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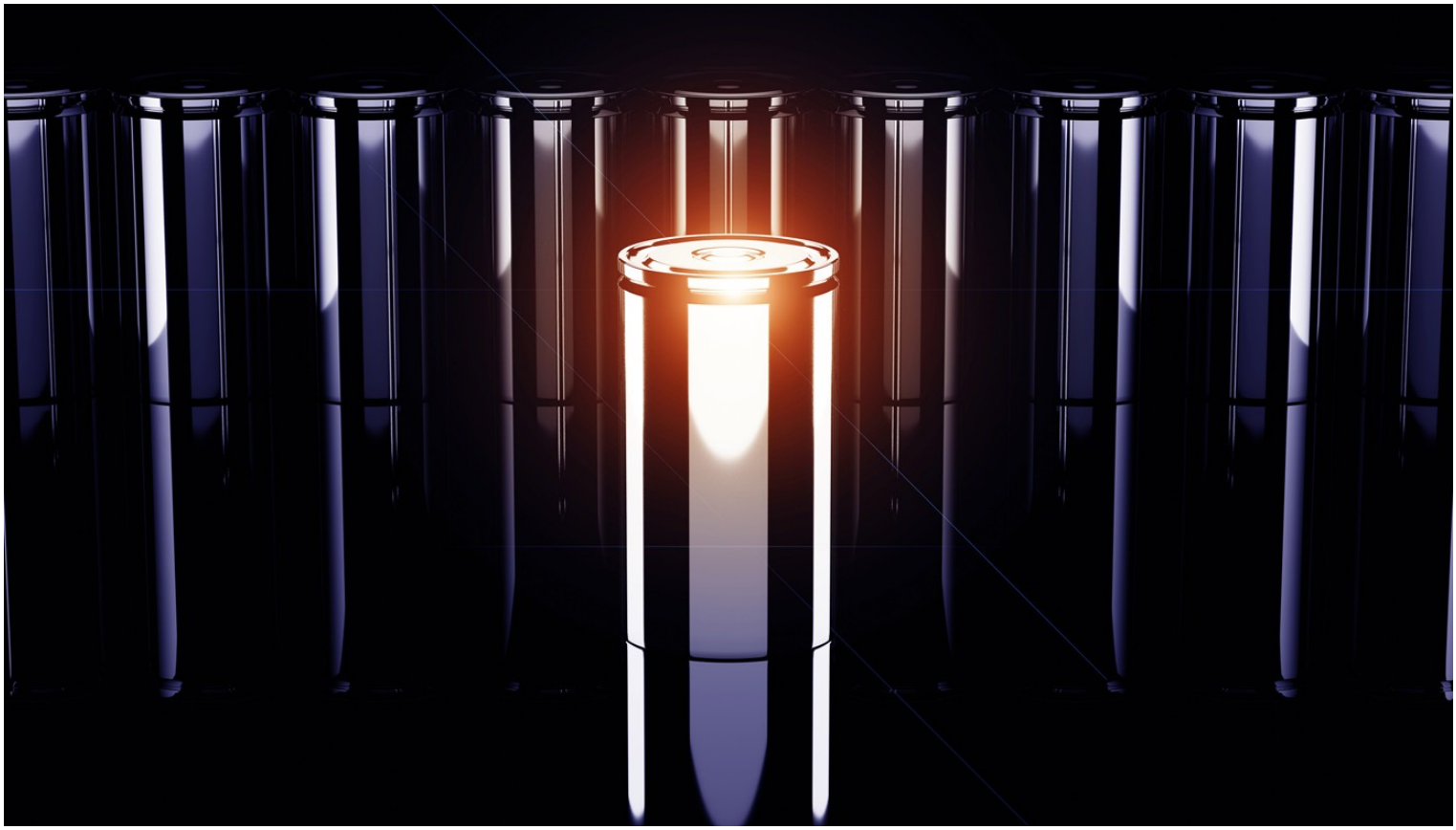
EV Battery Supply Chain

Charging Ahead: Positioning for Battery Tech's Next Iteration

The 4680 cell could help bring less expensive BEVs (US$25-30K) to market. In this report, we explain why the 4680 is likely to be the next battery iteration, how fast, and how the supply chain could be reshaped. Initiate EVE Energy at OW.



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What underlies potential for >50% EV penetration? The market appears to be valuing the EV battery segment with a >50% EV penetration assumption, but investors may be overlooking what kind of battery is needed to achieve such an assumption. We believe current battery technology has enabled US$35K BEVs, while a better and cheaper battery is needed to break into the US$25K car market and feed into our US$535bn TAM as laid out in our recent Blue Paper. Also, EV subsidy and/or tax credits would eventually phase out, thereby pressuring battery cost to further deflate.

INDUSTRY VIEW

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Attractive

Why is the 4680 cell likely to be the next battery iteration? Battery evolution in energy and cost, after a year-long halt, is likely to restart, led by the 4680 cylindrical cell, to be launched in 2022, driven by: 1) the right architecture to accommodate higher-energy materials and reduce overheating risk, 2) greater cost efficiency because of improvement in cell energy density and manufacturing efficiency, and 3) reduced battery management system complexity and improved packaging.

Who conducts the development and how fast? 4680 cell development is now led by Tesla and Panasonic, and many other battery majors are initiating commercialization, confirming its advancement. The 4680 cell supply chain is largely same as the current NCM battery chain, already in place to support a 4680 ramp, while silicon anode, a new feature that has been commercialized in China, should see supply rise efficiently to meet demand. As 4680 is more advanced than current battery technology in long-range models, we expect 4680 penetration to reach ~50% of the global EV battery market in 2025 and peak at 60% in 2027-2028, with upside if it can further reduce cost to a level suitable for standard-range models.

Exhibit 1: Initiating EVE Energy at Overweight

Company name	Ticker	Rating	PT	Current price	Upside /downside
EVE Energy	300014.SZ	Overweight	Rmb 149.0	Rmb 121.4	23%

Source: Morgan Stanley Research, Refinitiv. Share price as of December 28, 2021.

Leaders and laggards. We think the rise of the 4680 cell will reshape a significant portion of the supply chain, including anode, cathode, equipment, cell making and upstream materials. Other supply chain segments more or less remain the same. As silicon anodes take hold, we also expect nickel-rich cathodes and related upstream metals to regain market share. Equipment suppliers should see a larger TAM, given that the 4680 should spur part of existing capacity to retire. Cell makers such as Panasonic and EVE, with advanced 4680 initiatives, should benefit from the shift and gain share, while others, such as CATL, which is deeply rooted in prismatic cell development, may be too big to pivot for 4680. CATL's ambitious capacity expansion based on current technology could be hindered by the 4680 ramp. We initiate coverage on EVE at OW as it is a pioneer in 4680.

Where could we be wrong? Progress in 4680 commercialization could be slower than expected due to low yield rate at the mass production level, leading to higher-than-expected cost. Another tech direction, LMFP (an upgraded version of LFP) in prismatic form factor, could move faster than 4680.

Contents

Executive Summary

Rising EV penetration requires ongoing battery evolution in chemistry and architecture. Following our battery Blue Paper, "The New Oil: Investment Implications of the Global Battery Economy," we now further discuss our expectations for the next generation of battery technology, as we expect it to evolve over the next 3-5 years, and how we expect the supply chain to be reshaped.

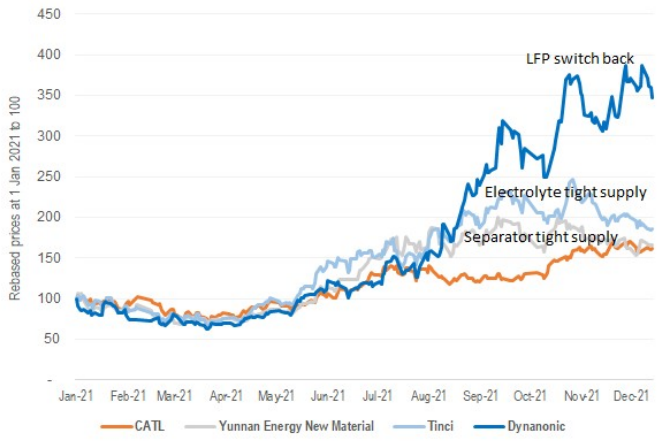
Previous battery iterations and supply chain reshuffling. In the past, battery technology iteration has led to many substitutions in the battery supply chain. The need for battery management system (BMS) simplicity on the OEM side benefited prismatic and pouch cells, allowing them to gain market share from cylindrical cells. The need for energy density improvement drove a shift in battery materials usage, to switch from dry separator to wet type, natural graphite to synthetic graphite, and lithium iron phosphate (LFP) to nickel manganese cobalt (NMC) cathode which further led to a switch from lithium carbonate to lithium hydroxide, and more demand for nickel and cobalt. But cost and safety concerns in 2021 have prompted a cathode material switch, back to LFP.

Share performances of battery chain names reflect such shifts in the supply chain. Supply chain leaders such as CATL have been mostly EV proxy and beta plays, while some names outperformed CATL in 2021 given the alpha play (Exhibit 1), including Dynanonic (NC) reflecting LFP switching back, Tinci owing to electrolyte price surge and Yunnan Energy owing to separator supply shortage. Exhibit 3 shows the historical share price of Cangzhou Mingzhu, a dry separator producer. The significant 2017-18 share price decline resulted from wet type product substituting for dry type.

So what's the next shift in the battery value chain and who could benefit? We think potential 4680 cylindrical cell adoption (as is being developed by Tesla and existing battery makers) could reshuffle the supply chain over the next five years (ahead of anticipated solid state battery commercialization). In this report, we explain why 4680 appears to be on track to be the next technology iteration, how fast this could occur, and which companies are exposed.

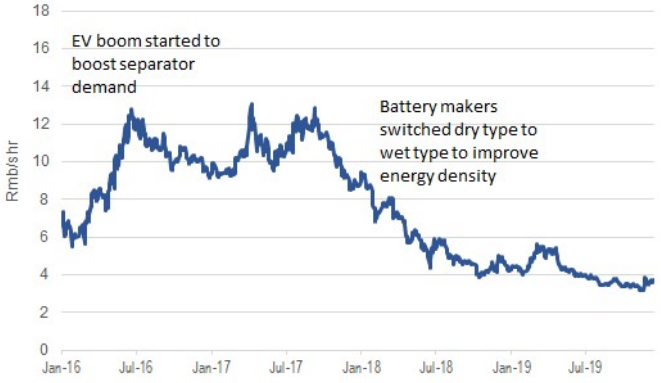
What underlies potential for >50% EV penetration? EV penetration already reached ~20% in 4Q21 in China, and the market expects 50% penetration by 2025. But – can current LFP and NCM battery technology drive EV penetration to 50%? We note that competitive BEV models are largely high-end/luxury cars, priced above US$35k, but, across China's auto industry, low-end to midrange cars below US$25k account for >50% of total car sales. Even for US$35k price range models, there are still EV subsidies and a purchase tax exemption (10% of price), and EV sales are still loss-making. It remains uncertain if such benefits for EV buyers will extend beyond 2022. If they are removed, EV cost would still need to decrease at least Rmb40k further to reach cost parity. This would require battery cost to decrease further. As such, we believe further battery evolution will be required to reach >50% EV penetration.

Exhibit 2: Relative share price performance, by category, in the battery supply chain



Source: Bloomberg, Morgan Stanley Research

Exhibit 3: Share price of Cangzhou Mingzhu, 2016-2019



Source: Bloomberg, Morgan Stanley Research

In our view, 4680 cells appear to be the right architecture to fit the chemistry. NCM811 cathode battery (with graphite anode) penetration has halted for a year, due to cost inflation and a battery thermal runaway issue (even without silicon anode adoption yet). We believe the next evolution is likely to be on the anode side, with silicon adoption to break through 300Wh/kg energy density. We believe that the 4680 cylindrical cell, scheduled to be launched in 2022, is likely to restart battery evolution in energy and cost after the NCM811-driven pause, given:

1) cylindrical cells appear better suited to combat the swelling issue of silicon anodes, as a circle encloses maximum area for a given arc length; a rectangular shape would be deformed when the anode expands. Initially, such deformation could affect cell consistency and cycle life. In more severe cases, swelling would break the solid electrolyte interface (SEI) and further lead to overheating and gas generation.

2) cost should decrease thanks to higher energy density, dry electrodes, and tabless structure that reduces production process complexity, eliminates manufacturing speed bottleneck, and enables some savings on material and energy costs. Tabless structure is a key to avoiding the rising thermal runaway issue that can occur in larger cells.

3) the larger cylinder is able to simplify BMS, enabling more OEMs to use the technology. Many OEMs avoid 1865/2170 small cylindrical cells as they are too small to control, given their limited BMS capability. BMW has now joined cylindrical group thanks to the larger cylinder. We would expect more OEMs to follow if the 4680 demonstrates desired performance. The larger cylinder also enables the battery pack to use a 'cell-to-pack' solution, avoiding a module in between.

Supply chain already in place to support the new cell's ramp-up. The 4680 cell supply chain is largely the same as the current NCM supply chain and is already in place to support the new cell's ramp. The silicon anode is the new feature that has been commercialized in China, and its supply should rise efficiently to meet the pace of the cell ramp-up. China's BTR (Not Covered) is now the world's largest silicon anode supplier in terms of 2021 volume. We believe China has proven the country's efficiency in battery supply chain building over the past five years.

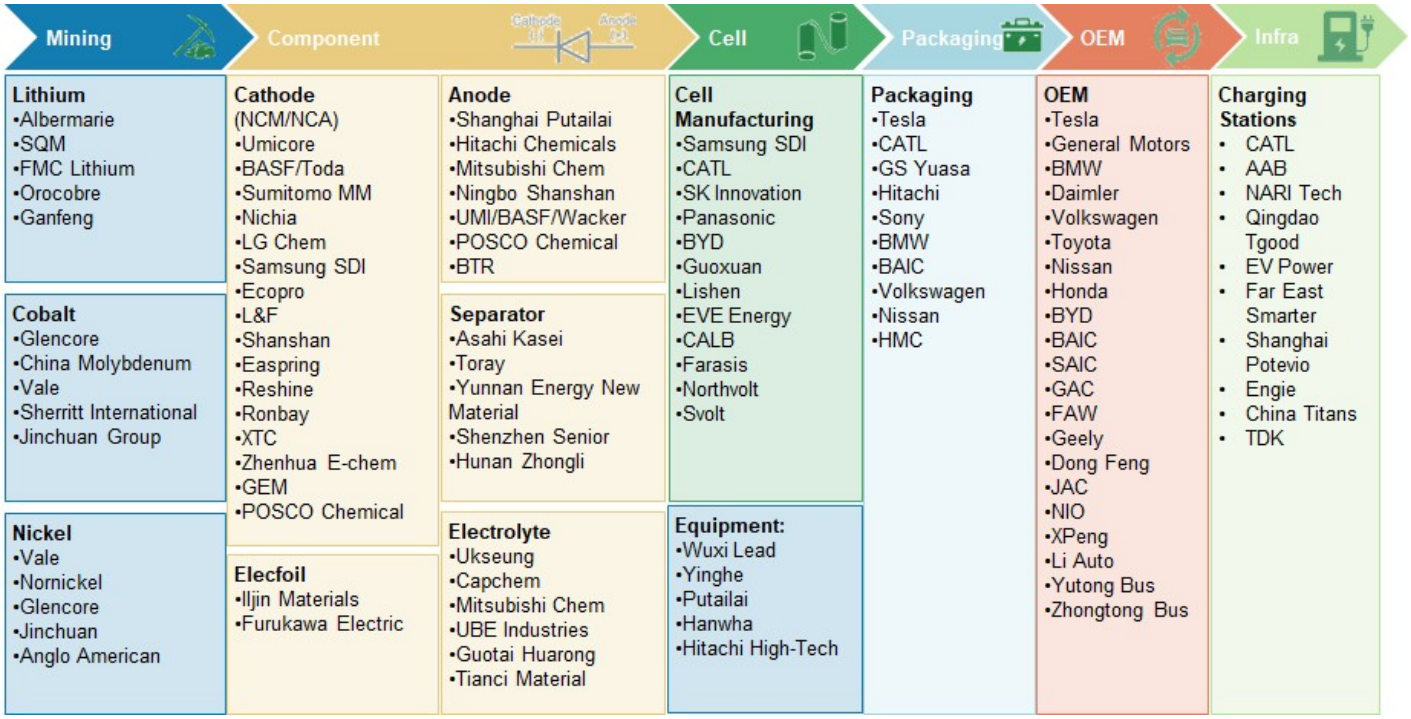
Just how fast? Since the 4680 is more advanced than current batteries in long-range models, and has the potential to enable US$25-30k BEVs, we expect 4680 cell penetration to reach ~50% of the global EV battery market in 2025, and peak at 60% in 2027-2028, considering the potential for solid state batteries to enter the market and climb the supply chain. This is our base case.

Bull case: Faster-than-expected progress in 4680 commercialization would lead to faster penetration, with greater-than-expected cost reduction, thanks to a higher-than-expected yield rate. Further evolution in energy and cost would continue, thanks to the adoption of a cobalt-free cathode and a rising mix of silicon in the anode. In this case, we would expect 4680 penetration to reach 80% in the global EV battery market in 2025.

Bear case: The progress of 4680 commercialization could be slowed by feasibility issues arising from the dry electrode and tabless structure at the mass production level. As a result, the yield rate would be lower than expected, leading to higher cost. In this case, we would expect 4680 penetration to reach 20% in the global EV battery market in 2025, and this would in turn affect EV penetration, given the bumps in battery development.

How supply chain would reshape. As far as chemistry, the current battery supply chain includes NCM and LFP chains; by form factor, the supply chain includes prismatic, pouch and cylindrical cells.

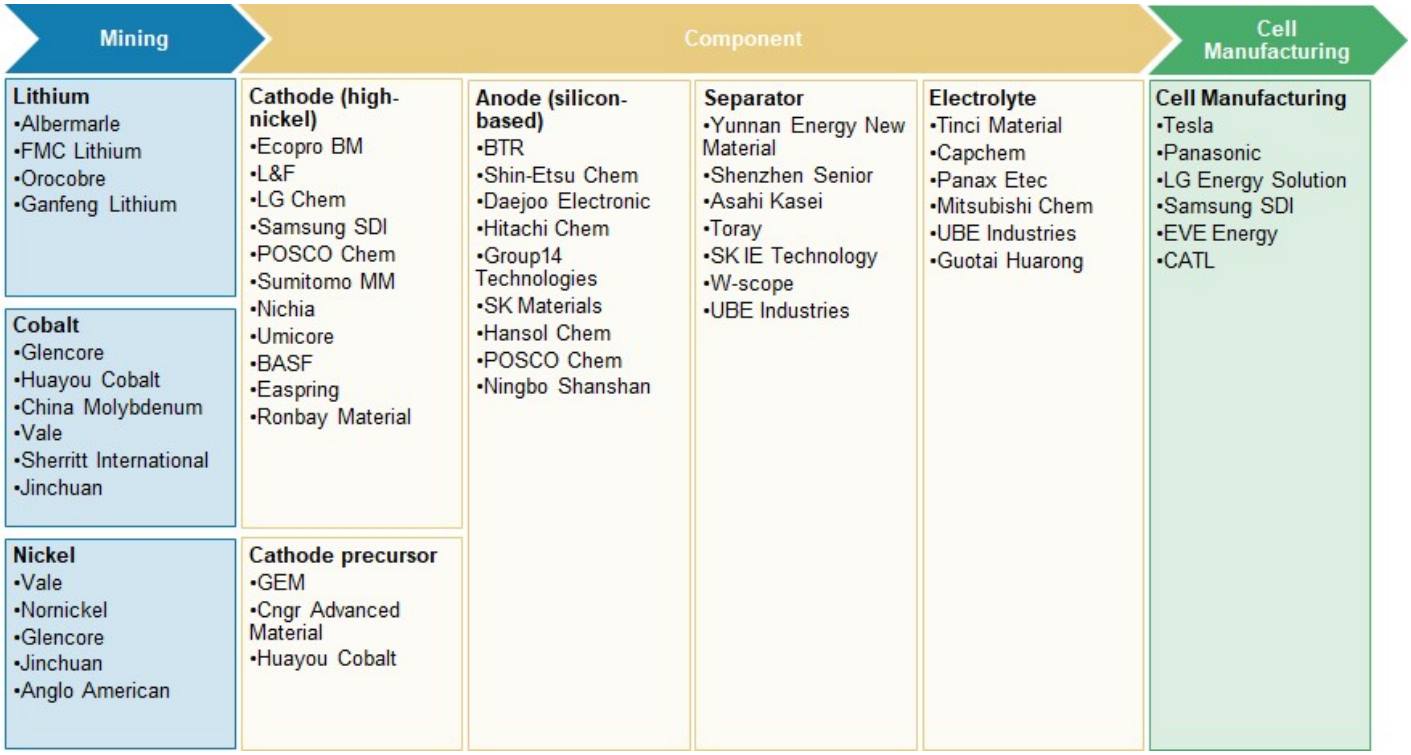
Exhibit 4: Current battery supply chain regime



Source: Morgan Stanley Research

The 4680 cell is an iteration in NCM chemistry, and it uses a cylindrical form factor. Assessing the 4680 battery value chain players, including upstream materials to midstream components to battery manufacturing, we think the rise of 4680 would significantly reshape the battery supply chain, including anode, cathode, equipment, cell and upstream metal materials. The 4680 will require a shift to silicon anodes (mixed with graphite). Nickel-rich cathode players, along with lithium hydroxide and nickel, will likely regain market share as the 4680 cell penetrates, given that this new form factor would be able to accommodate those higher-energy materials with reduced overheating issues. Equipment suppliers would see a larger TAM, given that battery makers would see rising capital replacement due to 4680 disruption. Prismatic cell makers would face challenges from 4680 cell penetration, and the worst case is that they would be forced to switch existing production lines to 4860 cells or lose market share.

Exhibit 5: 4680 cell exposure



Source: Morgan Stanley Research

In our view, CATL may be too big to change. We think 4680 could pose a key threat to CATL's dominance in the EV battery market. The company has been deeply rooted in prismatic cell R&D since the firm was founded a decade ago. The collaboration with BMW that focused on prismatic cells had significantly supported CATL's financials before 2016. CATL continued to try nickel-rich chemistry in prismatic form over the past three years, but its NCM811 penetration now appears to have halted for a year. Instead, the company switched back to LFP technology to gain Tesla orders and maintain market share. However, LFP batteries tend to be appropriate for standard-range models (<450km), while OEMs still need nickel-rich batteries to produce long-range models.

A 4680 cell that would initially serve as a replacement in the long-range model market would make NCM prismatic cells less competitive. 4680s could then further reduce cost to compete with LFP batteries in the standard-range market. If this were to occur, not only would CATL's future expansion plans be hindered, but its existing capacity would also be forced to exit. Given such possibilities, we view current investment behavior – that assigns zero WACC to value CATL – as being risky.

We initiate on EVE at OW. EVE Energy Co. is China's leading cylindrical cell maker, and it has developed the larger 4680 cylindrical cell. It plans to build 20GWh 4680 cell capacity in 2023, solidifying a leading position in new cell development in China. We expect the company to gain global market share, from its current 3% to 11% by 2025, spurred by: 1) 4680 cell development and capacity expansion, and 2) LFP prismatic cell penetration to more OEMs as a result of LFP battery industry commoditization and fragmentation. We expect EVE's EBIT to rise at a 61% CAGR, 2022-2025, vs. 33% for CATL, per our forecast.

EVE's battery business is now trading at 66x and 20x P/E multiples for 2022 and 2025, vs. CATL's 90x and 45x, respectively, as based on our EPS estimates. We believe EVE's valuation is compelling. We use a sum-of-the-parts methodology to value the company, with P/E methodology to value its battery segment, and PEG for its electronic cigarette vaporization segment, resulting in our price target of Rmb149. We assign a 30x P/E to EVE's 2025e battery earnings, in line with CATL's target multiple, as EVE would grow faster than CATL, but we believe CATL is likely to maintain its leadership position in the industry. We further apply a WACC of 8% to discount the 2025 value and arrive at our battery segment valuation of Rmb97/share. We value EVE's electronic cigarette vaporization business at Rmb52/share using 1.2x PEG on 2022e earnings from this segment.

Will 4680 be the next battery technology iteration?

Market view: No. EV penetration already reached ~20% in 4Q21 in Chins. The market expects 50% penetration in 2025 – with current battery technology. Supply chain disruption risk is small.

Our view: Yes. The US$35k car market has been disrupted by BEVs, while <US$25K car sales account for more than half of the BEV market. 50% EV penetration requires further reduction in battery cost. However, NCM battery technology iteration appears to have halted for a year, due to a cell thermal runaway issue and high cost, and the industry reverted to LFP technology in 2021. To restart battery evolution, we think the cylindrical 4680 cell is the right architecture, having proven the feasibility of silicon anode adoption. A move to 4680 would spur reshuffling in the supply chain.

What does an LFP renaissance suggest? The lithium ion battery technology roadmap is likely to move toward higher nickel content to improve energy density and to reduce cost. NCM811 cells were launched two years ago, but their penetration appears to have halted because of the thermal runaway issue and cost inflation (nickel and cobalt costs). As a result, the 2021 battery mix has shifted to a higher proportion of LFP batteries, with their lower cost and better safety, albeit also with lower energy density and shorter range. It seems the old LFP technology has turned out to be a better option than the advanced NCM technology. We see this as a dilemma in the battery evolution roadmap, with rising concerns on safety and cost.

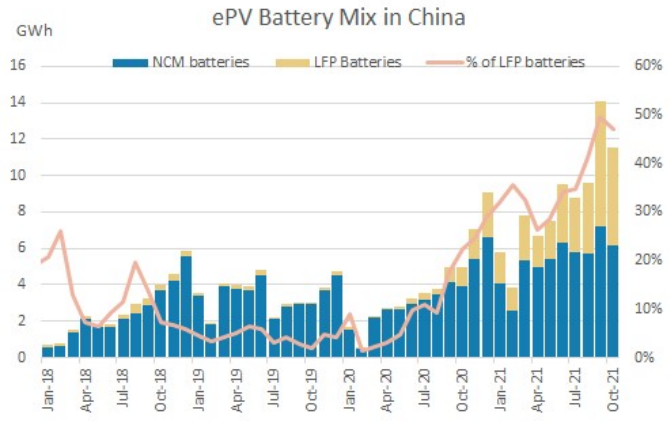
But ongoing EV penetration would still require further battery technology development. EV penetration reached ~20% in 4Q21 in China, and the market anticipates at least 50% penetration in 2025. However, a 50% EV penetration rate would require further battery evolution, in our view. We don't believe 50% penetration can be achieved with only the current battery technology. This is because:

1) LFP batteries are well suited to standard-range models (high to luxury end, NEDC<~450km), but OEMs still need a better solution for long-range models (NEDC>~550km), in our view, to further reduce cost and enhance safety.

2) EV subsidies, including Rmb10-20k/unit direct subsidy and purchase tax exemption (10% of car price) continue in China. High to luxury-end models offer >Rmb40k in total subsidies, which we believe is likely to phase out eventually.

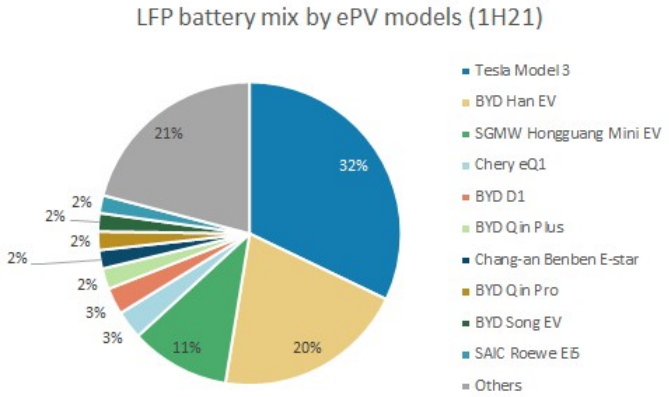
3) Low to medium range models, priced at <Rmb150/unit, account for over half of total car sales in China. Some mini EV models within this price range have good sales, but their battery capacity is only 10-30kWh per unit for 120-300km (NEDC). We think batteries still need to evolve to make A-level BEVs more competitive against ICE cars.

Exhibit 6: LFP battery proportion in China's total ePV battery installation



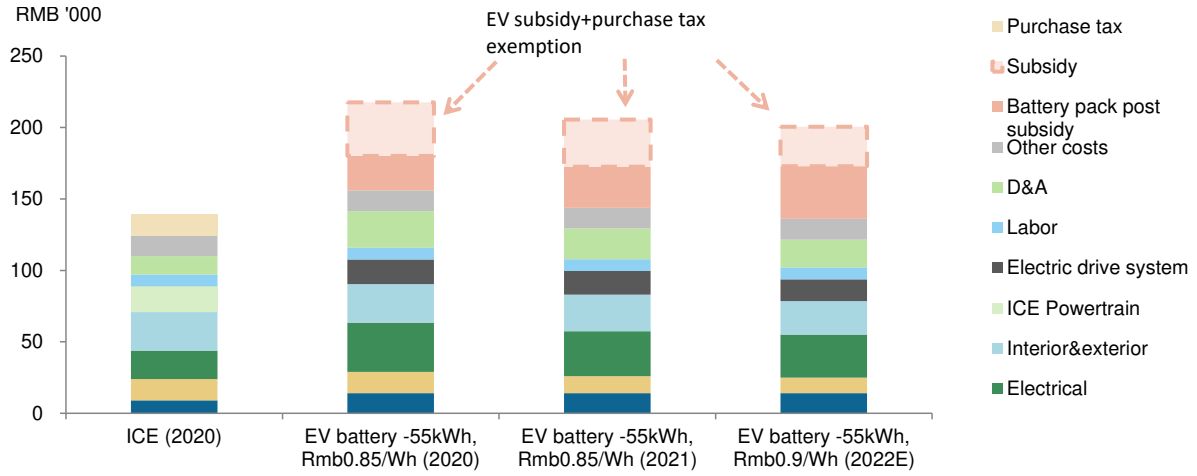
Source: GGII, Morgan Stanley Research

Exhibit 7: LFP battery models



Source: GGII, Morgan Stanley Research

Exhibit 8: Car cost comparison: ICE vs. BEV (China's Model 3)



Source: Morgan Stanley Research estimate

Silicon anodes can help reduce cost. Silicon anode energy density is ~10x that of graphite. Without silicon anodes, the NCM811 generation could be capped below 300kWh/kg. To break through such a cap, battery makers have been trying to determine the most effective chemistry to apply to a silicon anode. The primary issue is thermal swelling of electrodes as battery energy rises. Compared to the other two form factors (prismatic and pouch), cylindrical cells are better suited for silicon anodes, because:

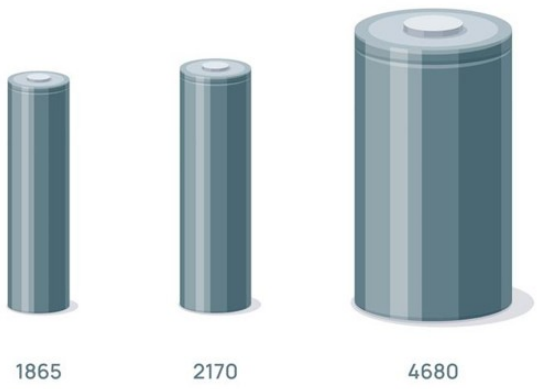
1) a circle encloses maximum area for a given arc length; rectangular configurations could expand when an anode electrode produces thermal swelling, but this is not the case for cylinder.

2) high consistency levels can be maintained for cylindrical cells since anode expansion can be contained. For other form factors, even if swelling isn't severe, cell consistency would be difficult to maintain, affecting battery life and potential thermal runaway.

3) thermal runaway would be greater if electrode expansion breaks the solid electrolyte interface, as it would lead to further overheating and gas generation.

The larger cylinder is likely to appeal to more carmakers. Given the feasibility of silicon anode adoption, its more standardized and efficient production lines, as well as high consistency in manufacturing, cylindrical cells look better than do other form factors. But the prevailing cylindrical cells, with sizes 1865 and 2170, are too small to be controlled by the current battery management system (BMS) capability of many OEMs. 4680 cells are big enough now to reduce BMS complexity for such OEMs, allowing an accommodation of only ~950 larger cells in the battery pack vs. ~4500 cells for the 2170 variety. BMW, which previously preferred prismatic cells, now plans to use the large cylindrical cells. We believe that more OEMs would be likely to follow if 4680's solid performance could play out in the commercialization stage.

Exhibit 9: Cylindrical cells evolving from 1865 to 4680



Source: Shutterstock

Exhibit 10: Tesla's 4680 design unveiled on Battery Day 2020

Source: Tesla

"Eliminating steps, streamlining processes, slashing costs." We cited Tesla's 4680 battery goal, as mentioned at the company's Battery Day in Sept 2020. Tesla's 4680 cell is one of the enablers that can help bring US$25k models to market, in our view. 4680 is not only about the silicon anode, but also has the following innovations:

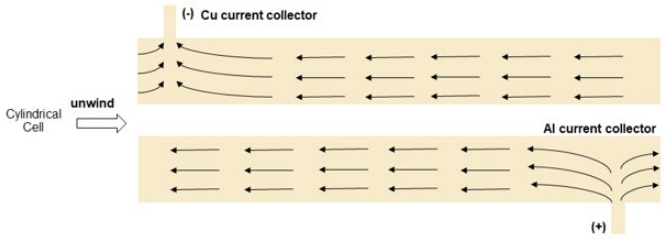
1) tabless structure (Exhibit 10): Conventional cells have a tab structure that connects cathode and anode to the terminals, creating a bottleneck in production speed. Tab installation slows manufacturing materially. Eliminating tabs could allow equipment to run faster and could reduce electric resistance in the cell. More importantly, the large conventional cell has a longer electrode roll inside and increases current resistance that more easily leads to thermal runaway. The tabless structure helps shorten the current path and significantly reduces the chance of overheating.

2) dry electrode: this is another measure that helps shorten the manufacturing process. This also enables battery production to move away from toxic and expensive solvents, as well as to save on energy costs vs. the drying process in the traditional approach.

3) larger scale manufacturing line: Tesla plans to introduce more standardized and efficient lines, with 10-20GWh annual single-line capacity vs. the 2-4GWh capacity of current battery manufacturing.

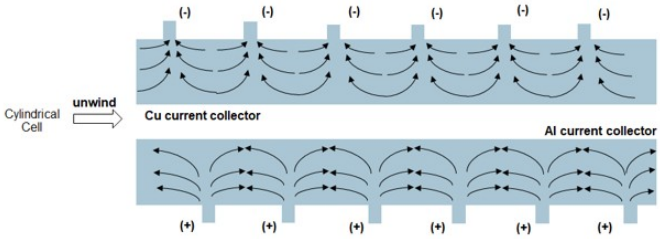
In our view, 4680's relative advantages are obvious. For premium long-range BEV models, range would likely be further improved by 16% with 4680 cells, and cost is cheaper vs. prismatic and pouch NCM batteries because of energy density improvement. We believe that the 4680 cell would likely reach cost parity, or better, with LFP batteries, with further iteration in chemistry, as nickel (on the cathode) and silicon (on the anode) content rises.

Exhibit 11: Conventional cell's current path



Source: Morgan Stanley Research

Exhibit 12: 4680 cell's current path with tabless structure



Source: Morgan Stanley Research

How Fast?

Market view: New battery technology takes a long time to commercialize. Mainstream battery technology will remain LFP/NCM prismatic and pouch cells.

Our view: The supply chain is largely already in place for 4680 cell production, unlike requirements for more advanced solid state technology. Given that Tesla, Panasonic's 4680, and EVE have made significant progress in the new cell commercialization, we expect 4680 cell production to kick off in 2022 and gradually ramp up over the next three to five years. In our view, without 4680, it could prove difficult for BEV to break into the US$25K car market and achieve a 50% penetration rate with current battery technology.

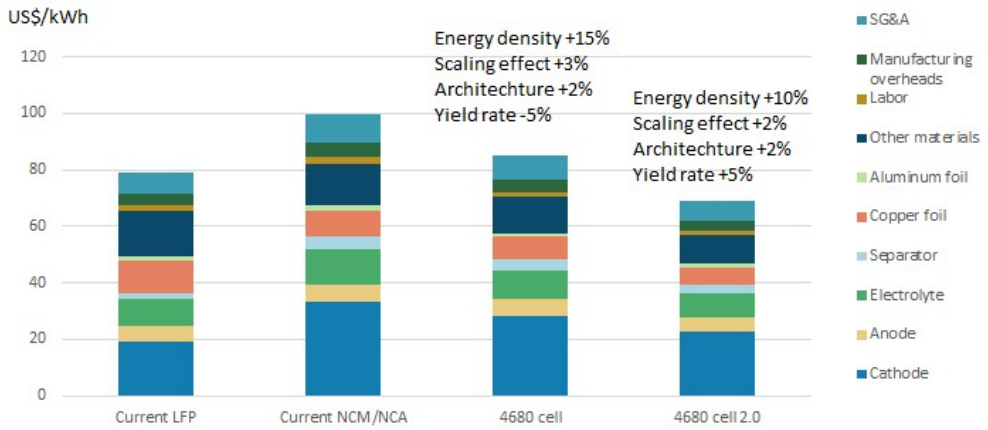
Advantage in range and cost. On Tesla's Sept 2020 Battery Day, the company stated a 50% target increase in range in the future, and 4680 cells will help to raise current range by 16%, according to Tesla. It also targets a 50% cut in battery cost. The energy density would improve to 300Wh/kg with silicon anodes, and theoretically further, to 330Wh/kg with a cobalt-free cathode and higher silicon mix in the anode (4680 cell 2.0), vs. current NCM battery energy density of ~260Wh/kg. Dry electrodes and tabless architecture could also simplify the manufacturing process and save some cost on material. Also, the production line would further scale up and the yield rate would improve as manufacturing becomes mature. Overall, we expect 4680 cells to reduce NCM battery cost by 15% in the early stage, and then further reduce cost by ~20% with 4680 cell v. 2.0. 4680 cell 1.0 would still be more expensive than LFP batteries, but would be able to replace current NCM batteries in long-range models.

Supply chain largely in place, but needs silicon anode scale. The 4680 cylindrical cell supply chain is still based on current battery chemistry. The cathode should be NCM811 or NCA, and then further upgraded to cobalt-free. The anode is silicon mixed with graphite, and silicon mix could improve step by step. Electrolyte and separator more or less remains same. The material supply chain capacity is already largely in place, except for silicon anodes, which needs to rise to meet 4680 penetration. We believe China has proven its efficiency in battery supply chain building over the past five years, and silicon anode production led by China Baoan (or BTR) would be able to scale up to meet the required the pace.

4680 cell potential penetration. NCM batteries have been evolving, from NCM333 to NCM532 to the current NCM811, two iterations in the past five years. Ahead of looming solid state battery commercialization, 4680, in our view, is the likely direction for the battery evolution roadmap over the next five years. Tesla plans to commercialize 4680 in 2022 and build 3TWh annual capacity in 2030, which we think could be completed by Tesla itself or by collaborating with current battery makers that could be Tesla's contract manufacturers.

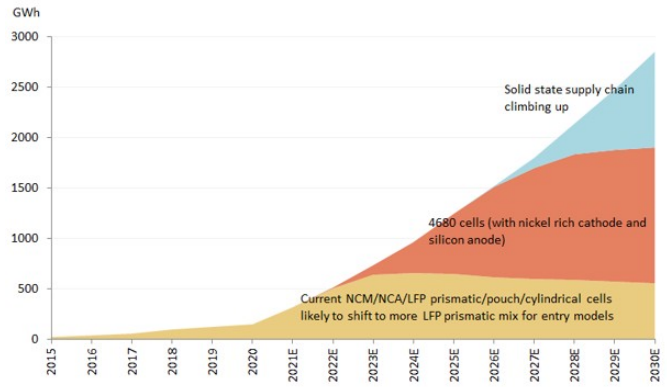
If Tesla can achieve only half of its target, we expect 4680 penetration to still reach ~50% of the global EV battery market in 2025 and peak at 60% in 2027-2028, considering the potential for solid state to then ascend the supply chain. On the other hand, current battery technology, including NCM/NCA/LFP prismatic/pouch/small cylindrical cells, is likely to see shipments peak in 2023, with a terminal decline in total volume mix going forward, but would see a rising proportion of LFP prismatic cells for entry models, per our forecast.

Exhibit 13: Cost comparison: Current LFP/NCM battery vs. 4680 cell vs. 4680 cell 2.0



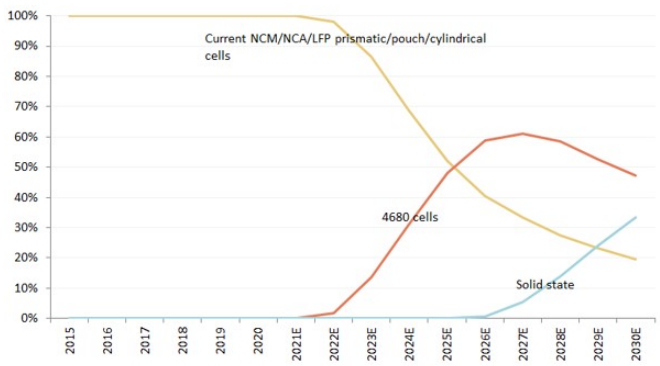
Source: Morgan Stanley Research estimates

Exhibit 14: Battery technology iteration roadmap



Source: GGII, SNE, E=Morgan Stanley Research estimate

Exhibit 15: Battery technology iteration roadmap



Source: GGII, SNE, E=Morgan Stanley Research estimate

Supply chain reshuffling

Anode: 4680 mixes silicon with natural graphite which is cheaper than synthetic graphite. The rise of the prismatic and pouch battery proportion in the overall EV battery mix over the past five years drove a switch from natural graphite to synthetic graphite. We think the potential adoption of 4680 would likely see a return to natural graphite.

Cathode: NCM811 or a higher nickel content cathode will likely resume penetration, as 4680 would likely enable battery iteration to continue. NCM811 would be able to substitute for NCM532/622 first. 4680 also has potential to achieve lower cost than LFP, if further upgraded in future. And then a nickel-rich cathode could replace the LFP cathode.

Separator: The segment will likely remain largely the same, although volume per kWh could slightly decrease because of 4680's higher energy density.

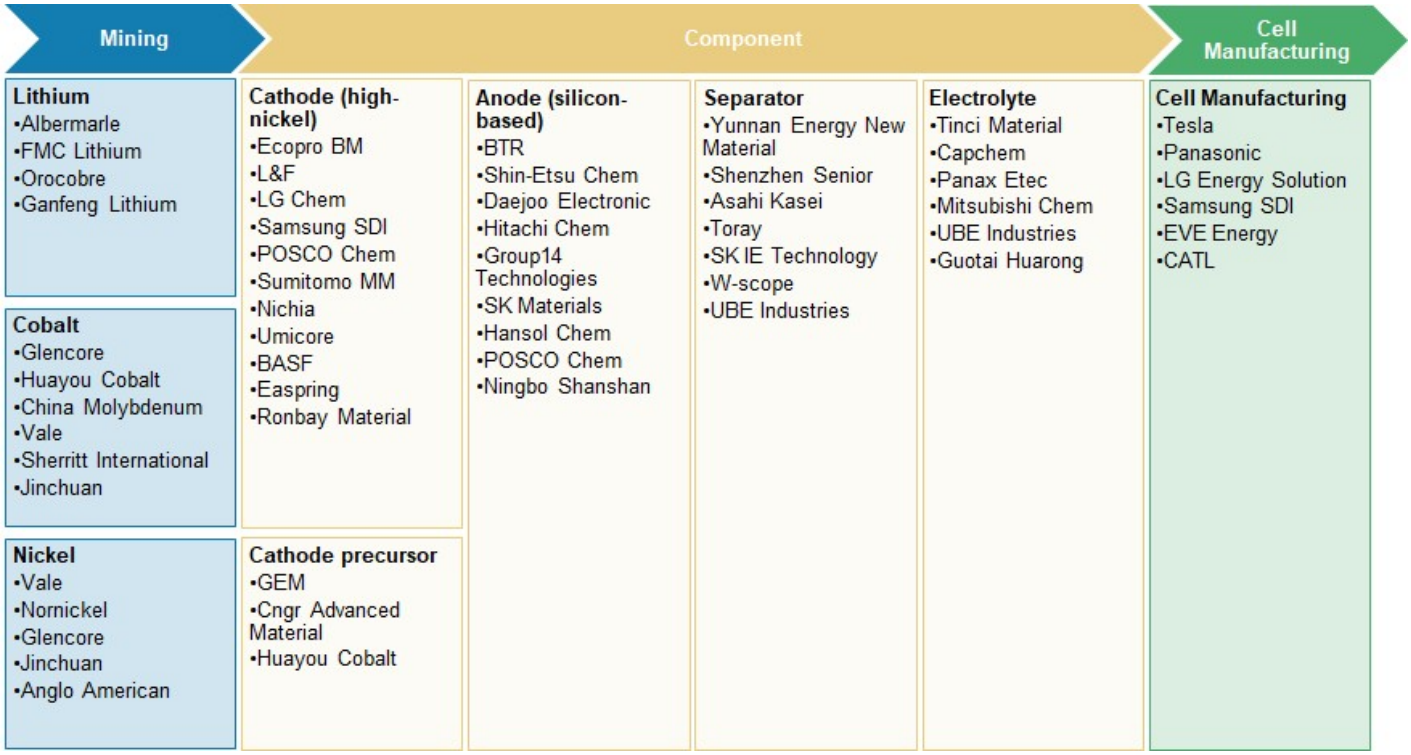
Electrolyte: The same outlook as in the separator segment.

Cells: 4680 will be developed by Tesla or possibly co-developed by Tesla and current battery makers. In our view, the least favorable scenario would be for current battery makers' business model to transition from ODM to OEM, if automakers switch to 4680 cylindrical cells. A 4680 cell that would initially serve as a replacement in the long-range model market would make NCM prismatic cells less competitive. 4680s could then further reduce cost to compete with LFP batteries in the standard-range market.

Upstream metals: Nickel demand growth could accelerate, driven by 4680 adoption. Cobalt is likely to be a transition product, and ultimately, the cathode could be cobalt-free. A nickel-rich cathode switch back would likely again boost demand for lithium hydroxide.

Cell making equipment: Equipment suppliers would see a larger TAM, given that battery makers would see rising capital replacement due to 4680 disruption. For the front process of production, dry process would likely replace wet process that includes coating, compressing and heating.

Exhibit 16: 4680 exposure



Source: Morgan Stanley Research

EVE Energy Co Ltd (300014.SZ, OW)

Domestic 4680 Cell Pioneer; Market Share Gain in LFP Battery; Initiating at OW

Evolution to 4680 cell. EVE Energy has evolved from a pure primary battery maker (prior to 2010) to one of the leaders in primary & 3C lithium-ion batteries (2011-16), and now to a comprehensive battery provider serving the primary, consumer electronics (3C), two-wheeler, EV and ESS segments (2017 onwards). It is now one of the few potential suppliers of 4680 cylindrical batteries globally, as it has already had 20GWh capacity under construction in Jingmen, Hubei province. Production of the new cell is expected start in 2023, and the order outlook is "highly visible," according to the company.

Market share gain amid LFP resurgence. The resurgence of LFP batteries brought second-tier battery makers like EVE Energy more opportunities in the domestic EV market. Currently, EVE Energy's major domestic electric passenger vehicle customer is Xpeng, suggesting EVE's product quality, and EVE is, in our view, likely add more OEMs into its customer profile in the future as more capacity expands, given that OEMs would be eager to diversify battery vendors from the current concentrated supply market.

Expecting ~60% CAGR in battery earnings, 2022-2025, vs. CATL's ~35% CAGR. This is driven by: 1) market share gain in LFP battery market, and 2) potential 4680 cell penetration. We expect the company's global market share in the EV/ESS battery market to rise from its current <4% to ~9% in 2025, according to the company's expansion plan.

Valuation. Excluding earnings contribution from Smoore, the company's battery business is now trading at 66x and 40x 2022 and 2023 EPS, vs. CATL's 90x and 72x, respectively, as based on our estimates. We believe EVE's valuation is compelling. We use a sum-of-the-parts methodology to value the company, using P/E to value the battery business and PEG to value the electronic cigarette vaporization segment, yielding our price target of Rmb149.

Key risks to our PT include: 1) potential delays in capacity expansions and exploration of new customers; 2) slower EV penetration and market share gain than originally expected due to supply chain bottleneck; and 3) regulatory risks surrounding Smoore's vaporization products as they are used in electronic cigarettes.

Exhibit 17: Key data

Reuters:300014.SZ / Bloomberg: 300014:CH China Specialty Chemicals	
Price target	149.00
Up/downside to price target (%)	23
Shr price, close(Dec 28,2021)	Rmb121.39
52-Week Range	Rmb152.90-66.25
Sh out, dil, curr (mn)	1,897
Mkt cap, curr (mn)	Rmb230,305
EV, curr (mn)	Rmb225,219
Avg daily trading value (mn)	Rmb3,234

Fiscal Year Ending	12/20	12/21e	12/22e	12/23e
ModelWare EPS(Rmb)	0.89	1.57	2.49	3.78
Consensus EPS(Rmb)§	0.92	1.68	2.47	3.54
Revenue, net (Rmb mn)	8,162	16,624	28,181	42,865
EBITDA (Rmb mn)	1,705	2,678	5,054	7,743
ModelWare net inc (Rmb mn)	1,652	2,963	4,733	7,168
P/E	91.6	76.9	48.3	31.9
P/BV	10.7	13.2	10.4	7.9
RNOA (%)	16.2	16.4	21.2	22.7
ROE (%)	21.9	20.6	27.4	32.6
EV/EBITDA	87.3	84.2	44.9	29.3
Div yld (%)	0.0	0.0	0.0	0.1
FCF yld ratio (%)	(0.3)	(1.6)	(1.6)	(1.4)
Leverage (EOP) (%)	(51.3)	(31.0)	(20.2)	(17.2)

Unless otherwise noted, all metrics are based on Morgan Stanley ModelWare framework

§ = Consensus data is provided by Thomson Reuters Estimates

e = Morgan Stanley Research estimates

Company description

EVE Energy Co Ltd is a China-based company principally engaged in the R&D, production and sales of lithium primary batteries and lithium-ion batteries. The company's lithium primary batteries are mainly used in smart meters, whereas its lithium-ion batteries are mainly used in electric vehicles, energy storage systems, 3C products, electronic cigarettes, TWS earphones, two-wheelers and electronic tools. The company distributes its products to both domestic and oversea markets.

Source: Refinitiv, company data, Morgan Stanley Research

Investment Positives

1) 4680 cell exposure: EVE Energy is one of the few potential suppliers of 4680 cylindrical batteries globally. The company is a domestic 4680 battery pioneer with high visibility, as it has already has 20GWh capacity under construction in Jingmen, Hubei province. Production of the new cell is expected start in 2023, and the order outlook is "highly visible", according to the company. This can potentially help the company gain access to the supply chains of top-tier EV producers and their popular models.

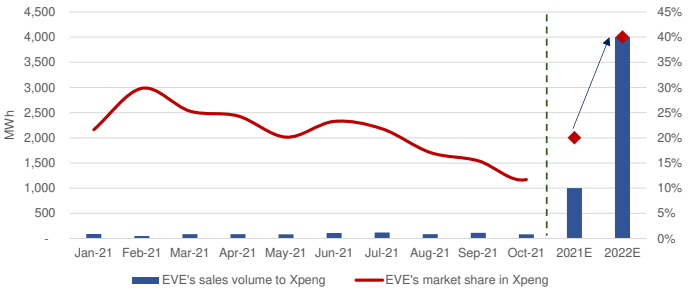
2) Market share gain amid LFP resurgence and ESS ramp-up: The resurgence of LFP batteries brings second-tier battery makers like EVE Energy more opportunities in the domestic EV market. Currently, EVE Energy's major domestic electric passenger vehicle customer is Xpeng. The latest statistics from GGII show that EVE Energy supplied ~0.9GWh of NCM batteries to Xpeng (for model G3 and P7) in 10M21, and EVE's market share in Xpeng is ~20% in 10M21. EVE expects to supply an additional 4GWh of LFP batteries to Xpeng in 2022 from its Jingmen plant, which means EVE's market share in Xpeng can double from the current ~20% to ~40% in 2022, according to our EV analyst Tim Hsiao's volume forecast for 2022.

In addition to the volume growth for Xpeng, the company is also planning additional capacities for commercial vehicles and ESS (+10GWh) for 2022. Beyond 2022, EVE will likely maintain a high growth rate, and we expect EVE's overall market share in the global EV and ESS market to surge from the current <4% to ~9% in 2025.

3) Capacity expansion on track to capture opportunity. EVE entered the EV battery market in 2019 and has an ambitious expansion plan. By the end of 2021, the company will have 20GWh LFP and 22GWh NCM battery capacity (including 10GWh capacity through an SKI Jiangsu JV). The company plans to add a further 20GWh LFP capacity and 27GWh NCM capacity in 2022. It also plans to add 20GWh large cylindrical (4680) capacity in 2023 and further targets 250GWh of EV/ESS batteries by 2025. For capacity additions of other types of batteries, EVE mainly has 600mn units of small cylindrical under construction (mainly 18650 for two-wheelers), given the strong demand.

4) Stable cash flow from consumer battery and electronic cigarette vaporization to fund expansion. EVE derives a significant amount of stable cash flow from: 1) ~32% equity stake in Smoore International (6969.HK, Not Covered); and 2) consumer battery business, such as TWS and two wheelers. The investment in Smoore is also expected to provide EVE Energy with a significant cash dividend, assuming the ~50% payout ratio seen in 2020, which can serve as part of the funding for capacity additions.

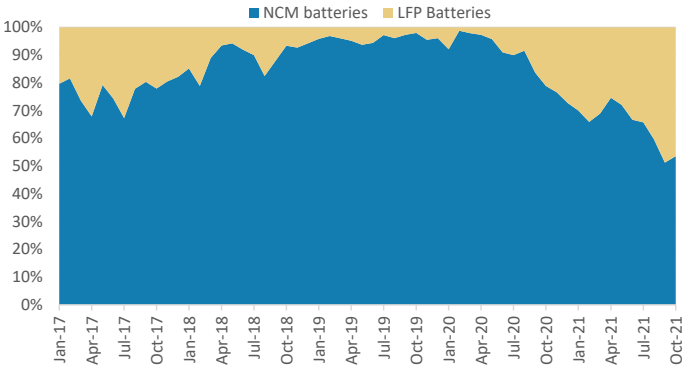
Exhibit 18: We expect EVE Energy's market share in Xpeng to double in 2022



Source: GGII, company data, Morgan Stanley Research (E) estimates

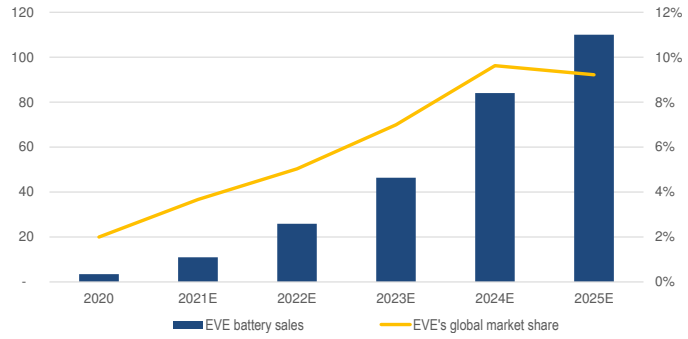
Exhibit 19: LFP resurgence in electric passenger vehicles

ePV Battery Mix in China



Source: GGII, Morgan Stanley Research

Exhibit 20: EVE's global market share in EV and ESS batteries may reach ~9% in 2025



Source: Company data, Morgan Stanley estimates

Investment Concerns

1) Potential delays in capacity expansion and exploration of new customers: Our estimates of earnings and market share are largely based on the company's project pipeline and capacity guidance – which is to raise EV and ESS battery capacity six-fold by 2025, to ~250GWh. However, there is still uncertainty on whether these capacities can be brought online as scheduled. Meanwhile, there is also concern on whether the company can explore more domestic customers in addition to Xpeng, especially those that produce popular models.

2) Slower-than-expected EV penetration and market share gain: Certain materials (e.g., separators, PVDF, lithium carbonate) required to make EV batteries may see supply shortages in 2022 or even over a multiyear period. This can potentially translate into slower-than-expected EV penetration and thus pose downside to EV battery makers. Our base case assumes ~21% EV penetration in China and ~8.5% EV penetration in rest of the world in 2022. However, if the material shortages kick in as we expect, EVE's volume growth and market share gain will be negatively impacted.

3) Regulatory risks surrounding Smoore: EVE Energy holds ~32% stake in Smoore International Limited (6969.HK, Not Covered), a leading vaping device maker that mainly distributes its products to global tobacco and electronic cigarette companies. The investment income and dividend payout from Smoore constitute a significant portion of EVE's net profit and cash flows. Nevertheless, the electronic cigarette value chain is still facing regulatory risks and uncertainties, especially in China because detailed regulations for this type of "new tobacco" have yet to be issued. Although, recently, the Chinese government brought electronic cigarettes under the scope of the monopoly law, giving the product a legal identity, and the State Tobacco Monopoly Administration drafted rules to require registration and licencing for electronic cigarette sellers and producers – the industry still awaits further details on national standards and a supervision framework, which could reshape the industry landscape. EVE Energy, as the second-largest shareholder of Smoore, would be exposed to such risks and uncertainties.

EVE Energy Company Profile

Background: EVE Energy was established in Huizhou, Guangdong in 2001. The company was listed on Shenzhen GEM in October 2009. Over the years, EVE Energy evolved from a pure primary battery maker (prior to 2010) to one of the leaders in primary & 3C lithium-ion batteries (2011-16), and now to a comprehensive battery provider, serving the primary, consumer electronics (3C), two-wheeler, EV and ESS segments (2017 onwards).

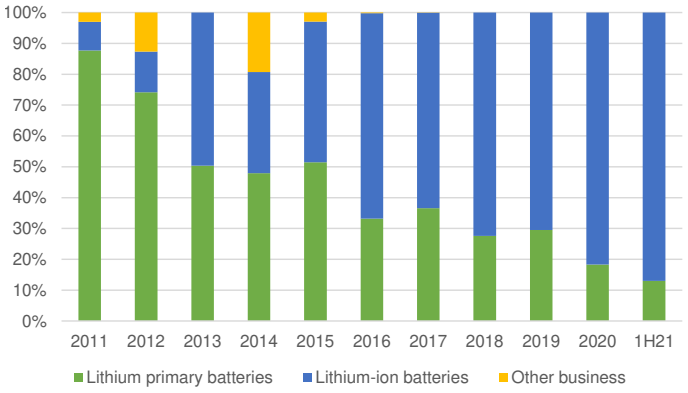
Product portfolio: The company's battery products can be divided into two general categories (i.e., primary batteries & lithium-ion batteries), with the following product portfolio.

Exhibit 21: EVE Energy's product portfolio

Category	Product	Applications	Current capacity	Future capacity targets
Lithium primary batteries	Li/SOCl2, Li-MnO2	Smart meters	412mn units	572mn units
Lithium-ion batteries	3C batteries	Consumer electronics, electronic cigarettes	N/A	N/A
	TWS batteries	True wireless stereo earphones	N/A	N/A
	Small cynlidricals (18650 & 21700)	Two-wheelers, electronic tools	600mn units	1,200mn units
	EV batteries (pouch, prismatic; future will include 4680 cylindrical)	EVs	~42GWh	250GWh by 2025
	ESS batteries	ESS		

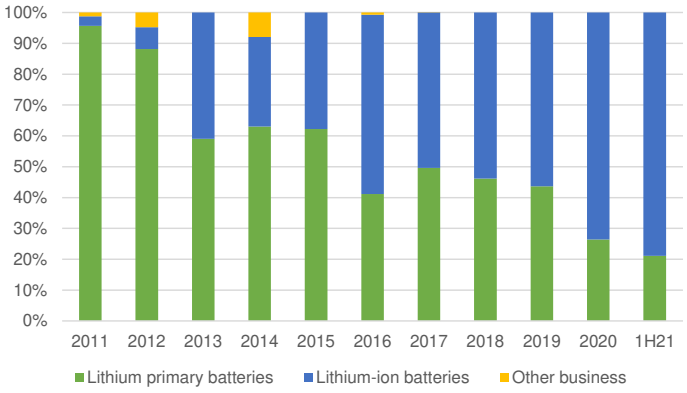
Source: Company data, Morgan Stanley Research

Exhibit 22: EVE Energy - Revenue composition



Source: Company data, Morgan Stanley Research

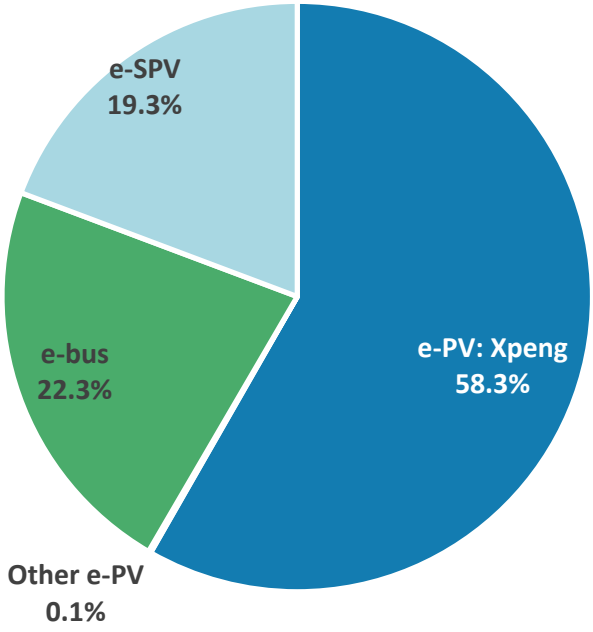
Exhibit 23: EVE Energy - Gross profit composition



Source: Company data, Morgan Stanley Research

EV battery customer profile: EVE's current EV battery installation concentrates on a few customers, especially Xpeng for e-PV. Other domestic customers are mainly domestic bus producers, such as Nanjing Golden Dragon and Dongfeng. The domestic installation breakdown is as follows in 10M21. The company is catching up in entering the overseas OEM market, including at Daimler and BMW.

Exhibit 24: EVE Energy - EV battery domestic installation breakdown in 10M21



Source: GGII, Morgan Stanley Research

Exhibit 25: EVE Energy - EV battery overseas customer lineup

Source: Company data, Morgan Stanley

EVE Earnings Prospects

Capacity: EVE entered the EV battery market in 2019 and has an ambitious expansion plan. By the end of 2021, the company will have 20Gwh LFP and 22GWh NCM battery capacity (including the 10GWh capacity in its SKI Jiangsu JV). The company plans to further add 20GWh LFP capacity and 27GWh NCM capacity in 2022. EVE also plans to add 20GWh large cylindrical (4680) capacity in 2023, and it further targets 250GWh of EV/ESS batteries by 2025. For capacity additions of other types of batteries, EVE mainly has 600mn units of small cylindrical under construction (mainly 18650 for two-wheelers), given the strong demand.

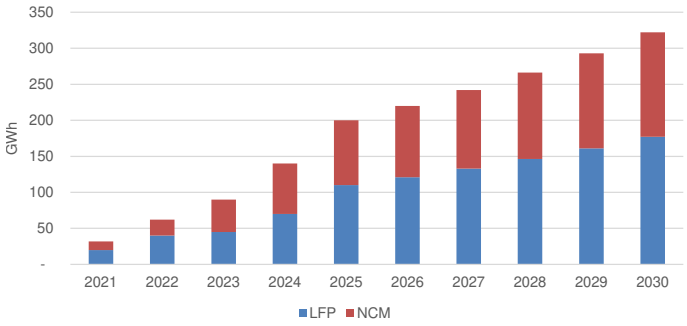
Sales volume: We estimate EVE's EV battery sales volume (excluding Jiangsu JV with SKI, in which EVE holds a 30% stake) to be ~11GWh in 2021, with ~5Gwh being LFP and the rest being NCM. As for 2022, LFP batteries will be the key growth driver, and the sales volume may reach ~16GWh thanks to additional volume from Xpeng (+4GWh), ESS, and special purpose vehicles, per our assessment. NCM sales increments in 2022 will mainly come from ramp-up of Huizhou JV with SKI, which should drive NCM sales volume in 2022 to ~10GWh. For other batteries, we expect the sales volume of small cylindrical to see significant growth in 2022, given the strong demand and order outlook. As the company targets 250GWh capacity in 2025 (MSe: ~10% of China capacity in 2025), we believe EVE will continue to gain market share and record a >70% CAGR in EV battery sales volume in 2021-2025 and achieve ~9% global market share, in 2025.

Exhibit 26: EVE's EV/ESS battery capacity breakdown

Category	Capacity end-2021	Capacity end-2022	Capacity target 2025
LFP	**20**	**40**	
Huizhou	4	4	**~125**
Jingmen	16	36	
NCM	**22**	**49**	
Pouch	20	37	
Huizhou JV with SKI (51%)	10	10	**~55**
Yancheng JV with SKI (30%)	10	27	
Prismatic (Jingmen)	2	12	
Cylindrical (Jingmen)	0	0	**~70**
Total	**42**	**89**	**~250**

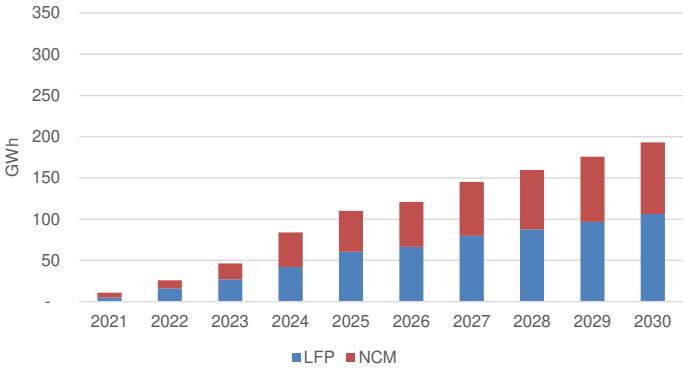
Source: Company targets, Morgan Stanley Research estimates.

Exhibit 27: EVE Energy - EV/ESS battery capacity



Source: Company data, Morgan Stanley Research estimates

Exhibit 28: EVE Energy - EV/ESS battery sales volume



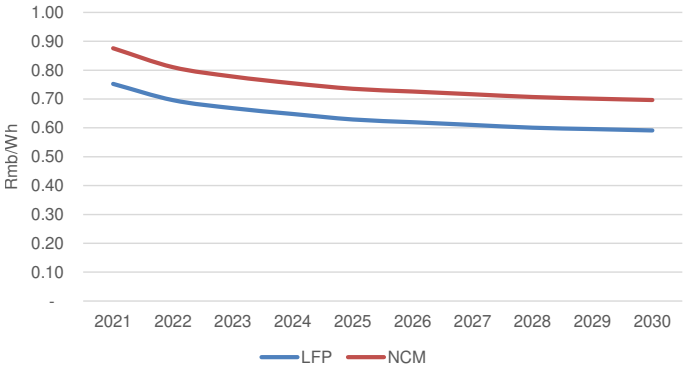
Source: Company data, Morgan Stanley Research estimates

ASP and margins: Similar to dynamics at other battery makers, raw material price hikes pose margin pressure to EVE's battery business, in our view; the company's GP margin dropped from 29% in FY20 to 25% in 1H21. Management previously explained that the reclassification of shipping cost from selling expenses to cost of sales dragged GP margin in 1H21, but we still think rising material cost remains a challenge, as 3Q21 GP margin also dropped ~2.5ppts QoQ, even without reclassification of shipping cost. As a result, we forecast EVE's GP margin will be ~23% in 2022 and then will gradually decline in the years beyond as battery cost will still need to be cut.

Investment income: EVE derives a significant amount of investment income from: 1) ~32% equity stake in Smoore International; and 2) 30% stake in the Jiangsu battery JV established with SKI (NCM pouch). For 1), we use the consensus net profit forecast for Smoore International as our base case estimate for investment income from Smoore. As for 2), the current capacity at the JV is ~10GWh and is slated to be increased to 27GWh by the end of 2022. The batteries manufactured by the Jiangsu JV will mostly be supplied to overseas OEMs, and we expect the sales volumes to be ~6GWh in 2021 and ~15GWh in 2022. In addition, the investment in Smoore should provide EVE Energy with a substantial cash dividend, assuming the ~50% payout ratio seen in 2020, which can serve as part of the funding for capacity additions.

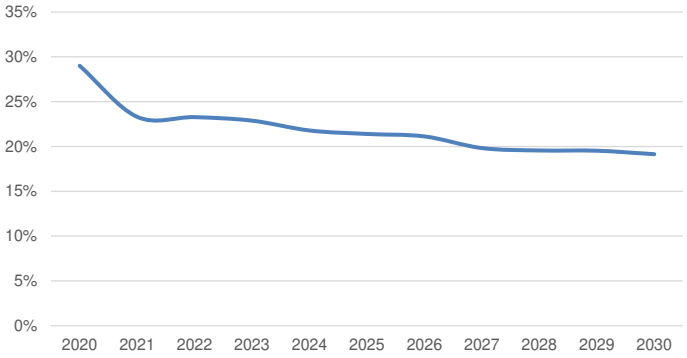
Overall, we expect EVE's net profit to achieve 79%/60%/51% YoY growth in 2021-23, given robust demand growth for EV batteries.

Exhibit 29: EVE Energy - ASP of EV batteries



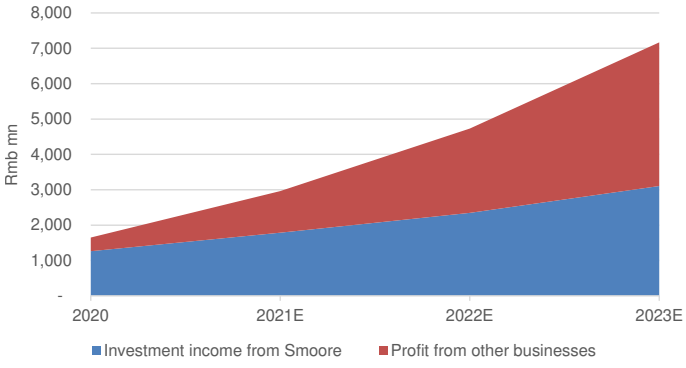
Source: Company data, Morgan Stanley Research estimates

Exhibit 30: EVE Energy - GP margin trend



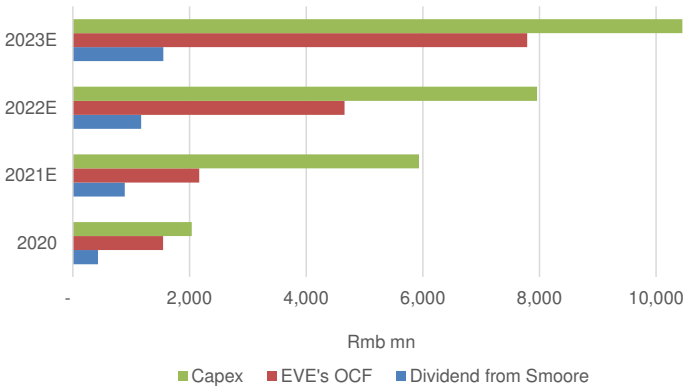
Source: Company data, Morgan Stanley Research estimates

Exhibit 31: Investment income from Smoore contributes significant amount of EVE Energy's profit



Source: Company data, Morgan Stanley Research estimates

Exhibit 32: Smoore also provides a significant amount of cash dividend



Source: Company data, Morgan Stanley Research estimates

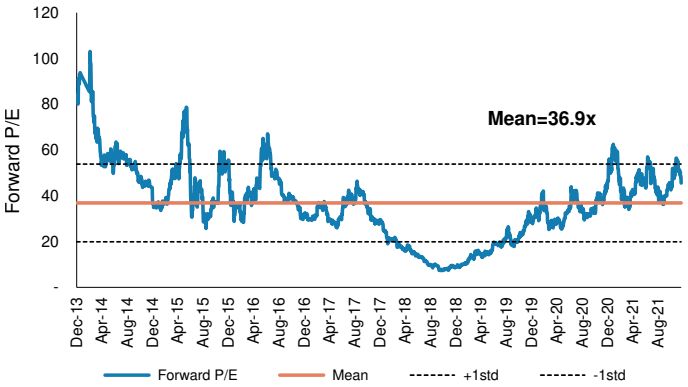
Valuation

The company has historically traded at 37x 12m forward P/E since 2014, with +1x standard deviation of ~55x and -1x standard deviation of ~20x. The company is now trading at 50x 12m forward P/E, between the historical average and 1x SD. We believe the shares will likely re-rate, driven by: 1) market share gain in the EV battery market, and 2) opportunity from 4680 cell disruption.

Excluding the earnings contribution from Smoore, EVE's battery business is now trading at 66x and 40x, vs. CATL's 90x and 72x, for 2022 and 2023, respectively. We believe EVE's valuation is compelling. We use a sum-of-the-parts methodology to value the company.

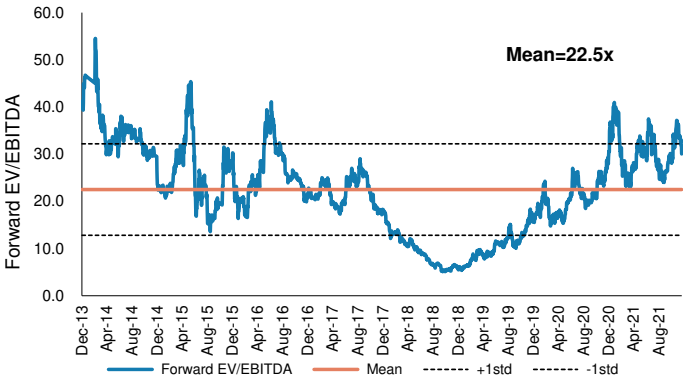
We, use P/E to value the battery segment and assign a 30x P/E to 2025e earnings, in line with our target multiple for CATL; we expect EVE to grow faster than CATL, but CATL is likely to remain the industry leader. We further apply a WACC of 8% to discount the 2025 value and arrive at our battery segment valuation of Rmb97/share. For EVE's investment in Smoore (electronic cigarette vaporization business), we use 1.2x PEG on 2022e earnings of this segment, yielding a value of Rmb52/share. Combining these two parts yields our price target of Rmb149.

Exhibit 33: EVE historical P/E



Source: Bloomberg, Morgan Stanley Research

Exhibit 34: EVE historical EV/EBITDA



Source: Bloomberg, Morgan Stanley Research

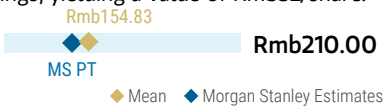
Risk Reward – EVE Energy Co Ltd (300014.SZ)

Domestic 4680 Cell Pioneer; Market Share Gain in LFP Battery; OW

PRICE TARGET Rmb149.00

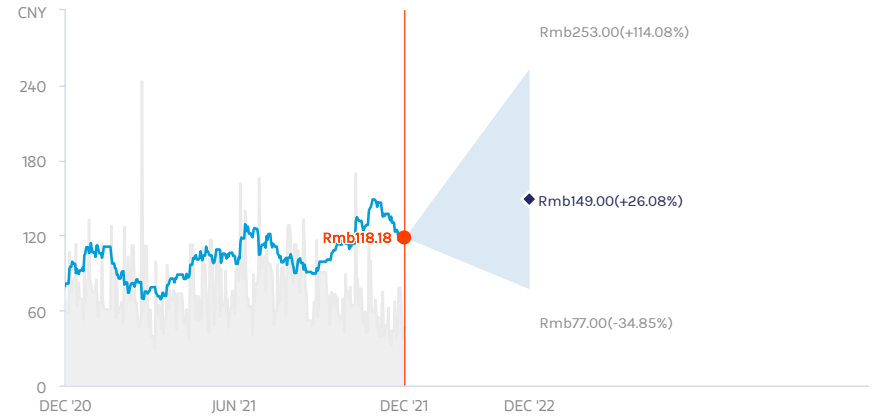
We adopt SOTP methodology and our price target is Rmb149. We assign a 30x P/E to EVE's 2025e battery earnings, in line with CATL's target multiple, as EVE would grow faster, but CATL is likely to maintain its leadership position. We further apply a WACC of 8% to discount the 2025 value and arrive at our battery segment valuation of Rmb97/share. For EVE's investment in Smoore, we use 1.2x PEG on 2022e earnings, yielding a value of Rmb52/share.

Consensus Price Target Distribution



Source: Refinitiv, Morgan Stanley Research

RISK REWARD CHART



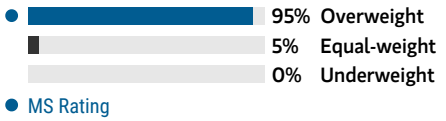
Key: Historical Stock Performance Current Stock Price Price Target

Source: Refinitiv, Morgan Stanley Research

OVERWEIGHT THESIS

- EVE is a domestic 4680 battery pioneer with high visibility, with 20GWh capacity under construction.
- We expect EVE Energy's overall market share to improve thanks to LFP resurgence and ESS ramp-up.
- Current EV/ESS battery capacity expansion schedule on track to meet the growing market opportunities.
- Stable cash flow from consumer battery and electronic cigarette vaporization to fund expansion.

Consensus Rating Distribution



Source: Refinitiv, Morgan Stanley Research

Risk Reward Themes

Electric Vehicles:	*Positive*
Market Share:	*Positive*
Secular Growth:	*Positive*

View descriptions of Risk Rewards Themes here

BULL CASE Rmb253.00

50x bull case 2025e earnings for battery segment

1) We expect EVE to gain a larger market share with its products penetrating more global major OEMs. 2) Gross margin to be higher thanks to higher proportion of 4680 batteries in its product mix. 3) Higher investment income from Smoore.

BASE CASE Rmb149.00

30x base case 2025e earnings for battery segment

1) We expect EVE to continue to gain market share and record high growth in EV battery sales volume by 2025. 2) We forecast EVE's GP margin will be ~23% in 2022 and will gradually decline in the years beyond. 3) We use consensus net profit forecast for Smoore International as our base case estimate for the investment income from Smoore.

BEAR CASE Rmb77.00

15x bear case 2025e earnings for battery segment

1) We expect EVE's growth to slow due to potential delays in capacity expansion and exploration of new customers; 2) Gross margin to be lower due to upstream supply strain and low production efficiency; and 3) Lower investment income from Smoore.

Risk Reward – EVE Energy Co Ltd (300014.SZ)

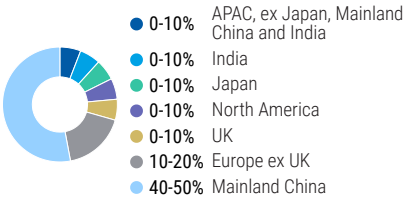
KEY EARNINGS INPUTS

Drivers	2020	2021e	2022e	2023e
EV/ESS battery sales volume (GWh)	3.5	11.0	25.9	46.4
EV/ESS battery ASP (Rmb/Wh)	0.8	0.8	0.7	0.7
EV/ESS battery gross margin (%)	18.3	20.1	22.2	21.9

INVESTMENT DRIVERS

- The company's 4680 batteries penetrate global major OEMs.
- Development of new EV customers.
- Capacity expansion on track.

GLOBAL REVENUE EXPOSURE



Source: Morgan Stanley Research Estimate
View explanation of regional hierarchies here

MS ALPHA MODELS

5/5 MOST — 3 Month Horizon

Source: Refinitiv, FactSet, Morgan Stanley Research; 1 is the highest favored Quintile and 5 is the least favored Quintile

RISKS TO PT/RATING

RISKS TO UPSIDE

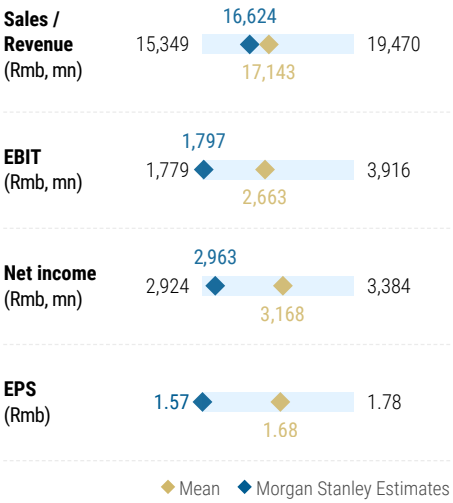
- Stronger EV penetration and ESS application.
- Stronger 4680 battery penetration in global EV battery market.
- Market share gains in global battery market.
- Better-than-expected margins.

RISKS TO DOWNSIDE

- Weaker EV penetration and ESS application.
- Weaker 4680 battery penetration.
- Potential delays in capacity expansion and exploration of new customers.
- Regulatory risks surrounding Smoore.

MS ESTIMATES VS. CONSENSUS

FY 2021e



Source: Refinitiv, Morgan Stanley Research

Financial Summary - EVE Energy

Exhibit 35: Financial Summary

Assumptions	2019	2020	2021e	2022e	2023e
Sales volume - EV/ESS battery (GWh)	2.4	3.5	11.0	25.9	46.4
ASP - EV/ESS battery (Rmb/Wh)	0.85	0.82	0.82	0.74	0.71
Sales - EV/ESS battery (Rmb mn)	2,002	2,855	9,017	19,156	33,089
GP Margin - EV/ESS battery (%)	17%	18%	20%	22%	22%
Sales - lithium ion battery (Rmb mn)	4,520	6,670	14,884	26,282	40,868
Sales - lithium primary battery (Rmb mn)	1,892	1,491	1,740	1,899	1,996
GP Margin - lithium ion battery (%)	24%	26%	21%	22%	22%
GP Margin - primary battery (%)	44%	42%	41%	40%	40%
Income Statement (Rmb mn)	**2019**	**2020**	**2021e**	**2022e**	**2023e**
Net sales	6,412	8,162	16,624	28,181	42,865
Gross profit	1,905	2,368	3,875	6,559	9,810
EBITDA	**1,359**	**1,705**	**2,678**	**5,054**	**7,743**
EBIT	**1,036**	**1,148**	**1,797**	**3,600**	**5,523**
Net financing cost	(95)	(60)	(64)	(147)	(227)
Pre-tax profit	**1,626**	**1,918**	**3,380**	**5,817**	**8,622**
Tax	(77)	(237)	(230)	(488)	(764)
Minority interest	(27)	(29)	(187)	(596)	(690)
Net profit	**1,522**	**1,652**	**2,963**	**4,733**	**7,168**
Adjusted earnings	**747**	**923**	**1,393**	**2,554**	**4,171**
Cash Flow (Rmb mn)	**2019**	**2020**	**2021e**	**2022e**	**2023e**
EBITDA	1,359	1,705	2,678	5,054	7,743
-Taxes paid	(77)	(237)	(230)	(488)	(764)
-Working capital	(176)	(51)	(280)	91	813
-Others	1	5	0	0	0
Operating cash flow	**1,139**	**1,548**	**2,169**	**4,657**	**7,791**
-Capex	(2,619)	(2,038)	(5,935)	(7,960)	(10,450)
FCF	(1,480)	(490)	(3,766)	(3,303)	(2,659)
Investing cash flow	**(2,928)**	**(2,259)**	**(5,043)**	**(6,788)**	**(8,897)**
Equity raised	2,468	2,476	8	0	0
Debt raised	1,867	1,654	1,603	1,599	3,598
Dividend	(83)	(213)	(111)	(187)	(300)
Financing cash flow	**2,718**	**2,293**	**1,000**	**913**	**2,800**
Net cash flow	**941**	**1,516**	**(1,875)**	**(1,217)**	**1,695**
Per Share Data (Rmb)	**2019**	**2020**	**2021e**	**2022e**	**2023e**
ModelWare EPS	0.86	0.89	1.57	2.49	3.78
DPS	0.09	0.03	0.02	0.04	0.06
BVPS	4.37	8.98	10.45	13.21	17.32

Profitability Ratios %	2019	2020	2021e	2022e	2023e
ROE	13%	8%	9%	13%	16%
EBITDA margin	21%	21%	16%	18%	18%
EBIT margin	16%	14%	11%	13%	13%
Pre-tax profit margin	25%	23%	20%	21%	20%
Net profit margin	24%	20%	18%	17%	17%
Net Debt / Equity %	-10%	-14%	3%	12%	13%
Interest cover (EBITDA) (x)	NA	6.8	14.3	28.5	41.8
Days sales AR outstanding	211	183	183	179	175
Days in inventory	92	108	108	108	108
Days payable outstanding	330	398	383	376	376
Cash conversion	(27)	(107)	(93)	(89)	(93)
Balance Sheet (Rmb mn)	**2019**	**2020**	**2021e**	**2022e**	**2023e**
Cash & equivalents	2,097	3,804	1,929	712	2,406
Receivables	3,711	4,085	8,320	13,808	20,575
Inventories	1,130	1,714	4,918	8,337	12,682
PP&E	4,022	6,322	10,009	14,744	20,704
Intangible asset	378	406	406	406	406
Long-term investment	728	4,810	5,765	7,156	9,129
Other current asset	1,289	1,270	1,270	1,270	1,270
Other asset	2,940	3,290	3,988	5,560	7,630
Total Assets	**16,295**	**25,700**	**36,605**	**51,992**	**74,801**
Payables	4,074	6,311	13,387	22,270	34,047
Borrowings	653	1,305	2,405	3,505	6,605
Other liabilities	3,856	1,413	1,031	1,146	1,293
Total Liabilities	**8,583**	**9,029**	**16,823**	**26,921**	**41,945**
Shareholders equity	7,553	14,376	17,300	21,993	29,088
Minority interest	159	2,295	2,482	3,078	3,767
Total Equity	**7,712**	**16,671**	**19,782**	**25,071**	**32,856**
Growth %	**2019**	**2020**	**2021e**	**2022e**	**2023e**
EV/ESS battery volume	-	49%	214%	135%	79%
EV/ESS battery ASP	-	-4%	0%	-10%	-3%
EV/ESS battery cost	-	-6%	-2%	-12%	-3%
Sales	47%	27%	104%	70%	52%
Gross profit	84%	24%	64%	69%	50%
EBITDA	114%	25%	57%	89%	53%
EBIT	165%	11%	56%	100%	53%
Adjusted earnings	247%	24%	51%	83%	63%

Source: Company data, Morgan Stanley Research (e) estimates

Panasonic (6752.T, OW)

Panasonic leads peers in 4680-type cells: We believe Panasonic can shore-up its position as the leading company in the era of 4680 battery cells. Panasonic and industry peers have been initiating 4680 battery cell development projects since 2019 2H. As of Oct 2021, Panasonic had completed product development, and it has announced its plans to commence a pilot line project with a view to mass production. Panasonic is so far the only cylindrical battery cell maker that has shown photos of completed products across all three product generations (1865, 2170, 4860).

Cylindrical NCA batteries still have the range advantage: Tesla's lineup now includes vehicles with prismatic LFP batteries in addition to those with cylindrical 2170 cells, but we do not expect the market share of cylindrical cells composed of NCA materials, which have the advantage in terms of driving range per charge, to be eroded to a great extent by the more cost-effective prismatic LFP offering. We do expect demands for lower-cost cylindrical cells to increase, but assuming that the driving range advantage remains intact, we think that as cylindrical cells are increasingly used on non-Tesla models, the resulting economies of scale will support efforts to reduce costs. Indeed, emerging North American electric vehicle maker Canoo has announced plans to purchase cylindrical batteries with the same design as Tesla's from Panasonic.

Rising priority of the N. American market: In late November, Panasonic decided to end the market assessment of its battery business in Europe, which was being conducted jointly by Norwegian energy firm Equinor and major aluminum company Norsk Hydro. The process of selecting a plant site in Norway and the EU will be terminated. Although it has become tough for Panasonic to produce batteries for European automakers in Europe, it does not mean that it cannot produce batteries for non-European automakers, including Tesla. We believe capital spending in N. America has become a top priority for Panasonic.

Importance of the automotive rechargeable battery business rising further under new management structure: With the start of Panasonic's new organizational structure from October 2021, we are seeing increasing communication form the new business unit, Panasonic Energy. For Panasonic, overall, along with the supply chain management business centered on Blue Yonder, which became a wholly owned subsidiary of Panasonic with an investment of ¥800bn, we believe the automotive rechargeable battery business have been positioned as the two key growth businesses.

Risk Reward – Panasonic (6752.T)

Focus on when the market recognizes transformation of the business portfolio

PRICE TARGET ¥1,900

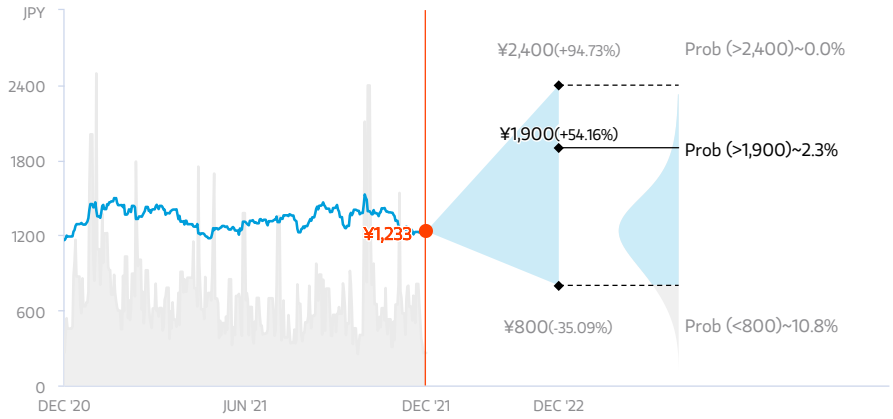
Applies EV/EBITDA 5.3x & F3/23e EBITDA of ¥839bn. Segment breakdown; F3/23e Lifestyle EBITDA ¥258bn x 4.0, Automotive EBITDA ¥68bn x 3.0, Connect EBITDA ¥115bn x 11.0, Industry EBITDA ¥144bn x 6.0, Energy EBITDA ¥140bn x 7.5.

Consensus Price Target Distribution ¥1,050.00 ¥1,669 ¥2,200.00 MS PT

Source: Refinitiv, Morgan Stanley Research

◆ Mean ◆ Morgan Stanley Estimates

RISK REWARD CHART AND OPTIONS IMPLIED PROBABILITIES (12M)



Key: — Historical Stock Performance ● Current Stock Price ◆ Price Target

Source: Refinitiv, Morgan Stanley Research, Morgan Stanley Institutional Equities Division. The probabilities of our Bull, Base, and Bear case scenarios playing out were estimated with implied volatility data from the options market as of 27 Dec, 2021. All figures are approximate risk-neutral probabilities of the stock reaching beyond the scenario price in either three-months' or one-years' time. View explanation of Options Probabilities methodology here

OVERWEIGHT THESIS

- Panasonic has started working on transforming its business portfolio.
- The company has already announced the carving out of prismatic rechargeable battery business and housing business, and we expect a gradually rising appreciation in the market regarding the future shape of the business achieved through such reforms.
- The company has now decided to pull out of LCD production and sell the semiconductors business, which makes us more confident now that profits can recover to a high level by F3/22.

Consensus Rating Distribution

55%	Overweight
40%	Equal-weight
5%	Underweight

● MS Rating

Source: Refinitiv, Morgan Stanley Research

Risk Reward Themes

Self-help:	*Positive*
Special Situation:	*Positive*

View descriptions of Risk Rewards Themes here

BULL CASE ¥2,400

F3/23e EV/EBITDA x 6.1

This case assumes EV/EBITDA 6.1x & F3/23e EBITDA of ¥916bn. Segment breakdown: F3/23e Lifestyle EBITDA ¥290bn x 4.6, Automotive EBITDA ¥71bn x 3.5, Connect EBITDA ¥127bn x 12.7, Industry EBITDA ¥161bn x 6.9, Energy EBITDA ¥155bn x 8.6.

BASE CASE ¥1,900

F3/23e EV/EBITDA x 5.3

Applies EV/EBITDA 5.3x & F3/23e EBITDA of ¥839bn. Segment breakdown: F3/23e Lifestyle EBITDA ¥258bn x 4.0, Automotive EBITDA ¥68bn x 3.0, Connect EBITDA ¥115bn x 11.0, Industry EBITDA ¥144bn x 6.0, Energy EBITDA ¥140bn x 7.5.

BEAR CASE ¥800

F3/23e EV/EBITDA x 2.6

This case assumes EV/EBITDA 2.6x & F3/23e EBITDA of ¥739bn. Segment breakdown: F3/23e Lifestyle EBITDA ¥219bn x 1.6, Automotive EBITDA ¥65bn x 1.5, Connect EBITDA ¥100bn x 5.5, Industry EBITDA ¥122bn x 3.0, Energy EBITDA ¥121bn x 3.8.

Risk Reward – Panasonic (6752.T)

KEY EARNINGS INPUTS

Drivers	2021	2022e	2023e	2024e
Appliance (¥, bn)	104.3	89.5	102.0	NA
Life Solutions (¥, mn)	69.2	71.6	70.8	NA
Connected Solutions (¥, mn)	(20.0)	70.4	116.4	NA
Automotive (¥, mn)	10.9	22.9	34.4	NA
Industrial Systems (¥, mn)	66.2	118.4	94.6	NA

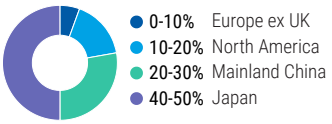
INVESTMENT DRIVERS

-Growth and profit contribution from Core Growth business, mainly in LS, CNS and IS.

-Specific measures in the semicon & solar biz and resolving losses.

-Lower fixed costs with the carved out co-creation biz being removed from consolidated accounts.

GLOBAL REVENUE EXPOSURE



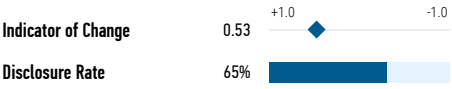
Source: Morgan Stanley Research Estimate
View explanation of regional hierarchies here

MS ALPHA MODELS

3/5 MOST — 3 Month Horizon

Source: Refinitiv, FactSet, Morgan Stanley Research; 1 is the highest favored Quintile and 5 is the least favored Quintile

SUSTAINABILITY & ESG



RISKS TO PT/RATING

RISKS TO UPSIDE

- ROE rising to 20% over mid/long term as high-margin solutions business expands.
- Decisions to sell off businesses to improve the growth potential of its core divisions, or to acquire growth businesses.

RISKS TO DOWNSIDE

- Renewed financial risks associated with Tesla.

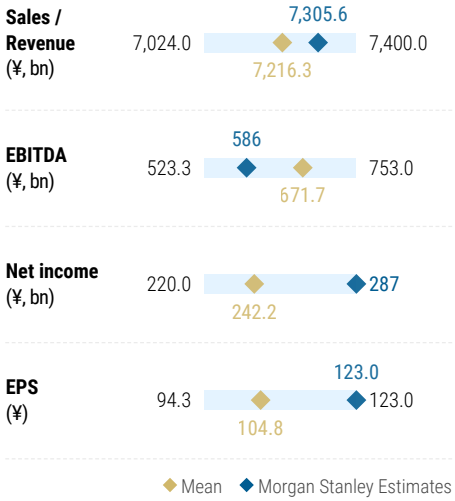
OWNERSHIP POSITIONING

Inst. Owners, % Active 79.8%

Source: Refinitiv, Morgan Stanley Research

MS ESTIMATES VS. CONSENSUS

FY Mar 2022e



Source: Refinitiv, Morgan Stanley Research

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(as of November 30, 2021)

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	Coverage Universe		Investment Banking Clients (IBC)			Other Material Investment Services Clients (MISC)	
Stock Rating Category	Count	% of Total	Count	% of Total IBC	% of Rating Category	Count	% of Total Other MISC
Overweight/Buy	1508	42%	391	45%	26%	679	43%
Equal-weight/Hold	1532	43%	407	46%	27%	675	43%
Not-Rated/Hold	0	0%	0	0%	0%	0	0%
Underweight/Sell	526	15%	79	9%	15%	209	13%
Total	3,566		877			1563	

Data include common stock and ADRs currently assigned ratings. Investment Banking Clients are companies from whom Morgan Stanley received investment banking compensation in the last 12 months. Due to rounding off of decimals, the percentages provided in the "% of total" column may not add up to exactly 100 percent.

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Overweight (O). The stock's total return is expected to exceed the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

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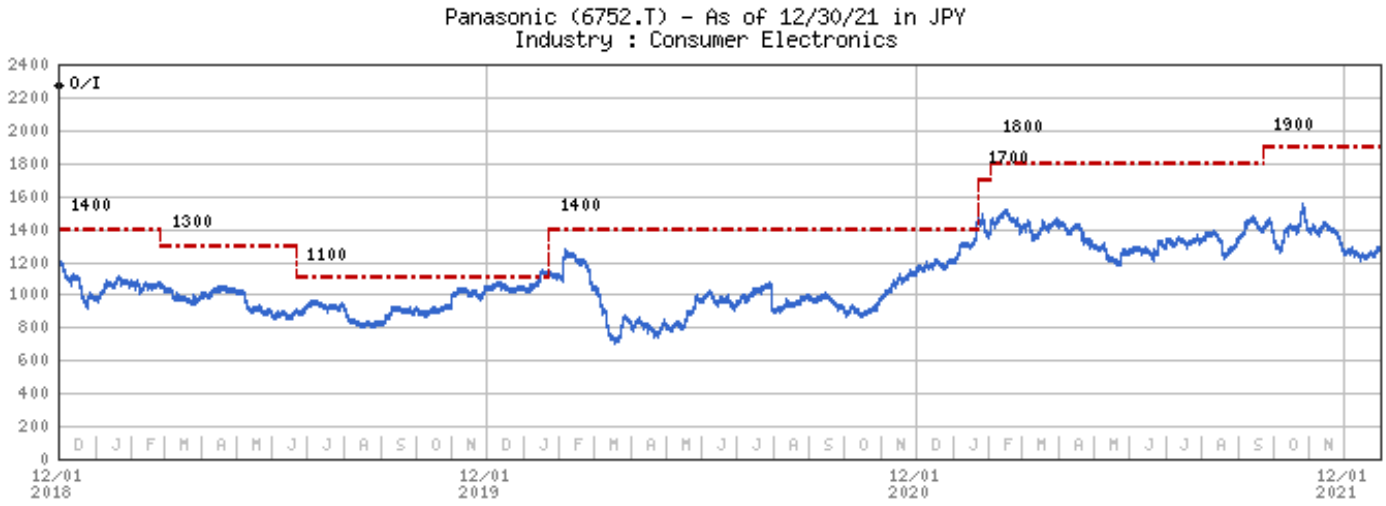
Stock Price, Price Target and Rating History (See Rating Definitions)



Stock Rating History: 1/1/17 : E/I; 10/11/17 : O/I

Price Target History: 2/17/16 : 1000; 3/28/17 : 1400; 10/11/17 : 2100; 11/10/17 : 2300; 8/10/18 : 2000; 9/14/18 : 1600; 11/20/18 : 1400; 2/26/19 : 1300; 6/21/19 : 1100; 1/23/20 : 1400; 1/22/21 : 1700; 2/3/21 : 1800; 9/22/21 : 1900

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target -·- No Price Target Assigned (NA)
Stock Price (Not Covered by Current Analyst) — Stock Price (Covered by Current Analyst)
Stock and Industry Ratings (abbreviations below) appear as ◆ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

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INDUSTRY COVERAGE: China Energy & Chemicals

COMPANY (TICKER)	RATING (AS OF)	PRICE* (12/31/2021)
Albert Li		
China BlueChemical (3983.HK)	E (09/10/2021)	HK$2.17
China Oilfield Services Ltd. (2883.HK)	O (03/17/2021)	HK$6.83
China Oilfield Services Ltd. (601808.SS)	U (03/17/2021)	Rmb15.00
Kingfa Sci&Tech Co Ltd (600143.SS)	E (09/02/2021)	Rmb12.58
LB Group Co Ltd (002601.SZ)	O (01/13/2021)	Rmb28.59
Offshore Oil Engineering (600583.SS)	O (03/17/2021)	Rmb4.61
Qinghai Salt Lake (000792.SZ)	U (09/10/2021)	Rmb35.39
Shandong Sinocera Functional Material (300285.SZ)	O (07/30/2021)	Rmb42.57
Sinofert Holdings (0297.HK)	O (01/11/2017)	HK$1.17
Sinopec Engineering Group Co Ltd (2386.HK)	O (04/22/2020)	HK$3.85
Sinopec Oilfield Service Corp (1033.HK)	E (03/17/2021)	HK$0.65
Sinopec Oilfield Service Corp (600871.SS)	U (06/02/2020)	Rmb2.14
Skshu Paint Co Ltd (603737.SS)	O (11/02/2021)	Rmb139.15
Yantai Jereh Oilfield Services Group (002353.SZ)	O (03/17/2021)	Rmb40.00
Jack Lu		
Beijing Easpring Material Technology Co (300073.SZ)	U (11/08/2019)	Rmb86.87
Beijing SinoHytec Co Ltd (688339.SS)	O (01/20/2021)	Rmb270.85
Bluestar Adisseo Co (600299.SS)	O (06/29/2020)	Rmb12.32
China Petroleum & Chemical Corp. (600028.SS)	E (03/17/2021)	Rmb4.23
China Petroleum & Chemical Corp. (0386.HK)	O (05/12/2021)	HK$3.63
CNOOC (0883.HK)	O (03/17/2021)	HK$8.03
Contemporary Amperex Technology Co. Ltd. (300750.SZ)	U (05/30/2021)	Rmb588.00
EVE Energy Co Ltd (300014.SZ)	O (01/02/2022)	Rmb118.18
Guanghui Energy (600256.SS)	E (09/23/2021)	Rmb6.54
Guoxuan High-Tech (002074.SZ)	E (04/26/2021)	Rmb51.25
Hengli Petrochemical Co Ltd (600346.SS)	O (10/29/2020)	Rmb22.97
Hengyi Petrochemical Co Ltd (000703.SZ)	O (12/10/2021)	Rmb10.62
Ningbo Shanshan Co. Ltd. (600884.SS)	U (09/09/2019)	Rmb32.77
PetroChina (601857.SS)	U (03/17/2021)	Rmb4.91
PetroChina (0857.HK)	O (03/17/2021)	HK$3.47
Rongsheng Petrochemical Co Ltd (002493.SZ)	E (10/19/2021)	Rmb18.16
Shanghai Putailai New Energy Tech Co Ltd (603659.SS)	E (08/06/2021)	Rmb160.61
Sinopec Shanghai Petrochemical Co Ltd (0338.HK)	O (09/30/2020)	HK$1.79
Sinopec Shanghai Petrochemical Co Ltd (600688.SS)	U (06/09/2015)	Rmb4.17
Wanhua Chemical (600309.SS)	O (07/02/2021)	Rmb101.00
Yunnan Energy New Material Co Ltd (002812.SZ)	U (01/17/2020)	Rmb250.40
Zhejiang Longsheng Group (600352.SS)	E (04/10/2019)	Rmb12.63
Zhejiang NHU Co. Ltd. (002001.SZ)	O (06/29/2020)	Rmb31.12
Zhejiang Runtu (002440.SZ)	O (03/01/2018)	Rmb9.59

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* Historical prices are not split adjusted.

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