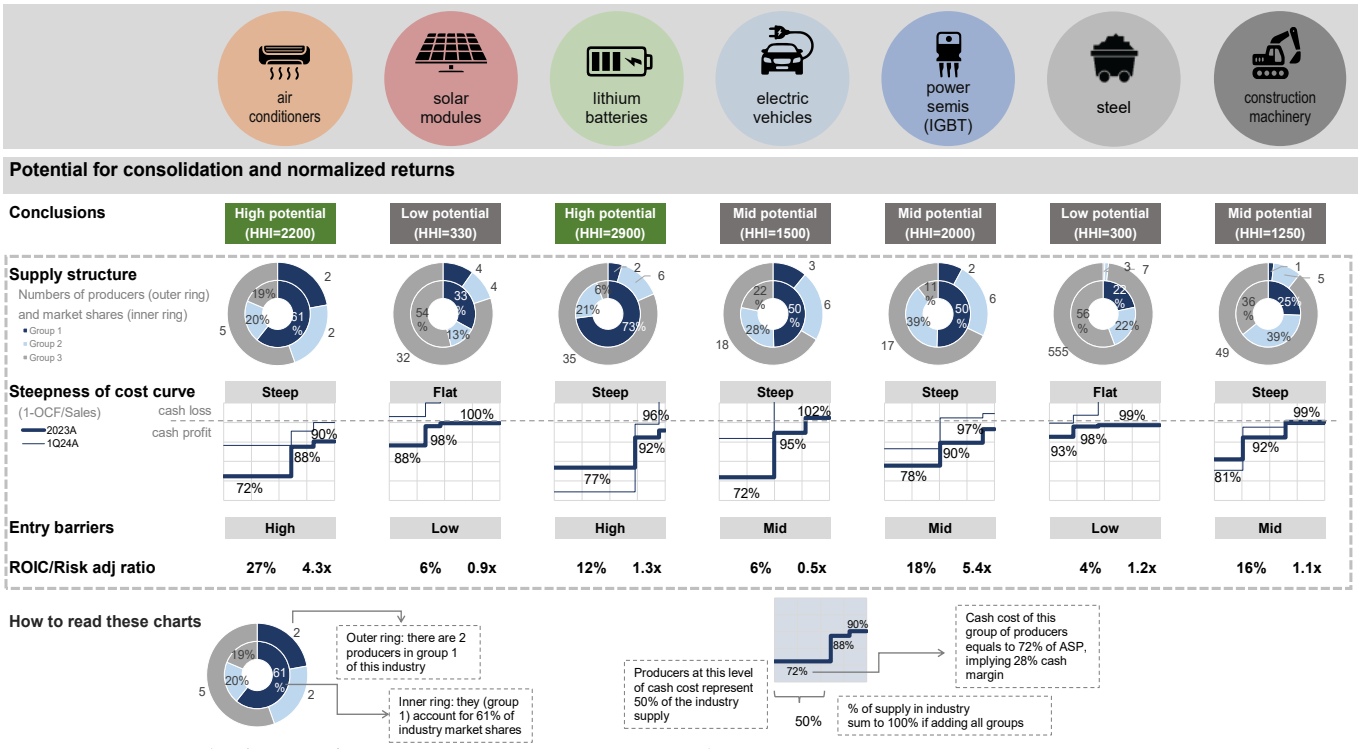
Beyond cycles - potential for consolidation

Beyond cyclical factors, we look for factors that define intrinsic returns and profitability of industries - underlying supply structure, the steepness of the cost curve (i.e., the difference between low cost and high end producers), and entry barriers. These factors determine the level of competition and thus a sustainable range of margins, the potential for consolidation through cycles (and its sustainability), and thus valuation multiples that investors are willing to ascribe.

Exhibit 29: Sector potential for supply consolidation - supply concentration, HHI index, cost curves, and investment returns - steep cost curves and concentrated supply usually yield higher returns



Source: Company data, Goldman Sachs Global Investment Research

We prefer industries with steep cost curves and strong top players

Sectors with strong leading producers in terms of both market share and cost competitiveness tend to consolidate more readily and deliver more favorable returns over time - air conditioners and lithium batteries are likely in this category. The top two players in lithium batteries command a 70% domestic market share and enjoy 20% higher margins than weaker competitors. Similarly, nine producers dominate the Chinese air conditioners sector after years of consolidation (there were ~400 players in 1996-2006). The average historical ROIC of these two sectors is 12-27% and risk adjusted ratio is 1.3-4.3x, at the higher-end of our seven sample sectors. Power semis has the highest risk adjusted return (5.4x), which we think is partly due to the short history of the sector. While electric vehicles have a steep cost curve, the market share of the leading producers is not as concentrated and entry barrier remains a concern.

On the contrary, sectors with flat cost curves, accompanied by less prevailing market

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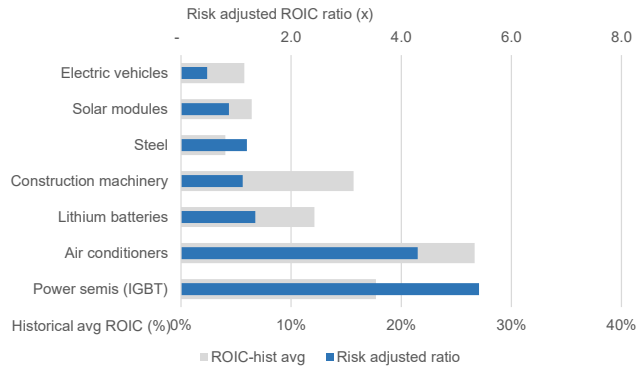
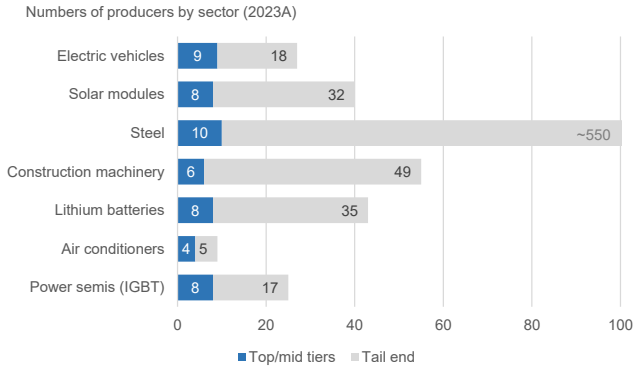
positions of top producers, suggest difficulty in consolidating - steel and solar are likely in this category - the historical average of the two sectors over the past 1-2 decades suggests less attractive risk-adjusted return ratios.

Exhibit 30: Average historical ROIC and risk-adjusted return by sector - air conditioners hold the highest, followed by lithium battery



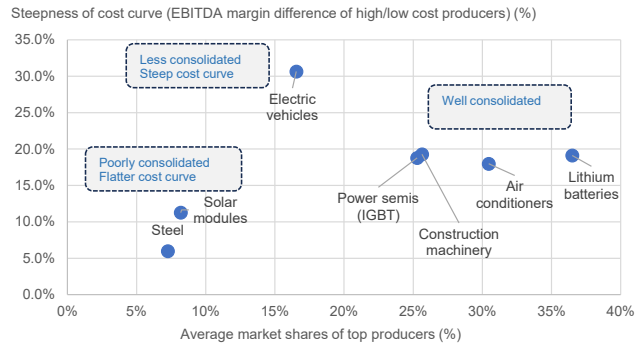
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 31: Industry supply structure - number of producers (2023A) - air conditioners has 9 producers versus over 500 in steel



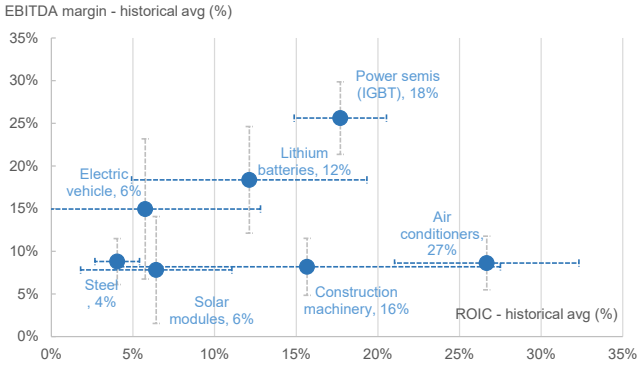
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 32: Cost curve steepness and top market share - strong top producers in market shares and cost differentiation are best positioned for consolidation



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 33: Historical average EBITDA margin and ROIC - electric vehicles, solar, steel are in the lower range, while air conditioners, lithium batteries, power semis (IGBT) are in the upper range



Data range: solar 2010-2023, electric vehicles 2016-2023, lithium batteries 2016-2023, power semis (IGBT) 2019-2023, construction machinery 2009-2023, air conditioners 2008-2023, steel 2002-2023

Source: Company data, Goldman Sachs Global Investment Research

HHI indicates consistently high and low rankings in our analysis

The Herfindahl-Hirschman Index ("HHI") is a statistical measure of concentration level of an industry. According to the U.S. Department of Justice, an HHI between 1,000 and 1,800 points is generally considered to be moderately concentrated. We estimate lithium batteries and air conditioners have a high level of concentration with HHIs of 2,900 and 2,200 respectively, while HHIs for steel and solar modules is only around 300.

Entry barriers sustain consolidation

Entry barriers determine the sustainability of consolidation. The most powerful barrier to overcome tends to be an ecosystem in the supply chain or distribution channels around producers. The consolidation of the air conditioner sector is testimony to how sustained barriers to entry (such as a distribution network) can sustain improved profit and returns.

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Exhibit 34: Entry barriers ranked by sector - a strong ecosystem on the supply side or customer side usually leads to high entry barriers

Assessment on levels of entry barriers		Policy approval	Technology hurdles	Resource constraints Supply chain mgmt	Customer qualification	Distribution network
Solar modules	Low	low Encouraging policy historically but incrementally higher requirement on new capacity by MIIT	mid Need to keep up with new cell tech and assembly know-how	low No constraint in raw materials	low Bankable module, quality after sales services	mid Need distribution channel for DS; USS (typically direct sales) requires customer resources
Electric vehicles	Mid	mid NDRC suspended the issuance of BEV production licenses since 2017. MIIT increasingly strict on issuing production licenses. Approval requirements on BEV capacity addition have also been tightened	mid Vehicle assembly requires technological know-how. Car makers tend to in-house R&D of key components, which are differentiated	mid No constraints in raw materials. Potential production bottlenecks in certain components such as LiDARs and chips	mid Strict and detailed national qualification standards for batteries, controller, energy efficiency, post-crash safety requirement, etc.	low Fragmented dealership market landscape in China and OEMs could choose a direct-selling model, therefore relatively low barriers for OEMs to expand their dealer network
Lithium batteries	High	low Requests mainly for local government approvals and approvals related to environmental impact assessment	mid Battery performance and quality are differentiated	high No constraints in raw materials, proximity and management of supply chain highly critical	high Typically required 1-2 years for verification in EV models	mid Direct sales bound by long-term contracts
Power semis (IGBT)	Mid	low Govt supportive of capacity expansion, suppliers need to obtain local environmental reports	mid Higher tech hurdles for industrial/ automotive IGBT	low Silicon based, no limitation on raw materials	mid Automotive products need longer time for customer qualification	mid Need long-term partnership with industry clients (automotive/ energy/ industrial)
Construction machinery	Mid	low Only environmental impact assessment needed but not a hurdle for capacity expansion	high Important for product line expansion and to stand out among peers	low No constraints in raw materials	low Standardized products	high In DMs, high-quality top-tier dealers have been taken by competitors. Difficult to build a dealer network from scratch
Air conditioners	High	low No special policy approval requirement. Local government has taken a neutral attitude and reviews projects case by case	high Technology hurdle: vertical integration and automation, which could improve efficiency and product quality	high Leading players have in-house key components development and manufacturing	n.a. n.a.	high Leading players have lower customer acquisition costs online, and possess more extensive offline channels
Steel	Low	high No policy approval required for greenfield expansions, strong execution	low Commoditized for most products	low No constraints in raw materials	low Commoditized nature for most	low Direct sales and trader sales bear no loyalty requirement

DS: Distributed solar, USS: Utility-scale solar, MIIT: Ministry of Industry and Information Technology

Source: Goldman Sachs Global Investment Research

Chinese air conditioners - A strong global presence *and* positive profitability

With only a handful of suppliers in the sector, the Chinese air conditioner sector holds a 55% ex-China market share (70% if based on unit sales) but is also a sector where most producers are currently generating positive margins. Since 1998, there have been several rounds of excess capacity, price wars and inventory cycles, and the sector managed to consolidate before demand matured. While the number of companies in the space significantly declined (97% from the peak), the remaining leading players established a sustainable ecosystem and entry barriers by investing in distribution networks and integrating production with core components. At the same time, maturing demand and technology have disincentivized large-scale supply expansion. Click here for full discussion.

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Sector Snapshots - Solar modules

- In 2023A, China supplied 86% of the global market, with 42% of production exported. Chinese exports increased 1.9x over 2020-2023A and market share ex-China increased from 67% in 2020A to 72% in 2023A. 49% of exports went to the US and EU.
- 2023A capacity in China equated to 4.0x the domestic demand pool and 2.0x the global demand pool, and operated at a 44% capacity utilization rate. In 1Q24A, pricing was 46% lower yoy, and 100% of the industry generated zero or negative operating cash flow. 2024E and 2025E industry Capex was revised down by 5%-16% over the past ~12 months.
- Manufacturing cost in China is 30-60% lower than ex-China peers on average, and 10% lower than our estimated cost of Chinese capacity overseas.
- Our view on the sector: The China solar industry is heading into the final stage of a downcycle, with a cyclical bottom likely in 2025E. We expect 1/3rd of industry capacity to shut down in the coming quarters, and sustainable demand to drive a recovery in utilization rate from 2025E onwards. Click here for details.

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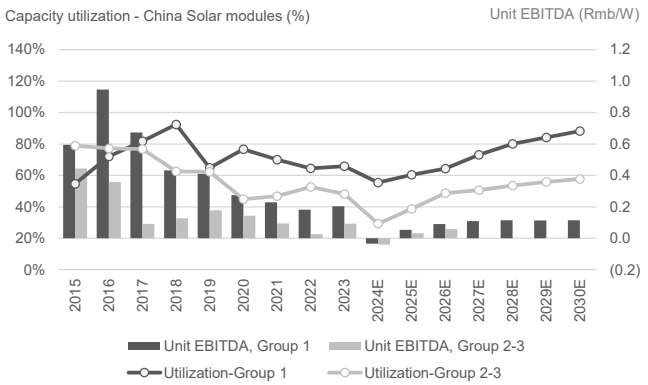
Exhibit 35: Industry S/D balance (base case) - solar modules

Chinese solar modules		2021A	2022A	2023A	2024E	2025E	2026E
Base case							
Output-China	GW	172	275	459	504	591	729
Output-ex China	GW	38	49	74	109	125	133
Demand-Global	GW	210	324	533	612	716	863
Demand-China	GW	64	105	260	290	340	408
yoy	%	7%	65%	147%	12%	17%	20%
Capacity-China	GW	347	527	1,036	928	1,009	1,091
Capacity utilization	%	50%	52%	44%	54%	59%	67%
Capacity/China demand	x	5.4	5.0	4.0	3.2	3.0	2.7
Capacity/Global demand	x	1.6	1.6	1.9	1.5	1.4	1.3
Direct export	GW	89	155	193	202	236	280
Indirect export-est	GW	-	-	-	-	-	-
Export as % of output	%	52%	56%	42%	40%	40%	38%

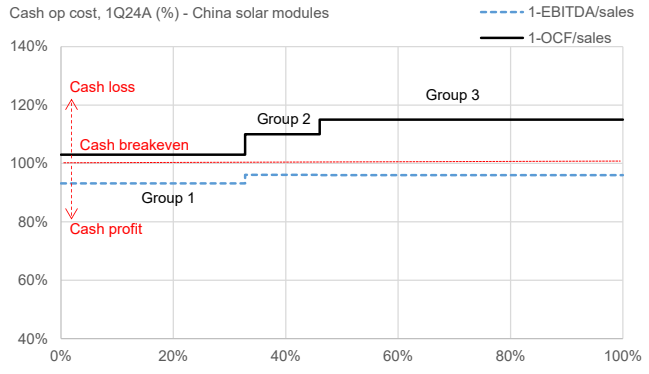
Source: CPIA, IEA, Wind, Company data, Goldman Sachs Global Investment Research

Exhibit 36: EBITDA vs capacity utilization - solar modules



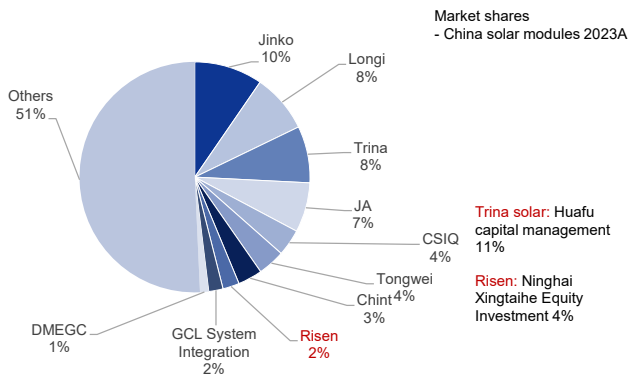
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 37: Industry cash cost curve and profit - solar modules



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 38: Market share by supplier (2023A) - solar modules



Source: PVinfolink

Sector Snapshots - Electric vehicles

- In 2023A, China supplied 66% of the global market, with 19% of production exported. Chinese exports increased 6.7x over 2020-2023A and market share ex-China increased from 10% in 2020A to 26% in 2023A. 42% of exports went to the US and EU.
- 2023A capacity in China equated to 2.1x the domestic demand pool and 1.2x the global demand pool, and operated at a 54% capacity utilization rate. In 1Q24A, pricing was 12% lower yoy and 50% of the industry generated zero or negative operating cash flow. Industry Capex for 2024-25E was revised by +35% and -15% over the past ~12 months.
- Manufacturing cost in China is 47% lower than top ex-China peers and 17-24% lower than our estimated cost of Chinese capacity overseas.
- Our view on the sector: The inflection point for domestic new energy vehicles has yet to arrive, given nearly half of the industry to generate positive cash margins, and the industry's positive perception on the margin outlook is still supporting continued expansion plans. Click here for details.

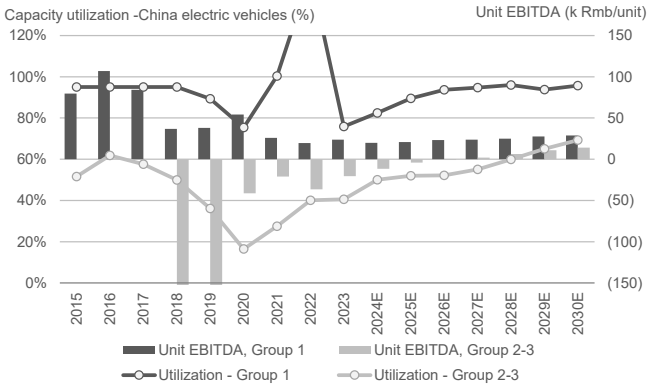
More reports @ wechat: Hillwood2024

Exhibit 39: Industry S/D balance (base case) - electric vehicles

Chinese electric vehicles		2021A	2022A	2023A	2024E	2025E	2026E
Base case							
Output-China	mn units	3	7	9	12	14	16
Output-ex China	mn units	3	4	5	4	6	8
Demand-Global	mn units	6	10	14	16	20	24
Demand-China	mn units	3	6	8	10	12	13
yoy	%	169%	90%	36%	27%	17%	13%
Capacity-China	mn units	8	11	17	20	22	25
Capacity utilization	%	42%	60%	54%	62%	65%	66%
Capacity/China demand	x	2.6	2.0	2.1	2.0	1.9	1.9
Capacity/Global demand	x	1.2	1.1	1.2	1.2	1.1	1.0
Direct export	mn units	0.5	1.0	1.7	2.3	2.9	3.4
Indirect export-est	mn units	-	-	-	-	-	-
Export as % of output	%	16%	16%	19%	19%	20%	20%

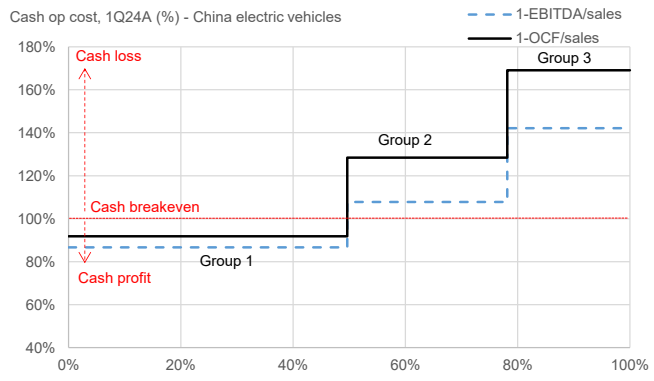
Source: CPCA, Goldman Sachs Global Investment Research

Exhibit 40: EBITDA vs. capacity utilization - electric vehicles



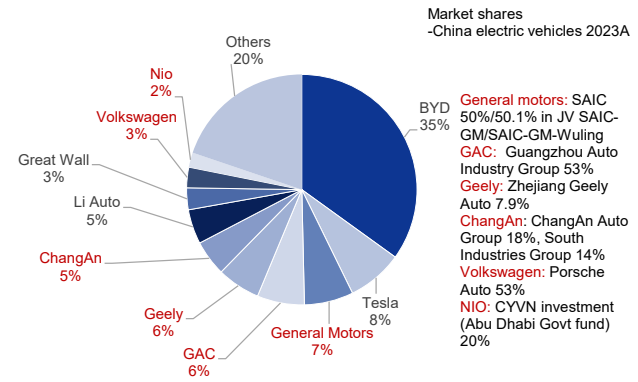
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 41: Industry cash cost curve and profit - electric vehicles



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 42: Market share by supplier (2023A) - electric vehicles



Source: CPCA, Data compiled by Goldman Sachs Global Investment Research

Sector Snapshots - Lithium batteries

- In 2023A, China supplied 81% of the global market, with 37% of production exported. Chinese exports increased 7.2x over 2020-2023A and market share ex-China increased from 26% in 2020A to 65% in 2023A.c.57% of direct exports went to the US and EU, per our estimation.
- 2023A capacity in China equated to 3.3x the domestic demand pool, and 1.5x the global demand pool, and operated at a 61% capacity utilization rate. In 1Q24A, pricing was 45% lower yoy, and 27% of the industry generated zero or negative operating cash flow. Industry Capex for 2024-25E was revised down by 28%-41% over the past ~12 months.
- Manufacturing cost in China is 28-56% lower than ex-China peers on average, and 20-30% lower than our estimated cost of Chinese capacity overseas.
- Our view on the sector: We are positive on China batteries given Capex cuts and demand growth. 2024E is likely to be the trough of this down cycle followed by a sustained recovery in utilization to 55%-60% in 2024E-26E. Accordingly, we expect China battery unit GP to recover with CATL's unit GP to rebound to Rmb198/kWh (from Rmb188/kWh) in 2024-2026E. Click here for details.

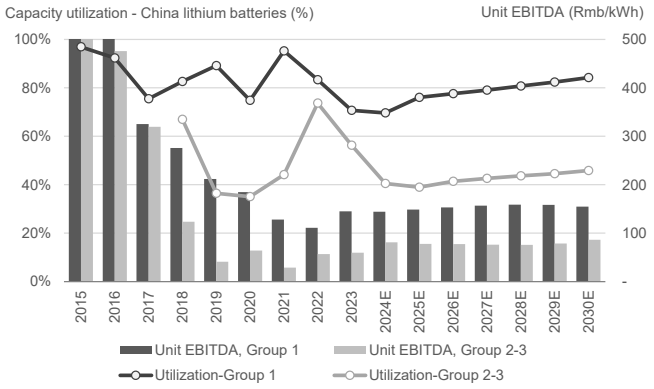
More reports @ wechat: Hillwood2024

Exhibit 43: Industry S/D balance (base case) - lithium batteries

Chinese lithium battery		2021A	2022A	2023A	2024E	2025E	2026E
Base case							
Output-China	GWh	283	663	819	985	1,243	1,533
Output-ex China	GWh	117	85	162	265	397	558
Demand-Global	GWh	400	749	981	1,250	1,640	2,091
Demand-China	GWh	142	292	411	536	686	879
yoy	%	133%	106%	41%	30%	28%	28%
Capacity-China	GWh	488	939	1,342	1,781	2,167	2,556
Capacity utilization	%	58%	71%	61%	55%	57%	60%
Capacity/China demand	x	3.4	3.2	3.3	3.3	3.2	2.9
Capacity/Global demand	x	1.2	1.3	1.4	1.4	1.3	1.2
Direct export	GWh	62	187	208	188	248	299
Indirect export-est	GWh	28	54	95	135	178	230
Export as % of output	%	32%	36%	37%	33%	34%	34%

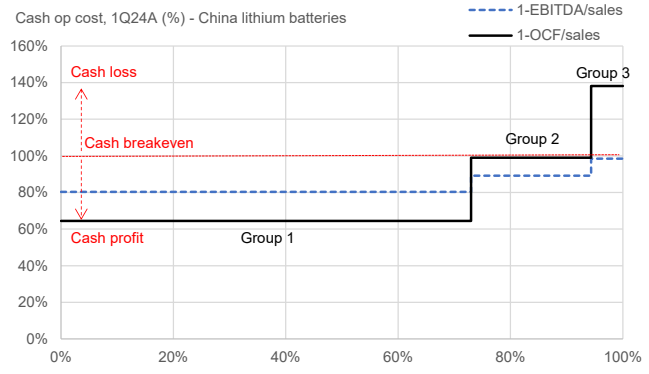
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 44: EBITDA vs. capacity utilization - lithium batteries



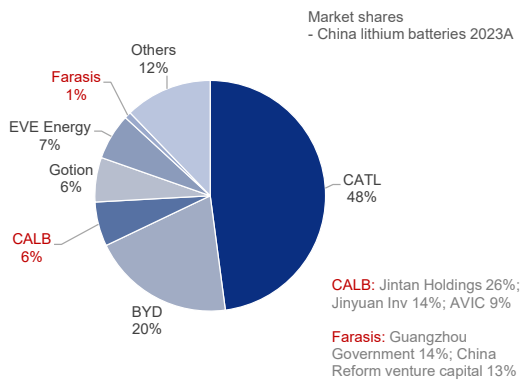
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 45: Industry cash cost curve and profit - lithium batteries



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 46: Market share by supplier (2023A) - lithium batteries



Source: Company data, Goldman Sachs Global Investment Research

Sector Snapshots - Power semis (IGBT)

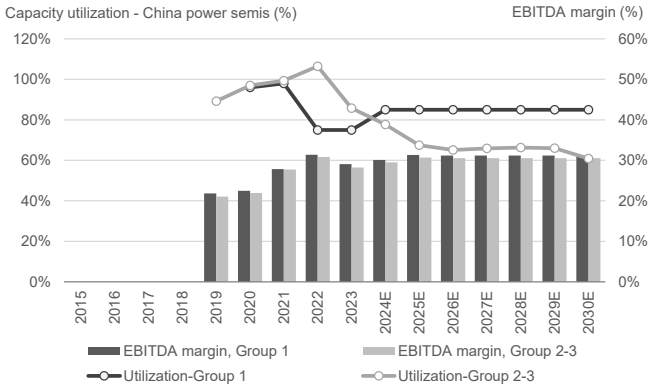
- In 2023A, China supplied 29% of the global market, with 15% of production exported. Chinese exports increased 2.7x over 2020-2023A and market share ex-China increased from 3% in 2020A to 6% in 2023A. 80% of exports went to the US and EU.
- 2023A capacity in China equated to 1.4x of the domestic demand pool and 35% of the global demand pool, and operated at an 87% capacity utilization rate. In 1Q24, pricing was 8% lower yoy, and 49% of the industry generated zero or negative operating cash flow. Industry Capex for 2024-25E was revised up by 130%-153% over the past ~12 months.
- Manufacturing cost in China is 3-5% lower than ex-China peers on average (same process nodes), and 5-10% lower than our estimated cost of Chinese capacity overseas.
- Our view on the sector: We expect continued capacity expansion in the China power semi (IGBT/MOSFET) space as local suppliers expand to gain market share and to meet client diversification demands and enhanced products. We are cautious on IGBT pricing, and expect declines due to oversupply. Click here for details.

Exhibit 47: Industry S/D balance (base) - power semis (IGBT)

Chinese power semis (IGBT)		2021A	2022A	2023A	2024E	2025E	2026E
Base case							
Output-China	mn wafers	2.1	2.7	3.2	3.6	4.0	4.5
Output-ex China	mn wafers	4.9	5.9	7.5	8.7	9.1	9.6
Demand-Global	mn wafers	7.0	8.6	10.8	12.3	13.2	14.0
Demand-China	mn wafers	1.9	2.3	2.6	2.9	3.1	3.4
yoy	%	23%	21%	13%	11%	8%	9%
Capacity-China	mn wafers	2.2	2.8	3.7	4.6	5.4	6.0
Capacity utilization	%	96%	98%	87%	78%	75%	75%
Capacity/China demand	x	1.2	1.2	1.4	1.6	1.7	1.8
Capacity/Global demand	x	0.3	0.3	0.3	0.4	0.4	0.4
Direct export	mn wafers	0.1	0.1	0.1	0.1	0.2	0.2
Indirect export-est	mn wafers	0.2	0.2	0.4	0.5	0.6	0.7
Export as % of output	%	11%	12%	15%	17%	19%	20%

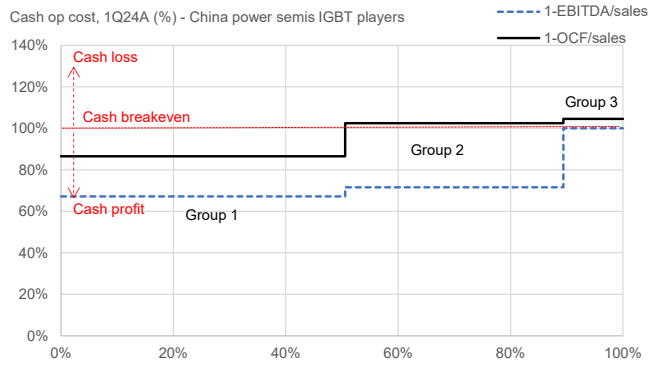
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 48: EBITDA vs. capacity utilization - power semis (IGBT)



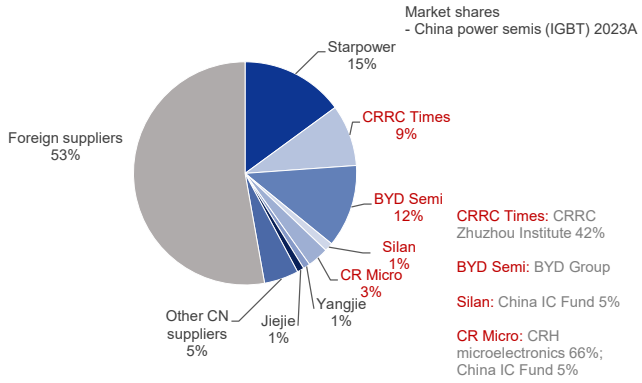
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 49: Industry cash cost curve and profit - power semis (IGBT)



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 50: Market share by supplier (2023A) - power semis (IGBT)



Source: Company data, Goldman Sachs Global Investment Research

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Sector Snapshots - Construction machinery

- In 2023A, China supplied 33% of the global market, with 53% of production exported. Chinese exports increased by 2.0x over 2020-2023A and market share ex-China increased from 11% in 2020A to 21% in 2023A. 21% of exports went to the US and EU.
- 2023A China capacity equated to 7.2x of the domestic demand pool and 1.1x the global demand pool, and operated at a 30% capacity utilization rate. In 1Q24A, pricing was flat yoy, and 74% of the industry generated zero or negative operating cash flow. Industry Capex for 2024-25E was revised by -12% to +6% over the past ~12 months, amid a low Capex/sales ratio.
- Manufacturing cost in China is 8-46% lower than ex-China production on average.
- Our view on the sector: The China construction machinery sector entered a multi-year downcycle beginning in 2021 due to the property downturn and issues around local government debt. We expect a potential bottoming in domestic demand in 2024-25E, as property new starts stabilize and the replacement cycle kicks-in, but with a lower normalized level supported only by replacement demand. Click here for details.

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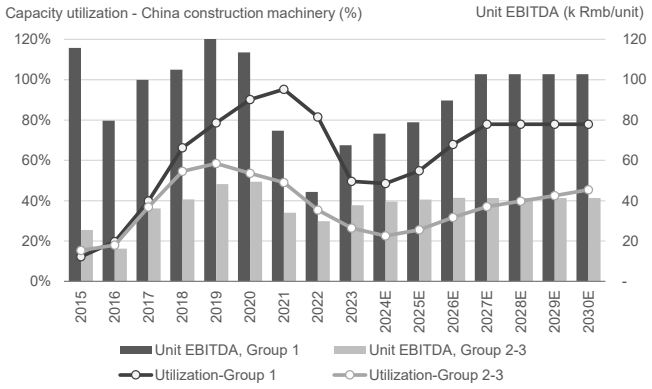
Exhibit 51: Industry S/D balance (base case) - const. machinery

Chinese construction machinery		2021A	2022A	2023A	2024E	2025E	2026E
Base case							
Output-China	k units	369	281	197	175	199	246
Output-ex China	k units	355	387	400	416	417	437
Demand-Global	k units	725	668	598	591	615	683
Demand-China	k units	274	152	90	80	99	133
yoy	%	-6%	-45%	-41%	-11%	24%	34%
Capacity-China	k units	650	650	650	650	650	650
Capacity utilization	%	57%	43%	30%	27%	31%	38%
Capacity/China demand	x	2.4	4.3	7.2	8.1	6.6	4.9
Capacity/Global demand	x	0.9	1.0	1.1	1.1	1.1	1.0
Direct export	k units	68	109	105	95	100	113
Indirect export-est	k units	-	-	-	-	-	-
Export as % of output	%	19%	39%	53%	54%	50%	46%

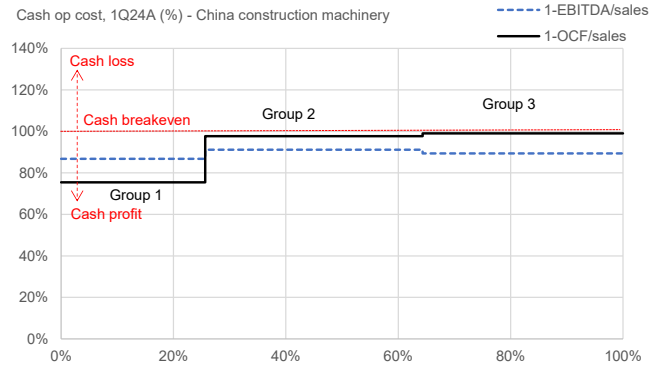
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 52: EBITDA vs. capacity utilization - const. machinery



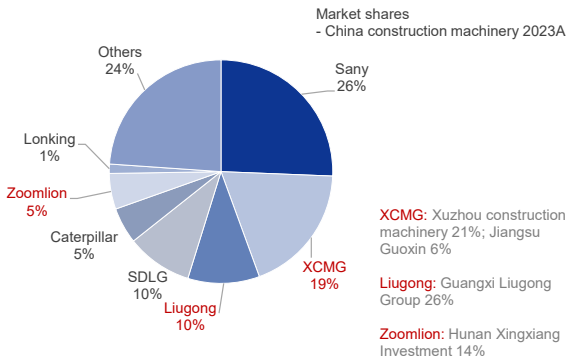
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 53: Industry cash cost curve and profit - const. machinery



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 54: Market share by supplier (2023A) - const. machinery



Source: Company data, Goldman Sachs Global Investment Research

Sector Snapshots - Air conditioners

- In 2023A, China supplied 75% of the global market, with 42% of production exported. Chinese exports increased 16% over 2020-2023A and market share ex-China remained flat at 55% in 2023A vs 2020A. 32% of exports went to the US and EU.
- 2023A capacity equated to 2.7x the domestic demand pool and 1.2x the global demand pool, and operated at a 62% capacity utilization rate. In 1Q24A, pricing was 3% lower yoy, and 19% of the industry generated zero or negative operating cash flow. Industry Capex for 2024-25E was revised down by 7% over the past ~12 months, amid a low Capex/sales ratio.
- Manufacturing cost in China is 10%-30% lower than ex-China peers on average, and 8%-20% lower than our estimated cost of Chinese capacity overseas.
- Our view on the sector: We expect healthy supply/demand dynamics and profitability, underpinned by diversified demand, disciplined Capex, a higher focus on margins, and consolidated supply structure. Click here for details.

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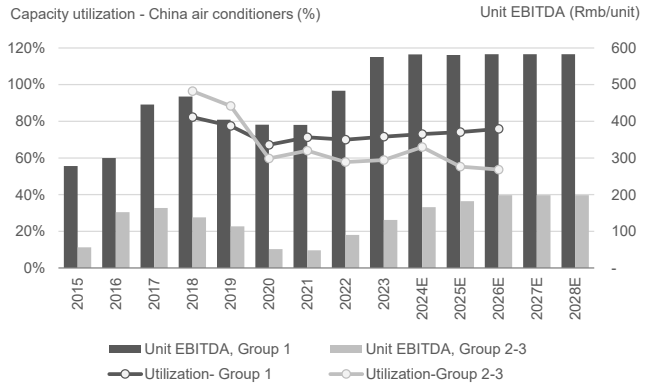
Exhibit 55: Industry S/D balance (base case) - air conditioners

Chinese air conditioners		2021A	2022A	2023A	2024E	2025E	2026E
Base case							
Output-China	mn units	158	152	169	182	173	174
Output-ex China	mn units	50	58	58	45	55	57
Demand- Global	mn units	208	210	227	227	228	231
Demand - China	mn units	88	88	100	101	94	97
yoy	%	10%	0%	14%	1%	-7%	3%
Capacity - China	mn units	249	251	272	276	280	280
Capacity utilization	%	64%	60%	62%	66%	62%	62%
Capacity/China demand	x	2.8	2.9	2.7	2.7	3.0	2.9
Capacity/Global demand	x	1.2	1.2	1.2	1.2	1.2	1.2
Direct export	mn units	68	66	71	81	79	77
Indirect export-est	mn units	-	-	-	-	-	-
Export as % of output	%	43%	43%	42%	45%	46%	44%

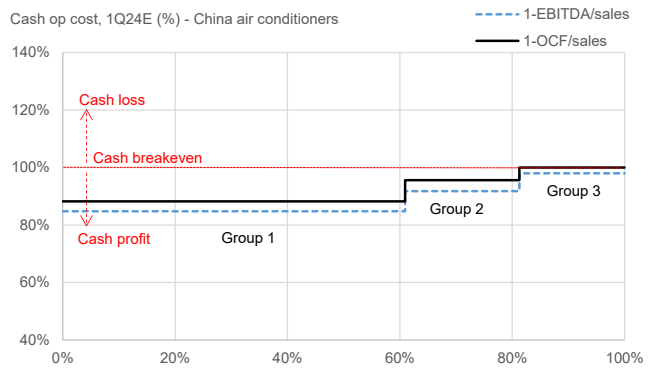
Source: IOL, Euromonitor, Goldman Sachs Global Investment Research

Exhibit 56: EBITDA vs capacity utilization - air conditioners



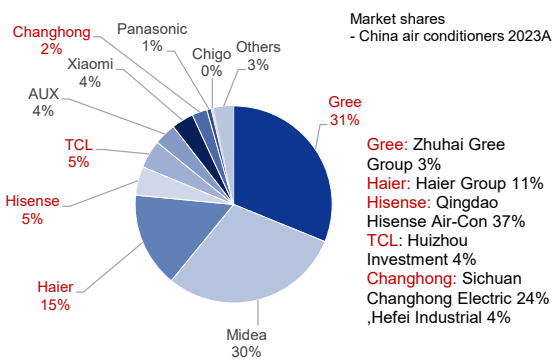
Source: IOL, Company data, Goldman Sachs Global Investment Research

Exhibit 57: Industry cash cost curve and profit - air conditioners



Source: Euromonitor, Company data, Goldman Sachs Global Investment Research

Exhibit 58: Market share by suppliers (2023A) - air conditioners



Source: Euromonitor, Company data

Sector Snapshots - Steel

- In 2023A, China supplied 54% of the global market, with 16% of production exported. Chinese exports increased 22% over 2020-2023A and market share ex-China increased from 14% in 2020A to 16% in 2023A. 6% of exports went to the US and EU.
- 2023A capacity equated to 1.5x of the domestic demand pool and 66% of the global demand pool, and operated at an 81% capacity utilization rate. In 1Q24A, pricing was 6% lower yoy, and almost 100% of the industry generated zero or negative operating cash flow. Industry Capex for 2024-25E was revised up by 0-19% over the past ~12 months, amid a low Capex/sales ratio.
- Manufacturing cost in China is mostly on par with ex-China peers on average, given nearly 70% of steel production cost is raw materials.
- Our view on the sector: We expect persistent weak margins in Chinese steel for most products, due to the structural correction in construction steel, despite much improved excess capacity following 2015-17 supply side reforms.

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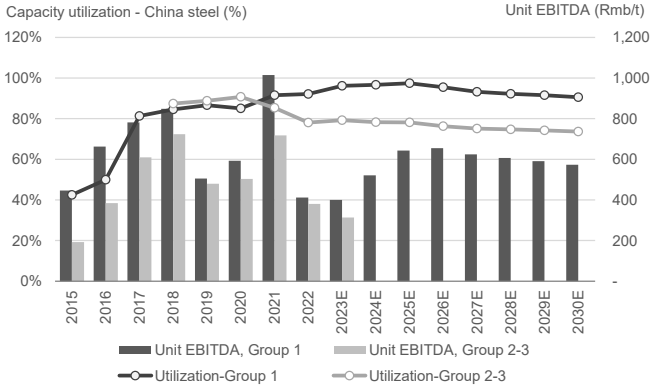
Exhibit 59: Industry S/D balance (base case) - steel

Chinese steel		2021A	2022A	2023A	2024E	2025E	2026E
Base case							
Output-China	mnt	1,033	1,013	1,019	1,010	979	959
Output-ex China	mnt	933	882	873	890	968	1,020
Demand-Global	mnt	1,965	1,895	1,893	1,900	1,946	1,979
Demand-China	mnt	928	889	865	842	821	812
yoy	%	-4%	-4%	-3%	-3%	-2%	-1%
Capacity-China	mnt	1,200	1,279	1,260	1,249	1,238	1,235
Capacity utilization	%	86%	79%	81%	81%	79%	78%
Capacity/China demand	x	1.3	1.4	1.5	1.5	1.5	1.5
Capacity/Global demand	x	0.6	0.7	0.7	0.7	0.6	0.6
Direct export	mnt	67	67	91	107	98	88
Indirect export-est	mnt	75	72	70	68	67	66
Export as % of output	%	14%	14%	16%	17%	17%	16%

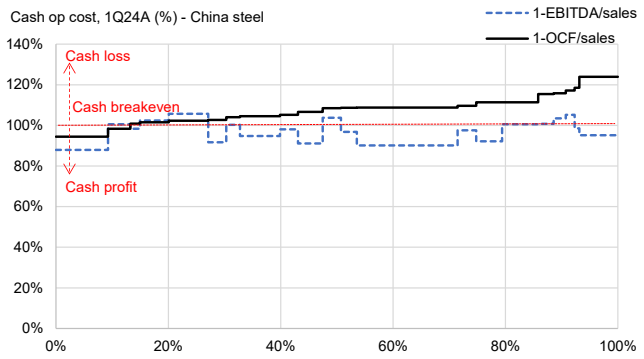
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 60: EBITDA vs. capacity utilization - steel



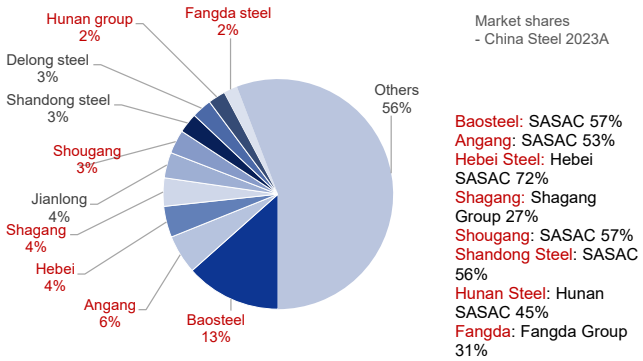
Source: Company data, Goldman Sachs Global Investment Research

Exhibit 61: Industry cash cost curve and profit - steel



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 62: Market shares by suppliers (2023A) - steel



Source: Company data, Goldman Sachs Global Investment Research

Stock picks

Exhibit 63: 11 stocks that provide exposure to both cyclical inflections and/or structural stability

Companies	*Price as of 2-Aug-2024*	CCY	Company profile, TP methodology & Risks
Solar			
Daqo ADR	Ticker DQ		*Company profile*: Daqo is a leading poly producer (14% global mkt share by end-2023)
	Rating Buy		with the strongest balance sheet among our China solar coverage.
	Target 21.8	USD	*TP methodology*: Our 12m TP is based on 0.4X 2024E P/B (based on 1 std dev below avg P/B),
	Price 16.1	USD	as we expect a lower mid-cycle margin for poly in the longer run; cross checked with its historical return profile.
	Upside 35%		*Key risks*: 1) Lower-than-expected poly price, 2) higher raw material and electricity prices.
Tongwei	Ticker 600438.SS		*Company profile*: Tongwei is a leading integrated solar producer with 24%/15%/6% share in poly/cell/module (end-23).
	Rating Sell		*TP methodology*: Our 12m TP is based on 1.1X 2024E P/B (derived from a 30% discount to 1X P/B for its solar business
	Target 13.4	CNY	due to a more pressured balance sheet and shorter FCF cash burn, and 3X P/B for the feeding business based on listed
	Price 17.9	CNY	peers); cross checked with its historical return profile.
	Upside -25%		*Key risks*: 1) Higher-than-expected market demand; 2) favorable chgs in raw material/electricity prices; 3) breakthrough in HJT; 4) earlier-than-expected ASP stabilization with efficient industry capacity adjustments across the value chain.
Electric vehicles			
BYD-H	Ticker 1211.HK		*Company profile*: BYD is a leading NEV maker both in China and globally, with 36%/4% NEV market share in
BYD-A	002594.SZ		domestic/overseas market in 2023.
	Rating Buy/Buy		*TP methodology*: 12m DCF-based (WACC 10.8%, TGR 2.0%) TPs of Rmb309/HK$295 for A/H shares
	Target 295.0/309.0	HKD/CNY	(applying a 14% discount to the H-shares).
	Price 219.2/234.8	HKD/CNY	*Key risks*: 1) Intensifying electric vehicle competition; 2) Slower-than-expected overseas expansion progress;
	Upside 35%/32%		3) Lower-than-expected external battery sales.
SAIC	Ticker 600104.SS		*Company profile:* SAIC is the largest Chinese auto OEM with a 14% domestic market share and 73% of sales volume
	Rating Sell		from ICE in 2023.
	Target 9.7	CNY	*TP methodology*: 12m P/E-based (8x) TP of Rmb9.7.
	Price 14.6	CNY	*Key risks*: 1) slower EV penetration progress; 2) stronger overseas expansion; 3) faster JV NEV product transition.
	Upside -33%		
Lithium batteries			
CATL	Ticker 300750.SZ		*Company profile*: CATL is the largest and most innovative battery maker globally, with a 40% global market share in 2023.
	Rating Buy		*TP methodology*: Our 12m TP is derived from an average of a near-term and long-term P/E valuation. We use the
	Target 307.0	CNY	company's past 3-month average P/E of 16.3x for 2023E to arrive at a near-term valuation, and employ a 15.0x
	Price 177.1	CNY	long-term P/E for 2030E and discount back to 2023E at 10.8% COE to derive a long-term valuation.
	Upside 73%		*Key risks*: 1) product upgrades by peers; 2) lower battery demand growth; 3) further deterioration in trade barriers.
Farasis	Ticker 688567.SS		*Company profile*: Farasis is the largest pouch battery maker in China with 1.7% global market share in 2023.
	Rating Sell		*TP methodology*: Our 12m TP is derived from an average of a near- and long-term valuation. We use a 1x P/B applied to
	Target 7.9	CNY	2024E BVPS to arrive at a near-term valuation, while employing an 15.0x long-term P/E for 2030E and discounting back
	Price 9.3	CNY	to 2024E at a 10.8% COE to derive a long-term valuation.
	Upside -15%		*Key risks:* 1) significant long-term contracts from OEMs; 2) stronger-than-expected growth from new batteries; 3) higher-than-expected government subsidies.
Power semis(IGBT)			
Hua Hong	Ticker 1347.HK		*Company profile*: Hua Hong is a semiconductor foundry (8" and 12") focusing on specialty technologies.
	Rating Buy		*TP methodology*: We are Buy rated on Hua Hong. Our 12-month target price of HK$30.0 is based on 24x 2025E P/E.
	Target 30.0	CNY	Our target multiple is derived from global semiconductor peers' P/E vs. earnings growth correlation.
	Price 19.3	CNY	*Key risks*:1) Uncertainties around US-China trade relations; 2) Weaker-than-expected end-market demand;
	Upside 55%		and 3) Slower-than-expected 12" fab ramp-up.
CR Micro	Ticker 688396.SS		*Company profile:* CR Micro is the leading power-semiconductor integrated device manufacturer (IDM) in China.
	Rating Sell		*TP methodology:* We are Sell rated on CR Micro. Our 12-month target price of Rmb36.37 is based on 28x 2025E P/E.
	Target 36.4	CNY	Our TP multiple is derived from sector P/E and earnings growth correlation and is within CR Micro's historical range.
	Price 39.4	CNY	*Key risks*: 1) Better-than-expected ASP trend among MOSFET, IGBT, SiC; 2) faster-than-expected new design wins
	Upside -8%		and market share gains; 3) faster-than-expected new product (IGBT and power IC) development progress; 4) fewer entrants within the IGBT/ SiC space, which helps to reduce competitive pressure.
Construction machinery			
Dingli	Ticker 603338.SS		*Company profile*: Zhejiang Dingli is one of China's largest suppliers of aerial working platforms (AWP).
	Rating Buy		*TP methodology*: We base our 12-m TP of Rmb81.0 on a 16.5X 2024E DACF. Our target EV/DACF multiple of 16.5X
	Target 81.0	CNY	implies a ~45% discount to its long-term historical average to reflect weak industry demand.
	Price 51.6	CNY	*Key risks*:1) Weaker-than-expected construction activity globally; 2) intensifying domestic competition;
	Upside 57%		3) slower-than-expected ramp-up of its boom lift margin and penetration of electrified boom products in US market; 4) escalating US-China trade tensions and unfavorable outcomes from EU anti-dumping and anti-subsidy investigations.
Sany	Ticker 600031.SS		*Company profile:* Sany Heavy is one of China's leading manufacturers of construction machinery including excavators
	Rating Sell		(ranked No.1 globally), concrete machinery (ranked No.1 globally) and cranes (top 3 in China).
	Target 11.0	CNY	*TP methodology*: We use a 2024E target EV/GCI of 1.0x based on its historical trading level against expected CROCI.
	Price 15.7	CNY	*Key risks:* 1) Stronger-than-expected construction activity in China and/or globally; 2) faster-than-expected market
	Upside -30%		share gains; 3) unexpected decrease in raw material prices; 4) unexpected depreciation in Rmb.
Air conditioners			
Hisense-H	Ticker 0921.HK		*Company profile:* Hisense holds a leading position (20%+ market share) in the structurally growing China VRF market, as
Hisense-A	000921.SZ		well as gaining market share within the white goods space globally, with 7 sub-brands and product offerings to 130+ regions.
	Rating Buy/Buy		*TP methodology*: Our 12m TP for H/A-shares are based on 17x/12x 2026E P/Es for Hisense-Hitachi JV/legacy white
	Target 35.0/40.0	HKD/CNY	goods, discounted back to 2025E at a 9.5% COE.
	Price 23.6/28.4	HKD/CNY	*Key risks*: 1) Weak white goods demand; 2) property market slowdown; 3) increasing domestic competition;
	Upside 49%/41%		4) developer channel contribution; 5) Hisense-Hitachi JV integration; 6) weak legacy white goods business.

Source: Company data, Goldman Sachs Global Investment Research

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Disclosure Appendix

Reg AC

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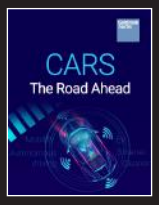

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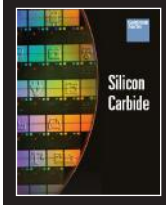
China Post-95s

Silicon Carbide



China Decarbonization

Sustainable ESG Investing

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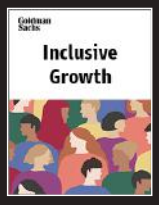
Inclusive Growth



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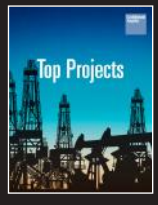

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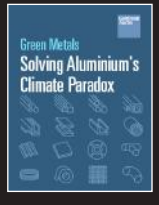
Green Metals



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