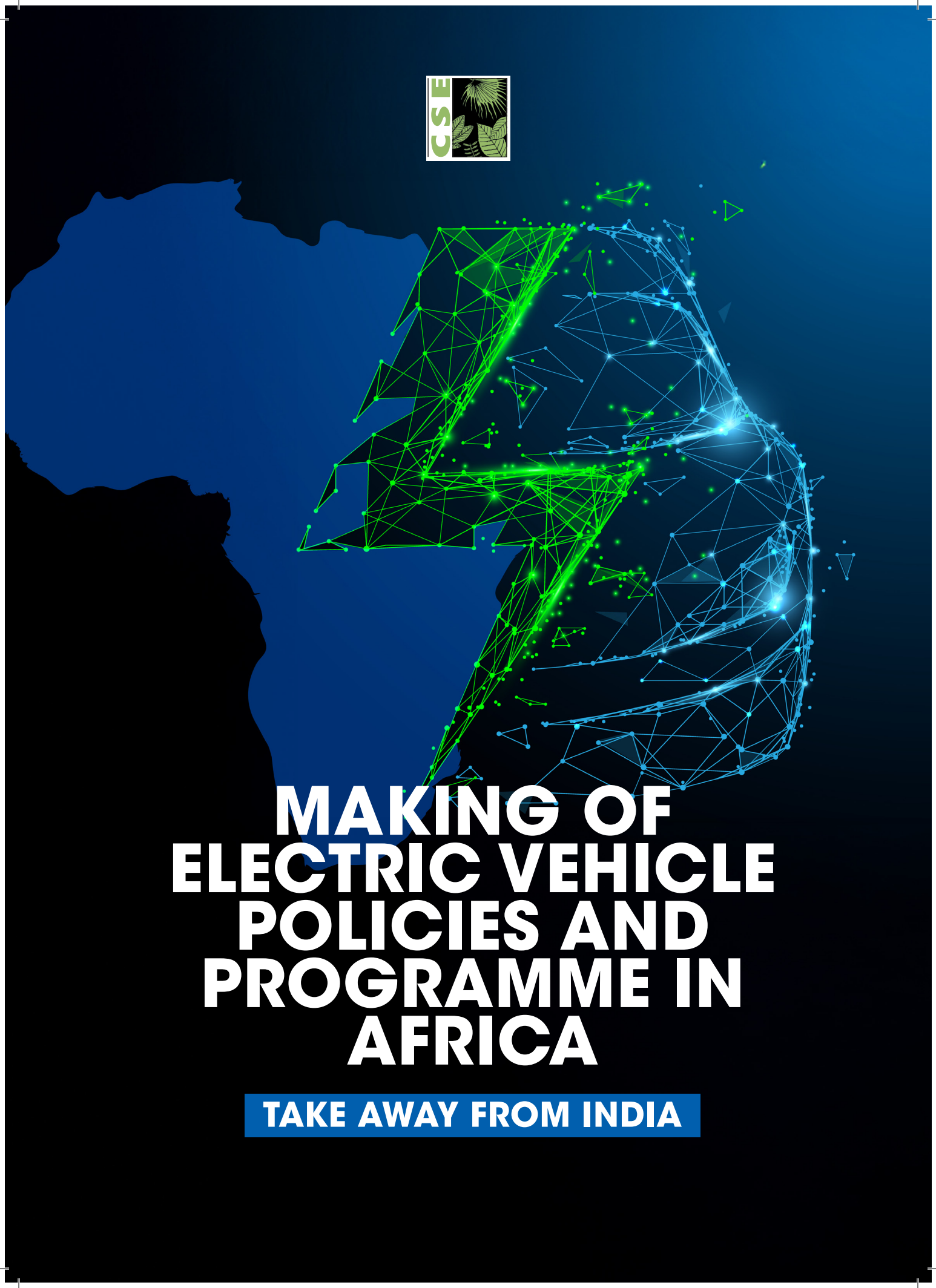

MAKING OF ELECTRIC VEHICLE POLICIES AND PROGRAMME IN AFRICA

TAKE AWAY FROM INDIA

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Take away from India

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The spotlight

As countries in Africa are ramping up their respective electric vehicle (EV) programmes to meet their clean air and climate goals, there is deepening regulatory interest to develop and tighten the regulatory platform to drive the EV technology, deployment and operations. This has catalysed the interest in the emerging learning in the Global South including India and how the exchange of ideas and practice can be enriched.

This has come out of the discussions in the Pan Africa Regulators Network on Clean Air Solutions that has been initiated by the Centre for Science and Environment (CSE) to bring together the key regulators and stakeholders from different countries of Africa for knowledge sharing and cross learning. Since 2015, this network has catalysed Pan-Africa level exchange of ideas on emerging issues, initiatives and solutions. This network has mobilized participation from Nigeria, Ethiopia, Kenya, Uganda, Zambia, Mauritius, Zimbabwe, South Africa, Rwanda, South Sudan, Tanzania, Zanzibar, Senegal, Cote d'Ivoire, Ghana, Egypt, Mozambique, and Malawi.

To enrich this discussion and exchange, the CSE has initiated this action tracker series to document emerging good practices in different areas of interventions and issue specific deep dive to inform the emerging initiatives on EVs in Africa. This rapid action tracking helps to keep the information flow dynamic and demand driven. This cross learning is important as all the countries in the Global South are developing regulations, policies and schemes to implement EV programmes. It is therefore important to understand what is working or not working and the possible inventiveness to address the larger challenges related to limited resources, smaller markets, small manufacturing base or heavy dependence on imports, weak regulatory framework, inadequate technical expertise and skills, absence of appropriate financing tools and instruments, and uncertainty around this new technology.

There are several common approaches that are unique to developing countries. Most countries in Africa and Asia, with lower level of personal vehicle ownership, are prioritising mass modes of transport to decarbonise urban commuting, - high-usage, high-occupancy vehicles like taxis, buses, microbuses, paratransit like matatus, tuktuks etc, and ride-share fleet to maximise emissions and carbon reduction benefits. Electrifying small para transit that meet the maximum travel

demand, focusing on two-wheeled vehicles that are most polluting and dominate the vehicle fleet, targeting the commercial fleet operations for delivery and the aggregator fleet to maximise impacts. This ties in well with the electrification landscape of India which has also taken a similar approach.
This opportunity has also created enormous demand to shape enabling policies, regulations, technology roadmap and policy accelerators to build scale. Countries in the global south are finding their distinct ways to design demand and purchase incentives for consumers and fleet operators to build markets, incentivise industry to produce, designing charging infrastructure, evolving battery chemistries, and developing funding strategies to meet the cost of transition. A learning curve is gradually evolving that needs to be tapped to inform each other and enable each other

There lies great value in adopting learnings on cell chemistry, battery pack design, thermal management systems, and the associated regulatory framework for safe and optimal use of the battery in an EV. As an example, African countries can learn from the journey of regulation in the EV sector in India regarding the updation of the standards from Lead acid batteries to Lithium ion batteries and the subsequent amendments in response to fire incidents.

The lessons learnt from EV adoption across various vehicle segments in India can be shared with African counterparts to anticipate roadblocks and avoid mistakes. Specifically, the phased implementation of the demand incentive driven FAME schemes (FAME 1 in 2015 and FAME 2 in 2019) have sparked momentum of two and three wheeler market which have seen significant EV penetration - 5.3 per cent e2w and 54.33 per cent e3w in 2023. There is considerable learning in India that has prioritised support for electrification of buses and is working with strategies of bulk purchase by transit agencies and demand aggregation. India is also adopting different business models including a gross cost contract that allows the bus manufacturers or a third party agency to provide the service of fleet operations and to take responsibility of maintenance and operations.

Once the FAME scheme created a critical mass for EV demand, India started to focus on supply side incentives like the Production Linked Incentive(PLI) scheme for cell and auto component manufacturing.

This is expected to provide the much needed thrust of localisation of EV manufacturing. African countries too which rely significantly on imports will require local capacity for cell manufacturing, battery assembling and advanced battery chemistry. An early roadmap even as the EV market begins to take off, is

important. The countries in Africa also need to pay attention quite early to these details while developing their regulations and incentive programmes to be able to plan their funding and financing strategies in advance. Countries are also adopting industrial policy to build local vehicle manufacturing bases to cater to the regional markets, retail value chain within the economy, create new and green jobs with related economic spin offs.

A critical part of EV adoption is the availability, discoverability and accessibility of charging infrastructure. Two specific policy interventions have driven charging infrastructure deployment – delicensing of public charging stations, democratized setting up of charging infrastructure and introduction of specific tariffs for EVs provided a fiscal incentive for charging. Battery swapping too has picked up and concurrently there are hurdles in rollout of a swapping standard for interoperability. These experiences can provide valuable insights for EV charging infrastructure in Africa which have similar settlement morphologies.

There are also examples of the application of the polluter pay principle to mobilise additional resources to fund the cost of transition to the EVs. In the capital city of Delhi an Air Ambience Cess has been imposed on each litre of diesel sold in the city, environment pollution charge has been imposed on all diesel cars with 2000cc engines and above, and environment compensation charge has been imposed on each truck entry into Delhi daily. From all these three taxes Delhi has generated an enormous revenue base and created dedicated funds which are now being used to give fiscal incentive and fund charging infrastructure in the city. The tax amount is very small but cumulatively has enormous revenue potential.

Thus, the multi-dimensional E-mobility landscape provides an opportunity to compare and analyse possibilities of replicating policy formulations, pilot projects, financing strategies, regulatory frameworks.

From this perspective CSE has put together this rapid action tracker to enrich the exchange on the emerging practices in the EV landscape in India to put a spotlight on the key aspects and elements of the regulations, programmes, and schemes for accelerating the EV programme and the scope of the development of the standards to have safe, durable and well performing EV technologies. This can help to inform the trajectory in Africa.

1. Step by step

As India learns by doing and continually shapes and modifies the regulatory instruments and approaches to drive the EV programme, it may be of value to understand this progress to inform regulation development in the Africa region. The scope of interventions include both national and sub-national policies. At the national level the main thrust has been an on demand incentive programme for targeted segments of the vehicles, production linked incentives for promoting local manufacturing of EVs and crafting of the fuel economy standards to drive adoption of EVs. In addition to that the national government has focused on standards norms for EV technology and charging technology.

The sub-national policies on the other hand complement the national programmes and schemes while further strengthening the local level initiatives. These policies also – with some variations - provide additional fiscal and non-fiscal incentives, support for charging infrastructure and electricity, targeted adoption of EVs, support for industrial bases within the respective jurisdictions, among others. Both national and subnational policies mutually reinforce each other and help to strengthen the pathways. This gamut of interventions are captured in a step by step guide.

However, it needs to be read with the caveat that while several positive steps have been taken to build the EV programme, there are still gaps and missing links that will have to be addressed going forward. These are also highlighted to indicate the comprehensive approach required to move forward.

1. Defining quantitative target and mandate for the electric mobility strategy: The key regulatory parameter that helps to provide the long term policy visibility is the regulatory target for overall fleet electrification as well as for specific vehicle segments. Setting targets is the fundamental tool to signal policy intent and priorities of the government to plan and effect change. Quantitative targets are measurable and can be used to track progress. They can be in the form of absolute numbers or as a percentage of overall deployment.

India is among a handful of countries that support the global EV30@30 campaign, which aims to have 30 per cent of newly registered private cars, 40 per cent of buses, 70per cent of commercial cars and 80 per cent of 2-wheelers and 3-wheelers to be electric by 2030.

However, these are voluntary and intended targets and are not backed by regulations to make them binding. Against this voluntary target the current level of new fleet electrification is about 6 per cent. In 2013, Government of India had launched the National Electric Mobility Mission Plan 2020 (NEMMP 2020) with a vision to register 6-7 million electric vehicles between 2013 and 2020.

It will be helpful if the programmes can adopt specific regulatory targets to drive the market and investment. There is an older example in India where a regulatory and a binding target was set to transitioning diesel run public transport buses and para transit to compressed natural gas in the city of Delhi. This was directed by the Supreme Court of India that became the basis of regulatory action.

Similar approach is needed for the EV programme to ensure time bound expansion of the programme. At the sub-national level, most Indian states and union territories (UTs) have also set their own targets for EV sales, charging infrastructure, and investments as part of their state EV policies. The targets for EV penetration are diverse and can be a percentage target or a target for absolute numbers without specifying the targets for each vehicle segment.

Vehicle segment-wise targets become necessary to ensure uniform progress across all targeted segments. The experience shows that without such targets most of the electrification has happened in the small format vehicles like the informally configured three wheelers (called e-rickshaws in India), three wheelers and two-wheelers. Only the bus segment in India has seen some expansion due to a focused programme. But overall four wheelers including commercial vehicles have not seen much traction and show the lowest penetration so far.

A more coordinated and aligned approach towards target setting can help to drive the market to help build scale across all segments.

National demand incentive programme – evolving strategy: This is a critical strategy to catalyse demand and build the market especially during the nascent stages of the EV programme.

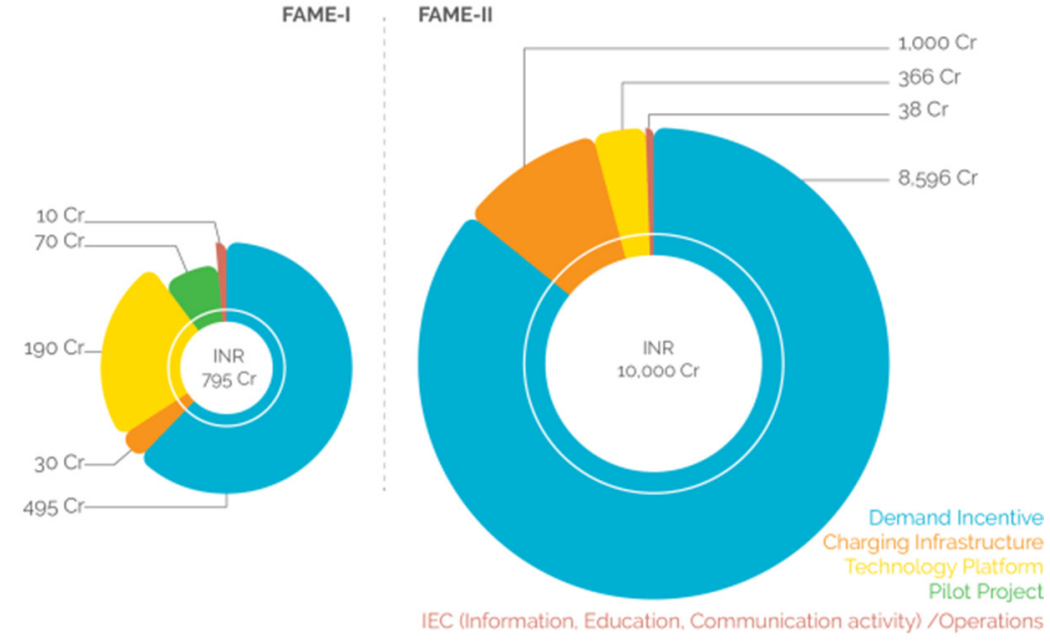
There are several lessons from the India programme on demand incentive in India. India launched the NEMMP 2020 in 2012—a roadmap for the planned development of the country's EV sector. Its strategic components included demand creation, strengthening the manufacturing ecosystem, providing charging infrastructure, supporting research and development (R&D), and building public awareness.

Following this, the government introduced the Faster Adoption of Electric Vehicles (FAME) scheme in 2015 to provide purchase incentives for electric vehicles in India. Purchase subsidy has been the primary instrument used by the government to spur EV adoption. Until the EV market reaches critical mass with adoption, providing fiscal support to consumers is key for transitioning to a new technology for achieving cost parity with conventional vehicles. FAME I was extended four times, each on a short-term basis. Later in 2019, the scheme was revised as FAME II, with higher fund allocation and revamped fund utilisation (see *Figure 1: Comparison of funds allocation in FAME 1 and FAME 2 schemes*).

The scheme was set to operate for three years (till FY 2021-22), however in view of COVID-19 restrictions which slowed down the industry, it was extended for two more years and concluded in March 2024. During this period, FAME II financial outlay was augmented to include more registrations, especially in the two- and three-wheeler segment.

As the FAME scheme came to a closure in FY24, there was widespread uncertainty and speculation about the future of purchase subsidy. The govt. launched an interim demand incentive scheme (EMPS) to provide a crucial 4-month transition

Figure 1: Comparison of funds allocation in FAME 1 and FAME 2 schemes



Source: Ministry of Heavy Industries & Public Enterprises, Government of India

period for the industry to stabilize. EMPS only supported electric two-wheelers and three-wheelers through demand incentives.

The latest iteration of the demand subsidy is the Prime Minister Electric Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) scheme. It was announced in September 2024 and will be in effect until March 2026, with Rs11,000 crore in funding. PM E-DRIVE continues to provide subsidies to the two and three wheeler segment albeit with a reduced emphasis, and heavily prioritizes e-buses and charging infrastructure. It has also for the first time introduced a demand incentive for electric trucks as well as e-ambulances.

There are several lessons from the demand incentive programme that bring out how vital it is to periodically review the impact of policies on ground-level EV adoption for course correction. Design of the incentives matter.

Learning from the stage one of demand incentive programme: The first attempt at the demand incentive programme missed out on several opportunities and had flaws in its regulation and operation. Learning from the Learnings from FAME I were crucial to how demand incentive schemes can maneuver the market towards both favorable and unfavorable outcomes: The 2015 iteration of FAME (FAME I) allowed mild hybrids, which offer only 10-15 per cent fuel consumption improvement, to be eligible for the incentives. In its first year after commencement, Rs 40 crore of the Rs 70 crore budget for demand incentives were availed by mild-hybrids. Mild -hybrid vehicles utilize a small motor and battery to assist in automatic start/stop of the ICE and provide very little emission reduction benefits. By the end of four years, out of the total car sales under FAME I, 95 per cent were mild hybrids.

Moreover, FAME I incentives were given out in two levels, Level 1 (lower) for "Conventional batteries" such as lead acid, etc., and Level 2 (higher) for "Advanced Batteries" such as Lithium composition batteries, due to which the cheaper (but less efficient and more hazardous) lead acid batteries dominated the market. The total two-wheeler share in all electric vehicles registered by the end of 4 years in India was 39 per cent, however most of these sales were lead acid batteries. In response to this, benefits for mild hybrids were withdrawn in 2017 and for lead acid batteries in 2018 to best utilize funds on cleaner vehicle segments.

Course correction in the second phase – linked with vehicle performance: The second phase of FAME began in 2019, with a much larger budget earmarked for incentives, however this time performance and other specifications of the vehicles

were tied with vehicle eligibility. This included more parameters other than minimum vehicle range, such as minimum energy consumption, minimum max speed, minimum acceleration. The scheme now supported commercial vehicles only, with an exemption for the two-wheeler segment, since it was the fastest growing segment after e-rickshaws in the country back in 2019.

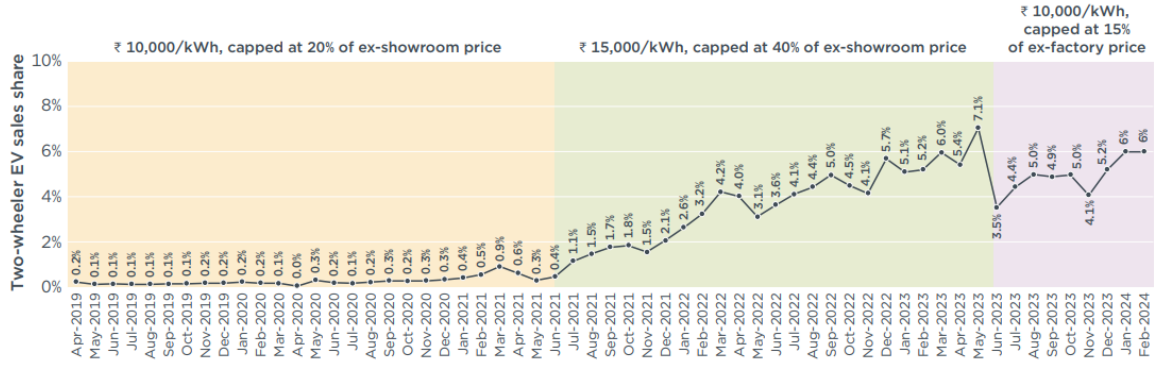
Incentives were linked with battery sizes, which provided a directly stipulated segment-wise incentive amount. FAME II also set targets for a number of vehicles (segment-wise) to be electrified.

The shift from FAME I to FAME II illustrates that performance-based criteria and segment-specific incentives can refine market outcomes.

Thus, India's strategy evolved through trial and error, shifting from broad and often misallocated subsidies to more targeted and performance based incentives. The experience underscores the need for precise targeting of incentives to ensure that they effectively promote the desired technology—electric vehicles with advanced batteries, for instance—without encouraging suboptimal alternatives.

Need to ensure consistency in subsidy policy to prevent disruptions: The erratic nature of purchase subsidy can distort demand patterns and hinder consumer acceptance of EVs. For example, in response to an ensuing FAME 2 subsidy reduction in June 2023, E2W manufacturers either partially or fully passed on the amount of subsidy markdown to the consumer by raising the prices of their vehicles, which caused E2W sales to slow considerably (see *Figure 2: Graph showing the electric two wheeler sales penetration from 2019 to 2024 and the FAME demand incentives during that period*).

Figure 2: Graph showing the electric two wheeler sales penetration from 2019 to 2024 and the FAME demand incentives during that period



Source:https://theicct.org/wp-content/uploads/2024/06/ID-169-FAME-opps_report_final.pdf

The experience with the Electric Mobility Promotion Scheme (EMPS) also serves as a cautionary tale about the risks of abrupt policy changes. The sharp reduction in incentives and the sudden narrowing of eligible vehicle categories led to a slowdown in market growth, emphasizing that any phase-out of fiscal support must be gradual, well-communicated, and accompanied by non-fiscal measures which translate to preferential treatment for EVs in urban settings, and supply side drivers such as zero-emission mandates.

Rapidly changing policies create uncertainty in the EV ecosystem and make it challenging for stakeholders like manufacturers, investors, and consumers to undertake long-term planning, which risks slowing down the transition .

2. Adopt Vehicle segment wise targets and adoption strategy

The Indian automotive market consists of highly diverse and stratified vehicle segments. There cannot be a one-size fits all approach policy intervention. Since there is a finite pool of fiscal resources, it is important to determine which segments need to be prioritized for electrification according to existing local conditions.

India has focused its EV promotion strategies towards small segment vehicles such as two-wheelers, and three wheelers due to their ease of charging and smaller upfront costs, which helps in reaching price parity with ICE models more easily. It has also focused on high-occupancy commercial vehicles like taxis, buses, and paratransit fleet to maximize emission reduction benefits by electrifying passenger trips.

Target two/three wheeler segments as first adopters: Two-wheelers make up the majority of the on-road vehicle market in India, accounting for over 75 per cent of all vehicle sales in FY 2022–2023[1]. About 60 per cent of the gasoline used in India is caused by this category. Additionally, India has a significantly larger capacity for producing two-wheelers than any other vehicle market, and is the largest two wheeler manufacturer in the world. Hence, there is a great chance to expand local EV manufacturing capacity at scale, which would help to reduce the price of EV batteries and componentry.

The initial expansion of e2W has been driven by commercial use in last-mile and hyperlocal deliveries, given the TCO parity with ICE vehicles. e2W-related ecosystem collaborations between aggregators and e-commerce entities, as well as the fleet greening pledges of major multinational corporations, are anticipated to further reinforce this (see Fig 3).

As market penetration of e2W has increased, the demand incentives have been tapered down by the government.

Under FAME II, the subsidy given was Rs 15,000 per kWh for two-wheelers, within a maximum cap of 40 per cent of the vehicle cost. In June 2023, this was revised down to Rs 10,000/kWh, with a maximum cap of 15 per cent of the value of the two-wheeler.

Figure 3: (L) e-rickshaw, (R) electric E-commerce delivery bike

Source: https://www.cbc.ca/news/world/india-electric-rickshaw-revolution-low-carbon-future-1.6642423, https://zypp.app/

In March 2024, this was further revised down under the Electric Mobility Promotion Scheme (EMPS) to Rs 5,000/kWh subject to a cap of Rs 10,000 per two-wheeler. Under the latest PM E-DRIVE scheme, the subsidies will be tapered down to to Rs 2,500 per KWH or a maximum of Rs 5000 per two-wheeler in 2025..

The E3W segment has emerged as the frontrunner in India's electric mobility transition. Uptake of EVs in the three-wheeler segment stood at 54 per cent in FY 2023–24, the highest across all vehicle segments. The segment is further divided into the following sub-segments: e-rickshaws, e-carts, goods three-wheelers, passenger three-wheelers (also known as "autorickshaws").

Electric rickshaws, which have replaced cycle rickshaws in Tier-I and II cities as last mile feeders, have dominated the growth share (see Figure 3: (L) e-rickshaw, (R) electric E-commerce delivery bike).

Similar to the e2W segment, the Total Cost of Ownership (TCO) for e3W is ~40% less than comparable ICE 3W owing to low operation and maintenance cost over the vehicle life and growing fuel prices[2]. This makes it attractive for commercial use such as for hyper-local and last-mile deliveries.

Adoption is more commercially viable for last mile delivery (e-rickshaws, e-carts, L5) basis the growth of e-commerce.

Battery swapping, which delivers a comparable refueling experience to ICE vehicles while lowering the initial cost of the vehicle by 30–40 per cent, is becoming a

feasible substitute for charging e3W, particularly for fleet operation. This is anticipated to improve battery health and longevity due to the controlled charging environment, as well as to create operational efficiencies for battery disposal and reuse.

Targeted programme for public transport buses: Since the beginning of India's electric mobility programme, the bus was considered as one the key sectors for electrification as this provides a unique opportunity to decarbonize a sizeable share of daily travel trips in cities and reduce toxic exposures. Public transport buses are characterized by fixed routes, availability of dedicated parking spaces in depots, and long stops after completion of their daily schedule, all of which make them a strong candidate for electrification (see Figure 4: Electric Bus in Delhi). One of the key enabling tools for the success of e-Bus deployment has been the use of GCC.

Experience from the FAME-1 scheme, helped policymakers to formulate the next phase of FAME, i.e., FAME-2 in a much better and effective manner. To achieve economies of scale, coverage of the FAME-2 incentives was extended to 40 cities with planned deployment of 7,000 e-buses, almost 8 times more than the FAME-1 scheme.

Two critical innovations followed to promote e-buses in India:

i) **Inventive bus procurement strategy -- Gross Cost Contract (GCC) model to reduce operational risk and the total cost of ownership:** Realising the issues with the outright purchase model which is hampered by the higher purchase cost of electric buses, GCC became mandatory for all the public transit authorities to avail the FAME-2 subsidy. Under the GCC model, the government transit authority manages the transit system while a contracted private entity owns, operates, and maintains the buses, for which the transit authority makes periodic payments to the private entity across the life of the contract on a per kilometer basis.

The GCC model allows for a more even distribution of cash flows across the life of the electric bus contract, which facilitates better matching of revenue and expenses. Further, the GCC model facilitates the distribution of risk associated with the deployment of electric buses between the government transit authority and the private operator.

The private sector, which accounts for nearly 90 per cent of the registered bus stock in India, has been slow with uptake of e buses.

Figure 4: Electric Bus in Delhi

Source:https://www.bloomberg.com/news/articles/2023-08-16/india-approves-7-billion-plan-to-electrify-public-transport?embedded-checkout=true

ii) **The demand aggregation model for scalability:** Electrification of public buses in India is considered a huge success, as within a short span of seven years, since the first electric bus was deployed, India has deployed more than 8,000 electric buses. Another 20,000 electric buses are planned to be added to the fleet in the next three to four years[3].

GCC by itself was not enough to spur the adoption of e-buses. The demand aggregation model provided the desired success by reducing the price of operation less than the internal combustion engine (ICE) technology driven buses.

The central government handed out the responsibility of demand aggregation to Convergence Energy Solution Limited (CESL), to aggregate bus demand on behalf of nine selected cities (i.e., Mumbai, Delhi, Bangalore, Hyderabad, Ahmedabad, Chennai, Kolkata, Surat and Pune) for targeted deployment. CESL introduced "Grand Challenge" (GC), to deploy 5450 electric buses in five cities in April 2022, which is reportedly the largest such bus tender globally. This has helped lower the prices for operations of electric buses quite significantly. Per kilometre (per-km) cost discovery under CESL GC was approximately 23 to 27 per cent lower than the price of diesel/CNG buses in cities, even without any subsidy, whereas in cities with subsidy offered by the central government, the prices were 31 to 35 per cent lower[4].

Viewing the success of the grand challenge, in 2022, the central government launched a more ambitious programme (i.e., National Electric Bus Programme – NEBP) of deploying 50,000 electric buses within next five years (i.e., till 2027).

3. EVs as industrial policy - promotion of localization of EV components

Governments in the Global South are now focusing on developing the EV programme as an industrial development programme to maximise the value chain around EV production, and for the larger economic spin off along with employment generation. The EV aggregates comprise mainly three fundamental components: batteries, electric motors, and power electronics.

Localization of EV components is driven by the objectives of reducing costs, promoting domestic manufacturing, lowering import bills and reducing supply chain risk. EV component localization has been particularly challenging due to the nature of components/assemblies and the available ecosystem in India. The unavailability of a hardware manufacturing base in India is pushing OEMs and Tier-1 suppliers for imports. While OEMs have been driving tier-1 localization through limited local value addition on some components, tier-2/3 localization is yet to be achieved.

Indian government initiatives like FAME 2 and PM E-DRIVE subsidy for vehicles meeting local sourcing targets, localization targets under the Phased Manufacturing Program (PMP), and fiscal incentives through the PLI scheme have provided a clear signal towards stimulating the domestic EV industry.

The Indian government also brought out incentives for foreign investment in local EV manufacturing. This was in light of negotiations with Tesla, with the intent of bringing the US automaker to the Indian market. The policy allowed import of completely built-up EVs with a reduced custom duty from 70 per cent to 15 per cent for a period of five years. This was subject to the OEM setting up a manufacturing facility with minimum investment of USD 500 million within three years with a domestic value addition of 50 per cent within five years.

4. Ensuring compliance with localization norms

The FAME 2 scheme was complemented by a phased manufacturing programme (PMP) that promoted domestic manufacturing of EV components in India. Specifically, 18 parts were listed that the original equipment manufacturers (OEMs) could import until a fixed deadline to get the incentive under the scheme. Barring these 18, other EV parts were to be manufactured or assembled locally. Additionally, FAME II discouraged import of complete knocked-down (CKD) kits for two-wheelers and three-wheelers and other EV components, by providing a timeline for increasing basic customs duty (BCD) on imports.

However, irregularities in localisation claims under FAME-II made by OEMs came to light in 2023. The government investigated the subsidy claims and concluded that six EV manufacturers had intentionally violated PMP guidelines. They had used imported products despite clear norms and yet wrongfully sought incentives for localization.

The new PM E-DRIVE initiative has continued with the PMP norms with some amendments. The new PMP guidelines are in the draft stage and are stricter in comparison to the previous version. The list of components which are allowed to be imported have been reduced from 18 to 8(in the case of two and three wheelers). There need to be regular audit mechanisms in place to ensure that companies comply with the localization requirements during manufacturing.

5. Addressing barriers in battery supply chain and recalibrate industrial policy

The Production Linked Incentive Scheme for Advanced Chemistry Cell Battery Storage (PLI-ACC scheme) was announced in 2021 aiming to indigenize battery manufacturing. The scheme links incentives to production volumes, thus encouraging manufacturers to scale up operations. The scheme has allocated INR 18,100 crore (USD 2.5 billion) in subsidies over 5 years, with the aim of installing 50 GWh of domestic battery manufacturing capacity by 2026. While Ola Electric has set up India's first gigafactory, other companies such as Amara Raja, JSW Neo Energy Ltd, Reliance Industries, Lucas TVS Ltd and Waaree Energies Ltd among others, have submitted bids for production of advanced chemistry cells under the government's PLI scheme.

While most of these firms have announced the availability of cell technology through in-house development or tie-ups, full scale industrialisation or commercialisation of these technologies will be challenging. The biggest obstacle is heavy reliance on imports from critical battery minerals like Lithium, Nickel, Cobalt and Graphite. There is also a high import dependence for key cell manufacturing equipment and a lack of skilled labour across several domains of the battery value chain.

The government can support localization of specific battery components cathodes, anodes, electrolytes, metal foils, casings and cell manufacturing equipment. It will enable firms to enter the value chain with small capital investment and lead to vertical integration of the industry.

6. Rationalization of taxation on Evs

In addition to purchase subsidies, rationalization of taxes is another major fiscal measure to incentivize EVs. The Goods and Services tax (GST) levied by the central government on EVs is set at only 5 per cent which is the lowest tax slab, compared to 28 per cent on hybrid and 49 per cent on ICE vehicles. However, the GST rate on batteries and EV charging services continues to remain at 18 per cent which impedes affordability. Reducing these tax rates will make EVs more competitive in the market.

State governments impose a road tax ranging from 5 to 15 per cent on conventional vehicles. Road tax for EVs has been exempted by many states like Maharashtra, Uttar Pradesh. Some states which earlier had road tax exemptions have withdrawn the waiver, such as Andhra Pradesh, Delhi. The price disparity caused by revoking the tax exemption had a significant impact on EV sales, underscoring the importance of tax breaks as a fiscal measure.

Developing robust regulations and standards for EV programme

Technology development pathways require robust standards, norms and regulations to drive technology development and deliver on the performance, energy efficiency, durability, safety, among others. This is necessary in countries that are developing manufacturing bases.

Standards should form an integral part of the drafting process of laws or guidelines by the government. By establishing the technical details and rigor through standards, the legislation can focus on long-term policy goals. Standards formulation for EVs require a different approach compared to ICE vehicles since they represent a mixed technology, being both a ‘road vehicle’ and an ‘electrical device’.

In India, the Ministry of Road Transport, Highways (MoRTH) acts as a nodal agency for formulation and implementation of various provisions of the Motor Vehicle Act and Central Motor Vehicles Rules, 1989 (CMVR). The ministry is assisted and advised by various technical committees to deliberate and advise the ministry on issues relating to safety and emission regulations (see Figure 5:

Automotive regulation landscape in India). The Automotive Research Association of India (ARAI), was established in 1966 and is one of the prime automotive testing and certification agencies. It is responsible for publishing the Automotive Industry Standards (AIS) which OEMs operating in India have to adhere to.

7. Harmonize domestic standards with global regulations

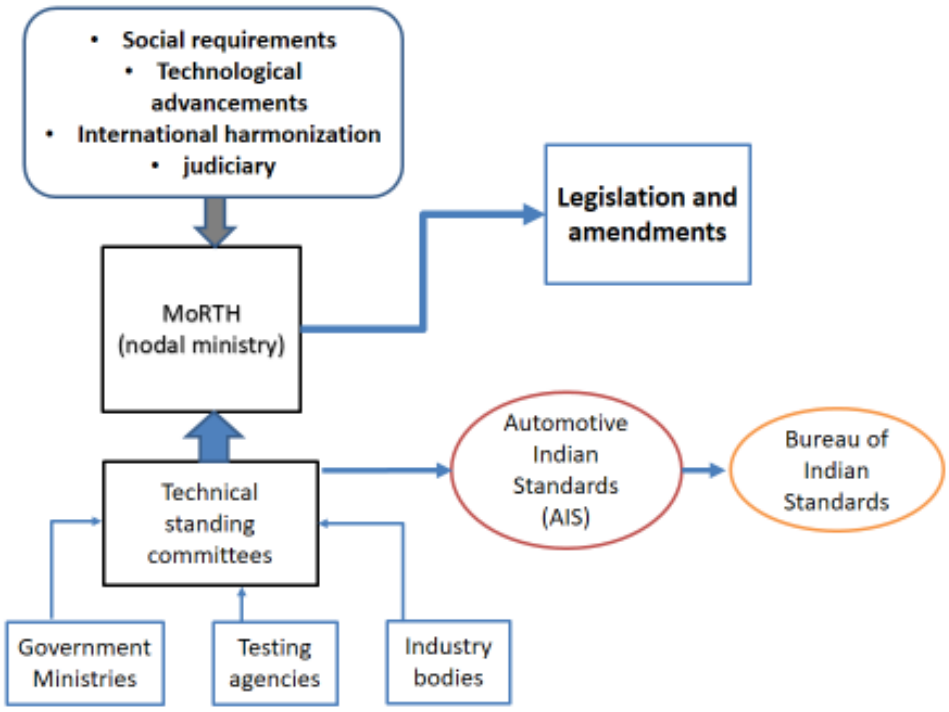
International standards are guidelines or processes that are developed by a group of experts from multiple countries and are set by an international standards organization. National governments analyze the international standards set by an international standards organization, then choose their own strategies.

Indian standards have been issued since the late 1960s for domestically manufactured vehicles, based on global standards bodies like ISO, DIN, EEC etc [5]. India took an important step in harmonizing its automotive industry with Global Technical Regulations (GTR) in 2006. It became a signatory of the UN Economic Commission for Europe (UNECE) WP-29, 1998 agreement [6]. The WP-29 guidelines prescribe standards for universal adoption, facilitating cross-border acceptance and trade. The standards published under AIS are technically aligned with UNECE GTRs that form the initial benchmark to develop regulations in India while adapting them to Indian environmental conditions.

The Bureau of Indian Standards (BIS), the national standards body of India established under the BIS act 2016. BIS is a member of the International Electrotechnical Commission (IEC), which is the global body that is developing reference standards to ensure interoperability and minimize trade barriers for electric vehicles and their components. BIS has developed EV charging standards (IS 17017) by deriving from the IEC 61851 series of standards. New standards that are uniquely applicable to India and comply with international standards are required due to the country's diverse range of vehicle types and local climate factors.

Safety regulations -- manage risk of Lithium-ion battery thermal safety with regulations: Prior to 2020, the primary standard applicable for EVs was AIS 048. It covered traction battery safety requirements and its requirements were formulated with Lead acid batteries as the battery technology in use. A separate standard, AIS 038 (Rev 1) covered the electrical safety for all L, M and N category vehicles. A system level safety approach was absent. Moreover, batteries were not subjected to environmental tests, which is crucial given the harsh operating conditions in India.

Figure 5: Automotive regulation landscape in India

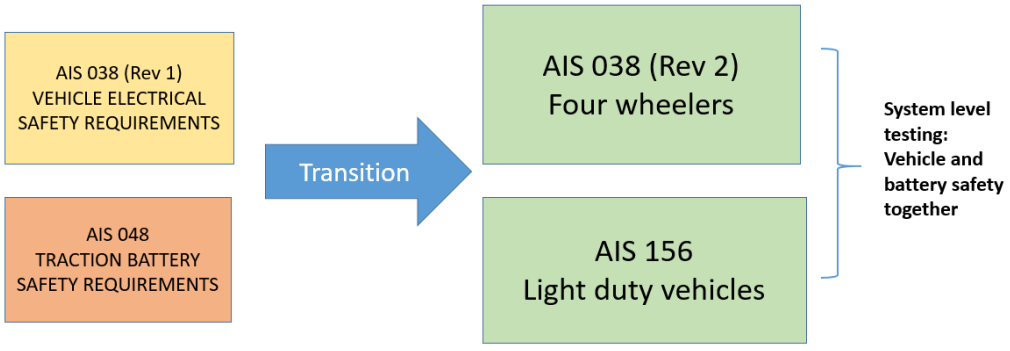


Source: CSE

With the increasing adoption of Lithium ion batteries, AIS 038 (Rev 2) standard was formulated for M & N category vehicles in line with GTR 20/ECE R100 (Rev 3). On the other hand, AIS 156 standard was formulated for L category vehicles such as 2W and 3W based on ECE R136. Both these standards adopted a system level approach by incorporating high voltage EV safety and battery safety together. The standards lay down specific requirements for construction, design, safety requirements, and performance parameters (see Figure 6: Evolution of EV regulation in India).

India strengthened its regulatory framework related to EV battery safety after a spate of EV fires took place in 2022. The official investigation by the MoRTH into the fire incidents highlighted several quality issues with sourcing of components. The investigation committee found that apart from the use of inferior quality (low-grade) cells, a key factor resulting in the safety lapses was the inadequacy of the Battery Management System (BMS) which failed to prevent thermal runaways or provide a warning signal. OEMs had deployed suboptimal BMS in their vehicles.

Figure 6: Evolution of EV regulation in India



Source: CSE

Additional safety requirements were published as part of amendments to EV standards related to battery cells, BMS, on-board charger, design of battery pack and thermal propagation due to internal cell short circuit leading to fire. (see *Figure 7: Electric two wheeler on fire due to thermal runaway of the battery*).

Figure 7: Electric two wheeler on fire due to thermal runaway of the battery

Source: https://www.autocarindia.com/bike-news/ola-s1-electric-scooter-catches-fire-423967

E-retrofitment of internal combustion vehicles – unique challenge of the Global South: Several Africa countries and also states in India have shown strong interest in retrofitting older internal combustion engines (ICE) with electric propulsion kits for full electric operations. Availability of the retrofitment kits, the possibility of a cheaper option to more expensive new vehicle purchase and target setting and advent of the start-ups to carry out retrofitment has cataysed this interest.

Yet another driver of this trend are the directives from the Supreme Court, some High Courts, and the National Green Tribunal (NGT), to phase out old internal combustion engine (ICE) vehicles. As the countries in the Global South are looking at this option it is necessary to inform the process well even though electrification based on new vehicles need to be prioritised and supported.

The emerging regulatory framework is providing safeguards against adhoc and unsafe retrofitment and also setting the regulatory boundaries to improve performance and safety. (see *Box: Regulation for retrofitment of internal combustion engine powered (ICE) vehicles*).

REGULATION FOR RETROFITMENT OF INTERNAL COMBUSTION ENGINE POWERED (ICE) VEHICLES

There have been several regulatory developments in India to guide this programme that provide the learning curve.

The EV retrofitting industry in India is also nascent like in Africa. Even though retrofitment is not being promoted with incentive at the national government in India, the sub-national programmes in states are supporting retrofitment. Nearly eight states including, Delhi, Assam, Chandigarh, Rajasthan, Telangana, Tamil Nadu, Uttar Pradesh and Kerala have provided for e-retrofitment in their respective electric vehicle policies. In most states, e-retrofitment has been permitted without adopting proper guidance framework for quality control of the programme. Only the Government of NCT of Delhi has a defined policy on e-retro-fitment that defines the type of diesel and petrol vehicles that can be retrofitted.

However, the scope of implementation is still very limited. Despite some state governments offering financial incentives for retrofitment, this market is yet to scale. In most states the market is still very limited and largely confined to some niche vehicle segments, use cases and pilot projects. There is barely any data and evidence from systematic assessment of on-road performance of retrofitted vehicles. Most of the understanding however is anecdotal as not well documented.

Nascent growth of the e-retrofitment industry in India: This industry largely includes small companies and start-ups. Retrofitment centres have been set up in metropolitan cities and industrial hubs such as Delhi NCR, Bangalore, Hyderabad and Pune. Retrofitters usually offer services for selected vehicle models, as the retrofitment kits are designed and certified for specific models and cannot be applied generically across all models. But separate homologation procedures add to costs significantly. Challenges such as expensive certifications and low consumer awareness/confidence are some of the impediments to achieving scale.

Evolving regulatory framework for retrofitment: There is already a regulatory mechanism in place for the certification of retrofitted vehicles. Specified regulatory requirements and conditions need to be fulfilled for quality control and safety. To address the concerns around safety, integrity, on-road performance and durability of the e-retrofitment technology and kits, regulatory framework and technical standards (AIS 123: Part 1,2,3) have been framed to ensure quality control, and safety, stability and on-road performance.

Need to align the technical standards for retrofitment with the newly amended safety standards: The retrofitting standard AIS-123 and AIS-048 standard for battery testing and certification are in place, but these have not incorporated newly amended EV battery safety standards AIS- 038(Rev 2) and AIS-156 that are more stringent and apply to new vehicles. AIS-123 also does not cover safety and integrity of the battery in the retrofitted system. There are no

tests for ensuring lower vibration levels with secure installation of the battery in the old vehicle chassis. This needs to be mandated.

Testing and certification capacity is limited and causes delay: For a retrofitted vehicle to be certified roadworthy, it needs to be homologated by a competent authority such as ARAI and ICAT. This includes fitness tests, emission and safety and road-worthiness tests as per the CMVR. But there are only two testing authorities to service large numbers of certification requests. The homologation process is also time consuming and involves high costs. Often the certifying body has to begin by buying the equipment required to test technology-rich vehicles. The high cost of certification affects the profit margin. Moreover, certification of one kit for a particular vehicle model cannot be used for another variant of the same model. If the kit fails the certification process, retrofitters have to re-apply and pay again.

Rationalize the cost of e-retrofitment: The cost of e-retrofitment of older ICE vehicles is much cheaper than the upfront cost of new EVs. The cost components of a new EV include the upfront costs of purchase and for the battery replacement after five to eight years. The total cost of ownership of new vehicles includes the entire useful life of the vehicles. Retrofitted vehicles have a much smaller lifespan depending on the age at the time of retrofitment. With retrofitment, a vehicle may get an additional life of another four to five years depending on the age of the vehicle. The GST on a new EV is five per cent while on spare parts (other than batteries), it is 28 per cent. The retrofitters also usually include registration fees in their overall retrofitment cost. However, overall, the lower cost of retrofitment (the range may vary across models and vehicle segment) makes this an attractive option for addressing the problem of old ICE vehicles.

Demand for adequate and effective safeguard while implementing retrofitment programme: While technically, retrofitment is possible and feasible, there are concerns that, if not done with adequate quality control, it may compromise on-road performance and safety. The Clean Air Policy 2022 of the Air Commission of Delhi-NCR states that "while technically and principally e-retrofitment is possible and feasible, several safeguards and preparedness are needed for its conditional implementation for safe and reliable conversion." This policy recommends that retrofitment be permitted under certain conditions, including the certification of retrofitment kits for specified makes and models according to established standards. Additionally, based on the central government rules, the state governments need to further define and notify the implementation mechanism for retrofitment. In fact, the Delhi government, in its EV policy, has outlined the technical and regulatory conditions to be fulfilled for e-retrofitment and even though the ARAI standards technically allow vehicles of 1990 vintage to be e-retrofitted, Delhi government policy does not allow diesel vehicles that are more than 15 years old to be retrofitted. Petrol vehicles are allowed to be retrofitted only if they fulfil fitness criteria.

Need effective screening of internal combustion vehicles for retrofitment: There are also concerns around maintaining the structural integrity of the chassis of a used ICE vehicle being considered for retrofitting. This needs very stringent screening and prevention of retrofitting of already compromised vehicles. The chassis will require proper testing for static and dynamic loads, fatigue and durability, etc to assess the prospects of packaging battery pack etc on the old chassis. Even though AIS-123 addresses these aspects in the respective models, its on-ground enforcement will be critical.

Build consumer awareness about quality of retrofitment: Customers need to do a thorough background check of the retrofitter including aspects such as the location of their workshop and

headquarters, certification and audits, whether their financials are capable of supporting the warranties they are offering on their components, especially the battery. Due diligence must be mandated to ascertain the retrofitter's supply chain feasibility and whether their vendor systems are capable of handling the particular request and also to find out whether the retrofitter is taking up projects based on their own technical expertise or has outsourced most of the work to third party with no quality control. These necessary checks have to be incorporated into regulation set up by the government.

Make state-level fiscal incentives performance linked for quality control and issues related to financing: As state governments are providing fiscal incentives, it may be linked with the performance and audit. Moreover, retrofitters also highlight the challenge of inadequate fiscal support and financing instruments for retrofitment, which is a common challenge in the EV sector. Several three wheeler retrofitters have pointed out that it is only recently that private financiers have begun to show interest in financing this strategy. In fact, one of the business models where retrofitters retrofitting a vehicle are also providing batteries on a rental basis has drawn interest of the financiers.

Frame comprehensive guidelines for state-level implementation: It will be beneficial if states have a national guidance framework for the implementation of retrofitment to guide the efforts and ensure effective quality control. This is important especially in view of the possibility of decentralized small enterprises and outsourcing of practices to third parties.

8. Need coordinated and integrated mechanisms for framing of legislation, standards and guidelines

Six years after first releasing the NEMMP, GoI recognized the criticality of batteries in the EV industry and the need for coordination across multiple agencies. It launched the National Mission on Transformative Mobility and Battery Storage (NMTMBS) in 2019. NITI Aayog, the public policy think tank of GoI heads the mission's Inter-Ministerial Steering Committee. The Steering Committee comprises representatives from the Ministry of Road Transport and Highways, the Ministry of Power, the Ministry of New and Renewable Energy, the Department of Science and Technology, the Department of Heavy Industry, the Department for Promotion of Industry and Internal Trade and Bureau of Industrial Standards.

The mission has been responsible for some of the flagship initiatives of the central government such as the FAME 2 scheme and ACC PLI.

The government also engages with bodies like Society of Indian Automobile Manufacturers (SIAM), Automotive Component Manufacturers Association of India (ACMA) and Federation of Indian Chambers of Commerce and Industry (FICCI) to elicit comments from industry stakeholders.

The multi-stakeholder aspect of electric mobility is reflected in the development of charging infrastructure. Each of the following bodies: Ministry of Power (MoP), Central Electricity Authority (CEA), State Electrical Regulatory Commissions (SERCs), Ministry of Housing and Urban Affairs (MoHUA), Urban Development Departments, Bureau of Indian Standards (BIS) have important roles to play in the expanding the network of charging stations across the country.

Similarly, in the context of R&D ecosystem, the Department of Science & Technology (DST) has published a white paper through consultative stakeholder discussions consisting of experts from Academia, Industry, Policy makers for creating a roadmap to provide clear pathways to significant R&D outcomes. This was followed by a release of an e-mobility R&D roadmap by the Office of Principal

Scientific Adviser. The culmination of these two reports along with three thematic R&D Roadmaps - batteries, power electronics and charging infrastructure resulted in creation of a dedicated funding program for academia-industry research collaboration.

9. Sub-national policy to drive adoption

All 28 States in India have notified electric vehicle policies which serve as policy instruments to advance the national electrification ambition. These policies offer incentives over and above the national incentive policy. Since electricity is a subject on the Concurrent List of the Constitution, both central and state-level bodies are involved in regulating electricity supply for EV charging.

Within the federal structure, state policies are expected to be uniquely designed according to local imperatives. This is reflected in the wide variety of targets set for the programmes, in different kinds of incentive structures, in varying combinations of instruments for demand creation and EV adoption, in diverse approaches to promote EV manufacturing and job creation, and in assorted funding strategies for market transformation.

There is a broad spectrum of policy approaches that have been adopted by the states and the general architecture of any state level electric vehicle policy in India includes: defined targets and mandates, demand and supply side incentives, support for charging infrastructure development, infrastructure support for promoting manufacturing and skill building, recycling and reuse provisions, and EV funding mechanisms, proposed institutional mechanism, and a periodic review mechanism.

The overall approaches of the sub-national policies vary considerably in design and quantum. But there is also a common ground. Some of the key highlights are as follows to indicate the scope of action at the sub-national level.

Target setting—set the overall target for fleet electrification by the end of the plan period; and a more stratified approach to setting targets for individual vehicle segments, charging infrastructure, investments and job creation.

Demand incentives have been broadly grouped as fiscal incentives and non-fiscal incentives. Fiscal incentives include purchase subsidy, tax exemption, interest subvention on loans, toll exemption, parking subsidy, scrappage/retrofitment and permit exemption.

Non-fiscal incentives include green or special mobility zones, preferential parking and public awareness strategies. These bestow preferential treatment to EVs without quantified monetary benefits. These may include allotting reserved parking, creation of low-emission zones and providing EVs an easy and free access to these zones, bans on polluting internal combustion vehicles (ICE), supporting workplace charging infrastructure etc. Non-fiscal incentives are intended to make owning an EV more convenient, and nudge consumers away from ICE vehicles by enhancing the perceived benefits of owning an EV. Many EV policies of the states in India have included the above mentioned non-fiscal incentives, considering their unique transport patterns and settlement geographies. Adopting these measures along with fiscal incentives will greatly aid EV adoption.

Charging infrastructure: Charging requirements and battery models which can be used, and have provided purchase incentives (along with other approaches such as reduced rates for land lease, etc.) for charging and support for electricity tariff for both distribution companies and consumers. To this is added the criteria for setting up networks of charging points and responsibility of agencies to provide charging facilities.

Industrial promotion incentives can be categorised into two categories - to develop EV manufacturing as part of the industrial plan of the state and to incentivize manufacturers to set up industries in the state. This includes stratified incentives based on the size of EV projects, with specific benefits for large, mega, and ultra-mega projects, including joint ventures for integrated automobile and battery plants. Capital subsidies are provided across the EV supply chain, with variations depending on the investment size, and some states offer additional subsidies for cleaner production or investments in specific sectors.

Tax and duty concessions are widespread, including exemptions or reimbursements for stamp duty, interest subventions, state GST, and road tax, along with interest-free loans and concessional registration charges. Infrastructure support covers subsidies for fixed power costs, electricity tariff discounts, subsidized water rates, and land conversion fee reimbursements, alongside incentives for effluent treatment, skill development, and marketing.

Startups receive prioritized support through funding, budget allocations, and infrastructure incentives. Land allocation is facilitated for EV parks with ready-made infrastructure, including water treatment plants, dedicated power lines, and EV quality test centers. Research and development are supported through

grants and funds for technology acquisition, with some states offering customized incentives for large-scale battery manufacturing.

Pilot projects related to clean energy management, wireless EV charging, and smart mobility solutions are being promoted to integrate electric mobility with broader transport planning. Overall, these measures aim to foster the growth of the EV manufacturing industry by addressing capital investment, infrastructure needs, and innovation.

Skill development and innovation programmes: States offer skilling and reskilling allowances for contractors and assembly line workers. Other approaches include setting up seed and venture capital funds, offering financial incentives for job creation, and contributing to employee provident funds. Additionally, there are provisions for employment incentives, skilling and reskilling programs, and allowances to support workers affected by the transition from ICE vehicles to EVs.

Recycling and reuse of batteries: While some states have taken steps to promote battery recycling through financial incentives, mandatory labelling, buy-back schemes, and the establishment of recycling units, others have yet to define specific strategies. Policies have emphasized labeling and collection schemes, while some have aims to set up Battery Industrialisation Hubs.

Dedicated EV funds: Very few states have provided for dedicated EV funds or have earmarked revenue sources to create that fund. The establishment of an EV fund represents a state's commitment to vehicle electrification. An EV fund may be set up through budgetary allocation or through a feebate scheme that aims to disincentivize ICEs. The capital city of Delhi has provided steps for creation of a dedicated fund that also includes the principle of polluter pay for ICE vehicles to meet the cost of EV transition. This includes the feebate concept—inefficient polluting vehicles to incur surcharge and efficient ones to receive rebate. State EV funds in Delhi are to be created from: Pollution cess on diesel (Air Ambience Fund); additional road tax on diesel and petrol vehicles on a sliding scale (diesel vehicles to pay higher and two wheelers lower); congestion fee on all trips with ride hailing and aggregator services (petrol and diesel vehicle trips); and environment compensation charge.

10. Circular economy: Enabling recycling of end-of-life batteries

As electric mobility is set to make significant inroads into the transportation sector in Africa, it offers a rare chance to make the system sustainable from the ground up — to maximise the recovery of battery material while ensuring that heavy metals and other problematic toxins from this e-waste do not end up in a landfill and contaminate the environment. This is also an important part of building material security.

Since many African countries are in the process of introducing clear policies supporting e-mobility, future End-of-Life (EoL) battery volumes from electric vehicles are hard to predict. While volumes will stay low to moderate for the next few years, there is bound to be an increase once the electric mobility sector gains market share.

Moreover, an estimated three million used EVs may arrive in Africa by 2050 from the countries of the Global North. In this context it is important to address the issue of battery circularity in Africa.

India is on the path to establishing a circular value chain and a battery recycling ecosystem (see Fig 9).

In India, the handling and managing of used batteries has been regulated since 2001 under the Batteries (Management and Handling) Rules. A big step further was taken with the notification of the Battery Waste (Management and Handling) Rules, 2022, which addresses concerns beyond lead acid batteries to include lithium-ion batteries from electric vehicles. The Rules bring within its ambit all manufacturers, producers, collection centres, importers, re-conditioners, refurbishers, dismantlers, assemblers, dealers, recyclers, auctioneers, vehicle service centres, consumers and bulk consumers.

The Rules said producers, which include battery manufacturers, importers and automakers that produce products with batteries, “shall have the obligation of Extended Producer Responsibility (EPR) for the Battery that they introduce in

the market to ensure the attainment of the recycling or refurbishing obligations".

This means they will have to collect, either directly or through third-party vendors, waste batteries from the market and ensure the collected batteries reach authorised recyclers and not end up being landfilled or incinerated. Producers will also be required to file an annual record of sales and buyback with the state pollution control board (SPCB) and ensure safe collection and transportation of batteries to authorised / registered recyclers.

The Rules have for the first time defined measurable targets for collection and recycling within a compliance timeframe. They have set a target of 90 per cent recovery of the battery material — 70 per cent by 2024-25, then 80 per cent by 2026, and 90 per cent after 2026-27 onwards.

Producers are expected to include 5 per cent of recycled material in the total dry weight of a cell by 2027-28, expanding to 20 per cent by 2030-31. In case of imported cells, the producer has to meet the obligation by getting the same amount of recycled materials utilised by other businesses or by exporting a similar amount of materials.

To ensure compliance with the obligations as well as safe and formalised recycling of batteries that are in use, the 2022 Rules mandated that the EPR registration system will be managed online on a portal by the Central Pollution Control Boards (CPCB). The portal will enable producers to engage a third party or recycler to collect and process the waste and will empower recyclers to issue EPR certificates to producers based on the quantity of battery they send for recycling. (see Figure 9: Battery recycling facility in Delhi NCR).

Figure 9: Battery recycling facility in Delhi NCR

source:https://lohum.com/media/news/yourstory-integrated-recycling-and-repurposing-battery-business-model/

11. EV charging infrastructure: Take away from India

Apart from demand incentives and supply-side policy, proliferation of charging infrastructure is the other crucial pillar of EV adoption. India has witnessed an exponential rise in the number of Public Charging Stations (PCS). According to the Bureau of Energy Efficiency (BEE), in 2021, there were only 451 PCS, but by June 2024, this number had surged to over 23,731.

Issue specific guidelines for EV charging; Delicense installation of EV charging stations: Electricity supply in India is a highly regulated market, with regulations at the central and state levels. The Ministry of Power (MoP) governs the provision of electricity connections for EV charging under a set of regulations and guidelines[7].

The MoP first issued guidelines and standards in 2018 for EV charging infrastructure. It delicensed the operation PCS by Charge Point Operators which was a major step in democratizing the charging infrastructure in the country, since it allowed anyone to set up a charging station (see Figure 8: Public charging station in India).

The Central Electricity Authority (CEA) introduced technical standards for charging stations in 2019. The guidelines by MoP have been revised from time-to-time with the latest version being released in early 2024. The newest guidelines recommend that in urban areas, at least one charging station should be available within a 1 km x 1 km grid by 2030.

Aiming to enhance localization in the charger manufacturer ecosystem, the PMP (phased manufacturing programme) for EV chargers mandates r 50 per cent domestic value addition for various charger sub-systems.

Provide fiscal incentives for charging infrastructure: Government subsidies for EV charging can be a great enabler for boosting adoption. The FAME I incentive scheme had a budget outlay of only ₹43 crore which was earmarked for the development of 520 charging stations.

The central government's FAME II scheme aimed to spur EV charging infrastructure by allocating ₹1,000 crore. This was aimed at providing location based subsidies to government entities ranging from 50% to 100% for 7,580 charging stations across the country.

Figure 8: Public charging station in India

Source: https://1charging.com/wp-content/uploads/2024/02/EV-Cars-in-India-min-1024x768.png

The new PM E-DRIVE scheme aims to support a total of 88,000 new fast charging stations—22,100 for four-wheelers, 48,400 for two and three-wheelers, and 1,800 for e-buses. The total outlay for charging infrastructure under the scheme is Rs. 2000 crore.

Moreover, the government has also reduced central tax (GST) from 18 per cent to 5 per cent on chargers.

In addition to central government policies, state governments have also been providing capital incentives, tax breaks, subsidized electricity tariffs and time-of-day rates to accelerate the development of charging infrastructure.

Assess user charging behaviour: EV charging includes the following scenarios- private charging, semi-public charging, public charging. It is important for policy makers to assess charging patterns for each vehicle segment to plan guidelines, tariffs and incentives to optimize charger utilization rates and minimize user charging anxiety.

Personal 2w and 4w mostly rely on home charging. The government amended the "Model Building Bye Laws 2016" to include requirements for parking spaces to be equipped with charging infrastructure in private and commercial buildings.

Semi-public charging occurs in the case of multi-unit dwelling(MUDs). According to housing trends in Indian cities, the percentage of MUDs to all dwelling units has been increasing [8]. MUDs are residential buildings that house several apartments in a single building or in several buildings that are part of a common complex.

In light of these trends, a large portion of the urban population can benefit from improved access to charging infrastructure if charger placement in MUDs is prioritized. Chargers in MUDs may be used by several houses, in contrast to single-

family home chargers, which are often utilized by only one household. This could result in increased utilization and greater profits for the charge station operator.

Manage emergence of diverse EV charging technology for various vehicle segments and use cases: There are a diverse range of EV chargers available in India including both AC and DC(fast charging) types, each corresponding to unique technical specifications(voltage/power levels) and standards. The AC chargers, such as Bharat AC - 001, Type-2 AC, and LEV AC (IS-17017-22-1. the DC charging standards, Bharat DC - 001, CHAdeMO, CCS-II, and two LEV DC versions (IS-17017-2-6 and IS17017-2-7)[9].

Bharat AC-001/Light EV Chargers have emerged as the most common charger, which are primarily designed for smaller vehicles like E-2Ws and E-3Ws.

For fast charging, the CCS-II standard has seen extensive adoption by auto manufacturers across India. This reflects a concerted effort among OEMs and charging point operators (CPOs) to establish a common, interoperable charger type for 4- wheeler passenger cars. A similar convergence towards a common fast charger for Light EVs is yet to emerge in the market in India.

The challenges faced by the EV charging ecosystem are the lack of charger interoperability, incidents of vandalism and theft and lack of reliable supply, especially in highway chargers.

Many African countries have initiated measures to boost charging infrastructure. The takeaways from India's experience include extending financial incentives to private CPOs, ensuring a robust compliance mechanism for localized manufacturing, sensitization of electricity distribution entities for supplying timely connections and innovative tendering models for renewable energy based charging systems.

12. Next steps

The transition to electric mobility presents a tremendous opportunity for a clean and low-carbon path in the African continent. With the dominance of used vehicle import and lack of local manufacturing to produce clean and fuel efficient ICE vehicles, it is imperative that African nations embrace the paradigm shift to EVs. Within Africa, individual countries will respond differently to policy resulting in different outcomes. Some of the key elements of this transition are already in place and lay down the foundation for future development. Ethiopia has become the first country in the world to ban the import of ICE vehicles. Countries like Togo, Ghana, Benin, Uganda, Tanzania, Rwanda and Kenya have passed tax incentives for EVs. Motorcycles,tuk-tuks and buses are driving the majority of EV uptake, especially in East Africa[10].

An innovative and dynamic policy landscape including regulations, standards, norms and guidelines is required to scale up EV adoption in the developing automotive markets of Africa. This document provides a snapshot of how India's EV adoption journey has responded to policy and regulatory action. It aims to serve as a guide and sensitise policymakers to develop well-rounded policies based on real-world experiences as a reference.

- Set ambitious and holistic targets to signal clarity of intent to industry and consumers
- Focus on public transport fleet electrification to maximise clean air and decarbonization benefits. Innovative models such as Gross Cost contracts contracts and payment security mechanisms can help scaling procurement by public and private fleet owners.
- Robust regulatory framework and standards should drive technology development of EV subsystems like battery, motor and power electronics
- Build EV technology testing infrastructure for ensuring compliance with safety standards
- Demonstrate policy consistency to crowd-in investments, encourage financiers and build confidence among early adopters of EVs

- Evaluate policy outcomes periodically and take incorporate learnings for next phase of EV promotion strategy
- Devolve policy implementation to federal units for better implementation
- Work towards interoperability of EV charging infrastructure through mandating standards
- Incorporate spatial planning and adopt EV-ready building codes to reduce charging anxiety
- Ensure Cross sectoral collaboration in policy making for convergence of outcomes across government bodies involved in financial disbursement, automobile and battery manufacturing, power sector, urban planning etc

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