

Present Ecosystem of BEV manufacturing: Challenges and Opportunities

Presented by: CRISIL Limited



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Research

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Manage and mitigate risks



Take pricing and valuation decisions



Reduce time to market

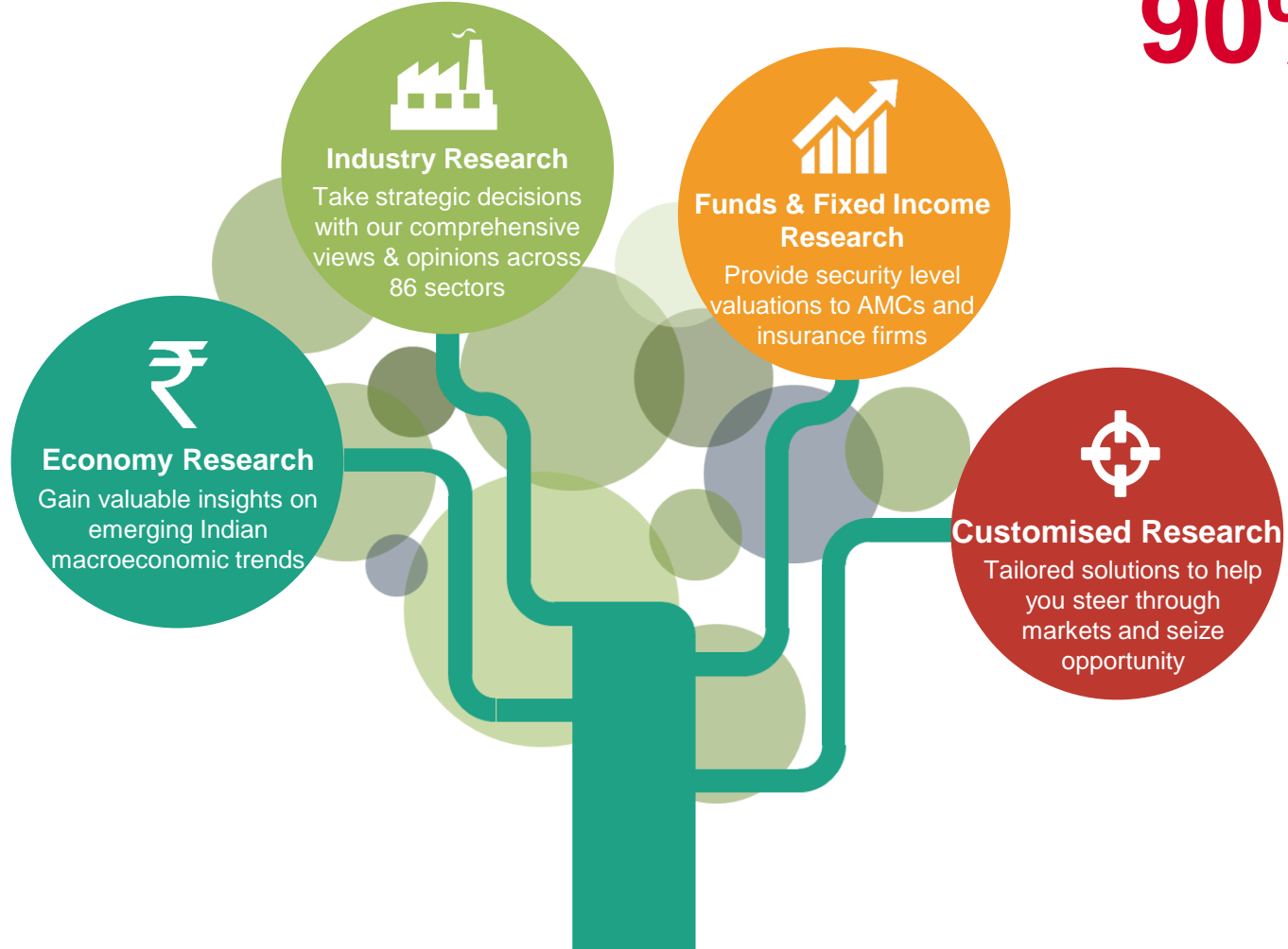


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90% of India's banking industry
by asset base served

Global and Indian clients exceeding **1,200+**

86 industries and sub-sectors tracked on regular basis since **two decades**

KEY INDUSTRIES COVERED

Pharma
Fertilizers
Transportation
Textile
Petrochemicals
Technology
Cement
Aluminum
Natural Gas
Coal
Steel
Automobiles
Telecom
Travel
Chemicals
Power
Healthcare
Food Beverage
Industrials
Agriculture
Banking
Crude Oil
Capital Goods
Construction
White Goods
Paper
Retail
Housing

Customised research offerings

Business Planning

- ✓ **Identification of attractive sectors/ sub-segments**
 - Demand-supply dynamics, profitability and opportunity
 - Sector / Company financial health
 - Policy and regulatory view
- ✓ **Opportunity mapping for planning**
 - Market dynamics, capacity utilization, economics
 - Policies and regulations
- ✓ **Demand dashboards across locations and sectors**
- ✓ **Commodity price tracking**
 - Short term/long term, regional markets, brand-wise assessments

Fund raising & valuations

- ✓ Feasibility/Viability studies /Credit Assessment
- ✓ Valuations including structured instrument valuation
- ✓ Exit diligence

Research

Strategic initiatives

- ✓ **Pre-investment commercial due-diligence**
 - Market assessment
 - Channel feedback
 - Financial assessment
 - Management assessment
- ✓ **Post investment monitoring**
 - Market feedback, end-user and growth outlook
 - Exit strategy
- ✓ **Assessment of partners and tie-ups**
- ✓ **Market entry strategy**

Competitor Benchmarking

- ✓ Competitor strategy – expansion, value addition, supply chain assessment, channel feedback, market intelligence
- ✓ Cost Benchmarking



Major Pillars for enabling BEV manufacturing in a country



Readiness status of industry

Manufacture and stakeholder willingness to enter EV business

End-use EV market and potential demand growth



Access to global supply chains

Availability of raw materials

Competitiveness in the EV manufacturing space



Key policy and regulatory stance towards EV manufacturing in the country

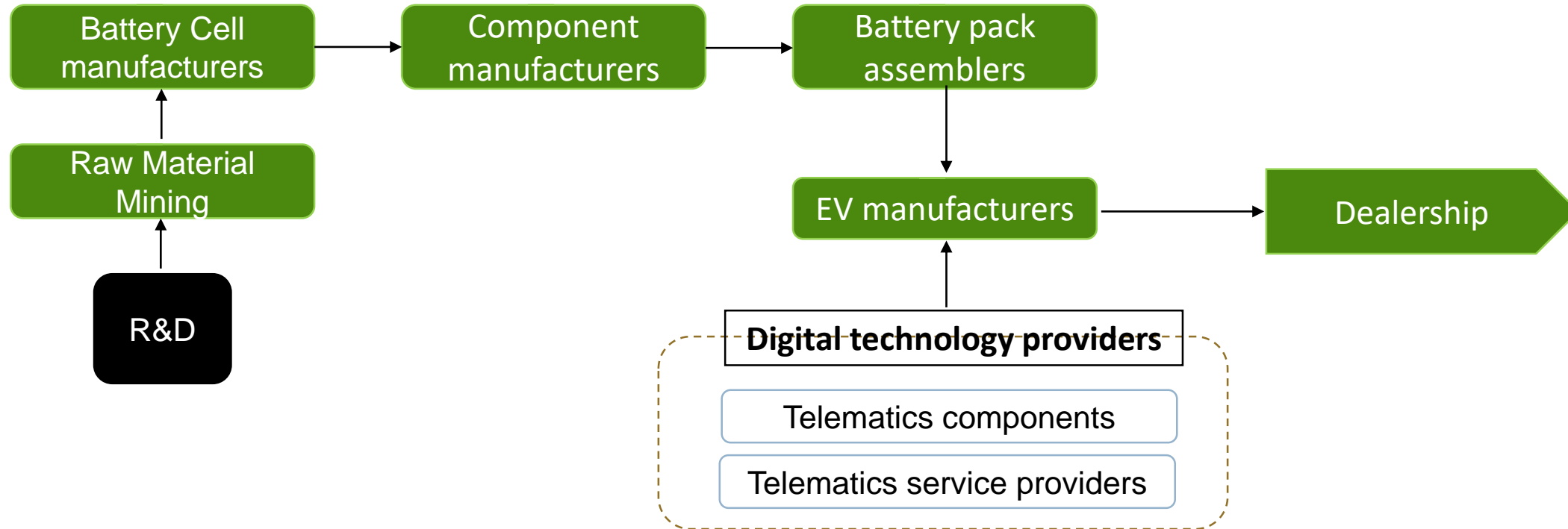
Steps taken to encourage PPP

Ease of funding opportunities in the segment

Indigenous skill development to promote domestic manufacturing of components

Stakeholders of a BEV manufacturing ecosystem

I. EV manufacturing

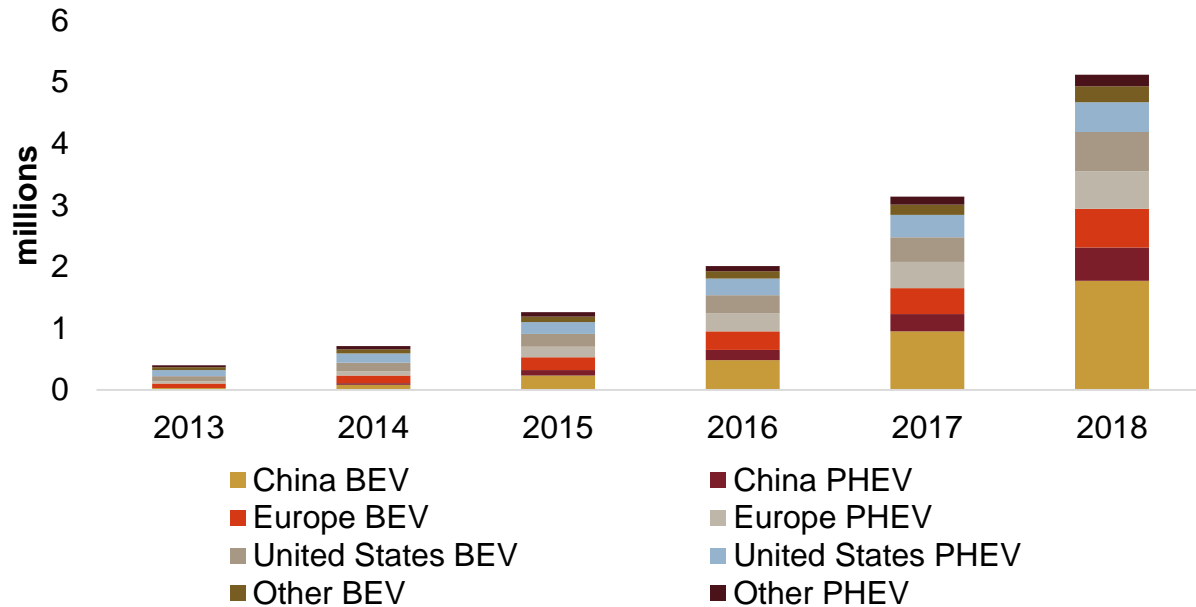


II. After Sales services



Pillar 1: Readiness Status of industry

Global EV Market



- As of end-2018, the global stock of EVs surpassed 5 million, an increase of 63% (3.14 million in 2017) from the previous year (IEA estimates). China led the deployment, accounting for ~45% of the electric car fleet, followed by Europe (24%) and the US (22%)
- The biggest EV penetration (in terms of volume and sales) occurred in China. The nation outperformed all other countries on both the market side as well as the industry side (component manufacturing).

Investments in EV manufacturing




- | | |
|---------------|-----------------|
| • China | \$135.7 billion |
| • Germany | \$71.7 billion |
| • USA | \$34 billion |
| • South Korea | \$20 billion |
| • Japan | \$18.9 billion |
| • France | \$10.4 billion |
| • Others | \$9.4 billion |

- Global automakers are planning an unprecedented level of spending to develop and procure batteries and electric vehicles over the next five to 10 years, with a significant portion of their budgets targeted at China
- Global auto makers like Volkswagen, Daimler, Ford, Fiat, Toyota, Nissan and Renault have begun investing in EVs (vehicles as well as batteries)

Pillar 2: Access to global supply chains




China's grip on battery metals supply chain

Stage 1: Mining

			
Nickel	8%	0%	31%
Cobalt	0%	0%	1%
Graphite	1%	0%	65%
Lithium	0%	1%	0%
Manganese	0%	0%	6%

Source: Benchmark Mineral Intelligence

Stage 2: Chemical Processing

			
Nickel	13%	1%	65%
Cobalt	17%	0%	82%
Graphite	0%	0%	100%
Lithium	0%	4%	59%
Manganese	7%	0%	93%

Source: Benchmark Mineral Intelligence




- China's dominance in battery raw materials can most clearly be seen in the market for graphite, which produces 65 per cent of the world's graphite
- Producing countries supply Lithium majorly from brines of Argentina, Chile and Bolivia and hard rock from Australia
- Cobalt mine supplies is monopolistic: more than 70% of cobalt mined originates from DRC, followed by Russia, Cuba, Australia and Canada

- China's dominance in battery raw materials encompasses across all major chemicals
- The USA has build up some supply chain in Nickel and cobalt
- The EU continues to lag behind, with no major share in chemical processing space

Pillar 2: Access to global supply chains (contd.)

China's grip on battery metals supply chain




Stage 3: Cathode and Anode Production

			
Cathode	0%	0%	61%
Anode	0%	0%	83%

Source: Benchmark Mineral Intelligence

- 61% for cathodes are produced in China
- 83 per cent of the world's anodes for lithium-ion batteries are produced in China, owing to dominance in graphite usage

Stage 4: Li-ion Battery Manufacturing

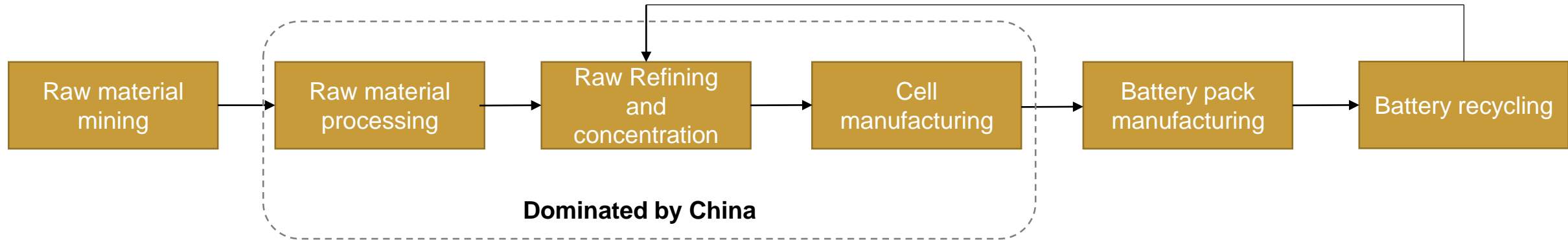
			
Cells	6%	10%	73%

Source: Benchmark Mineral Intelligence

- The rise of battery mega factories has predominantly been taking place in mainland China, which has contributed to ~73% of output in 2019
- Of the 136 lithium-ion battery plants in the pipeline to 2029, 101 are based in China

Pillar 2: Access to global supply chains (contd.)

Stakeholders of a BEV manufacturing ecosystem



- China's dominance in chemical production of battery-grade raw materials stand at ~80% of total global production
- Monopolistic advantage in capacity ownership can lead to global supply chain issues and pricing power by China
- Both USA and EU are still missing the chemical links in the supply chain
- In fact, the European Union have already sounded alarm with the European Commission warning that over-reliance on imports of critical raw materials can undermine EV industry. The commission has added Lithium into the critical supplies list

Pillar 3: Regulatory and Policy Incentives for BEV manufacturing

Examples from USA

Advanced Technology Vehicle Manufacturing (ATVM) loan program

Loan support for PEVs and PEV components, as well as associated engineering integration costs. Three loans of more than \$3 billion have been distributed to major firms including Nissan and Tesla, for PEV manufacturing

Advanced Stimulus-funded grants for advanced battery manufacturers program

Direct loans to manufacturers of up to 30% of the cost to re-equip, expand, or establish manufacturing facilities; more than ~\$5 billion grant program have been provided by the end by 2018

PEV-related research and development (R&D)

Direct grants for high-risk/reward research on next-generation battery systems. DOE expended ~\$2 billion till date towards innovation in batteries and electric drive technology, vehicle and systems simulation and testing

Federal PEV tax credits

\$2500 per vehicle with a 4 kWh battery, up to \$7,500 per vehicle for 16 kWh batteries. A phase-out period for a manufacturer's vehicles kicks in after the given manufacturer has sold 200,000 qualified PEVs.

Pillar 3: Regulatory and Policy Incentives for BEV manufacturing (contd.)

Examples from European Union

Strong policy overview to push EV sales

By 2025, the EU has sharpened the EV target to 20% of total sales while Norway has banned sales of gasoline and diesel cars. By 2040, France, Italy and UK (earlier part of EU) plan to target 100% zero-emission vehicle sales

Subsidies on EVs

Countries have set out tax benefits (registration tax, ownership tax), EV parking benefits, subsidies and sops for EV sales

Public funds-backed investments and research

- Governments, universities, EU institutions and scores of businesses, including the leading carmakers, have been pooling funds and working on a new industrial policy to improve EU's technological independence in EV manufacturing
- The EU is focusing on building open, competitive markets for EV manufacturing with strict controls on public subsidies

Pillar 3: Regulatory and Policy Incentives for BEV manufacturing (contd.)

Examples from China

Only 5,000 EVs were sold in China in 2011; 1.2 million EVs were sold in 2019

Dual Credit system

Allows auto manufacturers, regardless of country of origin, to sell surplus EV credits to other firms to earn additional revenue and has prompted foreign manufacturers like Volkswagen and General Motors to seriously consider manufacturing more EVs in China

Subsidies on EVs






Central subsidies covering electric buses, public vehicles (including taxi fleets), local governments roll out additional subsidies in the form of grants and loans

Federal support for manufacturing EVs

- Federal support for industry and academia to push manufacturers beyond niche vehicles and bolster largescale PEV commercialization.
- This includes grants and loans to industry, basic research and development support to academia and national labs, vehicle demonstration funds, support for charging infrastructure, market and other applied research,
- Grants are provided for training and education, including emergency response, technician training, and other supporting roles

India in Focus

Long term outlook for EVs: Electric Vehicle penetration to be driven by 3Ws and 2Ws

Vehicle Segment	EV Penetration (Sales)		
	FY19	FY24 P	FY30P
	0.1% (~3,600)	3-5% (~1,76,000)	25% (1,299,000)
	0.6% (~126,000)	12-17% (~3,497,000)	50% (13,168,000)
	0.5% (~500)	2-4% (~4,500)	20% (~42,000)
	0% (~100)	3-5% (~24,000)	10% (~86,000)
	0.01% (~700)	43-48% (2,97,000)	70% (~931,000)

Vehicle Type	Drivers for EV adoption for the period FY20-FY24	Drivers for EV adoption for the period FY25-FY230
Two Wheelers	E-Scooters to have better TCO than ICE scooters but weaker than ICE Motor cycles by FY24	Scooters to majorly shift to EV, motorcycles below 125 cc will begin conversion, majorly in the urban and semi urban regions
Three Wheelers	E- Auto to have favorable TCO and cost of acquisition (COA) as compared to a CNG powered three wheeler by FY24	Better cost economics, low running costs and rise in CNG prices to allure auto owners towards EV
PV and CV	Low annual running will hinder EV adoption in personal cars by FY24 while higher daily running to aid EV adoption in cab aggregators	CV segment expected to majorly convert to EV; PV segment will begin showing traction due to lowering cost and conducive economics
Bus	Subsidies will drive EV adoption for State Transport Undertakings (STUs)	Government push, lowering of battery prices to drive adoption

India in Focus

Regulatory and federal policies driving E-mobility

- 1 | *National Electric Mobility Mission Plan:* The scheme intended to catalyse market development (demand generation, technology development, pilot projects and charging infrastructure) for creation of an EV ecosystem
- 2 | *FAME II:* The FAME-II intends to support 10 lakh two-wheelers, 5 lakh three-wheelers, 55,000 four-wheelers, and 7,000 buses that operate on lithium-ion batteries or other electric power-trains. Under the scheme the government will offer incentives for electric buses, three-wheelers and four-wheelers to be used for commercial purposes
- 3 | *Subsidy support for setting up EV charging stations:* The Indian government plans to offer subsidy support to states for deployment of 5,000 EV charging stations in cities and highways
- 4 | *Focus on domestic manufacturing of EVs:* In order to encourage vehicle manufacturers to produce EVs in the country, the government plans to raise custom duties on EV parts and batteries in a phased manner. As part of the phased manufacturing program (PMP) of the Department of Heavy Industries, basic customs duties on completely built units of electric buses and trucks will be doubled from 25% to 50% from April 2020.

India in Focus

Stance taken by major states to promote EV manufacturing

With a target of 50 GWh, the NITI Aayog plan would support the establishment of anywhere between three to ten giga-factories of 20 GWh to 5 GWh capacity each in the country

- 1 | Gujarat, which has already seen large-scale investments for Li-ion battery manufacturing, is offering additional support in the form of subsidized utilities under the state's electronics policies.
- 2 | Telangana has announced the availability of 200 acres of land plus power and water for the manufacturing unit at a concessional rate
- 3 | Andhra Pradesh, as early as 2017, announced the allocation of 200-400 acres for development of the electric mobility-focused industrial park. The state also plans to provide capital subsidies of 50 per cent of fixed capital investments in building and common infrastructure (up to a maximum of INR 20 cr [INR 200 mn = \$ 2.8 mn]).
- 4 | Maharashtra has set its intent in setting up India's first five giga-factories. In addition to the capital subsidies on fixed capital investments, the state government shall be an equity partner up to nine per cent in large, mega, and ultra-mega projects, with FCI greater than INR 500 crores.
- 5 | Tamil Nadu, would be offering SIPCOT land at a subsidized rate in addition to other incentives

India in Focus

Opportunities in EV manufacturing

- With a global growth rate of 60% in EVs, India has the opportunity to become a global player in the space
- The market share of electric cars is around 2% in China while it is around 39% in Norway, whereas the Indian market share of electric cars is a meagre 0.06%
- Global focus on making supply chains self-reliant provides an opportunity for domestic manufacturing of EVs
- The government has raised tariffs on Li-ion batteries, providing domestic manufacturers a powerful incentive
- Roughly 50% of Build of Materials (BOM) in an EV is different from that of an ICE vehicle, it will create a new opportunity for auto component manufacturers

Challenges in EV manufacturing

- Lack of rare earth materials in the country
- Sourcing challenges for elements like lithium, cobalt, nickel, most mines and capacities have already been leased out by global EV majors
- Lack of a supporting supply chain, manufacturing and infrastructure ecosystem that deters the pace of adoption.
- Lack of dedicated focus on incubating new technologies pertaining to EVs, R&D spends are low
- Lack of large-scale investments towards EVs by home-grown auto majors. This makes global investments sceptical

Conclusion

- Presently, the global BEV manufacturing is tilted heavily towards China, however, USA and EU are investing in EV technologies
- China has gained dominance by securing access to supply chains, other countries are playing catch up
- Globally, EV growth is expected to remain strong; new innovation in battery technologies and scaling up of manufacturing capacities will help companies and countries achieve economies of scale, thereby reducing EV costs
- India's EV market is fledgling, however, it is poised to grow to ~80 million EVs by 2030
- Domestic manufacturing ecosystem in India is small to non-existent, however, with the right policies and improved investments by auto makers to manufacture EVs, it can tip the balance from challenge to opportunity for India



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