Global Electric Vehicle Review 2022

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1. EXECUTIVE SUMMARY

Executive Summary

Transportation Sector is Going through a Transition Phase

Globally, electrification in transportation is key to achieve objectives in carbon emissions control. A phase-out of internal combustion engines (ICE) is thus on the anvil both at national and/or municipal authority levels. The number of such announcements is on a rise, partly reflecting the convergence of goals worldwide.

Broadly, the direction is apparent in the trend of passenger electric vehicle (EV) sales. Between 2016 and 2021, global passenger EV sales grew at CAGR 46% (BNEF estimates) and held about 6% share in the total new vehicle sales by end-2021. Such a growth accordingly displaced the ICEs' share in the total automotive sales – from 97% to 87% during the same review period.

Charging Infrastructure is Instrumental for Mass Adoption of EVs

Range anxiety is the most challenging factor to spur the EV demand. Such an issue can be addressed only through comprehensive coverage of EV charging infrastructure. Between 2016 and 2020, cumulative installed charging connectors across key markets registered a CAGR 34%.

Along with government investment, the role of private sector is gradually coming to the fore, such as in terms of the conventional utilities pivoting to this industry by setting up or acquiring EV charging businesses. Also important is the development of requisite regulatory guidelines (standardisation in equipment, tariffs, etc.) for the EV charging infrastructure.

Transition to EV is Subject to the Level of Policy Support

There is a case for incentivising EVs to bridge the gap against ICEs. Policy support, in terms of the upfront purchase subsidies, have proven to be effective in propping up the demand. This is observed in the experience of European countries such as Norway, Netherland and Sweden, where passenger EV offtake was led by generous purchase price discounts funded by subsidy allocations.

Policy framework however is evolving with the stages of progress countries achieve. There is a gradual shift observed from a subsidy-led growth, demand-side support for nascent stage, to one based on fleet-wide emission targets incentivising EV adoption, supply-side norms at a mature/growth stage.

Trend of Localisation in EV Manufacturing

Increasingly, with market growth, there is a focus on localisation in EV manufacturing. Europe for example is increasingly seeking EV capacities closer to the high-demand regions. Such a push for localisation is also related to de-risking against the dependence on the Chinese EV market. However, the Chinese market will still play the most important role in the EV supply chain even as the new investments seek diversification across the globe. However, the rapid shocks, initially from the pandemic-led global shutdown and subsequently geopolitical issues such as US-China trade dispute and the ongoing Ukrainian armed conflict, have led major stakeholders and policy authorities to reconsider automotive industry's conventional globalised supply chain network.

The investment commitments and capacity development over the next few years will set the base for a potential mass-production scale that can generate economies of scale. Pure-play EV entities may not find this very easy.

2. EV PENETRATION & ADOPTION

Electric Vehicle Penetration & Adoption (1/5)

Introduction

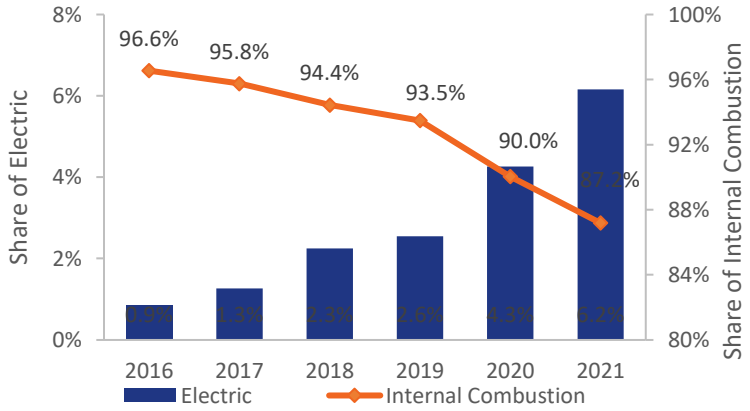
- The Electric Vehicle (EV) market has gradually assumed traction due to the policy direction globally at electrification of the transportation system
- While the passenger vehicles' offtake faces the challenge of a high ownership cost, the two-wheeler segment on the other hand has had a rapid growth due to greater accessibility in price points
- The competitive cost of EVs, as a culmination of technology improvement and ramping up the charging infrastructure hold the key to realise the objectives in EV penetration

Status and Trend at an Aggregated Level

Global Passenger Vehicle Fleet by Drivetrain (BNEF)

Drivetrain	2016	2017	2018	2019	2020	2021
Battery electric	995,177	1,698,643	3,028,422	4,614,028	6,734,252	10,058,783
Plug-in hybrid	784,391	1,180,594	1,800,948	2,347,826	3,333,137	4,749,517
Fuel cell	2,749	6,154	10,104	17,856	26,195	37,565
Hybrid	13,092,023	15,645,119	18,459,358	21,670,770	25,581,285	30,397,445
Internal combustion	1,057,448,435	1,094,673,838	1,130,961,065	1,166,547,390	1,187,691,774	1,188,664,187
Total	**1,072,322,775**	**1,113,204,348**	**1,154,259,897**	**1,195,197,870**	**1,223,366,644**	**1,233,907,497**

Global Share of Passenger Vehicle Sales in Electric and Internal Combustion Drivetrains



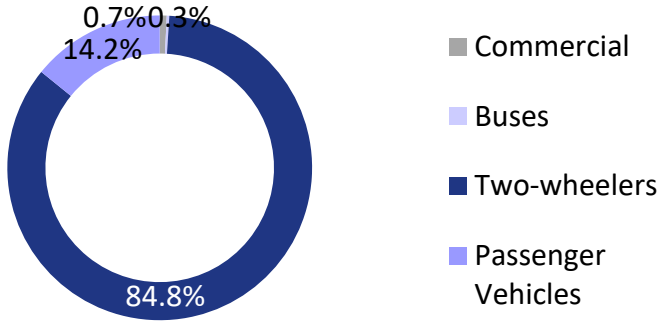
Source: BNEF

- EVs appear to be displacing the internal combustion-based vehicles, albeit slowly. To a significant extent, this is led by the policy consensus on managing carbon emission to mitigate climate change
- However, despite attractive growth prospects, so far EVs account for just about 1% of the total passenger vehicle fleet (IEA)
- With barriers such as in ownership cost and infrastructural gaps, the process to mainstream EVs is a protracted one

Electric Vehicle Penetration & Adoption (2/5)

Status and Growth by EV Segment:

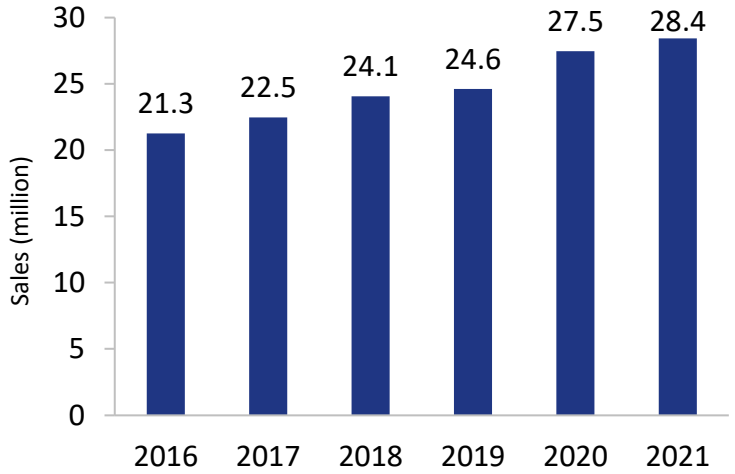
Global EV Sales by Segment (as of 2021)



Note: Commercial category above is an aggregate of light, medium and heavy commercial vehicles
Source: BNEF

- The current adoption appears to be predominantly skewed towards the two-wheeler segment
- The two-wheeler segment found steady offtake in China, Taiwan and Vietnam as well as Europe because of its affordability in terms of total ownership cost
- Startups lately emerged as the major entities pushing the case of electric two-wheelers, especially e-scooters

Global Electric Two-Wheeler Sales Trend

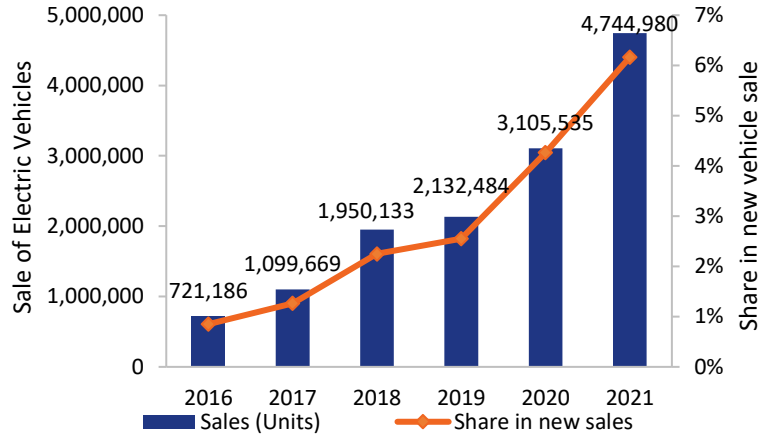


Source: BNEF

- The pandemic outbreak phase appears to have tempered the rate of growth in two-wheeler sales trend – a reflection of the postponed consumer purchases in most of the developing markets
- With decline in the upfront prices, due to cheaper Lithium-Ion batteries, such two-wheelers are expected to be a price competitive option against their IC counterparts

Electric Vehicle Penetration & Adoption (3/5)

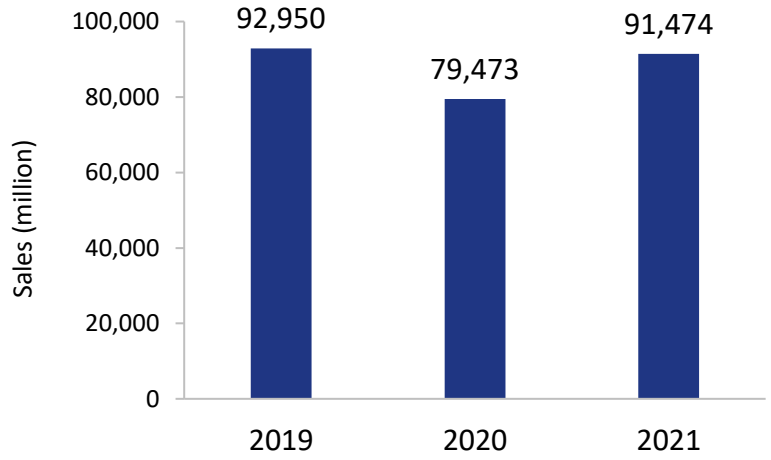
Global Passenger EV Sale and Penetration Trend



Source: BNEF

- The EV passenger market, gets the most focus in electrification of transportation, especially in private vehicle segment
- The EV passenger vehicles continue to be behind competition in cost, which impedes large-scale adoption in this segment
- Demand-side policy incentives and strict emission norms are thus instrumental in driving offtake

Global Sale of Electric Buses



Source: BNEF

- The growth in electric buses is an outcome of the policy stance on mitigating emissions in overall public transportation
- The drop in electric bus sales was observed during 2019 caused by Chinese subsidies rationalisation followed by COVID-19 outbreak in 2020. The business recovery since then helped improve the prospects
- However, despite demand recovery, lack of abundant fast charging infrastructure and absence of supportive local norms and regulations prolong the replacement of diesel-based buses by electric buses

Electric Vehicle Penetration & Adoption (4/5)

EV in Shared Mobility and/or Micro-Mobility

Trend in the Three-wheeler EV Fleet (BNEF)

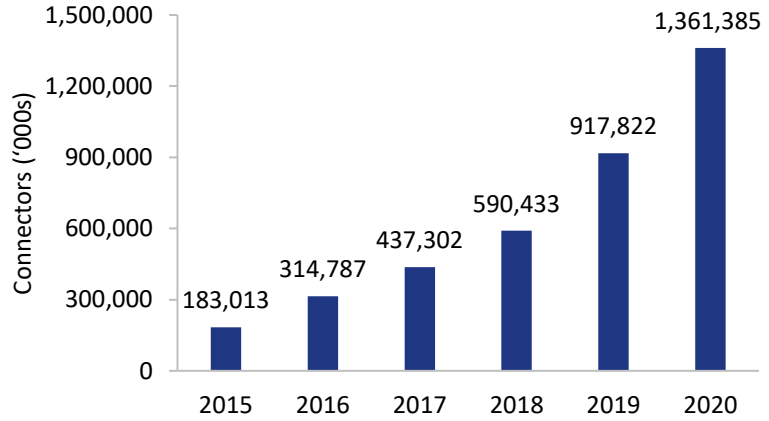
	2016	2017	2018	2019	2020	2021
China	49,400,000	54,000,000	60,000,000	63,646,749	67,525,790	70,800,057
India	900,000	1,737,500	2,350,000	2,930,000	3,088,941	3,273,729
Other	4,128	5,938	7,995	10,344	13,127	17,858
Total	**50,304,128**	**55,743,438**	**62,357,995**	**66,587,093**	**70,627,858**	**74,091,644**

- EVs are increasingly finding a critical role for the innovations in urban mobility, mainly through deployment as shared mobility or micro-mobility solutions
- Policy and regulatory environment in the countries, apart from technological advancements taking place, play vital role in shaping the market
- The three-wheelers constitute an important shared mobility vehicle segment in India and China, even as globally they account for a smaller market than the overall two-wheelers
- These vehicles are typically deployed commercially for the last-mile connectivity in passenger services or for light-freight delivery
- Electric bicycles of late emerged as a fast-growing medium. Notably, the sales growth in e-bikes has been steady, while the US is expected to become strong market for e-bikes in near future
- Electric scooter is another important segment, which has market expansion taken place across 50 countries globally, implying faster adoption compared to e-bikes

Electric Vehicle Penetration & Adoption (5/5)

Charging Infrastructure

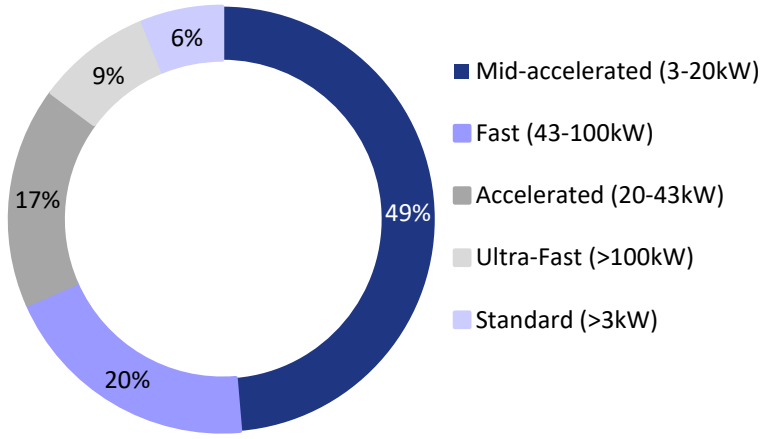
Cumulative Global Public Charging Connectors



Source: BNEF

- Charging infrastructure is the most critical element of EV adoption in the sense that ubiquitous charging base ameliorates the otherwise challenging limitation of range in a typical EV platform
- The growth of public charging infrastructure assumes significance, led by China. While in terms of charger density, the European countries rank among the highest
- As of 2021, the Netherlands has the maximum public charging connectors per 100,000 population, at 563, followed by others including Norway (315), Iceland (180), Sweden (114) and Denmark (112).

Public EV Charging Infrastructure by Power Category



Source: BNEF

- Several companies lately sought funding options for expansion or towards investing in EV charging companies
- Notable has been the rapid progress by global hydrocarbon majors, such as Shell, in acquiring the charging network companies to enter this space
- However, the need to upgrade the power standards of the charging points along with replacement of the legacy base of charging points with fast chargers persists

3. REGIONAL OVERVIEW OF EV ADOPTION

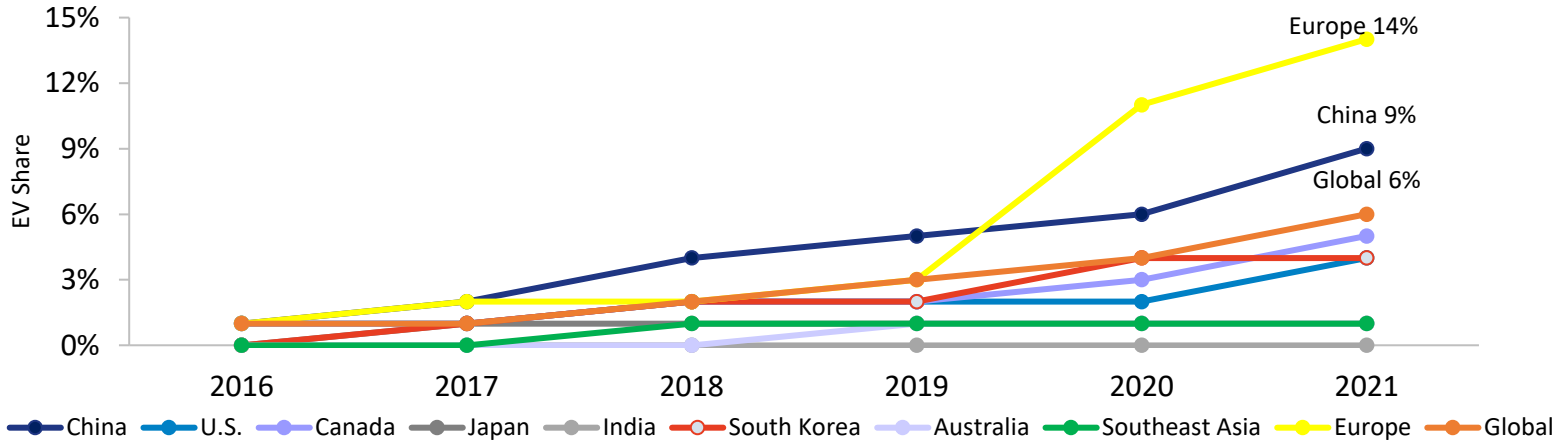
Regional Overview of EV Adoption (1/6)

Introduction

- European countries are the frontrunners in terms of EV penetration, share of battery-based vehicles is nearing a tipping point
- In absolute terms, China is the market leader in terms of the total EV sales as well as the supporting infrastructure
- Extensive adoption of EV in both Europe and China can be explained by strong regulatory support involving mix of mandate and incentives

The Top Countries/Regions in EV Adoption

EV Share of New Passenger Vehicle Sales by Country/Region

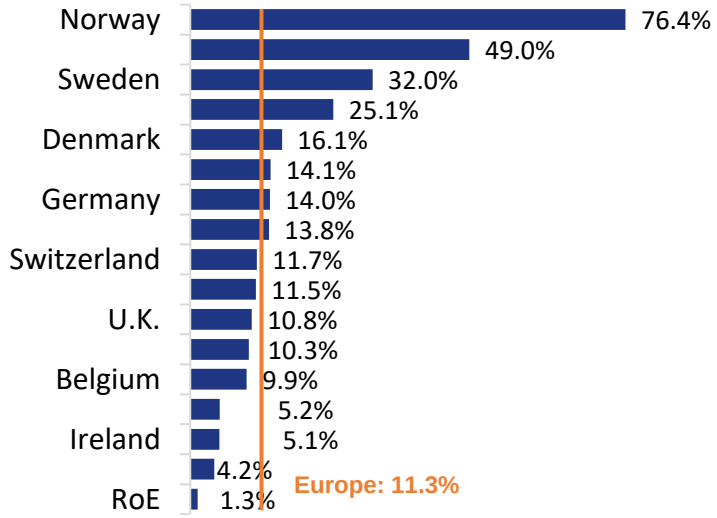


Note: Data refers to BNEF estimates for the year 2021
Source: BNEF

- China continues to be the leading country in terms of EV penetration, while Europe has a lead region in EV penetration
- North American region, led mainly by the US, has been lagging after a brief progress till last year in the EV penetration
- With all the countries taken together except China, the Asia-Pacific region's penetration is much lower
- The thrust for EV adoption in China is attributed to long-term economic growth and some of the strongest policy mandates towards electrification in transport
- Although, national plan of progressive phase-out of purchase subsidy support for EVs by 2022 negatively impacted the sales in China. But it made up for the lost ground with rapid recovery in 2020

Regional Overview of EV Adoption (2/6)

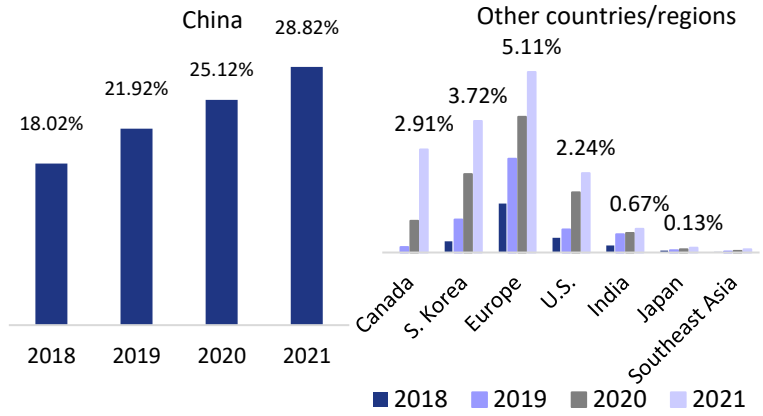
Share of Electric Vehicles in the New Vehicle Sales of European Countries (as of end-2020)



Source: BNEF

- Selected European countries are already the top-ranking ones globally in EV penetration
- Europe is currently the priority market for most of the OEMs to address for the sheer policy-led demand growth underway
- The manufacturers in the region, however, face the prospects of punitive costs for failure to meet emission targets, stem from the goals of reducing total carbon emissions in the economy
- Nevertheless, the persisting regulations are even expected to impact the bottom-line in the short-term

E-bus Share of the Total Bus Fleet across Key Regions/Countries



Note: Data refers to BNEF estimates for the year 2021
Source: BNEF

- As per BNEF estimates, electric buses account for approximately one-fifth of the total global bus fleet
- So far, the progress in this direction has been limited, in part due to the lack of adequate charging infrastructure
- China holds the largest share of electric buses in its total fleet thus, coming across as the largest e-bus market globally

4. TRENDS & DRIVERS

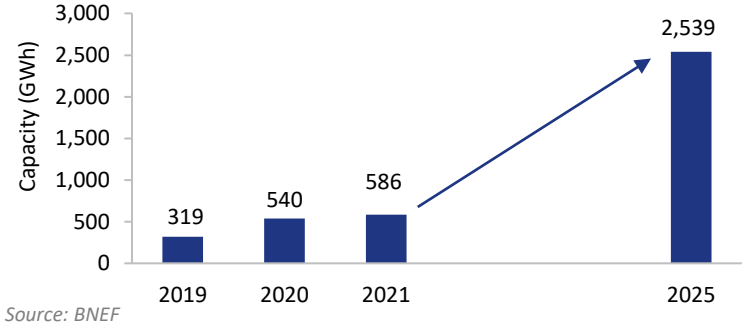
Trends & Drivers (1/6)

Introduction

- The transition to EV-based drivetrain is gaining momentum. Although, with barely 1% of the global passenger vehicle fleet by drivetrain, EVs have a long way to make a dent in this market
- Of late, deliberate policy and regulatory action have propelled the progress towards electrification. They have also pushed several automotive manufacturers, technology providers and related stakeholders to shift business orientation drastically

Battery Cost and Supply

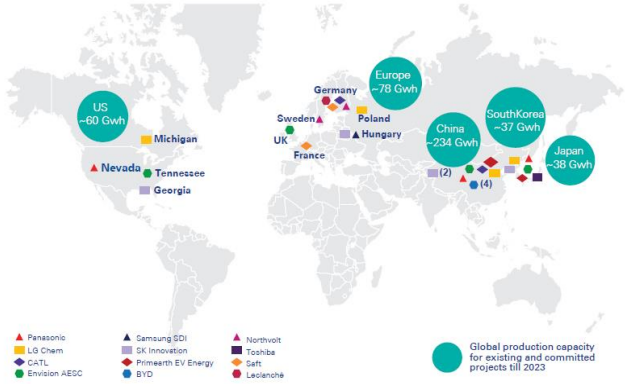
Lithium-Ion Battery Manufacturing Capacity Trend and Projection



Source: BNEF

- The Lithium-Ion battery plays the predominant role in the entire electric vehicle ecosystem.
- Existing annual battery manufacturing capacity stands at about 586GWh in 2021 – almost double than that of in 2019.
- As per BNEF estimates the various manufacturing projects in pipeline globally, point to an expected quadrupling of the current capacity by 2025.

Global Battery Cell Manufacturing Locations and Key Players

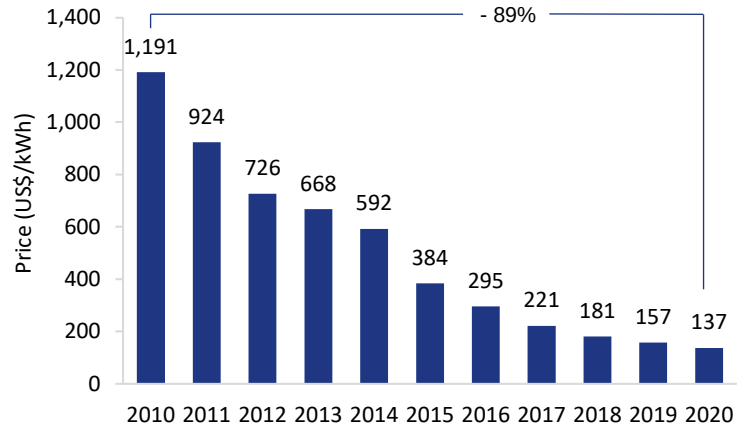


Source: KPMG and CII report on EV Landscape in India

- Globally, the battery manufacturing capacity is concentrated in selected production hubs
- China dominates over a three-quarter share of total global capacity in this regard. It has access to critical material supply and the facilities set up for the supply chain

Trends & Drivers (2/6)

Trend in Volume-weighted Lithium-Ion Battery Pack Price (Real 2020 USD/kWh)

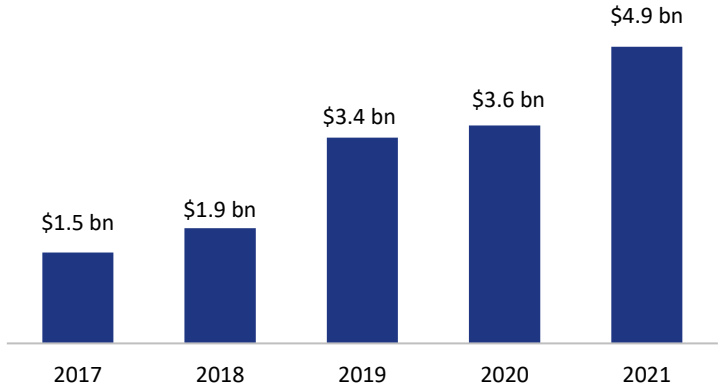


Source: BNEF

- The sharply declining trend in battery prices reinforces the competitiveness of Lithium-Ion technology over other storage options in the market
- The near to medium term battery pack prices may fluctuate but the long-term trend is clearly that of further decline is additional capacities come onstream

Charging Infrastructure

Trend in Public Charger Investment



Note: Data for 2021 is an estimated one
Source: BNEF

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