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CHARGING AHEAD

SPECIALE INVEST

Charging Ahead:

A Cross-Jurisdictional, Regulatory and Industry Analysis of Electric Vehicle Battery Packs

A GameChanger Law-Speciale Invest Report

October 2023

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The information provided regarding the laws and regulatory framework of battery packs in California, the United Kingdom, and the European Union is based on information that is available in the public domain, as of October 09, 2023. This Report seeks only to provide information. It is not a legal opinion on any aspect of battery or battery pack regulations in any of the jurisdictions analyzed i.e., India, California, the United Kingdom, and the European Union. Any questions regarding the interpretation of the laws mentioned in this Report should be addressed to attorneys who are qualified to practice law in India, California, the United Kingdom, and the European Union accordingly.

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Our Collaborators

SPECIALE INVEST

We are privileged to have Vishesh Rajaram, Arjun Rao and their wonderful team at Speciale Invest as collaborators of this Report. Since 2017, we have had the privilege of working with, and supporting them, on a number of groundbreaking investments in deep technology startups, including those in the domains of electric mobility, space tech, robotics, gaming and SaaS.

We also extend our gratitude especially to Vishnu Rajeev, Investment Principal at Speciale Invest. Vishnu, who has a focus on startups operating in the mobility, climate tech and energy sectors, kindly contributed his unique perspectives that have led to this Report being a truly unique collaboration between lawyers, investors and electric mobility industry operators.

Acknowledgements

êxponent

In April 2022, the team at GameChanger Law Advisors was introduced to Exponent Energy, an exciting startup that manufactures rapid charging batteries and develops charging networks for electric vehicles.

It was the start of a fascinating journey for our team, as we dived deep into the previously unexplored world of laws and regulations pertaining to batteries and charging stations. Our work on this report has been inspired by, and drawn from, the experience we have acquired while advising Exponent Energy over the last 18 months. Our gratitude goes out to the wonderful team there, especially Sanjay Byalal and Vivek Doulatani.

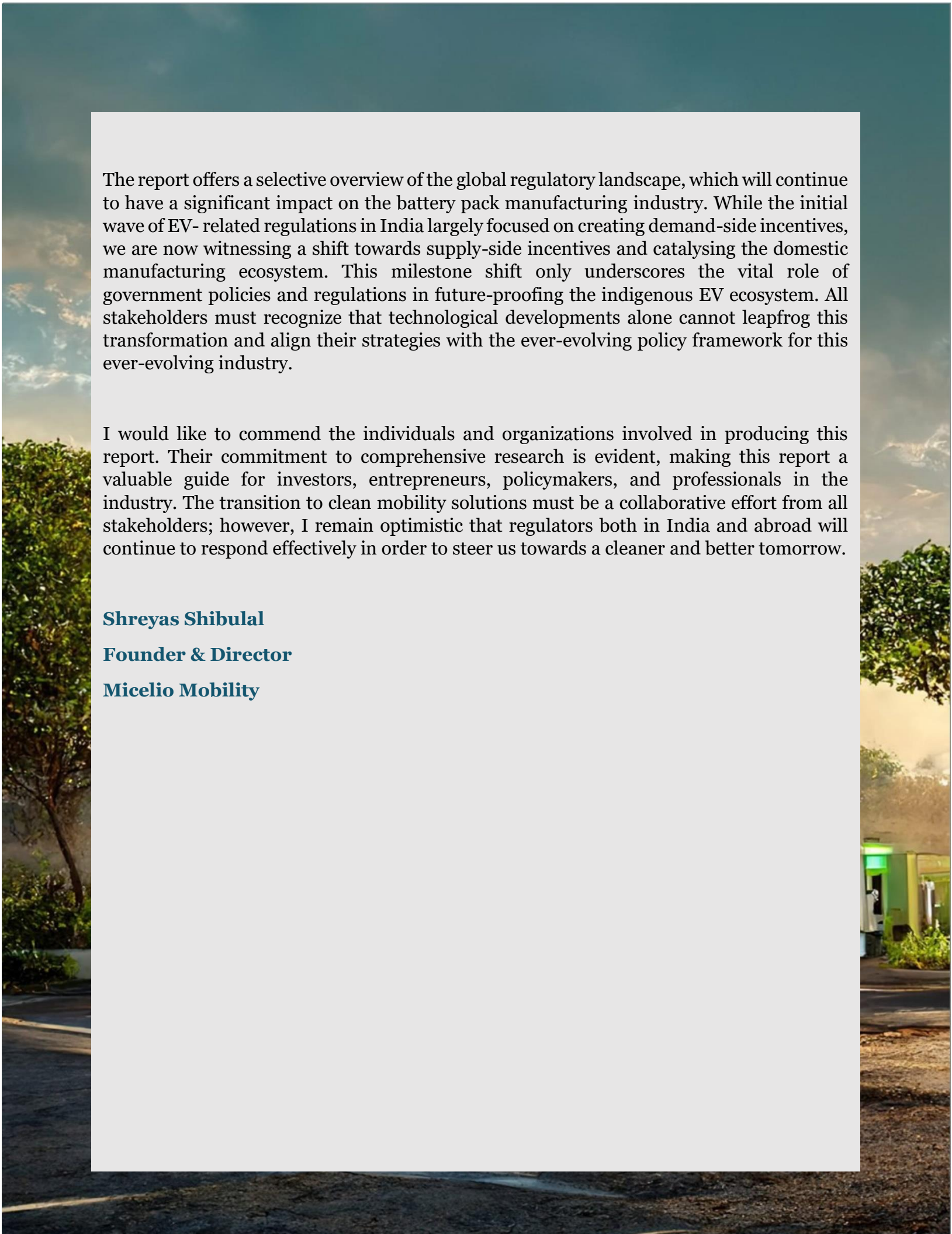
Foreword

It is apparent that we are currently in a transformative era for the automotive sector. Since the matter of transitioning towards clean mobility solutions is of great significance to the global community, this report is especially timely and relevant. The insights from this research have the potential to strengthen the industry's commitment to foster sustainable innovation at scale.

As the report highlights, it is evident that advancements in battery technology are the driving force behind this transition. We have witnessed remarkable advancements in battery chemistry, manufacturing processes for both battery packs as well as cells, battery pack design and thermal management. In the face of this rapid progression, it is critical that regulators respond appropriately to ensure that this new industry is fostered while ensuring safety and sustainability.

As with any new technology introduced to consumers, it is difficult for manufacturers to predict exactly how their product will function in every real world scenario. When it comes to mobility solutions, the industry cannot afford to overlook anything that could lead to a critical failure affecting passenger safety. With the advent of EVs and autonomous driving technologies, we have witnessed tragic technical failures which have compromised passenger safety and influenced public perception. It is therefore important for industry leaders to learn from past mistakes and adopt the best available product development and validation practices. It is equally important for regulators to not only be reactive, but also proactive in the face of an ever-changing technological landscape.

When it comes to battery packs, the regulations have evolved to ensure a higher degree of passenger safety. Questions pertaining to second-life and recycling of battery packs have also had an initial response from regulators. All stakeholders also appear aligned and determined to move towards a harmonization of global homologation norms. This report not only provides an in-depth analysis of these regulations and their impact on the industry, but also provides a much-needed larger context for the Indian EV landscape, which is important to consider while formulating policy suggestions.



The report offers a selective overview of the global regulatory landscape, which will continue to have a significant impact on the battery pack manufacturing industry. While the initial wave of EV- related regulations in India largely focused on creating demand-side incentives, we are now witnessing a shift towards supply-side incentives and catalysing the domestic manufacturing ecosystem. This milestone shift only underscores the vital role of government policies and regulations in future-proofing the indigenous EV ecosystem. All stakeholders must recognize that technological developments alone cannot leapfrog this transformation and align their strategies with the ever-evolving policy framework for this ever-evolving industry.

I would like to commend the individuals and organizations involved in producing this report. Their commitment to comprehensive research is evident, making this report a valuable guide for investors, entrepreneurs, policymakers, and professionals in the industry. The transition to clean mobility solutions must be a collaborative effort from all stakeholders; however, I remain optimistic that regulators both in India and abroad will continue to respond effectively in order to steer us towards a cleaner and better tomorrow.

Shreyas Shibulal

Founder & Director

Micelio Mobility

About Us

GameChanger Law Advisors

We are a trusted boutique corporate and commercial law firm that does purposeful work in the Venture Capital, Technology, Social Enterprises, Impact Investing, Sports and Gaming ecosystems in India.

Since 2011, we have advised clients operating in multiple industries on a range of business-critical corporate, commercial and governance assignments as well as on unique venture financing transactions in a wide variety of industries. We enjoy working with entrepreneurs, innovators, ecosystem builders and catalysts not just on their legal requirements, but also on research, teaching and knowledge building assignments.

Over the years, we have:

- Built deep expertise by being early movers into unconventional practice areas and sunrise industries;
- Developed thought leadership and provided solutions to clients across all the practice areas and industries that we operate in;
- Nurtured partnerships with various reputed global organizations; and
- Built a robust team to deliver sharp and high-touch client service and with a keen eye on learning.

This Report is the outcome of a unique collaboration between us and Speciale Invest, a leading seed-stage investment fund that has made investments in some of the most exciting deep tech startups in India. We are proud and grateful to have them as our collaborators!

About Us

Speciale Invest

Founded in 2017 by Co-founders Vishesh Rajaram and Arjun Rao, Speciale Invest is a seed-stage venture capital firm that invests in founders building technologies of tomorrow. The firm backs ingenious entrepreneurs who use disruptive technologies to find innovative solutions that make an impact. The fund is a SEBI-registered Category-II alternative investment fund (AIF) and has seen participation from high-net-worth individuals (HNIs), ultra-HNIs, and other family offices.

Speciale's investment philosophy is centered around providing capital to startups with the potential to disrupt and transform their industries, with a focus on emerging technology areas such as SpaceTech, Aerospace, Green Hydrogen, Robotics, Batteries, Quantum Tech, AI-led SAAS, Dev tools, Data Infrastructure, and Large Language Model (LLM) Applications/Infrastructure amongst others.

The fund has a successful track record of investing in pioneering deep-science & tech companies, including Ultraviolette, Agnikul Cosmos, ePlane Company, Cynlr, Qnu Labs, Galaxeye Space, Uravu Labs, NewTrace, e-TRNL Energy, Wingman, StreamAlive, Airboxr, Trainn, and more. Led by a strong leadership team with decades of experience building tech products and managing technology funds, Speciale Invest is committed to working closely with founders to guide, mentor, and help them scale and grow their businesses.

Preface

Why do Electrical Vehicle Batteries and Battery Packs fascinate us?

In 2021, the United States Environmental Protection Agency, in its publication, the Inventory of U.S. Greenhouse Gas Emissions and Sinks, estimated that the transportation sector generated 28% of the total greenhouse gas emissions in 2021. The greenhouse gas emissions from the transportation sector primarily emanated from burning fossil fuel for our cars, trucks, ships, trains, and planes. Over 94% of the fuel used for transportation is petroleum based, which includes primarily gasoline and diesel.

When we began work for a client, Exponent Energy, in April 2022 (see the Acknowledgments section), we were fascinated by the fact that they operated in the Electrical Vehicles industry, and that the work they did could aid in the fight against climate change-by electrifying the transportation sector in India. I don't make this statement lightly- in the 18 months we've worked with them, Exponent Energy has gone on to build and deploy its rapid charging solution that enables zero to 100 percent charge in 15 minutes and still guarantees that the batteries will be good for at least 3,000 charging cycles![1]

Their work on battery packs have inspired us to dig deeper into the world of regulations concerning Electrical Vehicles (EVs), EV Batteries and EV Battery Packs. And we began at a very basic conceptual level- that battery cells are different from battery packs. A battery cell is a single unit device that converts chemical energy into electrical energy. Battery cells are arranged in modules to achieve serviceable units. A battery pack represents a series of individual modules and protection systems that are organized in a shape that will be installed in a vehicle. The pack usually contains battery cells and/or modules, software (BMS - battery management system) and often a cooling and heating system, depending on where and how the battery pack is to be used.[2]

The Indian EV market, valued at USD 3.21 billion in 2022, is expected to grow to USD 113.99 billion by 2029. The Government of India has set a target to achieve 30% electrification of India's vehicle fleet by 2030. In our view, the battery is at the heart of

[1] See "Exponent: Solving a two-sided problem of fast charging", at https://www.forbesindia.com/article/innovation/exponent-solving-a-twosided-problem-of-fast-charging/88327/1.
[2] See https://www.acc-emotion.com/stories/battery-cell-module-or-pack-whats-difference-infographics for more information on the differences.

the challenge confronted by various stakeholders in the Indian EV industry if the above-mentioned electrification targets are to be met.

In our effort to unravel the regulatory framework for Electric Vehicle Battery Packs, we have been joined by Speciale Invest, a leading seed-stage venture capital firm that has made some audacious bets on startups operating in the fields of electric mobility, space technology and deep tech[3].

The outcome of our combined research is *Charging Ahead 2023- a Cross-Jurisdictional, Regulatory and Industry Analysis of Electric Vehicle Battery Packs*. This Report is a truly unique collaboration between lawyers, investors, and electric mobility industry operators. In this Report, we have examined the current legal landscape for EV battery packs in India, and then mapped it with the regulatory framework in 3 other chosen jurisdictions i.e., California, European Union (EU), and the United Kingdom (UK).

Speciale Invest have provided their unique investor perspectives on India's EV industry. Our combined insights and analyses culminates with a set of suggestions for Indian policy makers on a host of concepts, including but not limited to Carbon Footprint Declaration (CFD), Battery Swapping Policy, Standards for Different Vehicle Models, Regulations on Alternative Battery Technologies, Due Diligence and Risk Assessment, Battery Passport, Second-Life Battery Policy, Safety Standards for Second-Life Batteries and Assigning Responsibility for Second-Life Batteries.

We hope that this Report will trigger a series of constructive conversations amongst various stakeholders, and that it can also lead to positive legal and regulatory changes, all aimed at helping India in its shift towards electrical vehicles, and more broadly speaking, in its fight against Climate Change!

Amrut Joshi

Founder

GameChanger Law Advisors

[3] See "What do we mean when we talk about deep tech?" at https://techcrunch.com/2020/03/11/what-do-we-mean-when-we-talk-about-deep-tech/.

Preface

Navigating the Regulations and Laws of Electric Battery Packs in India

In a rapidly evolving world towards sustainable and environmentally conscious solutions, the electric vehicle (EV) industry has emerged as a formidable force, promising a cleaner, greener future. At the heart of this global shift stands India, the fastest-growing economy in the world with immense potential to lead the electric mobility revolution.

As a result, the demand for electric battery packs has increased substantially. However, there are several laws and regulations in place that govern the manufacture, distribution, and use of these battery packs. Therefore, the startup community must know these regulations and laws to ensure compliance and avoid legal issues.

The Report provides information on the regulations and laws and highlights some key trends and developments in India's electric battery pack industry. This will help founders and investors stay up-to-date with the latest developments and make informed decisions about their ventures. It will be a valuable resource for founders, investors, and the larger startup community as they navigate this burgeoning sector.

At the core of this venture into regulatory exploration is Speciale Invest, a forward-thinking, deep tech-focused venture capital fund. Speciale Invest's investments in companies like Ultraviolette, the ePlane company, and eTRNL have provided invaluable insights into the intricacies of the Indian electric vehicle and battery pack markets.

Ultraviolette, with its innovative electric motorbike offerings, is a testament to India's capability to compete on a global scale. The ePlane company is pioneering electric urban aerial mobility solutions, demonstrating India's readiness to embrace groundbreaking technologies. Meanwhile, eTRNL's novel Li-ion battery cell designs epitomize the spirit of deep tech innovation in the Indian startup ecosystem.

Speciale Invest's journey alongside these trailblazing companies has underscored the importance of a well-defined regulatory framework. It has revealed the challenges and opportunities that founders and investors face within India's dynamic and evolving landscape of electric battery packs. "Charging Ahead" represents our commitment to share these experiences and insights with the broader community.

"Charging Ahead" is a roadmap for the future. It is divided into five sections, each addressing a critical aspect of India's electric vehicle and battery pack ecosystem. The

Report aims to empower founders, investors, and policymakers with the knowledge and guidance needed to accelerate India's transition towards a sustainable, electric future.

GameChanger Law Advisors has been our long-standing partner and has supported us in multiple innovative deep tech investments. They embody the essence of the innovative mindset required to complement India's deep tech innovation revolution that is currently underway.

As we embark on this journey with GameChanger Law Advisors, "Charging Ahead" aims to empower founders, investors, and policymakers alike with the knowledge and guidance needed to accelerate India's transition towards a sustainable, electric future. Through collective effort and informed decision-making, we can drive positive change and propel India to the forefront of the global electric mobility revolution.

Vishesh Rajaram

Managing Partner

Speciale Invest

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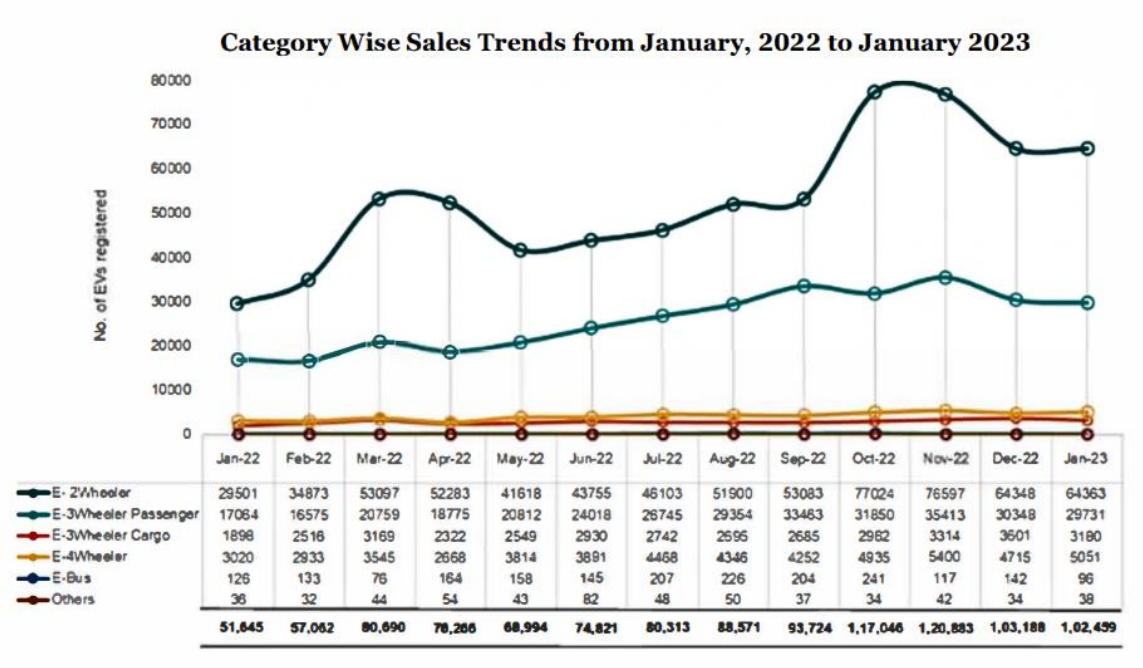
PART I

The Electric Vehicle Industry in India - An Overview

- Current Indian EV market trends
- Government schemes and programs to facilitate the growth of the EV industry in India
- Future targets for battery pack manufacturers in India

Current Indian EV Market Trends



	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23
E- 2Wheeler	29501	34873	53097	52283	41618	43755	46103	51900	53083	77024	76597	64348	64363
E-3Wheeler Passenger	17084	16575	20759	18775	20812	24018	26745	29354	33463	31850	35413	30348	29731
E-3Wheeler Cargo	1898	2516	3169	2322	2549	2930	2742	2695	2685	2982	3314	3601	3180
E-4Wheeler	3020	2933	3545	2668	3814	3891	4468	4346	4252	4935	5400	4715	5051
E-Bus	126	133	76	164	158	145	207	226	204	241	117	142	96
Others	36	32	44	54	43	82	48	50	37	34	42	34	38
	51,645	**57,062**	**80,690**	**76,266**	**68,994**	**74,821**	**80,313**	**88,571**	**93,724**	**1,17,046**	**1,20,883**	**1,03,188**	**1,02,459**

Source: https://evreporter.com/indias-electric-vehicles-sales-trend-january-2023/

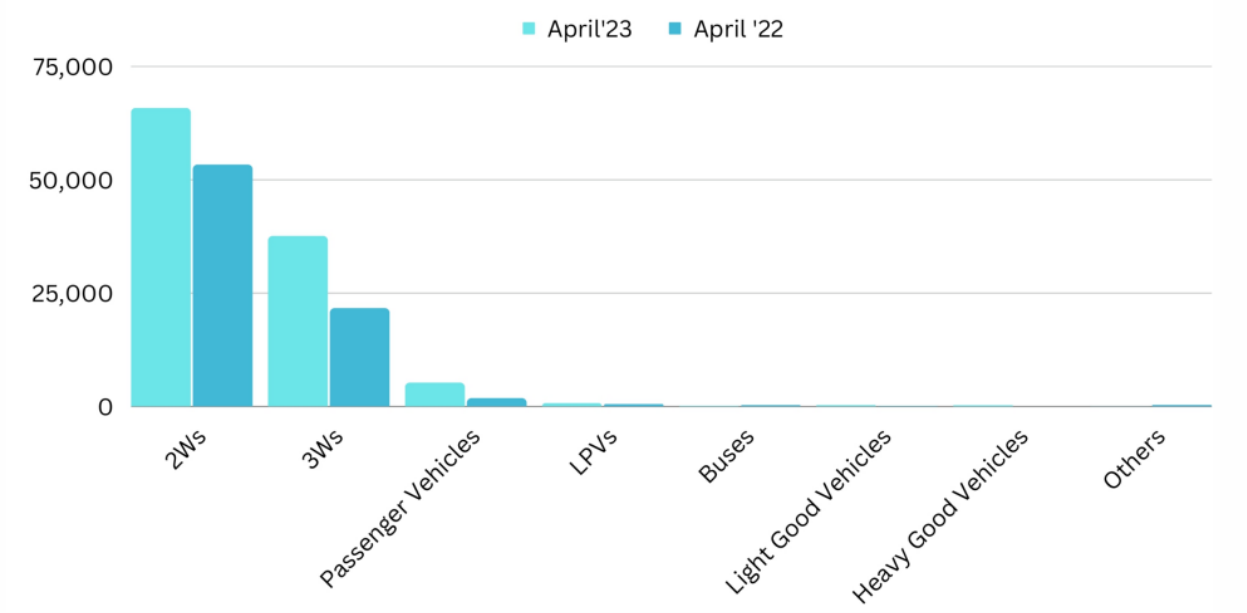
Growth of EV Retail Sales in India – 2023

The Indian EV market was valued at $.3.21 billion in 2022[4], and is expected to grow to $113.99 billion by 2029 at a compound annual growth rate of 66.52%. In 2022, 25% of EVs sold in India were purchased by fleet operators, including for taxis. In recent years, EV sales in India have significantly increased given that it is a cleaner and more efficient alternative to gasoline-powered vehicles. With the growth of sales of EVs in India, the Indian government has set a target to achieve 30% electrification of India's vehicle fleet by 2030.

The Economic Survey 2023[5] predicts that India's domestic EV market will witness a 49% percent compound annual growth rate between 2022 and 2030, and the number of EV units sold annually will touch 10 million by 2030.

[4] See "India's Impending Economic Boom" at https://www.morganstanley.com/ideas/investment-opportunities-in-india.
[5] See " India's EV Economy: The Future of Automotive Transportation at https://www.investindia.gov.in/team-india-blogs/indias-ev-economy-future-automotive-transportation#:~:text=The%20Economic%20Survey%202023%20predicts,and%20indirect%20jobs%20by%202030.

EV Retail Sales in India: 2022 – 2023



Graph Data Source: https://www.autocarpro.in/analysis-sales/ev-sales-in-india-rise-41-in-april-2023-to-over-109000-units-114897

Manufacturing Units for Future Production:

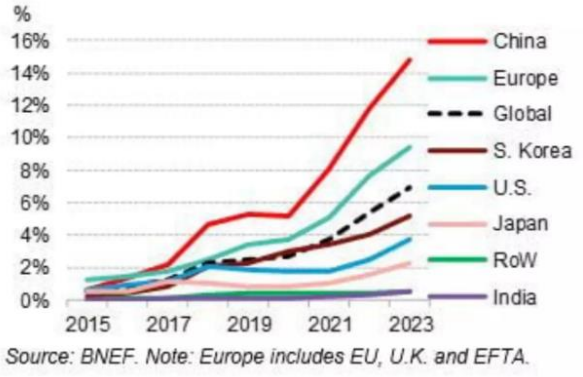
Tesla[6] has opened discussions with the Government of India regarding its plan to set up a factory in India with a yearly capacity of 500,000 EV units, while Ola[7] has announced its USD 330 million investment plan on the world's largest electric scooter plant in Tamil Nadu, with a capacity to produce 2 million EV units a year.

[6] See "Rs. 20 lakh for Tesla: Musk's India Electric Factory Plan Gathers Speed" at https://economictimes.indiatimes.com/industry/renewables/teslas-india-electric-car-factory-talk-gathers-speed-prices-may-start-at-rs-20-lakh/articleshow/101720190.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

[7] See "A Deep Dive Into the World EV Market" at https://auto.economictimes.indiatimes.com/news/a-deep-dive-into-world-ev-market-in-india-only-8-of-new-car-sales-will-be-electric-by-2030-against-28-globally-says-report/82570153

A Comparative Analysis: Global EV Sales

Global short term EV Share of new passenger vehicle sales by region



Global long term EV Share of new passenger vehicle sales by region

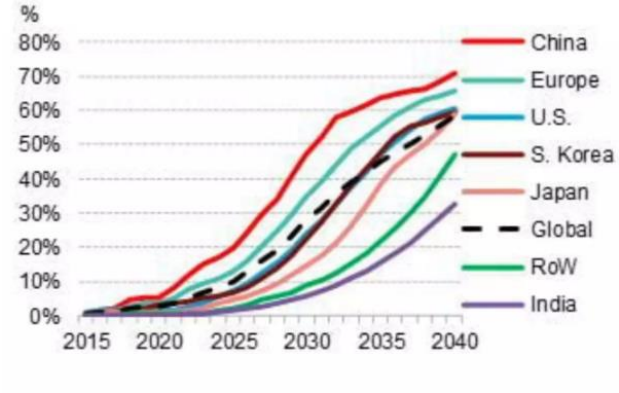


Image source: https://auto.economictimes.indiatimes.com/news/a-deep-dive-into-world-ev-market-in-india-only-8-of-new-car-sales-will-be-electric-by-2030-against-28-globally-says- report/82570153

While Europe took over China[8] in terms of EV sales in the global market in 2021, with a 137% year-on-year increase in EV sales to 1.4 million in 2020, currently, China[9] accounts for more than 58% of all new EVs sold across the world. The European Automobile Manufacturers Association[10] (ACEA) stated that EVs accounted for 13.8% of all car sales in May 2023, up from under 10% in 2022.

[8] See "Electric Vehicle Sales Headed for Five and a Half Million" at https://about.bnef.com/blog/electric-vehicle-sales-headed-for-five-and-a-half-million-in-2021-as-automakers-target-40-million-per-year-by-2030/.
[9] See "Visualising the Growth of the Electric Car Industry" at https://www.aljazeera.com/news/2023/6/5/visualising-the-growth-of-the-electric-car-industry.
[10] Read about " New Car Registrations in May" at https://www.acea.auto/pc-registrations/new-car-registrations-18-5-in-may-battery-electric-13-8-market-share/.

Manufacturing EV Battery Packs In India

In India, there has been a significant increase in venture capital (VC) funding for early-stage startups that develop battery technologies in the recent past. Investors view EV startups as a potential for future returns with high exit values. This enables innovation in the battery pack manufacturing space, and enables startups to adapt to evolving market trends and regulatory environments.

While a majority of EV Original Equipment Manufacturers (OEMs) have developed battery pack assembly facilities in-house by using imported lithium ion cells or purchase imported battery packs, VC funded startups such as Ather, Ola Electric, Cosbike and Pure EV, continue to supply their battery packs to most two and three-wheeler OEMs, and this is reflection of recent market trends. In 2022, VC investments in battery technology development startups increased by 15% from 2021, to approximately USD 850 million.

In April, 2023, Log9 Materials[11] became the first entity in India to develop lithium-ion cells, which are going to be used in making locally built battery packs. This could potentially reduce the cost of EVs, given that battery packs comprise of 40 - 50% of the total cost component of EVs.

[11] See "Log9 Materials Reveals First Made in India Battery Cell for Electric Vehicles" at https://auto.hindustantimes.com/auto/electric-vehicles/log9-materials-reveals-first-made-in-india-battery-cell-for-electric-vehicles-41682068051681.html.

Indian EV Battery Pack Manufacturing Landscape

Existing Capacities of LiB Battery Pack Manufacturers

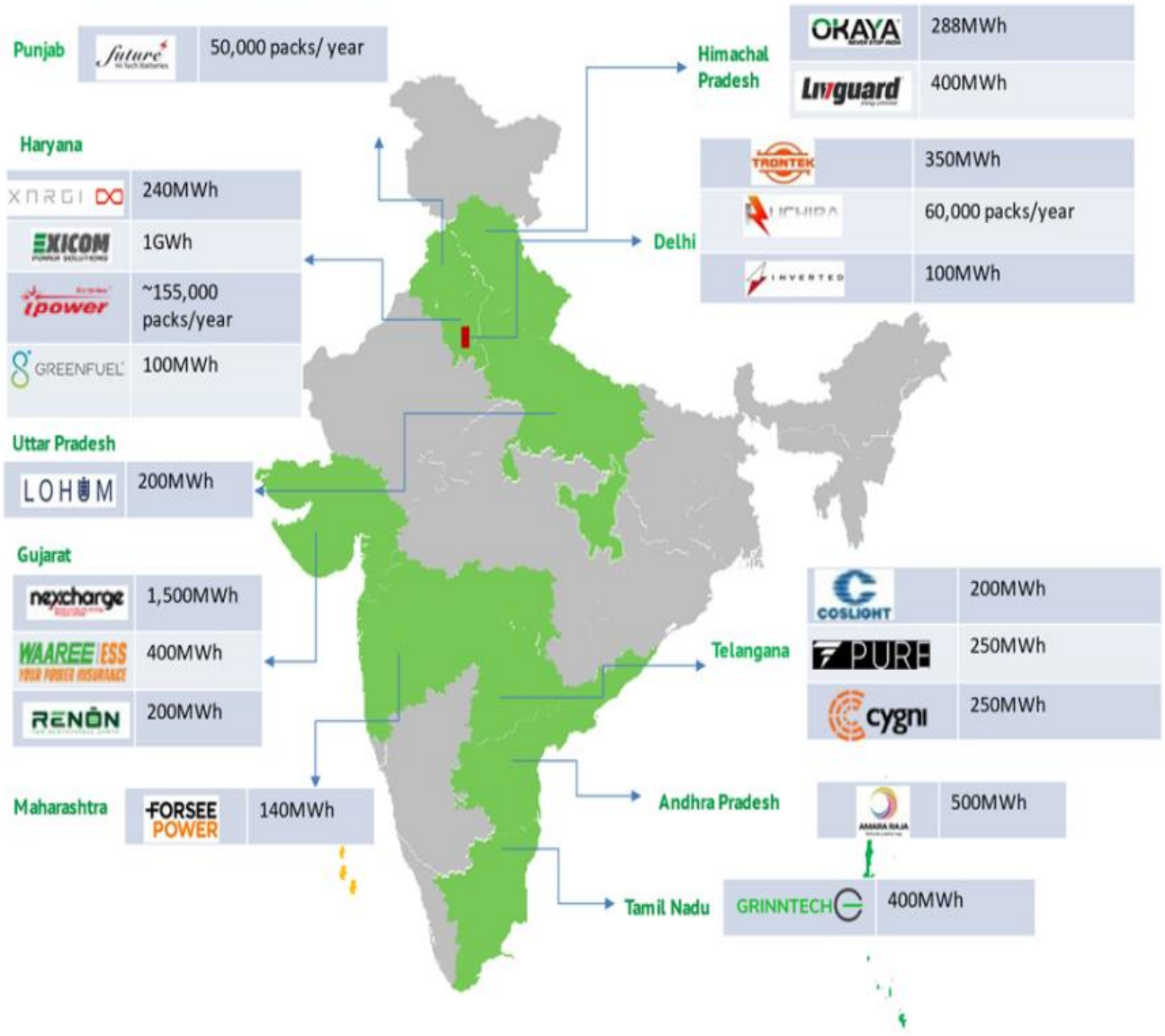


Image Source: https://ieefa.org/wp-content/uploads/2022/01/Lithium-Ion-Battery-Manufacturing-Landscape-in-India_January-2022.pdf

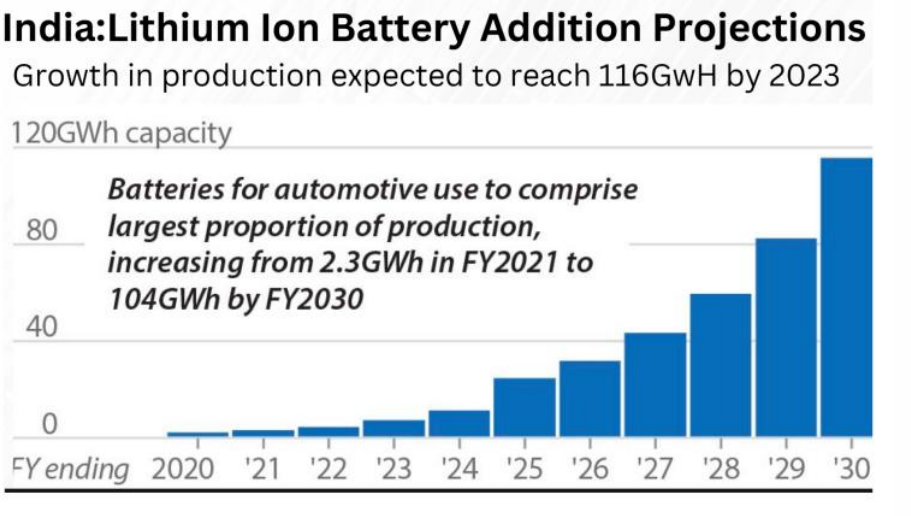
Investments - Investments in battery manufacturing are concentrated in the northern region of India.

Imports - Due to the lack of infrastructure and high cost of raw materials, India is still heavily dependent on imported lithium-ion batteries. Recently, the Government of India has confirmed that lithium reserves have been identified for the first time in India, in Jammu and Kashmir[12].

Alternatives - India's abundance[13] of sodium sources could potentially make Sodium-ion batteries[14] an alternative to reduce India's dependence on imported lithium-ion cells and create an independent local EV value chain[15].

[12] See "In a first, Lithium Reserves found in J&K" at https://www.ndtv.com/india-news/in-a-first-in-country-5-9-million-tonnes-lithium-deposits-found-in-j-k-3769563.
[13] See "Cathode Material Na-ion Battery Benefits" at https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1924518.
[14] See "Revolutionizing EV Batteries: A breakthrough for India" at https://www.ey.com/en_in/automotive-transportation/revolutionizing-ev-batteries-a-breakthrough-for-india#:~:text=Rising%20demand%20for%20electric%20vehicles,overall%20performance%20of%20EV%20batteries.
[15] See "Local production of EV battery resolving major challenges to make India global" at https://auto.economictimes.indiatimes.com/news/auto-components/local-production-of-ev-battery-resolving-major-challenges-to-make-india-global-export-hub-arthur-d-little-report/94505618.

Manufacturing Projections in India



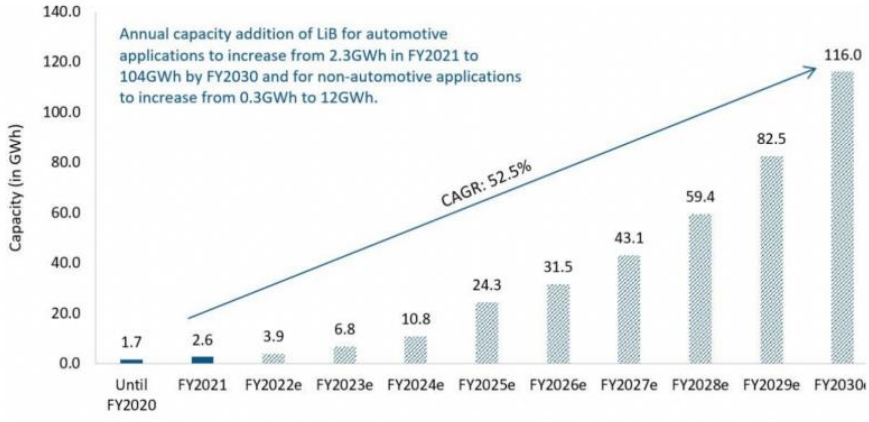


Image Source: (in order as above)

https://jmkresearch.com/electric-vehicles-published-reports/lithium-ion-battery-lib-manufacturing-landscape-in-india-jan-2022/
https://jmkresearch.com/wp-content/uploads/2022/02/Lithium-Ion-Battery-Manufacturing-Landscape-in-India_January-2022.pdf

The annual growth rate for battery pack manufacturing is expected to be around 18.5% until 2030. The Indian EV battery market size[16] is also expected to grow from USD 16.77 billion in 2023 to USD 27.70 billion by 2028, at a compound annual growth rate of 10.56% between 2023 and 2028.

[16] Read about "Indian EV Battery Market Sie" at https://www.energyportal.eu/.

Government Schemes and Programs to Facilitate the Growth of EV Industry in India

The EV centered policies and schemes launched by the Indian Government, including purchase incentives, supply side incentives and tax benefits under the schemes mentioned below, along with India's 'Go Electric' campaign, which was launched by the Bureau of Energy Efficiency to create awareness about the e-mobility system and encourage adoption of EVs, have all contributed to reducing the upfront costs of EVs[17].

1. Tax Reduction on EVs[18]

In the Union Budget 2023-24, the Finance Minister proposed (i) customs duty exemptions on the import of capital goods and machines required to manufacture lithium-ion batteries, and (ii) to reduce the number of basic customs duty from 21% to 13% on lithium-ion cell, thereby cutting down the manufacturing cost of EVs[19].

The Government has also introduced income tax deductions on the interest component of EV loans to enable greater EV adoption. Section 80EEB of the Indian Income Tax Act, 1961[20], provides tax incentives for EV buyers where an exemption of up to 1.5 lakh on loans can be availed by individuals, provided that the EV was obtained from a licensed financial institution or a non-banking finance company, on or after the assessment year beginning from April 1, 2020.

2. Battery Swapping Policy[21]

Given the constraint of space for setting up charging stations, the NITI Aayog issued the draft policy in 2022, which allows for the exchange of discharged batteries in return for new batteries. Key features of the Battery Swapping Policy include:

(i) Batteries are to be tested and certified as per AIS 156 (2020) and AIS 038 Rev 2 (2020) standards for safety of traction battery packs, along with additional tests that may be prescribed for swappable batteries;

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[17] See "Global EV Outlook 2023" at https://iea.blob.core.windows.net/assets/dacf14d2-eabc-498a-8263-9f97fd5dc327/GEVO2023.pdf; "BEE-GO Electric Campaign" at https://evyatra.beeindia.gov.in/go-electric-launch/.
[18] See "Electric Vehicle Incentives" at https://e-amrit.niti.gov.in/electric-vehicle-incentives.
[19] See paragraph 119 and 120 of the Budget 2023-24 Speech, accessible at: https://www.indiabudget.gov.in/doc/budget_speech.pdf
[20] Refer to "Income Tax Act,1961" at https://incometaxindia.gov.in/pages/acts/income-tax-act.aspx.
[21] See" Government Initiatives for Electric Vehicles in India" https://corpbiz.io/learning/government-initiatives-for-electric-vehicles-in-india/.

(ii) Basic standards for battery swapping stations and battery charging stations will be developed or approved by Bureau of Indian Standards (BIS) or Ministry of Power, in order to ensure adequate safety and cost-effective infrastructure usage; and

(iii) A unique identification number to be assigned to every battery pack at the manufacturing stage to track and monitor the EV batteries.

3. PLI Scheme[22] (Production Linked Incentive)

The Government of India has approved the PLI Scheme in 2020 for the automotive industry, providing financial incentives, including a direct subsidy to buyers and financing manufacturers. This scheme offers production linked incentives to encourage domestic manufacturing of EVs and to attract investments in this sector. The approved financial outlay for the PLI scheme with respect to automobiles and auto components is a total of INR 57042 crores, for a period of 5 years – beginning from the Financial Year 2022-23[23].

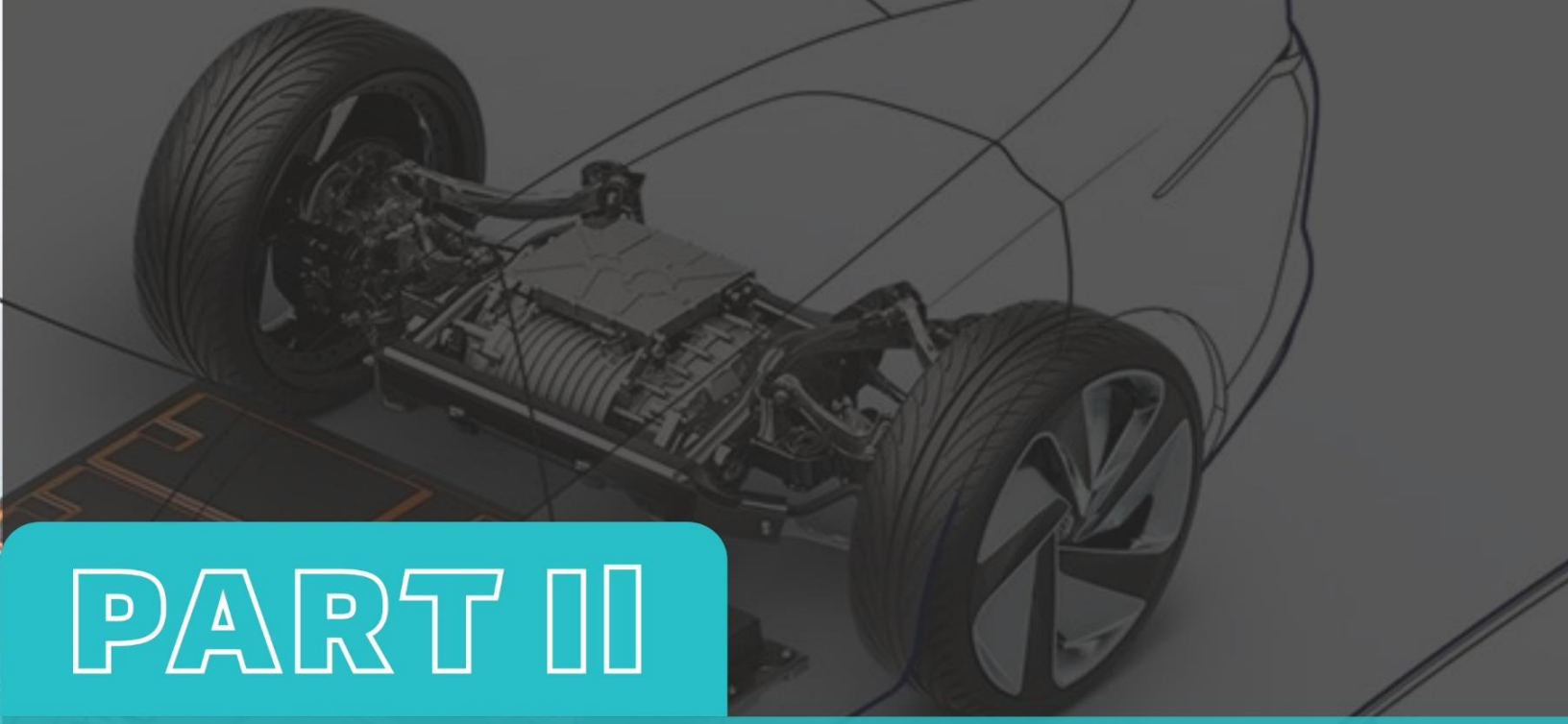
4. Special Electric Mobility Zone[24]

As per the Union Budget 2022-23, special mobility zones will be demarcated only for EVs and for the setting up of charging stations. Only EVs are permitted to operate in such zones identified by the authorities, in order to avoid overcrowding of private vehicles.[25]

5. FAME II[26]

Faster Adoption & Manufacturing of Hybrid & Electric Vehicles in India - II (FAME II) brings a reduction in the price of EVs on account of incentives provided to buyers of EVs. The Government approved FAME-II with an outlay of INR 10,000 crores for a three-year period commencing from April 1, 2019, which has been extended for another two years, with the aim to support electrification of public transportation and to encourage the purchase of EVs by providing financial incentives.[27]

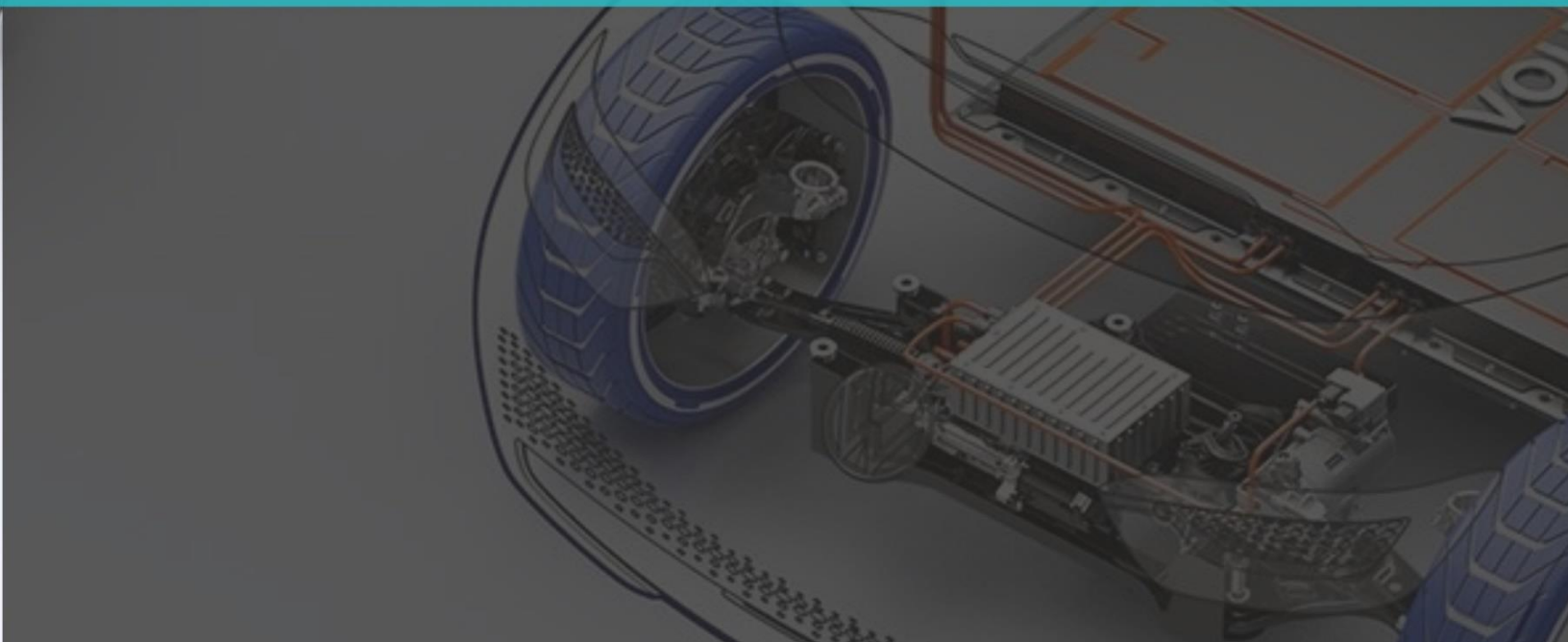
[22] See "PLI Scheme for Large Scale Electronics Manufacturing" at https://www.meity.gov.in/esdm/pli.
[23] See "Cabinet Approves PLI Scheme to 10 key sectors" at https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=1671912.
[24] See "Battery Swapping Policy an inter-operability standards" at https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1794338.
[25] Same as above.
[26] See " Electric Vehicle incentives" at https://e-amrit.niti.gov.in/electric-vehicle-incentives.
[27] https://fame2.heavyindustries.gov.in/.



PART II

Legal landscape for EV battery packs in India

- Introduction - Overview of the Legal Framework in India
- Automotive Industry Standards
- Battery Waste Management Rules 2022



Introduction

In India, the Motor Vehicles Act, 1988[28], read with the Central Motor Vehicle Rules, 1989[29] (Rules), regulates motor vehicles. The Rules prescribe that every manufacturer of a vehicle is required to submit a prototype of the vehicle for testing by any of the testing agencies specified in the Rules. These testing agencies establish compliance with the quality standards mentioned in the Automotive Industry Standards (AIS).

AIS[30] prescribes the standards for battery pack manufacturing and specifies the safety standards. AIS is drafted by the Automobile Industry Standards Committee (AISC), which comprises various stakeholders from the automotive industry in India. The AISC submits the draft safety standards (as recommendations) to the Technical Standing Committee and Ministry of Road Transport and Highways (MoRTH) for approval.

[28] Refer to "Motor Vehicles Act, 1988" at https://www.indiacode.nic.in/bitstream/123456789/9460/1/a1988-59.pdf.
[29] Refer to " Motor Vehicles Rules, 1989" at https://morth.nic.in/central-motor-vehicles-rules-1989-1.
[30] See "Automotive Industry Standards (AIS)" at https://morth.nic.in/ais.

Current EV Regulatory Standards in India

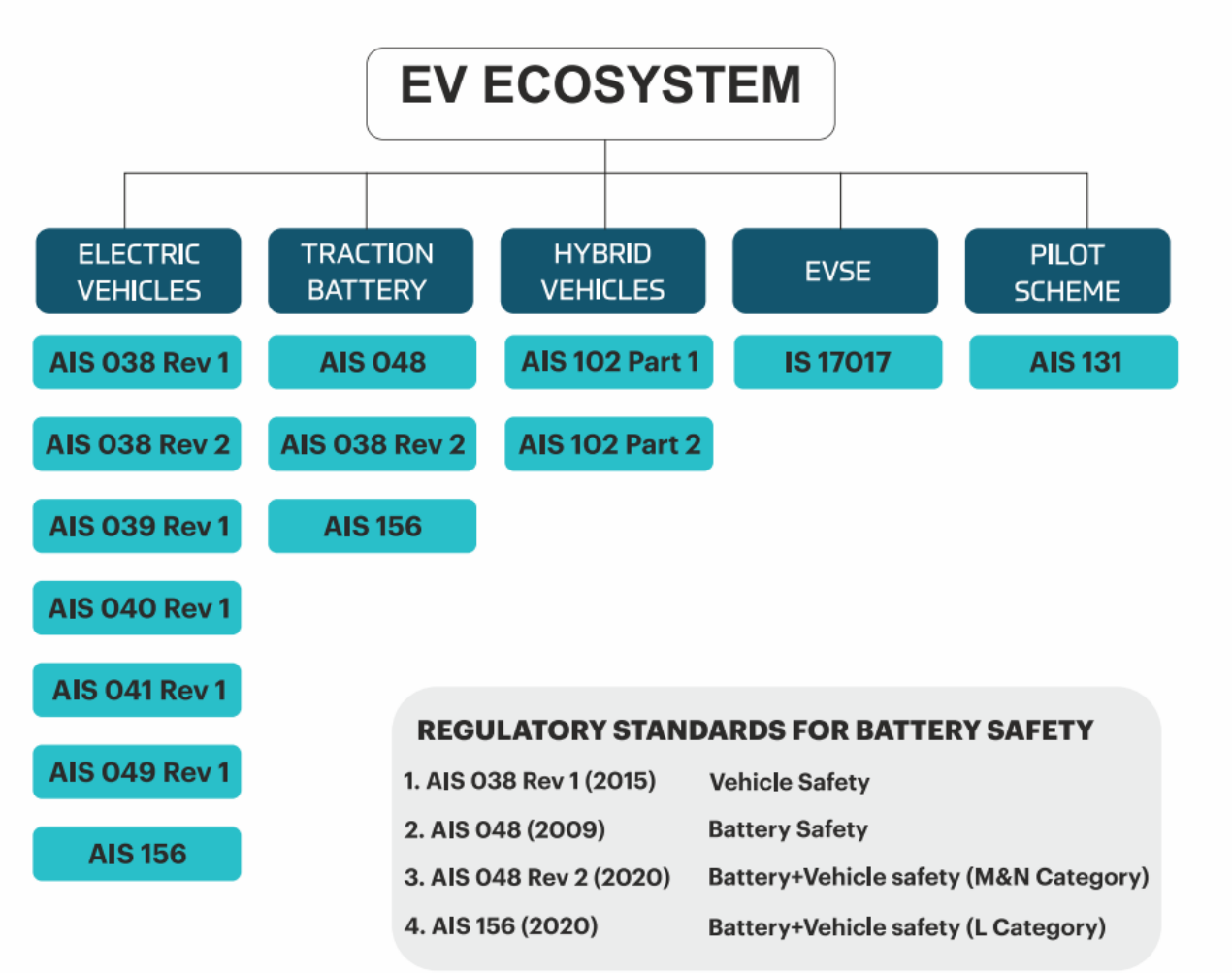


Image Source: https://evreporter.com/battery-safety-standards-in-india-by-arai/

In 2022, the MoRTH implemented additional safety standards[31] for battery manufacturing - AIS-156 and AIS-038 (Rev 2).

These additional standards were implemented in a phased manner on December 1, 2022 (Phase 1) and March 31, 2023 (Phase 2) to allow manufacturers time to comply with the new standards.

[31] See "Amendments to EV Battery Testing Standards" at https://morth.nic.in/sites/default/files/ASI/Press%20note_Extension%20of%20timelines_v2.pdf.

AIS 048 (2009): Battery Operated Vehicles Safety Requirements of Traction Batteries[32]

AIS 048 (2009) governs traction (driving power) batteries used for battery-operated vehicles, which include e-rickshaws and e-carts.

It provides for two types of testing:

(i) **Electrical Tests** (short circuit and overcharge tests), which are performed at the cell level; and
(ii) **Mechanical Tests** (vibration, mechanical shock, and roll-over tests), which are conducted at the module or pack level.

This standard stipulates the following:

(i) There should be no physical damage to the casing or other mechanical parts of the battery.
(ii) None of the components of the battery should have melted.
(iii) No fire/explosion should have been caused due to the batteries.

AIS 038 Rev 2 (2020): Specific Requirements for M, N Category Electric Power Train Vehicles[33]

The AIS 038 Rev 2 (2020) standard governs traction battery safety requirements for four-wheeler EVs. The tests include protection against electric shock, direct and indirect contact, and water effects, along with functional safety.

AIS 038 Rev 2 sets forth additional safety requirements with respect to battery cells, the battery management system (BMS), the on-board charger, and the design of battery pack, among others. For instance, the BMS must be verified for the following safety features:

(i) Over-voltage protection
(ii) Over-charge /discharge
(iii) Over-temperature protection
(iv) Over-current protection, and
(v) Short circuit protection.

[32] See "Battery Operated Vehicles- Safety Requirements of Traction Batteries" at https://emobility.araiindia.com/wp-content/uploads/2018/06/AIS-048.pdf.
[33] See "Requirements for Electric Power train Vehicles" at https://morth.nic.in/sites/default/files/ASI/AIS%20038%20(Rev2)_Amend%202.pdf.

AIS-156 (as amended): Specific Requirements for L Category Electric Power Train Vehicles[34]

AIS-156 governs safety requirements for the electric power train of the EVs and the rechargeable energy storage system (REESS) of two-wheelers, three-wheelers, and quad cycles EVs.

This standard includes

(i) REESS ingress protection requirements - to be tested for water ingress, and no fire or explosions; and
(ii) BMS of REESS to be as per specifications provided in the standard.

Thermal Propagation Test - to ensure the overall safety of EVs equipped with a REESS; i.e., that the EV user and bystanders should not be exposed to the hazardous environment resulting from a thermal runaway (a situation when excessive heat is generated and not properly dissipated in the battery).

[34] See "Specific Requirements for L Category Electric Power Train Vehicles" at https://morth.nic.in/sites/default/files/ASI/Amendment%203%20to%20AIS%20156.pdf.

Guidelines for Battery Safety Test

In November 2022, the Ministry of Heavy Industries (MHI) issued the Guidelines for Battery Safety Test[35] (Guidelines). These Guidelines specify testing parameters to enhance the safety of EVs that will be incentivized under the (i) Production Linked Incentive (PLI) Scheme, (ii) PLI Scheme for Advanced Chemistry Cell, and (iii) FAME - II.

These Guidelines are in addition to the AIS and have only been made mandatory for those entities that are seeking to claim incentives under the PLI Scheme for automobile and auto components, PLI Scheme for Advanced Chemistry Cell, and FAME -II.

The MHI has made compliance with the Guidelines mandatory with effect from April 01, 2023.

An EV battery typically consists of the following parts:

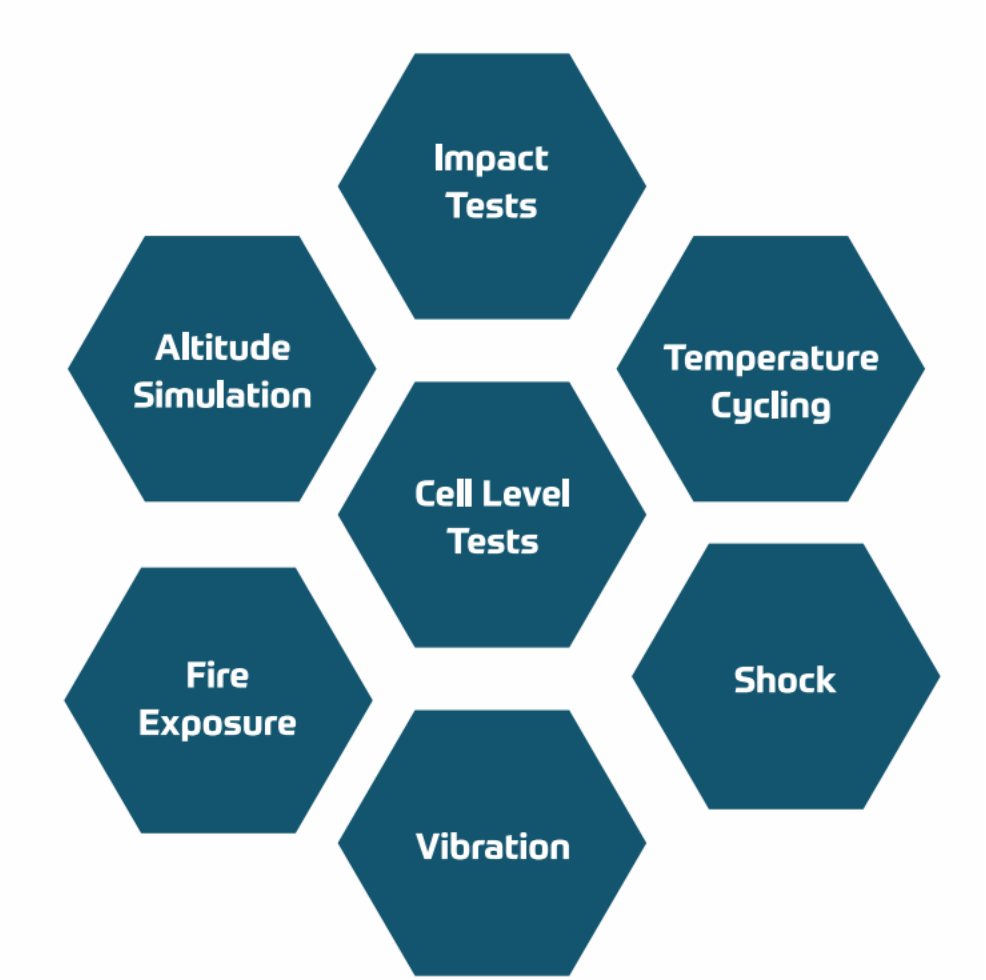
(i) The cell, which is a single unit that produces electricity through chemical reactions,
(ii) The battery, which comprises of a combination of cells in series, and converts the chemical energy directly into electrical energy, and
(iii) The battery management system (BMS), which is an electronic system that manages the batteries itself, monitors the cells, monitors the temperature of the battery, and the state of charge.

The tests set forth under the Guidelines are aimed at enhancing human safety by ensuring quality of the battery at three levels, namely:

(i) The battery pack;
(ii) BMS; and
(iii) The cell level.

[35] See "Office Memorandum on enhancing testing parameters for safety of EVs" https://heavyindustries.gov.in/writereaddata/UploadFile/MHI_Guidelines_Testing_parameters_for_EV638125072319654066.pdf.

Prescribed Tests – Cell Level

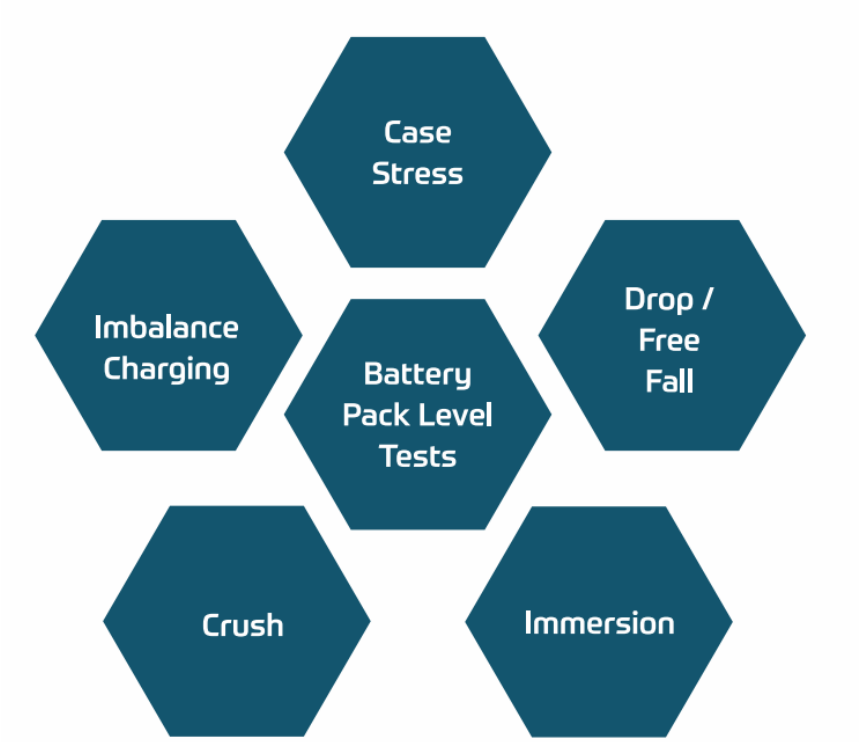


1. **Impact Test:** The stress load of a lithium-ion cell under immense force.
2. **Temperature Cycling:** Increasing and holding the chamber temperature to observe the reaction of the cell.
3. **Shock and Vibration:** Whether the batteries catch fire or explode under certain circumstances.
4. **Fire Exposure:** Testing batteries against explosion resistance.
5. **Altitude Simulation:** Observing whether batteries catch fire when stored at a certain pressure and temperature.

Prescribed Tests – BMS

1. **Over Current Protection** – to confirm that design conditions are such that the protection circuit gets activated.
2. **Communication Interface** – checks if the communication interface works properly.
3. **Cell Voltage Check** – checks if the cell voltage for each series can be monitored correctly.
4. **Current Sensors Check** – checks if charge/discharge can be monitored correctly.
5. **Current Temperature/MOS (metal oxide semiconductor) Check** – If the specific cell/MOS temperature can be monitored correctly.
6. **Charge/Discharge MOS Check** – to confirm if charge/discharge MOS can be turned on/off correctly.
7. **Power Rail Check** – to confirm if the power rail of the circuit works correctly.
8. **Fuse Current Check** – to confirm the fuse current meets design considerations.
9. **Cell Balance Function Check** – to confirm that the cell balance function works correctly.

Prescribed Tests – Battery Pack Level



1. **Case Stress and Drop/Free Fall** – to ensure lithium-ion cells do not explode/catch fire under a range of possible abuses.
2. **Immersion** – checks if batteries can withstand environmental tests, such as immersion.
3. **Crush** – checks if the battery enclosure is crush resistant.
4. **Imbalance Charging** - checks if batteries can withstand imbalance charging.

Homologation Requirements

1. Battery Homologation

Battery homologation is the process of certifying that the battery packs meet the standards, including the safety standards, set forth by the Government of India.

Pursuant to Rule 124 of the Central Motor Vehicle Rules, 1989[36], all components of a vehicle need to be certified by the authorities, to ensure that they are as per the standards set forth by the Government of India.

Once the batteries have been developed by the manufacturer, the manufacturer will then need to provide a prototype of the battery pack for homologation, to the certifying authorities.

2.Vehicle Homologation

Vehicle homologation is the process of certifying that the integrated vehicles meet the standards, including the safety and emission standards set forth by the Government of India. Once the batteries have been integrated with the vehicle, the manufacturers will then need to provide the EV for homologation, to any of the certifying authorities mentioned below.

Rule 126 of the Central Motor Vehicle Rules, 1989[37] lists the certifying authorities for vehicle homologation. These include, amongst others, the

(i) Vehicle Research and Development Establishment of the Ministry of Defence, Government of India;
(ii) Automotive Research Association of India, Pune;
(iii) The Indian Institute of Petroleum, Dehradun; or
(iv) The Central Institute of Road Transport, Pune.

[36] Refer to "Central Motor Vehicle Rules, 1989" at https://morth.nic.in/central-motor-vehicles-rules-1989-1.
[37] Refer to "Central Motor Vehicle Rules, 1989" at https://morth.nic.in/central-motor-vehicles-rules-1989-1.

End of Life Treatment of Battery Packs

The Union Ministry of Environment, Forest and Climate Change notified the Battery Waste Management Rules, 2022[38] (Rules) on August 24, 2022, which applies to various types of batteries, including electric vehicle batteries. As per the Rules, any entity engaged in manufacturing, selling or importing batteries (including any equipment containing a battery) (collectively, termed as Producer), has an 'Extended Producer Responsibility' (EPR).

These Rules prohibit Producers from disposing waste batteries in landfills and incinerators, and as part of their EPR obligations, they are obligated to (i) Recycle (process waste batteries into raw materials for manufacturing new products), (ii) Refurbish (recondition the battery to allow it to recharge and function like new) or (iii) Re-purpose (use the waste battery for a different purpose) waste batteries.

Key Producer EPR Obligations

The manufacturer is required to register through an online centralized portal[39] as a Producer and obtain a certificate of registration from the Ministry of Environment, Forest and Climate Change.

The Producer is required to meet the collection and recycling and/or refurbishment targets mentioned in the Rules, and must ensure that it collects waste batteries and send them for recycling or refurbishing.

The Producer must also provide an EPR plan to the Central Pollution Control Board by the end of June every year, with respect to the batteries manufactured in the preceding financial year.

Additionally, the Producer is responsible to adhere to prohibitions and labelling requirements prescribed by the Rules and handle the batteries/waste batteries in such a way that no damage is caused to human health and/or the environment.

[38] Refer to "Battery Waste Management Rules, 2020" at https://cpcb.nic.in/uploads/hwmd/Battery-WasteManagementRules-2022.pdf.
[39] See EPR login portal at http://www.eprbatterycpcb.in/.

Consequences for a Breach of Manufacturer Obligations

In the event that the manufacturer breaches any provision of the Battery Waste Management Rules, 2022[40], it will be liable to imprisonment for a maximum period of five years, along with a fine of up to INR 100,000, as per Section 15 of the Environment Protection Act, 1986[41].

Every person who is directly in charge of, and responsible for the conduct of the company, will be deemed to be guilty of an offence committed by the company.

[40] Refer to "Battery Waste Management Rules, 2020" at https://cpcb.nic.in/uploads/hwmd/Battery-WasteManagementRules-2022.pdf.
[41] See "Environment Protection Act, 1986" at https://www.indiacode.nic.in/bitstream/123456789/18998/1/environment_(protection)_act,_1986.pdf.

PART III

Battery Pack Regulations in EU, UK and California

We have analyzed the regulations on EV battery packs in the following jurisdictions, and compared them with India's current regulatory framework:

- European Union - The European Parliament has approved the legislation on banning non-electric cars by 2035[39], to promote the switch to EVs in the EU.
- United Kingdom - EV industry experts predict that EVs sold will be 22.6% of the market share in 2024[40], after EV sales in July, 2023, surged almost 88%.
- California - The state has the highest EV penetration in the United States of America, where EVs were 16% of the total vehicles[41] sold in 2022.

European Union

On June 14, 2023, the European Union (EU) Parliament voted in favor of the updated Directive, which is titled as the EU Regulations concerning batteries and waste batteries[42] (EU Regulations). This Regulation will replace the current EU Directive 2006/66/EC[43] on batteries and accumulators. The EU Regulations were introduced to account for technological developments and future challenges in the EV industry, and the scope of the EU Regulations encompasses the entire battery life cycle, from design to end-of-life.

EU DIRECTIVE 2006/66/EC[44] on Batteries and Accumulators and Waste Batteries and Accumulators

The EU DIRECTIVE 2006/66/EC sets forth rules for the collection, treatment, recycling, and disposal of waste batteries, and applies to all types of batteries. Article 4 of the Directive also prohibits placing certain batteries containing hazardous substances.

The key requirements of this Directive are as follows:

(i) Every producer of batteries is required to be registered in their respective country,
(ii) End-users are to be fully informed of the potential environment/health impacts of the substances used in the batteries and the collection and recycling schemes, and
(iii) The battery packs need to be appropriately labelled as per the Directive.

[42] Refer to "EU Act on batteries and waste batteries" at https://data.consilium.europa.eu/doc/document/PE-2-2023-INIT/en/pdf.
[43] See "Directive of EU on batteries and waste batteries" at https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02006L0066-20131230&rid=1.
[44] Same as above.

EU Regulations (2023)

Key features of the EU Regulations include: The EU Regulations sets forth requirements on sustainability, safety, labelling, marking, and information of batteries, along with minimum requirements for extended producer responsibility, and collection and treatment of waste batteries. It applies to EV batteries, industrial batteries, light vehicle transport batteries, and waste portable batteries.

The EU has also recommended that the standards set forth in UN-R101[45] with specific details on battery performance, charging, power speed, etc. be followed by battery pack manufacturers. Battery companies need to also register the batteries with the appropriate authorities in the EU countries where the batteries are to be sold.

The key provisions of the EU Regulations are:

Carbon Footprint Declaration: For EV batteries, a carbon footprint declaration of battery manufacturing needs to be issued for each battery model per manufacturing plant, which will include, (i) administrative information about the manufacturer, (ii) the carbon footprint of the battery, and (iii) details of the battery module etc.

Digital Battery Passport: Each EV battery shall have an electronic record, i.e., battery passport, containing information relating to the battery model and information specific to the individual battery, including information resulting from the use of that battery.

Due Diligence Policy: The manufacturers, except small and medium-sized enterprises, are required to set up and implement battery due diligence policies, which include (i) adopting a company policy for the supply chain of raw materials, (ii) annual report to show compliance with the Regulation, and (iii) grievance mechanisms and risk-awareness systems, etc.

[45] Refer to "EU Regulations on approval of internal combustion passenger vehicles" https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:048:0078:0081:EN:PDF.

Technical Harmonization in the EU

In the EU, technical harmonization for EV certification is based on the whole vehicle type-approval system, wherein a manufacturer can obtain certification for an EV in one EU country and market it across the EU without further tests.

The certification is issued by a type-approval authority and the tests are carried out by the designated technical services, in accordance with Regulation (EU) 2018/858 of the European Parliament and of the Council (2018)[46] (Regulations).

Member States are required to appoint their own approval authorities for the purposes of approving the EVs, and the approval authorities will only approve EVs, systems, components, or separate technical units that comply with the Regulation.

The manufacturer is required to submit an application for EU type approval along with an information folder, detailing the information of the EV to the approval authority.

EU DIRECTIVE 2006/66/EC[47] – Battery End of Life

Member States need to ensure that manufacturers design the EVs in such a way that waste batteries can be readily removed.

Member States are required to ensure that manufacturers of EV batteries, or third parties, set up schemes for the collection of waste EV batteries from end-users or from an accessible collection point in their vicinity.

Further, Member States need to ensure that:

(i) Manufacturers set up schemes, using the best available techniques, to provide for the treatment and recycling of waste batteries, and
(ii) All identifiable batteries collected are required to undergo treatment and recycling through schemes that comply with waste management laws.

Each Member State has prescribed penalties for a breach of national provisions adopted pursuant to this Directive. As per the Directive, the penalties must be *effective, proportionate*, and *dissuasive*.

[46] Read "Technical Harmonization in the EU" at https://single-market-economy.ec.europa.eu/sectors/automotive-industry/technical-harmonisation/technical-harmonisation-eu_en.
[47] See "EU Directive of EU on batteries and waste batteries" at https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02006L0066-20131230&rid=1.

United Kingdom

In the United Kingdom (UK), the British Standards Institution (BSI) has issued guidelines with respect to the safety and design specifications of electric vehicles and battery packs. The BSI has issued the following three guidelines:

(i) PAS 7060 - covering vehicle design;
(ii) PAS 7061 - covering pack and modules; and
(iii) PAS 7062 - covering electrode and cell.

PAS 7060: 2021 Electric vehicles - Safe and Environmentally Conscious Design and Use of Batteries

PAS 7060 provides guidelines safety standards and environmental considerations[48] for the process of vehicle design, battery integration, and battery use for electric vehicles. PAS 7060 provides that:

(i) Organizations should have systems for detecting defective / damaged battery modules and packs, along with a product traceability system,
(ii) Organizations should undertake a life-cycle assessment study of the battery back to understand its environmental impact,
(iii) The original equipment manufacturer (OEM) should design the vehicle to enable repair of the battery pack, and
(iv) Organizations should conduct risk assessments to determine the severity of the risks and the counter measures to be used.

PAS 7061: 2020 Batteries for Vehicle Propulsion Electrification – Safe and Environmentally-Conscious Handling of Battery Packs and Modules

PAS 7061[49] provides guidelines on environmentally conscious management of battery packs throughout the life cycle of the battery - from sourcing of material to manufacturing, regular use, and battery's second life or disposal.

[48] Refer to "PAS 7060:2021 GUIDE" at https://knowledge.bsigroup.com/products/electric-vehicles-safe-and-environmentally-conscious-design-and-use-of-batteries-guide/standard.
[49] See "Code of Practice on Batteries for Vehicle Propulsion Electrification" at https://www.bsigroup.com/en-GB/industries-and-sectors/energy-and-utilities/faraday-battery-challenge/pas-7061/

Organizations must have a documented quality management policy and system, along with systems to detect any defective / damaged battery modules and packs. Additionally, organizations must also document the process for transporting battery modules and fully-assembled battery packs.

It also provides that the battery control unit should be developed in accordance with:

(i) For safety-related systems in electrical, electronic, and programmable electronic safety systems - IEC 61508, and
(ii) For safety-related systems that include one or more electrical and/or electronic systems and that are installed in series production road vehicles - ISO 26262.

The Risk Hierarchy Approach - Using Personal Protective Equipment (PPE) to Control Risks at Work

Managing risk using PPE[50]

As part of your risk assessment you should decide whether PPE is needed. Use the hierarchy of controls to make this decision.

Hierarchy of controls

PPE should be the last resort to protect against risks. Consider controls in the following order, with elimination being the most effective and PPE being the least effective:

- Elimination – physically remove the hazard
- Substitution – replace the hazard
- Engineering controls – isolate people from the hazard
- Administrative controls – change the way people work
- PPE – protect the worker with equipment

You must select equipment carefully. Make sure all workers are trained to use it properly and know how to detect and report any faults.

[50] See "Managing risk using PPE" at https://www.hse.gov.uk/ppe/managing-risk-using-ppe.htm

PAS 7062: 2021 EV battery cells – Health and Safety, Environmental and Quality Management Considerations in Cell Manufacturing and Finished Cell

PAS 7062[51] sets forth guidelines on safety, environmental performance, and quality management in the manufacturing process of battery cells (such as lithium-ion cells) for vehicles.

PAS 7062 provides that:

(i) The organization should have a documented process control policy to ensure the reproducibility of the cell,
(ii) Risk hierarchy approach: eliminate > substitution > engineering control > administrative control > personal protection equipment,
(iii) The organization should assess chemical hazards and risks during the manufacturing and recycling of lithium-ion cells, and
(iv) The organization should have a documented process for cell storage and cell monitoring.

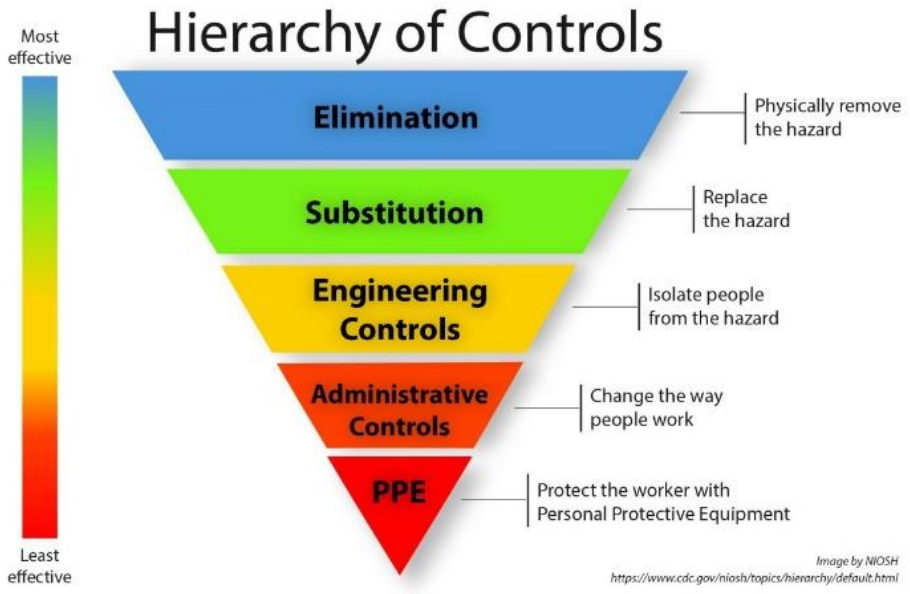


Image Source: https://www.cdc.gov/niosh/topics/hierarchy/default.html

[51] Refer to "PAS 7062:2021 Electric Vehicle battery Cells" at https://www.bsigroup.com/en-GB/industries-and-sectors/energy-and-utilities/faraday-battery-challenge/pas-7062/.

Vehicle Type Approval in the United Kingdom

In the UK, the Vehicle Certification Agency[52] (VCA) is the UK Type Approval Authority for automotive products, and the designated Technical Service for type approval testing in the United Nations scheme. VCA is also responsible for certification under UK type approval schemes.

Vehicle type approval is a confirmation that production samples of a type of vehicle, vehicle system, component, or separate technical unit meet specified performance standards. Vehicles that meet the specified performance standards through type approval markings are marked with an 'e' or 'E'.

Types Approval for Different Categories of Vehicles in the United Kingdom

Type approval is available for different kinds of vehicles, systems, components and STUs;

Vehicle Type	Category
Motorcycles	Category L
Passenger Vehicles	Category M
Goods Vehicles	Category N
Trailers	Category O
Agricultural Vehicles	Category T, C, R & S
Non-road Mobile Machinery	Various engine categories

[52] See "Vehicle Type Approval" at https://www.vehicle-certification-agency.gov.uk/vehicle-type-approval/.

Approval Type	GB	NI	Details
Provisional GB Type Approval	X		For all categories
GB Type Approval	X		For categories M, N, O, and their components
UK(NI) Type Approval	X	X	For all categories
United Nations (UN) Type Approval	X	X	Primarily for systems, components and separate technical units, for use in global markets of UNECE 1958 Agreement
EU Type Approval	QNIG only	X	For all categories, EU Type Approval is accepted in Northern Ireland as part of the Northern Ireland Protocol and may only be accepted in Great Britain where the product is a Qualifying Northern Ireland Good (QNIG)

Image Source: https://www.vehicle-certification-agency.gov.uk/vehicle-type-approval/what-is-vehicle-type-approval/

The Waste Batteries and Accumulators Regulations, 2009[53]

In the UK, the Waste Batteries and Accumulators Regulations, 2009 (Regulations), makes it compulsory to collect/take back and recycle batteries, and like India, prohibits batteries from being incinerated or dumped in landfill sites.

As per the Regulations, producers who place automotive batteries on the market for the first time in the UK are required to be registered with the Secretary of State, via the National Packaging Waste Database[54].

Producers must record the tonnage and chemistry of the batteries they place on the market and provide this information annually via the National Packaging Waste Database[55]. In particular, producers of automotive batteries must collect waste automotive batteries, within a reasonable timeframe, from the end-users.

All waste batteries need to be processed[56] by an Approved Battery Treatment Operator / Approved Battery Exporter and producers need to pay for their collection, treatment, and recycling.

In the event of a breach of the Regulations, a producer will be liable:

(i) On summary conviction – to a fine not exceeding the statutory maximum; or
(ii) On conviction – to a fine.

[53] Refer to "The Waste Batteries and Accumulators Regulations 2009" at https://www.legislation.gov.uk/uksi/2009/890/contents/made.
[54] See "National Packaging Waste Database" at https://npwd.environment-agency.gov.uk/Default.aspx.
[55] Same as above.
[56] Refer to "Guidance - Regulations: waste batteries" at https://www.gov.uk/guidance/regulations-batteries-and-waste-batteries#:~:text=producers%20of%20automotive%20batteries%20must,and%20in%20certain%20other%20circumstances.

California

The California Exhaust Emission Standards and Test Procedures, along with the California Code of Regulations, currently govern EVs and provide standards for the EV battery packs for different models of EVs.

On August 25, 2022, the California Air Resources Board[57] approved the new electric vehicle-focused regulations, that require all new 2035 and later passenger vehicles to be zero-emission vehicles. This regulation takes regulatory steps to ensure that zero-emission vehicles can replace gasoline vehicles, and ensure that used customers receive quality vehicles that do not pollute. Additionally, the Advanced Clean Cars II[58] Regulations (2022), specifies a year-wise roadmap to ensure that by 2035, 100% of new cars and light trucks sold in California will be 'zero-emission vehicles[59]'.

California Exhaust Emission Standards and Test Procedures[60]

The California Exhaust Emission Standards and Test Procedures applies to 2018 and subsequent model zero-emission vehicles and hybrid electric vehicles, in the passenger car, light-duty trucks, and medium-duty vehicles. The regulatory authority is the California Air Resources Board[61].

This standard requires the following:

(i) That NEVs (neighborhood electric vehicles[62]) be equipped with sealed and maintenance-free battery packs,
(ii) NEVs should have a warranty of 24 months for the battery packs, and
(iii) Certification requirements - all vehicles, including NEVs information on safe handling of the battery system, method for determining battery state-of-charge, charging capacity and recharging procedures, etc.

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[57] See "California moves to accelerate to 100% new zero emission vehicle sales by 2035" at https://ww2.arb.ca.gov/news/california-moves-accelerate-100-new-zero-emission-vehicle-sales-2035.
[58] Refer to "Advance Clean Cars Regulations" at https://ww2.arb.ca.gov/rulemaking/2022/advanced-clean-cars-ii.
[59] See "California moves to accelerate to 100% new zero-emission vehicle sales by 2035" at https://ww2.arb.ca.gov/news/california-moves-accelerate-100-new-zero-emission-vehicle-sales-2035.
[60] See at "California Exhaust Emission Standards and Test Procedures" at https://ww2.arb.ca.gov/sites/default/files/2020-03/2018+_my_hevtps_clean%20complete_1_16_accessible_ac.pdf.
[61] Refer to "California Exhaust Emission Standards" at https://ww2.arb.ca.gov/sites/default/files/2020-03/2018+_my_hevtps_clean%20complete_1_16_accessible_ac.pdf.
[62] See "Neighborhood Electric Vehicles" at https://www.longbeach.gov/pw/resources/neighborhood-electric-vehicle/#:~:text=A%20Neighborhood%20Electric%20Vehicle%20(NEV,speed%20limits%20exceeding%2035%20mph.

California Code of Regulations § 1962.6[63]

Battery Labeling Requirements

The California Code of Regulations § 1962.6 applies to 2026 and subsequent model year zero-emission vehicles, plug-in hybrid electric vehicles, hybrid electric vehicles, and 48-volt hybrid electric vehicles certified for sale in California. The regulatory authority is the California Air Resources Board[64]. This regulation requires that all vehicles covered under this standard, be equipped with permanent labels in accordance with the requirements of the standard. The standard specifies

(i) Label information,
(ii) Label format, and
(iii) Label location

California Code of Regulations § 1962.8[65]

Warranty Requirements for the Vehicles

The California Code of Regulations § 1962.8 applies to 2026 and subsequent model year zero-emission vehicles certified for sale in California. The regulatory authority is the California Air Resources Board[66].

It prescribes the following warranty coverage:

(i) Propulsion-Related Part Warranty,
(ii) Battery Warranty, and
(iii) Zero-Emission Vehicle (ZEV) Warranty Information Reports (based on which a ZEV field information report is to also be submitted to the Executive Officer).

[63] Refer to "California Exhaust Emission Standards" at https://ww2.arb.ca.gov/sites/default/files/2020-03/2018+_my_hevtps_clean%20complete_1_16_accessible_ac.pdf.
[64] Refer to "California Exhaust Emission Standards for 2018 and Subsequent Model Zero Emission Vehicles" at https://ww2.arb.ca.gov/sites/default/files/2020-03/2018+_my_hevtps_clean%20complete_1_16_accessible_ac.pdf.
[65] Refer to "California Code of Regulations 1962.8" at https://documents.dnrec.delaware.gov/Admin/Hearings/2022-R-A-0011/Exhibits/California-Code/2acciifro1962.8.pdf.
[66] Same as above.

New Vehicle and Engine Certification in California[67]

The Federal Motor Vehicle Safety Standards[68] (FMVSS), issued by the National Highway Traffic Safety Administration (NHTSA), are the federal vehicle regulations in the United States of America that provide specific provisions on the design, construction, performance, and durability requirements for the vehicles. FMVSS also regulates the safety standards of vehicles, along with its related components and systems.

The US Department of Transportation (DoT) implements the manufacturer's self-certification mode for safety certifications of vehicles. Self-certification can be done once the manufacturer has obtained the necessary registrations and submitted the required documents to DoT - NHTSA does not pre-approve vehicles, through testing or other means.

[67] See "New Vehicle and Engine Certification" at https://ww2.arb.ca.gov/our-work/programs/new-vehicle-and-engine-certification.
[68] Refer to "Federal Motor Vehicle Safety Standards" at https://www.govinfo.gov/content/pkg/CFR-2017-title49-vol6/xml/CFR-2017-title49-vol6-part571.xml.

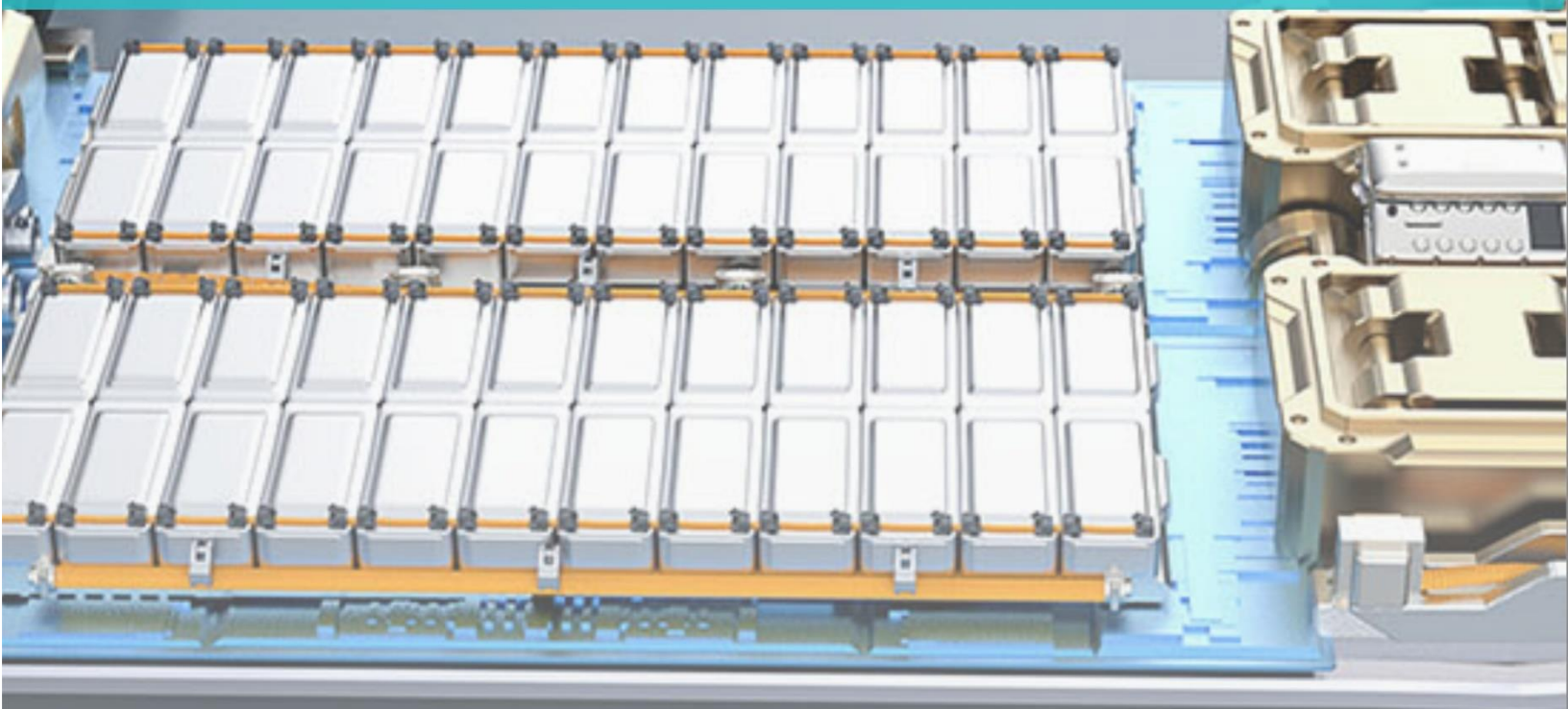
A Comparative Analysis

	India	United Kingdom	California	European Union
Key Features of the Laws Governing Battery Packs	• Governs each component of the battery, which includes the cells, battery packs, along with the BMS; and • Separate testing requirements for different classes of vehicles.	• Requirement of traceability systems, risk assessments; and a quality management and control policy; and • Organizations must document the transportation process of battery packs.	• Each set of regulations apply to different models of vehicles; and • Clearly outlines the warranty requirements for the batteries.	• Carbon footprint declaration; • Digital Battery Passport; and • Due Diligence requirements to be undertaken by the manufacturer.
Labelling Requirements	Labels to be printed visibly, legibly and indelibly. Battery packs must be marked with the crossed out-wheeled bin symbol. There shall be no sale of a battery containing mercury, cadmium or lead unless it is marked with the respective chemical symbol.	Batteries must be labelled with a crossed out wheeled bin symbol with clear visibility. Chemical symbols are required to be added directly below the crossed out wheeled bin symbol and cover an area of at least 25% of the crossed out wheeled bin symbol.	Must include chemistry identifier designating the battery chemistry, cathode type, anode type, manufacturer, and date of manufacture. It must also have a minimum voltage of the battery pack, the rated capacity of the unit, and a digital identifier.	Member States shall ensure that all batteries, accumulators, and battery packs are appropriately marked with the 'separate collection' symbol (WEEE Marking). Batteries containing more than a certain percentage of mercury, cadmium or lead, shall be marked with the chemical symbol.
Approvals / Certification of the Integrated EVs	**Certificate required**. Vehicle homologation is required pursuant to the Central Motor Vehicle Rules, 1989[69] - which lists down the certifying authorities.	**Certificate required.** Vehicle certification is issued by a type-approval authority to ensure compliance with Regulation (EU) 2018/858 of the European Parliament and of the Council (2018).	The US Department of Transportation implements the manufacturer's self-certification mode for safety certifications of the vehicles in accordance with FMVSS.	**Certificate required.** The Vehicle Certification Agency is the UK Type Approval Authority for EVs.
EV Battery Recycling Measures	**Mandatory.** Battery Waste Management Rules, 2022, provides for Extended Producer Responsibility.	**Mandatory**. Waste Batteries and Accumulators Regulations, 2009, makes collection and recycling of EV batteries compulsory.	USA does not mandate EV battery recycling.[70]	**Mandatory**. Governed by Member States.
Penalties for Breach of Manufacturer Waste Battery Obligations	Manufacturers will be liable to imprisonment for a maximum period of five years, along with a fine of up to INR 100,000, as per Section 15 of the Environment Protection Act, 1986.[71]	Each member State prescribes penalties for a breach of national provisions adopted pursuant to the EU Directive. As per the Directive, the penalties must be ***effective***, ***proportionate*** and ***dissuasive***.		A producer will be liable: (i) on **summary conviction**, to a fine not exceeding the statutory maximum; or (ii) on **conviction**, to a fine.

[69] Refer to https://morth.nic.in/central-motor-vehicles-rules-1989-1.
[70] See, "The US doesn't have a law mandating EV battery recycling. Should it?" at https://grist.org/technology/the-u-s-doesnt-have-a-law-mandating-ev-battery-recycling-should-it/.
[71] Refer to https://www.indiacode.nic.in/bitstream/123456789/18998/1/environment_(protection)_act,_1986.pdf.

PART IV

Investor Perspective on Battery Pack Regulations in India



Investor Perspective on Battery Pack Regulations in India

The Indian legal framework for battery packs are fairly comprehensive and is on par with global standards in terms of battery and vehicle safety.

However, India is still heavily dependent on importing about 60-65%[72] of the total component requirement for battery packs from China.

Therefore, large scale market adoption is crucial to unlocking further innovation. Indian regulators need to be proactive in ensuring the battery packs in the markets are compliant with safety standards and regulations.

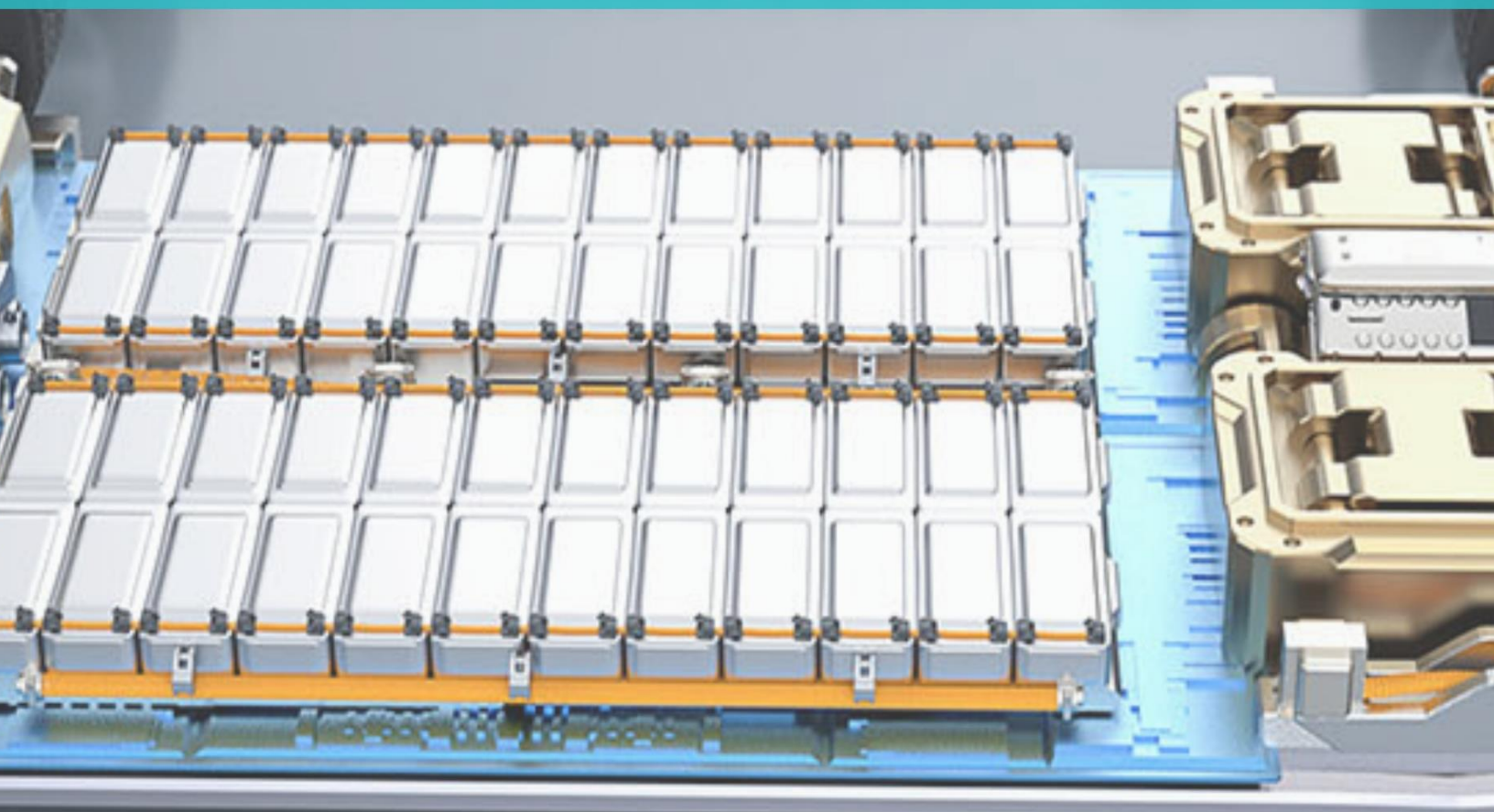
In this context, we would urge the reader to review the suggestions proposed in Part V below.

[72] See "Lithium-Ion Battery (LiB) Manufacturing Landscape in India" at https://ieefa.org/wp-content/uploads/2022/01/Lithium-Ion-Battery-Manufacturing-Landscape-in-India_January-2022.pdf.

PART V

Suggestions for Indian Policy Makers

Addressing Industry, Investor and Legal Concerns



Suggestions for Indian Policy Makers

1. Carbon Footprint Declaration:

Manufacturers can submit a 'Carbon Footprint Declaration' (CFD) to any appropriate Government authority appointed by the Union Ministry of Environment, Forest and Climate Change. A CFD will enable the Government to track the carbon footprint for manufacturing EV batteries, which will enable it to formulate policies to reduce the carbon footprint for battery manufacturing.

2. Battery Swapping Policy:

Battery swapping solves the problem of difficulties in setting up charging stations, and is also time efficient. While the NITI Aayog released the draft Battery Swapping Policy[73] in 2022, this has been opposed by stakeholders in the industry due to the interoperability standards and the standardizing battery dimensions is not feasible, given that stakeholders will be required to make many changes.

3. Standards Governing Different Models of Vehicles, as per its Manufacturing Date:

California has taken into account the dynamic nature of the EV industry, and has framed its EV regulations around the different models of vehicles, depending on the year in which the vehicle was manufactured. This provides flexibility to the authorities to modify the laws on testing, approvals, and certifications.

[73] Refer to "Battery Swapping Policy" at https://pib.gov.in/PressReleasePage.aspx?PRID=1818569.

4. Looking Ahead - Regulations on Alternatives to Lithium-ion Battery Packs:

While India is still heavily dependent on the import of lithium-ion batteries, sodium-ion is one alternative[74] that is set to improve energy density, charging speed, and overall performance of EV batteries. Policymakers should start discussing potential quality and safety standards for such alternatives with experts from the EV industry, and frame legislations that are specific to such alternatives.

5. Due Diligence / Risk Assessment:

As provided for in the EU, Indian policy makers can also consider making manufacturers undertake a due diligence or a risk assessment of the battery packs. There have been several cases of battery explosions in India, which have led to the death of the vehicles user. This provides as an additional safety measure, and will help reduce the chances of any defects / damage to the battery pack.

6. A Battery Passport:

Digital battery passports provide stakeholders with crucial data in support of the sustainable management[75] of batteries; such information includes information specific to the battery pack, regarding the environment, social and governance performance, manufacturing history, and so on. Further, since there is more data available about the EV as it goes through its life cycle, if manufacturers are aware of what has happened to a battery pack - how it started its life, what it has been through and how it has been used, they would get a better picture of its condition. Hence, there is a better data driven picture of its value. Thus, a battery passport most importantly unlocks the 'value' of EVs.

[74] See "Sodium-ion battery offers a potential low-cost alternative to lithium-ion battery for India" at https://www.ey.com/en_in/automotive-transportation/revolutionizing-ev-batteries-a-breakthrough-for-india#:~:text=Rising%20demand%20for%20electric%20vehicles,overall%20performance%20of%20EV%20batteries.

[75] See "EV Battery Passport" at https://www.nist.gov/programs-projects/ev-battery-passport.

7. Second-Life Policy:

When EV batteries reach its end life[76], manufacturers have three options:

(i) to dispose it,
(ii) to recycle the valuable metals, or
(iii) reuse it (second life).

Second-life batteries are batteries that can be applied for a different use after their initial lifecycle is over, such as such as stationary energy-storage services. Giving a second life to batteries by reusing them in different, but still effective, ways leads to economic and environmental benefits. Policymakers should propose market-wide regulatory standards for second-life batteries for manufacturers or end users.

International agencies and stakeholders, such as OEMs and second-life-battery companies, are aiming to establish second-life-battery safety standards -which would classify batteries based on their performance potential[77]. If Indian policymakers establish a regulatory body to review the battery standards and report annually on average cost and operating benchmarks, this could further improve the prospects of developing a financially sustainable second-life battery ecosystem.

Assigning responsibility to different stakeholders along the second-life battery value chain can help in implementing cost-effective solutions while also aiding in combating climate change.

[76] See "Power spike: How battery makers can respond to surging demand from EVs" at https://www.mckinsey.com/capabilities/operations/our-insights/power-spike-how-battery-makers-can-respond-to-surging-demand-from-evs.
[77] See "Second-life EV Batteries: The newest value pool in energy storage" at https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/second-life-ev-batteries-the-newest-value-pool-in-energy-storage.

Conclusion

While considering our suggestions based on the study of regulations in EU, UK and California, Indian policymakers should take into account, unique geographical, supply chain, competitive and strategic factors at play while shaping laws and policies that could enable India's push towards greater adoption of EVs.

Hence, we are not advocating a "cut and paste" approach that would have unintended consequences for the Indian EV industry, including stifling of innovation or placing the industry at a competitive disadvantage.

Thank You!

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