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# The Electric Vehicle Revolution and ESG Charge Ahead

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An in-depth look at the investment case for companies transitioning to EVs and their global ESG footprint.

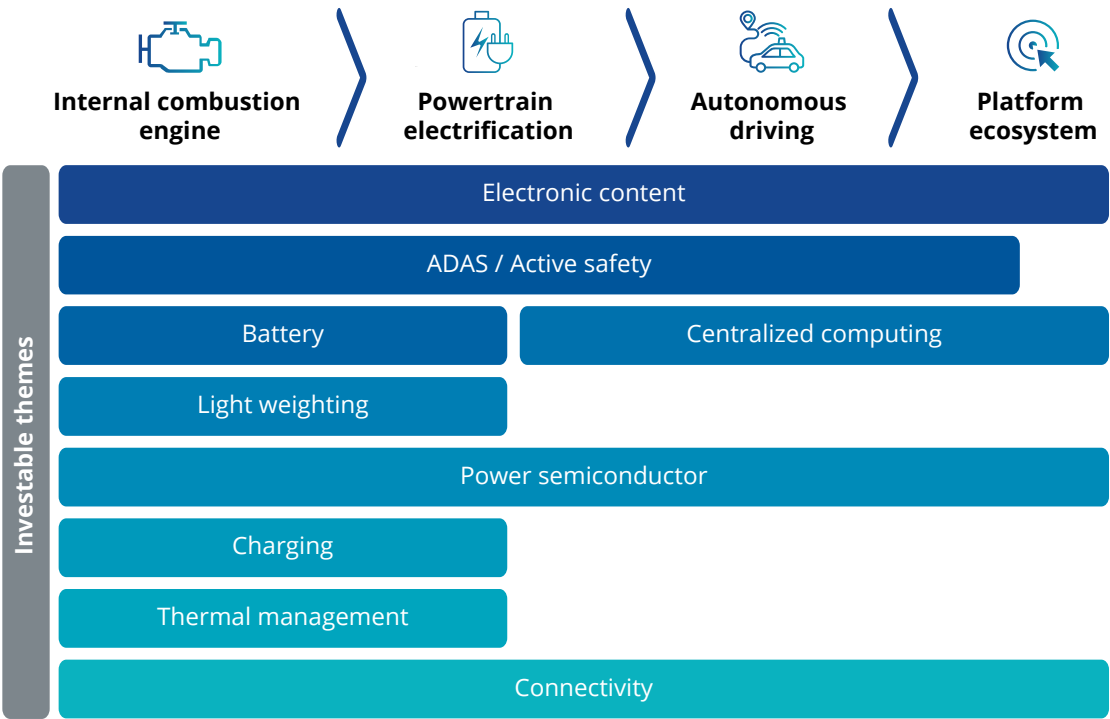
The transition from conventional cars to electric vehicles (EVs) is accelerating, directly impacting auto makers and auto parts providers.

This is creating investment opportunities in battery cell makers, charging infrastructure and charge stations, optimization software, as well as semiconductors, cameras, etc. We strongly believe this acceleration will continue, as stickier price parity between EV and fossil fuel autos is upon us and Wright’s Law<sup>1</sup> continues to drive down EV costs – especially in the battery and battery software space. In our view, **EV investing is a forward-looking, innovative and disruptive theme.**

In this white paper, we will explore:

- Growing EV demand, which is driving an accelerated conventional cars-to-EV transition and its hyper adoption globally.
- Two major inflections on the supply side—an EV-dedicated platform and technological innovation—that are driving EV penetration and adoption levels.
- Our investing in the EV ecosystem and ESG.

A Road to Platform Ecosystem – Key Investment Themes



Source: Macquarie Research. Data as of September 8, 2020.

<sup>1</sup> Pioneered by Theodore Wright in 1936, Wright’s Law aims to provide a reliable framework for forecasting cost declines as a function of cumulative production. Specifically, it states that for every cumulative doubling of units produced, costs will fall by a constant percentage

Cracking the investment code across the vast and diffuse EV investment universe includes understanding complex global supply chains, competing standards, prevailing regulatory structures and national policy and subsidy decision making. The answer to “Do you invest in EV?” is staggering in its complexity and scope.

Based on years of research conducted across the Investment Teams for the **VanEck Emerging Markets Equity Strategy (EME)** and the **VanEck Global Hard Assets Strategy (GHA)**, greater sustainability, cost optimization and more visible and persistent returns appear to reside in very specific parts of the value chain. These include static battery cells (**EME holdings: Samsung SDI<sup>2</sup> and LG Chem Ltd.<sup>3</sup>**; **GHA holding: Freyr<sup>4</sup>**), storage software (**GHA holding: Stem<sup>5</sup>**), as well as infrastructure such as semiconductors and EV charge

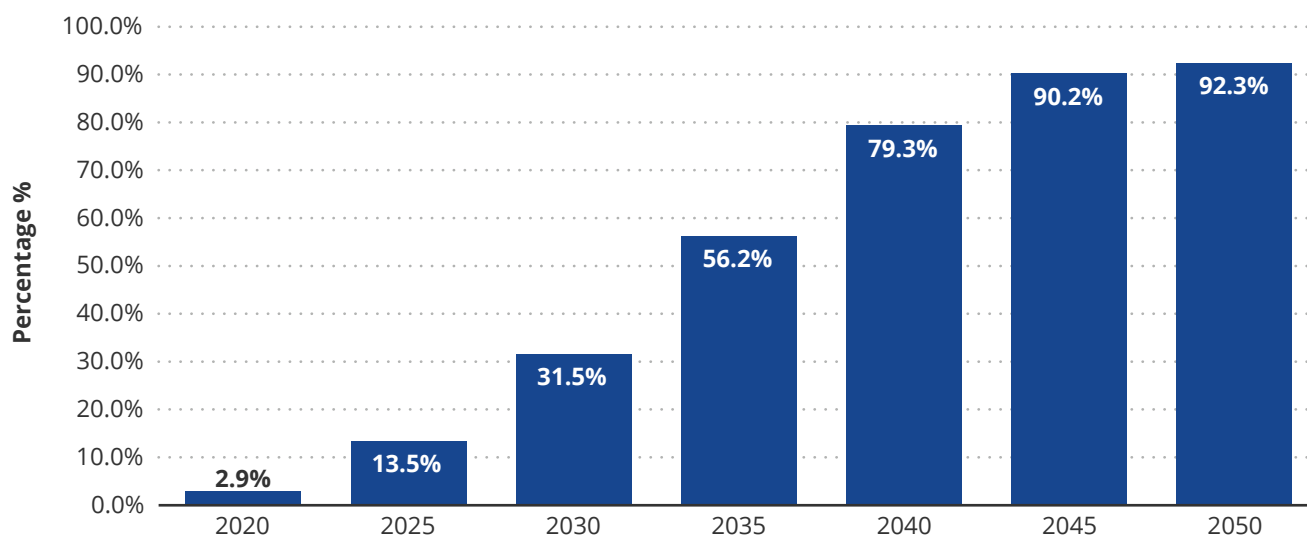
stations (**EME holding: Qingdao TGOOD Electric Co. Ltd.<sup>6</sup> and GHA holding: EVgo<sup>7</sup>**).

### Global EV Penetration: Unprecedented Levels, Groundbreaking Speeds

From a consumer preference, competitive unit pricing and regulatory perspective, conventional automobiles are becoming increasingly unwelcome across the world. This accelerating trend lifts demand, which helps add production scale, increasingly helping to drive down the cost of EV ownership to a level where the economic choice tilts in favor of EVs. In the past, the demand momentum was largely driven by the environmental concerns of the buyer, subsidies, as well as increasing performance and innovation.

Growing demand and supply innovations are driving an accelerated conventional cars-to-EV transition globally. In 2021, for the first time in history, we expect strong growth in EV sales in both China and EU, the two largest EV markets.

### Global EV Penetration Forecast



Source: Morgan Stanley Research. Data as of February 2021.

<sup>2</sup> Samsung SDI is 2.81% of EME Strategy assets as of January 31, 2021.

<sup>3</sup> LG Chem Ltd. is 0.99% of EME Strategy assets as of January 31, 2021.

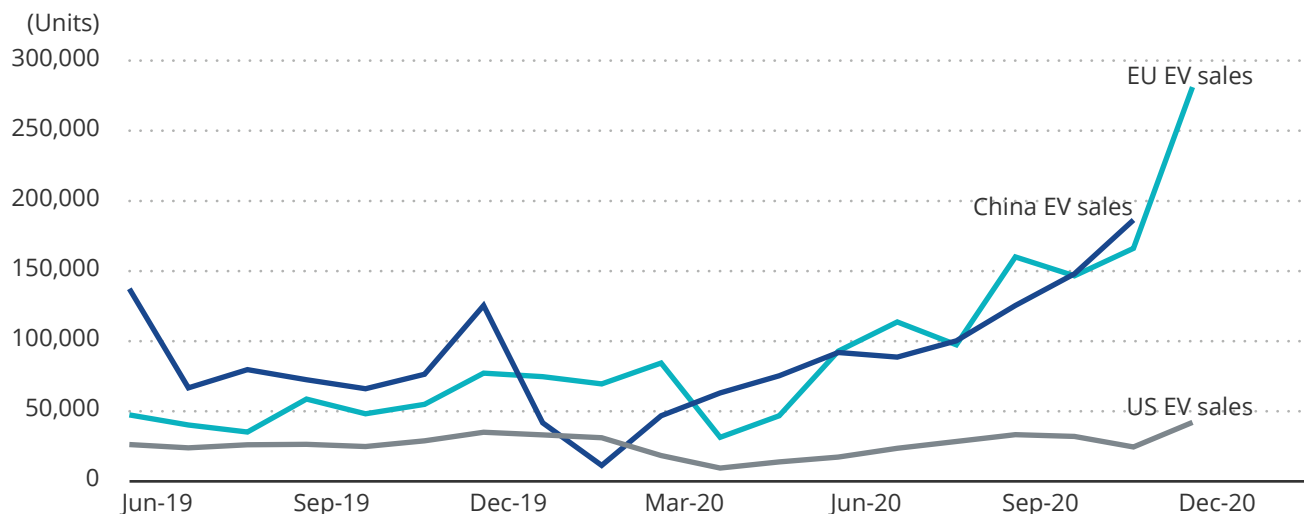
<sup>4</sup> Freyr, coming public via merger with Alussa Energy, 0.52% of GHA Strategy assets as of January 31, 2021.

<sup>5</sup> Stem, coming public via merger with Star Peak Energy, 5.23% of GHA Strategy assets as of January 31, 2021.

<sup>6</sup> Qingdao TGOOD Electric Co. Ltd. is 0.67% of EME Strategy assets as of January 31, 2021.

<sup>7</sup> EVgo, coming public via merger with Climate Change CR Restricted, 0.91% of GHA Strategy assets as of January 31, 2021.

## EV Growth Around the World



Source: EAAM, CAAM, EVinside, Macquarie Research. Data as of December 15, 2020

### Here is an overview of the latest policy developments relating to EVs globally<sup>8</sup>:



#### EU

EU commission meeting could propose a ban on the internal combustion engine (ICE) by 2025.



#### UK

The UK is set to ban sales of new gas and diesel cars beginning in 2025 (five years earlier than initially planned).



#### GERMANY

Germany is extending cash bonuses for purchasing EVs until 2025 (from 2021).



#### JAPAN

In December 2020, the Japanese government announced plans to phase out conventional cars by mid-2030.



#### CHINA

In November 2020, China stated its goal to transform the nation's auto industry into a wholly electric industry by 2035.

### Global government policy support for EV is growing.

We have seen this through outright future regulatory elimination of conventional cars, coupled with supportive policies around EV subsidies and infrastructure. Given the boost from these initiatives, EV sales growth in China, for example, is likely to be in the region of 1.7M units next year (+31% YoY) and in the EU 1.9M units (+58% YoY).<sup>8</sup>

**Battery innovation helps address bottlenecks.** Other than price, in the past, the two biggest drawbacks for consumers has tended to be EV's limited range and slow charging. Battery innovation is a potential solution for both of these demand bottlenecks, and offers an opportunity for investors to gain exposure to growing EV adoption.

Tier one battery manufacturers are key enablers of the electric revolution, and over recent years, they have formed a global oligopoly. Their commitment to research and development (R&D) and ever increasing manufacturing efficiency continues to result in improvements in the range, cost and safety of EVs. The EME Investment Team's discussion with management and industry experts indicates that short-term battery

<sup>8</sup>Source: Macquarie Research. Data as of December 15, 2020



performance will be driven by further optimization of cathode chemistry, silicon-carbon blended anodes and cell-to-pack (CTP) efficiency. While longer-term innovation will be found in solid state batteries and other next generation technologies, we are optimistic that **Samsung SDI and LG Chem (EME holdings)** will spearhead battery innovation over the next decade.

We strongly believe that EVs will be competitive when the time to charge them is as quick as filling a gas tank. Technology has advanced to a stage that a battery can now be partially charged very quickly, and we are very attracted to mass charging infrastructure. Helping to promote adoption, government policy is increasingly supporting funding alongside private investments toward buildout of the charging infrastructure. Capitalizing on the need by auto original equipment manufacturers (OEMs) to address the bottleneck limiting mass market adoption of their products are companies such as **EVgo (GHA holding)**. EVgo builds and operates charging stalls and maintains nearly a 50% share in the public fast charging market in the U.S., with partnerships to support the upfront capex investment of their stations. In China and the U.S., scale and first-mover advantage are critical for companies to become regional leaders in high density areas – and payback of the infrastructure investment is also shorter and much faster.

**Innovation extends beyond the cell.** The value proposition for faster EV adoption extends beyond the cost of the battery itself and includes the battery manufacturing method, as well as energy management around EVs, batteries and the grid.

The number of models and types of EVs slated to come to market within the next five years currently outpaces

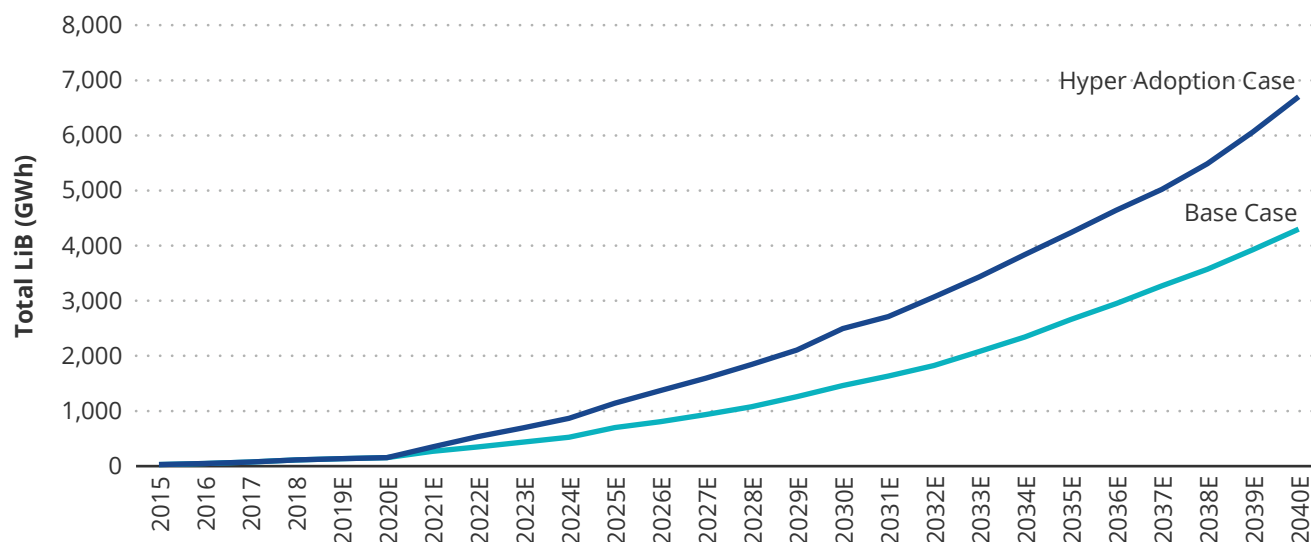
battery manufacturing supply. Both Asian and European battery manufacturers are establishing regional supply chains closer to the European auto OEM and putting their own, unique spin on manufacturing. **Freyr (GHA holding)**, coming public via merger with Alussa Energy, is establishing a presence in Norway to build chemistry-agnostic batteries using a production process 30% shorter than the conventional method. It will be powered by 100% renewable resources, addressing the longstanding debate of absolute emission impact around EV, from well to wheel.

While manufacturing and cell design are driving down battery cost, we are seeing an increasing focus from the industry toward behind-the-meter energy management. A standalone battery is used as energy backup, whereas a battery connected to the grid harnesses a much more efficient flow of two-way electricity usage that leverages utility rates with optimal time-of-use. Predictive analytics between the grid and battery results in a lower electricity rate, which is then translated into better economics for EV and battery owners. **Stem (GHA holding)**, coming public via merger with Star Peak Energy, is a software platform that uses AI to optimize energy usage between commercial batteries and the grid. The software contributes to a meaningful reduction in monthly bills, and the customer data collected over time is then used toward better grid management for utilities.<sup>9</sup> The ecosystem results in higher adoption of batteries, given the lower cost of ownership for the entire system.

**Capacity needs are growing.** The need for higher battery capacity to meet the fast-growing, global EV demand is another integral component in the EV supply chain and penetration efforts.

<sup>9</sup> Company Data.

## Strong Growth: Automotive Battery Demand Estimates



Source: IHS Global Insight, Goldman Sachs Global Investment Research. Data as of September 24, 2020.

**Costs are decreasing.** Lower battery costs (implicit in cell design, material, manufacturing, cell-to-vehicle production streamlining, etc.) should lead to an increase in overall capacity and further acceleration of EV adoption levels globally. Securing strategic domestic battery input materials is a high priority for governments around the world and is considered a vital aspect of driving down integrated battery manufacturing costs. As EVs and batteries proliferate, consumption of minerals such as copper, lithium, cobalt, manganese, rare earth metals and graphite are predicted to grow to exceptional levels. Existing mining firms (**GHA holdings: First Quantum<sup>10</sup> and MP Materials<sup>11</sup>**) as well as numerous new players (**GHA holdings: Euro Manganese<sup>12</sup> and Piedmont Lithium<sup>13</sup>**) are emerging to satisfy this demand, and additional geographically diverse suppliers are expected to come to market.

## Battery Cost Composition and Cost Cutting

Cathode	21%
Cell cost	17%
Depreciation	10%
Others	10%
Anode	8%
Electrolyte	8%
Separator	7%
Direct Labor	4%
Energy	4%
Margin	3%
Overheads	2%
R&D	2%
Warranty	2%
Sales & Admin	1%

Source: Company Data, Goldman Sachs Global Investment Research. Data as of September 24, 2020.

<sup>10</sup> First Quantum is 4.19% of GHA Strategy assets as of January 31, 2021.

<sup>11</sup> MP Materials is 0.25% of GHA Strategy assets as of January 31, 2021.

<sup>12</sup> Euro Manganese is 0.08% of GHA Strategy assets as of January 31, 2021.

<sup>13</sup> Piedmont Lithium is 0.43% of GHA Strategy assets as of January 31, 2021.

To further reiterate our investment case for identifying and investing in forward-looking, sustainable growth names in the EV space, please see below highlights of several companies in our EME and GHA Strategies.

## Samsung SDI – Leader in Innovation and Battery Cost Compression

### Company Overview:

Samsung SDI (SDI) (2.81% of EME Strategy assets) is a global leader in the development and production of lithium-ion batteries. The EME Investment Team has held the view for a number of years that SDI is the most investable part of the global EV supply chain. The company produces arguably the most important component of electric vehicles, which determines the most valued characteristics of EVs: range and cost. In addition, it currently trades at a digestible valuation multiple – which cannot be said for many other companies associated with this theme.

### Investment Case:

- The mass adoption of electric vehicles has and will continue to be met by a corresponding rise in the demand for batteries. The global battery market is expected to grow 10x to ~970GWh by 2025 equating to EV battery revenue of US\$90B, while global EV penetration will rise to 18% by 2030 and 80% by 2050, from ~1-2% now.<sup>14</sup>
- Technology, capital and regulations suggest that an oligopolistic market structure among tier one battery manufacturers will prevail for the foreseeable future.
- SDI is consistently at the forefront of leading edge battery technology. Their ability to optimize battery

components such as cathode chemistry and subsequently manufacture them at scale is only matched by a handful of companies globally.

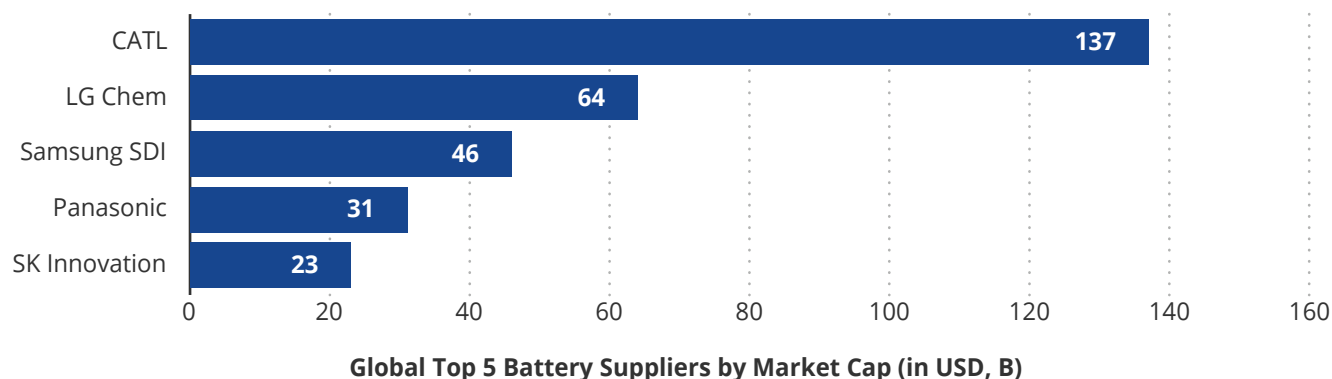
### ESG Tilt:

- As a battery-cell and electronic-materials maker, there is no question about Samsung SDI's commitment to the development and overall contribution to electric vehicles.
- From the corporate governance perspective, the issuer was not involved in any major corporate misconduct in the last 15 years. In addition, the company has a diverse board (4/7 independent), including industry experts and academics (with infrequent board changes), who have been instrumental in making important investment decisions.

SDI remains a high conviction name, and we have been invested in it since December 2017. As part of our ongoing engagement and due diligence effort, we met with company management three times in the past year.

Samsung SDI's recent outperformance was primarily driven by its significant exposure to the European EV market, which has benefitted from green stimulus, as well as a general positive market sentiment towards companies that are linked to the global EV theme.

## Global EV Battery Market Share: CATL, LG Chem and SDI Are Long-Term Winners



Source: Company Data, Macquarie Research. Data as of January 21, 2021.

<sup>14</sup> Source: UBS.

## Freyr – Bringing Groundbreaking Battery Manufacturing Method to Europe

### Company Overview:

Freyr (coming public via merger with Alussa Energy, 0.52% of GHA Strategy assets as of January 31, 2021), through a business combination agreement with SPAC (special purpose acquisition company), Alussa Energy Acquisition Corp. is aiming to become a major battery cell manufacturer and is based in Norway. The GHA Investment Team has long held the view that EV battery supply chain was positioned to regionalize, and shift away from the Asia-centric operations that fueled the first leg of EV growth. Freyr's licensing partnership with 24M Technology is poised to deliver battery cells 20% cheaper than the incumbent – which, in conjunction with scale, positions it very favorably to be a leader in the core component of the EV value chain.

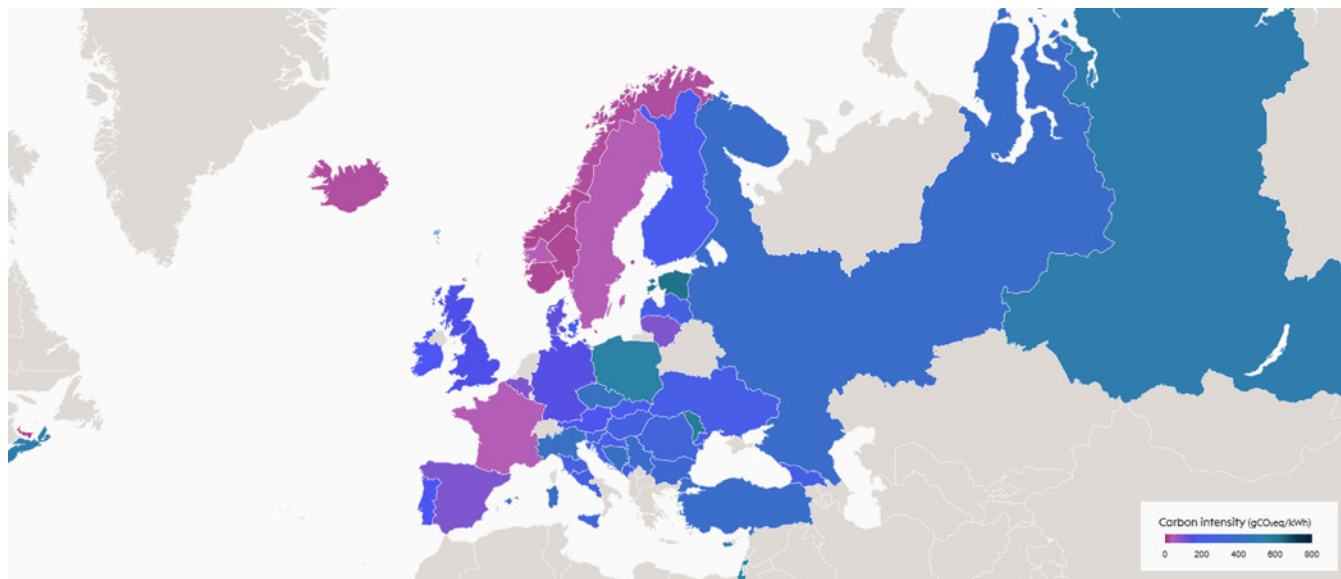
### Investment Case:

- Conventional lithium ion battery cell manufacturing processes have been established and relatively unchanged for years. The production of cells requires 15 steps, which require time, machinery and materials. Freyr's manufacturing process reduces the conventional process down to five steps, due to a "semi-solid" electrode innovation, which fundamentally changes the structure of the cell, while allowing it to become more chemistry agnostic and flexible to different designs of the anode and cathode.

- Why is this process not more mainstream? Money and time. Current battery manufacturers have invested significant capex into gigafactories designed to produce battery cells using the conventional method, and greenfields require significant capex upfront. In addition, the certification process for customers, particular automotive OEMs, is lengthy – upwards of five years of stress testing a battery before considering using for mass deployment.
- We believe Freyr is well positioned to be a major player in the European battery supply chain. Its leverage to a manufacturing base out of Norway, which utilizes clean energy and solves for the zero-carbon well-to-wheel requirement, as well as highly cost competitive battery solutions given its novel manufacturing method addresses the core issues the industry is focused on in creating a sustainable EV value chain.

### ESG Tilt:

- Freyr is advantageously positioned to utilize Norway's access to renewable energy and some of Europe's lowest electricity prices. As such, it expects to have some of the lowest emissions in the industry on a global basis. Given the increased scrutiny by consumers, governments, corporates, and shareholders of lifecycle carbon footprint on the auto industry, a major source of GHG (greenhouse gas) emissions, we believe Freyr is a leader in sustainability.



Source: <https://www.electricitymap.org/map>

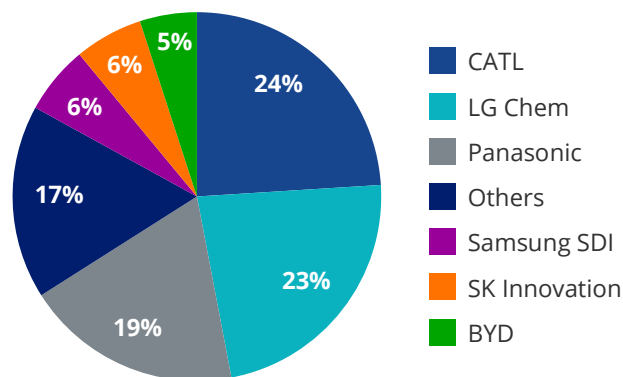


## LG Chem Ltd. – Another Leading Player in the EV Battery Space

### Company Overview:

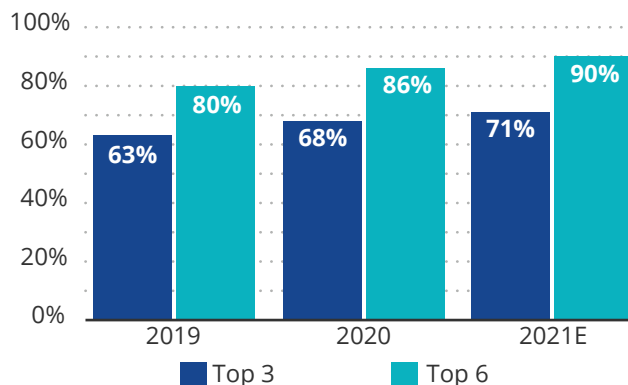
LG Chem Ltd. (LGC) (0.99% of EME Strategy assets) is another example of a global EV battery leader the EME Strategy is invested in. While LG Chem and SDI are similar in many ways, each company has a unique and differentiated customer base – e.g., LG Chem supplies batteries to Tesla and SDI does not. Hence, having positions in both companies gives the Strategy more exposure to the broader EV end market.

### Global EV Battery Market Share (2020)



Source: SNE Research, Morgan Stanley Research.  
Data as of January 4, 2021.

### Market Share of Major EV Battery Players is Getting More Concentrated



Source: SNE Research, Goldman Sachs Investment Research.  
Data as of January 28, 2021.

### Investment Case:

- Although we place equal value on LGC and SDI's respective battery businesses, there are some key differences between the two companies. Unlike SDI, LGC is not a pure play on the global EV adoption theme. A meaningful portion of their revenue is generated from their chemical materials business, which is less aligned with the EME philosophy. Hence, the EME Strategy's total issuer weighting in LGC is lower than SDI.
- We continue to believe that LGC is inextricably tied to a multi-decade structural growth trend and will be able to deliver "fully charged" alpha by leveraging its economies of scale, track record and leading edge battery technology.

### ESG Tilt:

- LG Chem's commitment to sustainability and its footprint is unquestionable. Recently, LGC CEO Mr. Shin was invited to speak at the World Economic Forum 2021. He is the first Korean business leader to discuss strategies relating to climate change at the Forum. Mr. Shin introduced the company's proposal to achieve carbon-neutral growth by 2050 and called

on industry leaders around the world to "Commit," "Operationalize" and "Engage" as a solution to climate change. The proposal refers to suppressing carbon emissions in 2050 to 10 million tons, and to achieve this challenging target, it has to reduce about 30 million tons of carbon emissions.

- Some of LG Chem's key strategies include:
  - Practicing Renewable Energy 100 at all global business sites
  - R&D effort to commercialize breakthrough technologies such as carbon capture and utilization to directly reduce carbon from manufacturing processes
  - Replacing fossil fuel based feedstock with bio based raw materials

We have been following LG Chem closely since 2017, when we initially took position in Samsung SDI. We invested in the company in the first half of 2020, when we became incrementally more bullish on the global EV adoption trend. The EME Investment Team met with LGC's company management two times in 2020.

## Stem, Inc. – Market Leader in AI-driven Storage Solutions Software

### Company Overview:

Stem (coming public via merger with Star Peak Energy, 5.23% of GHA Strategy assets as of January 31, 2021), through a business combination agreement with SPAC Star Peak Energy Transition Corp., the company provides its customers and partners with software technology that enables seamless switching among battery power, onsite generation and grid power. It is a first mover in the space, and as such has collected significant breadth of data which feeds into its predictive analytics toward customer electricity usage – delivering up to a 30% monthly energy bill reduction for customers. As the race between renewables vs conventional electricity generation continues to accelerate, hardware is only half of the solution, in our view. The more efficient management of electricity usage is the critical other half – and Stem is starting to gain ground in an addressable market of \$1.2 trillion through 2050.

### Investment Case:

- Stem operates an asset-light software model that is compatible with a number of established battery brands, such as LG, Tesla and Samsung. Its first leg of growth piggybacks on the growth of battery systems, which are expected to increase 25x by 2030. The payback period for the software platform is very short – its customers are large corporations who focus

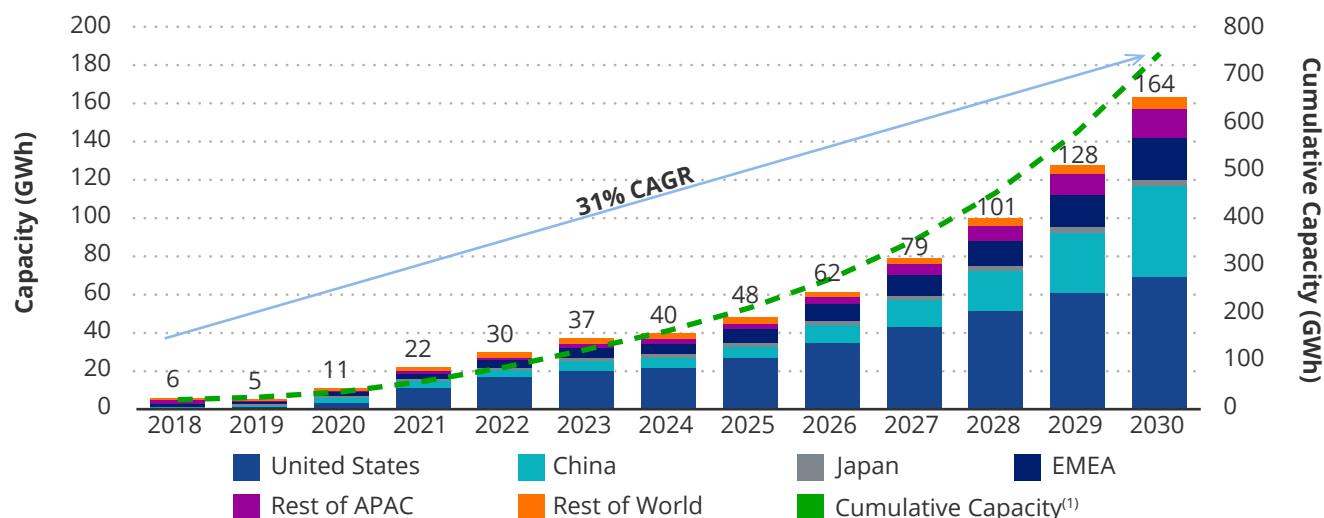
on minimizing energy spend and benefit from the 10-30% energy bill reduction given significant scale.

- Given the increasing move by customers toward renewable generation and storage, the software platform finds itself in a sweet spot – more user data enriches the predictive analytics, and this data is highly useful for utilities managing a number of intermittent renewable assets that require intelligent, adaptable management.
- We believe Stem is in an attractive position to capitalize on significant TAM as energy management software becomes par for the course for homeowners, commercial operators and utilities.

### ESG Tilt:

- Stem's software directly addresses some of the core issues with climate change. Electricity production is the #2 polluter responsible for 27% of GHG emissions, and Stem's asset-light platform seeks to mitigate inefficient energy usage.
- Stem's customers in the commercial and industrial sectors have corporate ESG targets, with 35% of Fortune 500 companies committed to carbon neutrality. By reducing electricity bills through optimizing time-of-use and demand charges, Stem helps these corporations reach their goals with a positive carbon footprint.

## Global Energy Storage Outlook



Source: EEI, Wood Mackenzie.

## Qingdao TGOOD Electric Co. Ltd. – Leader in EV Infrastructure

### Company Overview:

The EME Investment Team recently initiated a new position in Qingdao TGOOD Electric Co. Ltd. (0.67% of EME Strategy assets), the leading operator of charging stations in China. TGOOD has advantages due to both technology and scale.

### Investment Case:

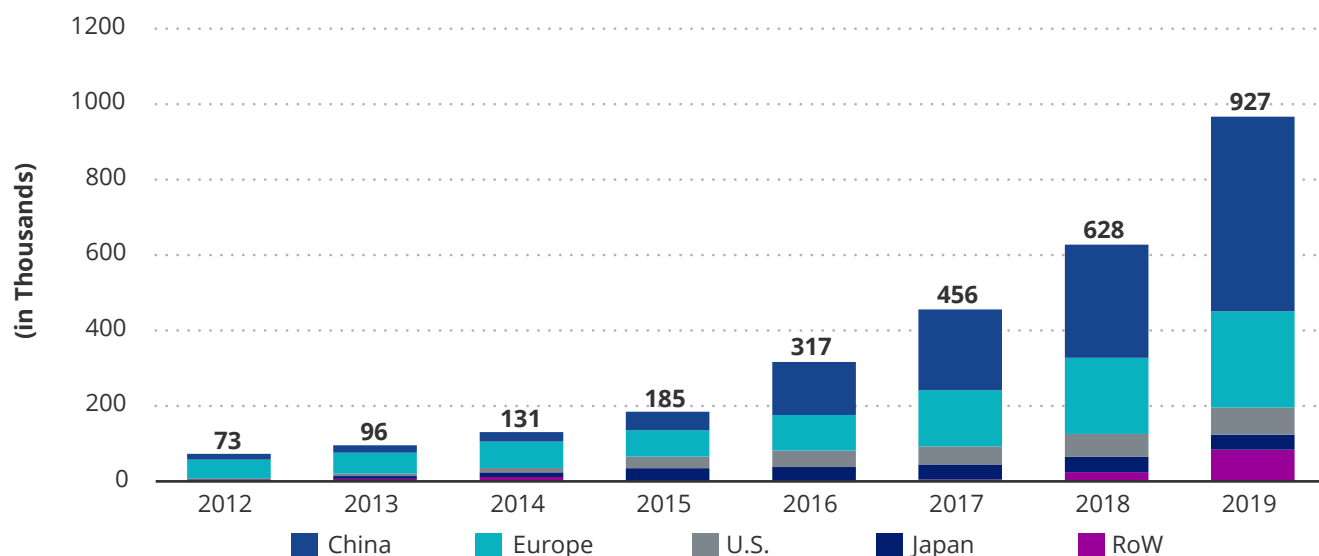
- TGOOD is a collaboration with Siemens, which provides access to its technology and process, and has helped it build scale leadership.
- This leadership provides a powerful competitive moat around its leading position in China with ~30% market share.
- The Chinese market is regulated to one single charge standard. With regulation favoring rapid rollout, asymmetric competitive surprises appear, to us, quite unlikely.

- Similarly, the exponential growth in demand for and productive installation of new infrastructure seems relatively predictable for several years to come (as outlined in the chart below).

### ESG Tilt:

- QTGOOD represents a major enablement hub of continued electrification for the commercial and passenger transport fleet in China, with its considerable positive environmental impact.
- The company's profitability, strong free cash generation, solid balance sheet and high quality management speaks to its sustainability advantages during the highly capital intensive and sometimes loss making early stages of this (sub) industry.

### Cumulative Global Public Charging Connectors



Source: BNEF. Data as of December 31, 2020. Includes Tesla destination and supercharger network, even though this is semi-private.

## EVgo – 100% Renewable-Powered Public EV Charging Leader

### Company Overview:

EVgo (coming public via merger with Climate Change CR Restricted, 0.91% of GHA Strategy assets as of January 31, 2021), through a business combination agreement with SPAC Climate Change Impact Solutions, this company will be the largest public fast charging network in the U.S. It has steadily grown market share over the past decade through partnerships with auto manufacturers, fleet and rideshare operators, retail site hosts, utilities and governments. Its first-mover advantage is critical, in our view, to secure optimal ROI's, as it is both the owner and operator of its network, particularly as the public fast charging landscape is positioned to grow exponentially over the next decade. We view charging stations as a critical bottleneck to the potentially rapid adoption of EVs, and believe EVgo is in an advantageous position in the market to capitalize on that growth.

### Investment Case:

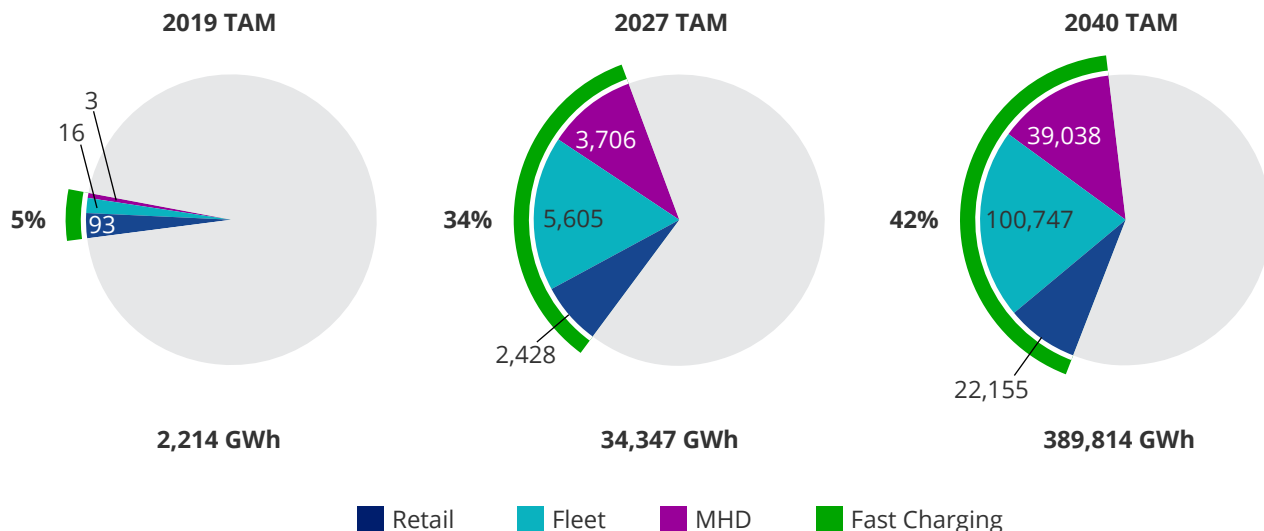
- Over the next two decades, the EV market in the U.S. is expected to expand nearly 100x, to scale with EV market growth of nearly twice that. The infrastructure in the U.S. is severely lacking in its current form; EVgo is the largest public DC fast charging network with 818 sites, compared to 168,000 gas stations.

- We prefer the owner-operator model of EVgo. In our view, the revenue stream that comes from the retail channel is as critical as owning the infrastructure and ultimately informing optimal location and network design. The financing piece is also accretive to ROI, as the payback period for the asset is significantly shortened with financing partnerships. Auto OEMs and rideshare operators are aligned to increase density and pace of network buildout to support their EV fleets.

### ESG Tilt:

- EVgo is the only 100% renewable powered EV charging network in the U.S.
- The company, led by CEO Cathy Zoi, employs a multi-faceted employee led action plan on diversity and inclusion.
- During the COVID pandemic, EVgo implemented COVID-care pricing for essential frontline workers serving communities during the pandemic.

### EVgo

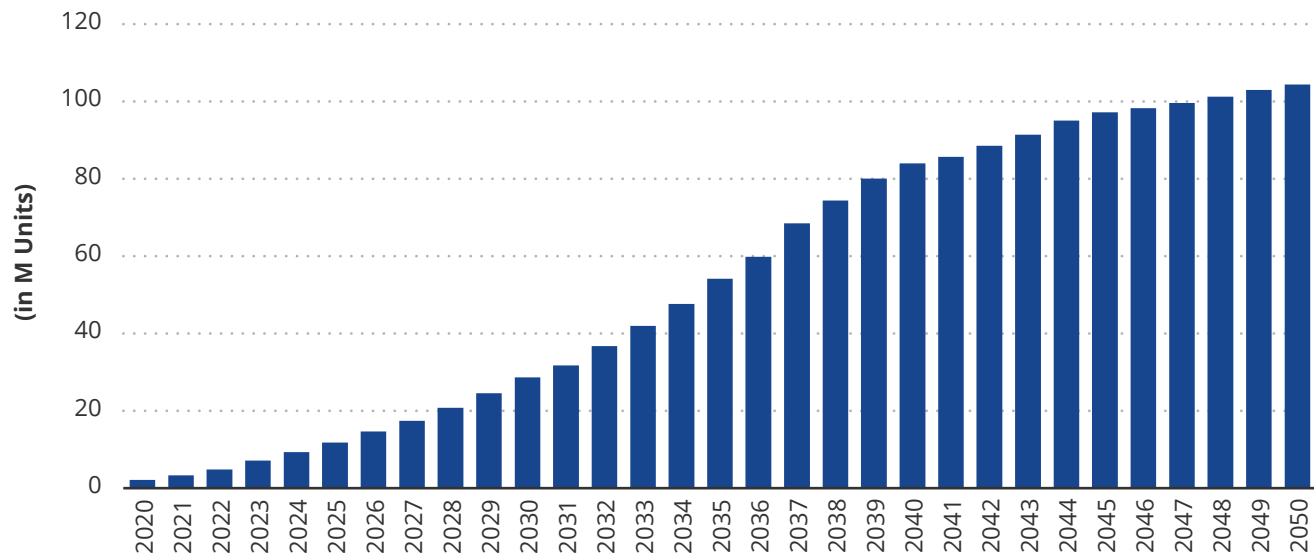


Source: EVgo, BloombergNEF.

Robust Outlook for EVs Globally

Looking forward, we expect the robust growth outlook for electric vehicles to continue globally. This is driven by growing EV demand coupled with the introduction of EV-dedicated platforms, new EV model launches, expanded production volume, continuous government policy support and new players entering the market. We expect China and Europe to drive the growth, with upside potential from the U.S.

Global EV Shipment Forecast



Source: Morgan Stanley Research. Data as of January 4, 2021.





## DISCLOSURES

All asset percentages are as of January 31, 2021.

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