E-Vroom! An Overview of the Electric Vehicle (EV) Sector in India

INTRODUCTION

The road transportation sector accounts for a significant proportion of global emissions, making electric vehicles ("**EVs**") a key focus area, including in India's union budget announced a few days ago (the "**Budget**"). Meanwhile, the Indian government remains committed to its national mission on transformative mobility and battery storage (the "**E-Mobility Mission**").[1] Over the last few years, a plethora of EV-related policies and laws has been introduced, spanning several discrete pivots, such as in respect of: (1) local manufacturing, (2) emissions and waste reduction, and (3) charging infrastructure and batteries. Accordingly, this note aims to highlight some of the key initiatives undertaken by the government in the Indian EV sector, along with existing concerns and future opportunities in such sector.

MANUFACTURING

The National Electric Mobility Mission Plan 2020 ("**NEMMP**") was launched in 2013[2] to achieve national fuel security by promoting hybrid vehicles and EVs in India. At the time, the government aimed to provide (i) fiscal and monetary incentives to encourage the nascent technology, as well as (ii) monetary support to potential buyers for the purpose of purchase. Accordingly, the NEMMP aspired to establish a roadmap for increased adoption of EVs in India, including in respect of sales targets.

In 2015, the Ministry of Heavy Industries ("**MHI**") launched Faster Adoption and Manufacturing of Hybrid and Electric Vehicles in India scheme I ("**FAME 1**"),[3] which focused on creating demand, technology platforms, pilot projects, and charging

[1] See here and here.

[2] See here.

[3] See here.

infrastructure related to EVs. However, even after substantial funds had been utilized over four years, an independent consultant evaluated FAME 1 along unfavorable lines, including on account of suboptimal performance in key targeted parameters – such as in respect of saving fuel and reducing carbon dioxide.[4] Accordingly, the MHI notified FAME 2.

Now extended until 2024, FAME 2 aims at providing incentives to: (i) buyers in the form of upfront reduction in the purchase price of EVs (including under income tax[5]), and (ii) support demand for a specified number of EVs across categories.[6] As per the last Budget, the government has almost doubled its budgetary allocation for FAME 2.

For the purpose of availing incentives provided under FAME 2, manufacturers need to increase their local sourcing of EV components as per phased manufacturing program ("**PMP**") targets.[7] In addition, the last Budget further increased the already-high customs duties on imports of semi-knocked down and built EV units, presumably to spur domestic production.

In 2021, the government approved the Production Linked Incentive ("**PLI**") scheme for (i) the automotive sector (which includes EVs),[8] and (ii) the manufacture of advanced chemistry cells ("**ACCs**").[9] ACCs are a relatively new technology with the potential to replace lithium-ion in EV battery production. Accordingly, pending further developments with respect to green hydrogen technologies, this PLI scheme aims to reduce both import dependance and battery prices, and ultimately, EV costs.[10] In addition to incentives provided by the central government, several Indian states have introduced EV-related manufacturing policies which include subsidies, exemptions, and other miscellaneous incentives.[11]

[4] See here.

[5] Section 80EEB of the Income Tax Act, 1961, as amended, provides tax deductions of up to INR1,50,000 on the interest paid on loan amounts in respect of EV purchases. Such deduction is available for individuals alone, albeit both for personal and/or business purposes until loan repayment.

[6] See here.

[7] Ministry of Heavy Industries, "Phased Manufacturing Programme to promote indigenous manufacturing of Electric Vehicles, its assemblies / sub-assemblies and parts / sub-parts / inputs of the sub-assemblies", February 11, 2022, available here.

[8] See here.

[9] See here.

[10] See here.

[11] For a list of state EV policies, see here.

EMISSIONS AND WASTE

The Draft National Auto Policy of 2018[12] (the "**Draft NAP**") had proposed making provisions for the banking and trading of carbon dioxide ("**CO2**") credits by vehicle manufacturers, where such credits awarded to a manufacturer may be: (i) used to compensate against debits, or (ii) traded/transferred among companies. The Draft NAP had also suggested that manufacturers should be allowed to form a pool to jointly meet their CO2 emission targets.

The Energy Conservation Act, 2001 (the "**EC Act**") was recently amended to improve upon the current framework for regulating energy consumption. Among other changes to the EC Act, the central government has now been empowered to specify a carbon credit trading scheme. Further, the scope of the EC Act has been expanded to include emissions by vehicles, as defined under the Motor Vehicles Act, 1988. Pursuant to the amendment, a failure to comply with prescribed standards will be punishable with a penalty of up to INR 10 lakh. Vehicle manufacturers in violation of fuel consumption norms will be liable to pay an additional penalty of up to INR 50,000 per unit sold.

Given the above, energy consumption standards may be specified for vehicles by the Bureau of Energy Efficiency ("**BEE**"), along with a carbon credit system for compliance with fuel economy regulations. Recent media reports[13] suggest that a national framework for trading in carbon is poised for a rollout this year. A draft blueprint for such a market,[14] prepared by the BEE, was released for stakeholder consultations in late 2021. In the future, charging systems could earn carbon credits for providing renewable energy to run EVs. Owners of EV charging stations ("**EVCS**") could then generate additional revenue from this parallel income stream.

Meanwhile, the Battery Waste Management Rules, 2022 (the "**BWM Rules**"),[15] replacing an erstwhile legislation,[16] were notified last year by the Ministry of Environment, Forest and Climate Change. Under the new BWM Rules (which cover EV batteries), producers, sellers, and importers (collectively, "**producers**") are required to collect and recycle/refurbish those batteries which they introduce into the market with 'extended producer responsibility' ("**EPR**") obligations. To meet such EPR obligations, producers may themselves engage or authorize any other entity. Further,

[12] Available here.

[13] See here.

[14] Available here.

[15] Available here.

[16] The Batteries (Management and Handling) Rules, 2001.

the BWM Rules aim to provide for an exchange of EPR certificates between producers and recyclers/refurbishers to comply with such obligations.

Moreover, the BWM Rules are intended to (i) encourage the setting up of new industries and (ii) promote new business opportunities and entrepreneurship with respect to: (1) the collection and recycling/refurbishment of waste batteries, as well as (2) using recovered material from such waste to make new batteries. By prescribing a minimum percentage of recovery, the BWM Rules hope to attract new technologies and investments in the recycling and refurbishment industry.

CHARGING INFRASTRUCTURE AND BATTERY SWAPPING

About a year ago, the Ministry of Power consolidated and issued revised guidelines/standards in respect of EV charging infrastructure,[17] last amended in November 2022.[18] The private sector is already investing in the manufacture and installation of EV-related supply equipment ("**EVSE**"), including with regard to charging and battery swapping technology. The Ministry of Housing & Urban Affairs amended the model building bylaws of 2016 to include enabling provisions for installing EV charging infrastructure in private and commercial building premises, including across core urban areas.[19] Further, the viability gap funding (VGF) for battery energy storage systems ("**BESS**") announced in the Budget will likely create additional critical infrastructure.

Meanwhile, the draft battery swapping policy, released for comments by NITI Aayog in April 2022,[20] may be finalized soon, according to media reports.[21] This policy may include a voluntary design standardization, pursuant to stakeholder requests made in this regard. Furthermore, in response to incidents of fire in e-two-wheelers,[22] amendments were introduced in respect of EV battery testing standards by the Ministry of Road Transport and Highways late last year.[23] A few months prior, the Bureau of Indian Standards had formulated performance standards for EV batteries.[24]

[17] See here.

[18] See here.

[19] See here.

[20] Available here.

[21] For example, see here.

[22] See here.

[23] See here.

[24] See here.

PRESENT AND FUTURE INNOVATIONS

The Center for Study of Science, Technology and Policy ("**CSTEP**") conducted a pilot project in 2021 (the "**CSTEP Study**")[25] to ascertain whether solar rooftop photovoltaic ("**SRTPV**") technology can be scaled up in Indian cities. Since India's power grid is still predominantly coal-based, CSTEP sought to demonstrate the use of solar energy for charging EVs. Among other advantages, the CSTEP Study found that SRTPV systems: (i) represent an economically viable technology for the purpose of sourcing clean energy, (ii) are easily installable on account of their modular design, (iii) provide a cost-effective alternative and/or supplement to conventional grid-charging, and (iv) may effectively balance the detrimental consequences of demand surges with respect to grid-based EV charging. Accordingly, CSTEP examined the commercial aspects and economic benefits with respect to the use of grid-connected SRTPV both *with* and *without* a BESS[26] to power EVCS.[27] In that regard, the CSTEP Study suggested that the mismatch between the generation and consumption of solar energy could be addressed by deploying net metering at EVCS.[28]

Nevertheless, the simultaneous electrification of road transport and deployment of decentralized renewables such as rooftop solar may make power grid distribution more complex to manage in the long run. Thus, even in a conservative scenario, big cities could face situations of grid congestion. Accordingly, digital grid and 'smart' charging technologies[29] may need to be employed. Reports[30] published in cooperation with NITI

[25] The report, titled "Solar Energy-Based EV Charging: A Pilot and Techno-Economic Study," can be found here. See the press release, "Clean Mobility: Study recommends electric vehicle charging stations powered by solar rooftop photovoltaic technology," CSTEP, Bengaluru, December 22, 2021, available here. Media reports about the CSTEP Study can be found here and here.

[26] For more on BESS, see here and here.

[27] This examination was based on a parameter known as the levelized cost of charging ("**LCOC**"). LCOC includes all costs incurred over the lifetime of an asset. LCOC was useful in the CSTEP Study to estimate the economic benefits of using solar energy and BESS for EV charging.

[28] Net metering or net billing enables the deduction of electricity produced on-site using renewable energy from the total electricity consumed in a billing period. This helps lower the consumer's electricity bill. The consumer would either need to pay for the difference in units or would get paid by an electricity distribution company/public utility for extra units at the end of the billing cycle. See "Residential EV Charging Guidebook," Report by Dialogue and Development Commission of Delhi (DDC) and WRI India, February 2022, available here.

[29] Smart charging software allows EV owners to plug in during expensive peak hours without the vehicle drawing power until cheaper (off-peak) hours. This eases strain on the electric grid, makes better use of renewable energy and saves money for consumers. In the absence of smart charging, electric grids may get overloaded. See here.

[30] Two reports were prepared by the Indian Institute of Technology, Bombay (IIT Bombay) in collaboration with the Florence School of Regulations Global (FSR Global), as part of the Nationally Determined Contributions - Transport Initiative for Asia ("**NDC-TIA**") initiative. The NDC-TIA is implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) and is funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety under its International Climate Initiative. The two reports are available here and here.

Aayog (the "**NITI Aayog Reports**")[31] recognize this contingency.[32] Smart charging with better load management facilities, usage based analytics, and automated payment – coupled with ultra-fast charging technology – enables consumers to usefully exploit battery storage and allows for increased uptakes of renewable energy.[33] In addition, developments in technologies such as portable charging stations and bi-directional charging will create new opportunities for the EVCS market. As the NITI Aayog Reports suggest, 'vehicle-to-grid' ("**V2G**") charging technology[34] enables EVs to store unused power and discharge it to the grid.

KEY FOCUS AREAS

Efficient Charging and EV Fleets

In China, more than two out of every five publicly available charging units are fast, signifying a substantially higher proportion compared to other EV markets. Indeed, the deployment of Chinese public charging infrastructure has been rapid, led by government subsidies and proactive developmental initiatives undertaken by public utilities. In turn, regulatory controls on electricity prices, along with a growing demand for public charging (stemming, in turn, from increased urban consumption), have improved the profitability of the EV charging business as a whole – including through a rise in new use patterns such as electric taxis, ride-sharing, and other public/logistical fleets. Further, the speed and scale at which EVSE has been rolled out in China has led to a substantial reduction (almost 70%) in manufacturing costs of the underlying charger modules for fast charging stations.

With rising sophistication and growth in the sector, access to public charging needs to evolve in commensurate fashion. Specifically, in the long run, the EV ecosystem must aspire towards a level of functionality which consumers are familiar with in terms of traditional vehicles. Yet, at present, most EV charging occurs at private hubs only. An appropriate number of chargers per EV will depend on local conditions and requirements, including in respect of real estate availability, median travel distances, population density, and a reliance on 'private' charging (at home or at the workplace). While private modes of charging are likely to continue in terms of matching a large part of the aggregate demand, the number of public chargers still needs to expand

[31] The NITI Aayog Reports undertake a global review in respect of integrating EV charging infrastructure with distribution grids, along with an analysis of India's gaps in this regard, and ultimately suggest potential policy measures towards improvement.

[32] Among other things, the NITI Aayog Reports acknowledge that smart charging represents a key solution in respect of achieving higher EV penetration with minimum grid upgrades, as well as to address issues related to congestion and voltage.

[33] See here.

[34] Comprising a system with bi-directional electrical energy flow between plug-in EVs and the power grid. This, in turn, improves the performance of electrical components and adds value for EV owners.

manifold. Moreover, planning for long journeys requires EV chargers to be both publicly accessible and fast performing. Unless consumers who lack the means to access private EVCS are appropriately incentivized, range anxieties[35] alone may continue to pose a significant obstacle in widespread EV adoption.

ZEV Mandates

Given that new registrations of EVs still account for less than a twentieth of annual sales, industry stakeholders have suggested that a regulatory mandate for Zero Emission Vehicles ("**ZEV**") may be necessary in India. Such a mandate may establish EV-related percentage targets for annual production/sales, along with a credit trading mechanism to generate additional income streams.[36] For instance, the EU, China, and several states in the US have adopted ZEV mandates with credit/offset-based elements along with financial penalties for non-compliance, leading to a significant growth in EV sales. The state of California, for example, which has more ZEV models than the rest of the US combined, has a percentage credit requirement, where such credits – awarded based on ZEV sales – can be traded.

Indeed, ZEV mandates globally have helped accelerate EV incorporation into mainstream transport, including by diversifying the range of products, providing roadmaps for innovation, pushing down prices, promoting investments in charging infrastructure, and generally building confidence among investors and consumers. Further, like in Europe, in order to increase electrification, India could redesign its extant fuel economy regulations[37] in a manner that champions technological innovation. That way, domestic manufacturers may be incentivized to make more EVs for the purpose of meeting fleet average norms.

Dependence on Imports for Raw Materials: Lithium

As evident from a 2022 press release issued by the Ministry of Mines,[38] India remains heavily reliant on imports from Hong Kong and China to satisfy local demand for lithium and lithium-ion (together, "**li-ion**") for the purpose of EV battery production. Li-ion accounts for almost 40% of the total cost of an EV. Due to supply chain issues and high import dependence, India's original equipment manufacturers ("**OEMs**"), and ultimately consumers, remain leashed to higher priced EVs relative to traditional

[35] As the name suggests, 'range anxiety' is the fear that an EV will not have enough battery charge to reach its destination, leaving its occupants stranded. This anxiety is particularly prominent when considering long-distance travel along stretches of road where EV charging points might be few and far between. See here.

[36] See here.

[37] See the fuel economy norms on the website of the Bureau of Energy Efficiency, Ministry of Power, available here.

[38] See here.

vehicles. This keeps the Indian EV industry susceptible to global supply chain disruptions.[39]

Another major barrier to India's EV growth is the country's poor access to key raw materials such as lithium, nickel, cobalt, and manganese, which collectively account for 80% of EV cell costs. India not only has low lithium and cobalt reserves, but it also lacks necessary mineral refining capabilities in this regard.[40]

CONCLUSION

To address India's reliance on li-ion imports, local battery manufacturing plants and OEMs could develop their in-house capabilities further, including through foreign partnerships, alliances with global technology players, and joint ventures and acquisitions. Metal and mining companies could also invest towards refining their capabilities and acquiring global resources. Meanwhile, technology-led start-ups in India have already started foraying into cell/battery manufacturing. Ultimately, developing indigenous EV cell technologies at scale and suited to local climatic conditions remains a critical requirement, including for reasons of passenger and vehicular safety. Like China, India needs to continue focusing robustly on R&D and attract more FDI in the sector.

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[39] See here.

[40] See here.