# ELECTROMOBILITY & INDIA

# OPPORTUNITIES FOR ENGAGEMENT

Confederation of Indian Industry

SWEDEN - INDIA BUSINESS COUNCIL

SWEDISH SMARTGRID.SE
FORUM FÖR SMARTA ELNÄT

# ELECTROMOBILITY & INDIA:
# OPPORTUNITIES FOR ENGAGEMENT

# ABOUT

**SWEDISH SMART GRID FORUM**

The Swedish Smart Grid Forum is an initiative of the Swedish Government. It is led by a steering group with representatives from authorities, academia and industry. The Swedish Smart Grid Forum also works closely with the Swedish Energy Agency.

The mission of the Forum is to develop dialogue and enable actions towards a smarter grid. A digitalized, flexible and interactive electricity system will make it possible to use energy more efficiently. It will also enable integration of an increased share of renewable energy production, including small scale production. Smart grids empower consumers and give all stakeholders in the electricity market the opportunity to contribute to a sustainable energy system.

**SWEDEN INDIA BUSINESS COUNCIL**

The Sweden-India Business Council (SIBC) is the first-choice network for growing business between Sweden and India.

Established in May 2003, SIBC now grows rapidly every year adding small, medium and large companies as members. SIBC arranges focused meetings, roundtables and more with high value in terms of knowledge and time.

As a result of discussions between the Swedish and Indian Business Community in 2002, and MOU was signed between the Confederation of Indian Industry (CII) and the Confederation of Swedish Enterprise to form SIBC. Since then SIBC has also signed a collaboration agreement with federal Chamber of Commerce and Industry (FICCI) in India.

SIBC works with the Swedish Smart Grid Forum, and CII to develop and deploy the Government of Sweden's strategy for smart grids for India. SIBC is the co-secretariat of the India Sweden Business Leaders Roundtable (ISBLRT) together with CII. ISBLRT is chaired by Marcus Wallenberg, Chairman, SEB and Baba Kalyani, Chairman and MD, Bharat Forge.

## CONFEDERATION OF INDIAN INDUSTRY

Confederation of Indian Industry

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, playing a proactive role in India's development process. Founded in 1895, India's premier business association has more than 9100 members, from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 300,000 enterprises from 291 national and regional sectoral industry bodies.

CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes. Partnerships with civil society organizations carry forward corporate initiatives for integrated and inclusive development across diverse domains including affirmative action, healthcare, education, livelihood, diversity management, skill development, empowerment of women, and water, to name a few.

India is now set to become a US$ 5 trillion economy in the next five years and Indian industry will remain the principal growth engine for achieving this target. With the theme for 2019-20 as 'Competitiveness of India Inc - India@75: Forging Ahead', CII will focus on five priority areas which would enable the country to stay on a solid growth track. These are - employment generation, rural-urban connect, energy security, environmental sustainability and governance.

With 68 offices, including 9 Centres of Excellence, in India, and 11 overseas offices in Australia, China, Egypt, France, Germany, Indonesia, Singapore, South Africa, UAE, UK, and USA, as well as institutional partnerships with 394 counterpart organizations in 133 countries, CII serves as a reference point for Indian industry and the international business community.

# FOREWORD
## SWEDISH SMART GRID FORUM

**Maria Sandqvist,**
**Executive Director, Swedish Smart Grid Forum**

The Swedish Smart Grid Forum is a government authority, appointed by the Swedish Ministry of Environment and Energy. The Forum's mission is to strengthen the capability for smart grid solutions in the future. Digitized, flexible, and interactive grids will make it possible to use energy more efficiently. And this is something we all need to focus on, as we work towards the Sustainable Development Goals and Agenda 2030. Sweden cannot work alone with this objective. International collaboration in this process will be critical.

The Swedish Smart Grid Forum has identified India as one of the key markets with which to work and began discussions with India in 2016. The India Sweden Smart Grid Workshop at the India Smart Grid Week was the opening of a dialogue between stakeholders in both countries, about the steps we can take to work towards a smarter grid.

In 2019, the Swedish Smart Grid Forum has focused on the possible bridges between India and Sweden in the area of electromobility and the associated infrastructure. Sweden and India share many commonalities in the challenges and opportunities ahead. We both have ambition targets for decarbonizing transport and meeting both the needs of our citizens as well as that of the climate.

This toolkit was put together through primary stakeholder engagement, roundtables held with sector leaders and secondary data collection and undertaken by the team from the Forum, SIBC, and CII.

# FOREWORD
# CONFEDERATION OF INDIAN INDUSTRY

**Chandrajit Banerjee**
**Director General, Confederation of Indian Industry**

Mobility has seen disruptive growth across the globe over the past few years. This has been triggered by growing population, urbanisation, smarter cities, connected technologies, conscious consumerism, and a need to travel quickly, but also safely and efficiently.

India in its effort to reduce vehicular pollution, address energy security concerns and reduce its rising imports bills has embarked on a mission to provide and encourage the adoption of vehicles which run on clean fuel and to shift towards a future ecosystem which is sustainable. Reduction of toxic emissions from private and public transport hinges strongly upon increased sales of alternatively-powered vehicles such as electric, hybrid, fuel-cell, bio-fuel, ethanol and natural gas-based. To pave the way for India's transition to a cleaner and sustainable mobility ecosystem, the Government of India has outlined its vision for the future of mobility in India based on 7Cs – Common, Connected, Convenient, Congestion-Free, Charged, Clean and Cutting-Edge. Supportive policies like FAME II, National Policy on Biofuels, and National Electric Mobility Programme and initiatives like GST reduction on EVs and charging infrastructure will augur well for India's mobility transition.

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes. CII is a non-government, not-for-profit, industry-led and industry-managed organization,

playing a proactive role in India's development process. CII through its focused committee works to ensure moving towards a sustainable means of transportation in India, to reduce cost and ensure secure supplies of raw materials for local manufacturing of storage batteries.

It is encouraging to know that Sweden is moving towards sustainable and energy efficient transportation and has done commendable work in this space. To realise the vision of India's mobility transition, CII has been actively working with the Swedish Smart Grid Forum (SSGF) and Sweden India Business Council (SIBC) to identify key opportunities for collaboration in the electromobility sector. I am happy to share the report on "Electromobility & India Opportunities for Engagement" which has been developed by SSGF and SIBC in partnership with CII. The report, based on stakeholder engagement, roundtables, and detailed secondary research, provides a snapshot of the EV market in India and focuses on five states which have come out with their EV policies– Andhra Pradesh, Delhi, Karnataka, Kerala, and Maharashtra. It specifically highlights the areas of opportunities, collaborations and business models for Swedish SMEs and discusses a few case studies of the key stakeholders in India.

We will continue our engagement with Sweden as we move ahead in our mobility transition journey.

# CONTENTS


| | |
|---|---|
| EXECUTIVE SUMMARY | **01** |
| INDIA OVERVIEW | **03** |
| POLICIES AND INCENTIVES | **08** |
| EV GOVERNANCE LANDSCAPE AT THE STATE LEVEL | **14** |
| MARKET ENGAGEMENT | **30** |
| KEY TAKEAWAYS WITH A VIEW ON INDIA | **41** |
| REFERENCES | **45** |

# EXECUTIVE SUMMARY

This report is the result of an ongoing partnership between the Swedish Smart Grid Forum, Sweden India Business Council and the Confederation of Indian Industry. It is the findings of discussions with key stakeholders in the Indian electromobility ecosystem both in April and November 2019. The target for this report is Swedish small and medium-sized companies. Understanding the Indian marketplace can be overwhelming and take time. This report aims to provide a picture of the situation today, with respect to electromobility and the associated ecosystem.

India's electromobility ambition is triggered by issues of energy security, the visible impacts of increasing air pollution, and a commitment to international climate goals. 2018-2019 has been a big year for the electric vehicle (EV) sector in India. A consecutive series of policy and government actions have made clear the commitment to an EV future. India has committed to having 30 per cent of all new vehicles on the road being electric by 2030. In order to make this happen, vehicles will need to be supported with manufacturing incentives, charging infrastructure, and friendly power tariffs along with building capacity and a skilled workforce. Today India is the fourth largest automotive market in the world, and the sector employs approximately 37 million people. Making the shift to electric will require changing this existing landscape, by bringing in new components, developing effective charging infrastructure and ultimately changing business as usual on the roads.

India's policies actions take place within a larger backdrop of falling growth rates and increased urbanization. India's unemployment rates have also been increasing over the past two years and a strong focus is now on re-skilling a traditionally agricultural population. For this reason, most national policies, irrespective of the sector in focus, have a strong localization component to them. The Make in India campaign, launched by Prime Minister Modi in 2014, was a response to these challenges of domestic growth within an interconnected global economy. The Faster Adoption and Manufacturing of Electric Vehicles in India (FAME), the most

impactful national policy with regard to electromobility is no different. It echoes the need for a strong local manufacturing and skill base, but also the need for support and partnership at the international level. The strong participation of the private sector will be required to realise these policy directives. Given the importance of the private sector, policies like FAME are developed in close association with market stakeholders. Collaboration between, and iterative feedback from, Ministries, and within lobby organisations and expert bodies are built into the policy process.

India has 29 states and 7 Union Territories, each having their own set of strategies for local growth and development. For this reason, policies taken at the central level need to be considered together with actions taken at the state level. The EV discussion is no different. We have selected 5 states that were the first to come out with dedicated EV Policies and focus on the incentives and subsidies being put forward for key actors - Andhra Pradesh, Delhi, Karnataka, Kerala and Maharashtra.

While there is a strong push to develop an enabling ecosystem for electric vehicles, today there are 750,000 registered electric vehicles sold, which is less than one percent of overall vehicles, and of these 2 wheelers and 3 wheelers dominate. The price of vehicles is still a large barrier to uptake, due to the overwhelming cost of the battery. For this reason, battery swapping and fleet operators, like India's domestic Ola, are currently the centre for successful business models. Addressing the issues of range anxiety, the role of the distribution utility and the need for a stronger understanding of potentials for home-charging will be the focus of the next steps for the electromobility space.

We close this report by providing some key recommendations about what to look out for, if interested in the Indian electromobility marketplace. SME companies are, in general, unlikely to directly be affected by policy decisions. Most business will be done with and through Indian actors. But as is the case with with market players such as Mahindra & Mahindra, one of only two domestic original equipment manufacturers (OEMs) at present offering electric vehicles, policy incentives will play a strong part of business decisions

With new actors entering the market, India's electromobility scenario is at the tipping point. New products, a focus on battery development, and private sector ownership of charging infrastructure will all play into the maturity of this sector.

# 2
# INDIA OVERVIEW

## MISSION SETTING: GOING ELECTRIC

India's leadership and willingness to incorporate renewable energy, and electric vehicles is underlined by the country's rapidly growing population and steadily increasing per capita demands on energy. In 2018-19, the country's oil import dependence was 83.7 per cent of total energy supply, compared to 3 per cent in Sweden and 55 per cent as an EU (28) average[1]. In India, transport accounts for one fifth of this[2]. India's GDP has been growing on an annual average of 6 per cent between 2008 – 2018, making it one of the fastest growing economies globally. The growth in per capita incomes has a direct and positive correlation to energy demand. India's per capita electricity consumption has grown from 98.06 KWh in 1971 to 1181 KWh in 2018[3]. With a population of 1.3 billion,one third of which continue to rely on biomass as primary energy source[4], energy demand is likely to continue increasing India has set a target of achieving 175 GW of installed renewable energy by 2022. Between 2013 – 2019, the country's installed renewable energy capacity has increase from 28 GW to 83 GW[5].

Air Pollution is another critical, and tangible trigger factor in the move to EVs. In 2017, more than one million people died of air pollution related illnesses in India. In 2018, twenty-two of the thirty most polluted cities in the world were in India[6]. The move to electric vehicles, and away from diesel and petrol is seen to be a positive factor to decreasing carbon emissions and improving pollution levels. Breathe India, launched in 2017 by the country's planning commission – Niti Aayog- made clear the parallels the country drew between reducing air pollution and the role of electric mobility solutions.

# MAKE IN INDIA NEEDS AN AUTOMOTIVE MANUFACTURING BASE

In 2018 India's manufacturing sector contributed to 16 per cent of the country's GDP. Manufacturing has been a critical component of the Indian economy since Independence[7]. Taking on the role of building the country, the manufacturing sector is seen to be one of the backbones of employment for the country.

Hon'ble Prime Minister Modi's Make in India Mission aims to increase domestic employment through a) manufacturing and b) re-skilling. Make in India (MII) is the underpinning agenda across all politics and programmes, with the core focus on increasing India's contribution to GDP from manufacturing to 25 per cent by 2025. The role of the automotive sector in India will be an integral part of reaching these numbers.

India has the world's fourth largest automobile market and the sector contributes 7.5 per cent of the country's Gross Domestic Product (GDP). Two wheelers make up seventy-five percent of the market. India's annual production of vehicles in 2018 was 29.08 million. The country's auto component industry accounts for 2.3 per cent of India's GDP and employs over 1.5 million people.

The Automotive Mission Plan 2016-2026 (AMP 2026) put forward the country's ambition to become a global hub for design and manufacturing automobiles. AMP 2026 committed to creating an automotive sector that will employ 65 million people by 2026 and push the sector's contribution to GDP up to 12 per cent[8].

However, since September 2018, India's traditional automotive sector has seen a severe slowdown in growth by over 20 per cent and overall GDP growth stands at 5.6 per cent from a high of 8 per cent in 2016. Changes in regulatory requirements to align closer to norms like Euro VI, the increasing price of energy, and the relative lack of liquidity in the banking sector have all been contributory factors to the downward trend in sales. This has both positive and negative impacts on the move to electric.

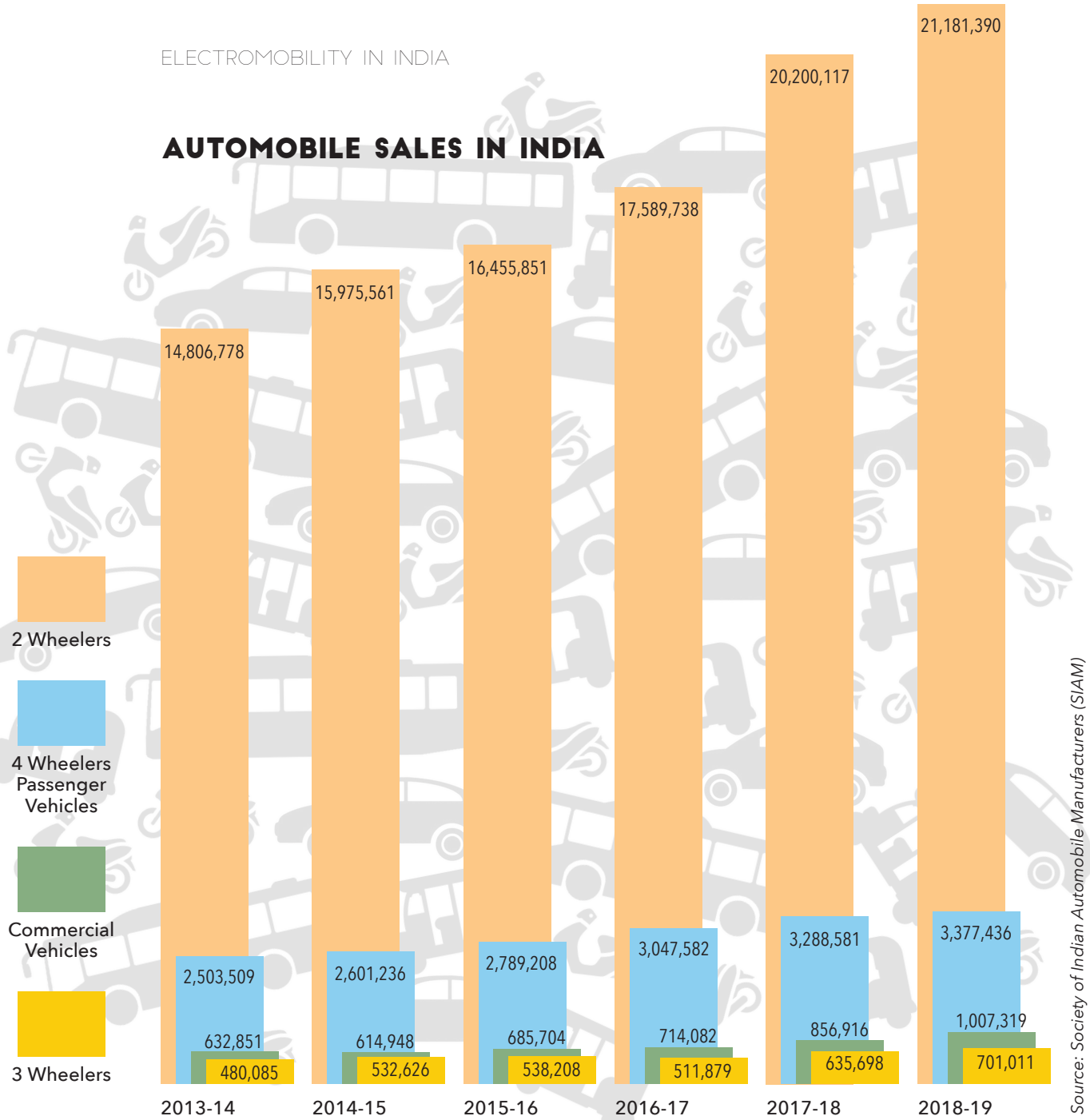
Original equipment manufacturers (OEMs) will be forced to make production more efficient, leaner and in response to a willingness to pay. The growth of millennial buyers, many of whom prefer not to own vehicles but rather ride share and have a stronger openness to electric than their parents will impact market dynamics[9]. The relationship between OEMs and Fleet operators will be a strong enabling factor in the growth of the EV market and optimizing output.

For Sweden, and international SME actors looking to engage in the electromobility sector, it will be critical to choose routes of market entry that have the least points of friction. Make in India definitely provides multiple benefits to those companies who have reason to manufacture domestically.

100 per cent Foreign Direct Investment is permitted in the automotive and infrastructure sectors. In the short term, and in response to falling growth rates, India has opened up its import market extensively. In the area of electric vehicles, taxes have been reduced for vehicles and component parts to 5 per cent. But traditionally product engagement that involves imports face a more difficult entry process. As the sector matures, it will not be surprising to expect that market entry regulations will also evolve.

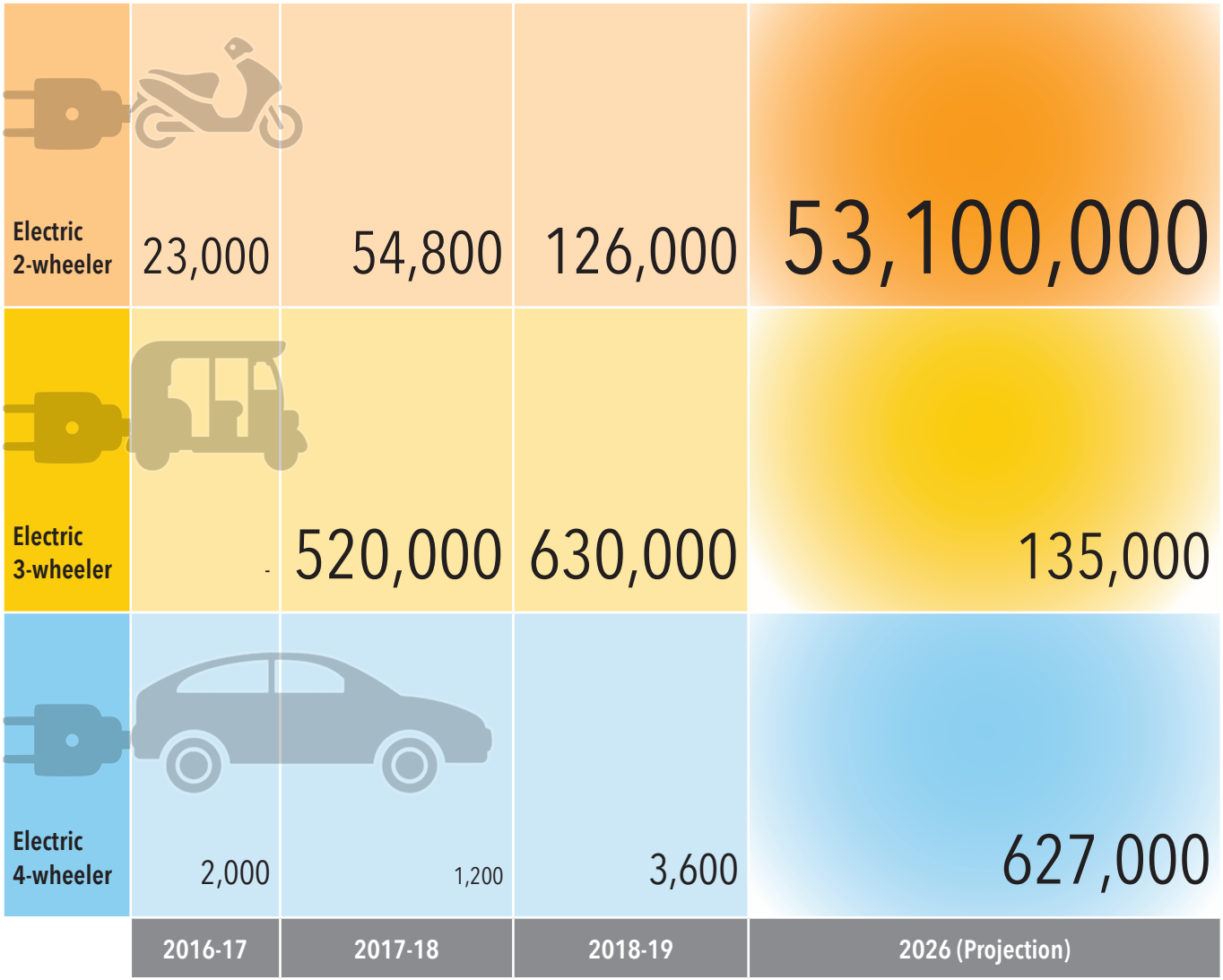
Finding strong local and credible partners, who can help navigate the maze of central and state level policy will continue to be an important first step for Swedish companies, looking to engage in the EV ecosystem in India.

## AUTOMOBILE SALES IN INDIA




*Source: Society of Indian Automobile Manufacturers (SIAM)*

## EV SALES IN INDIA BY VEHICLE TYPE




*Source: Society of Manufacturers of Electric Vehicles (SMEV)*

# 3 POLICIES AND INCENTIVES

India has a federal system of government, with 29 states and 7 union territories. Union territories are of strategic importance for the country and are administered by the Central Government. According to the Indian Constitution all policy matters are handled by either the central government, which is the Union List, or the state government known as the State List but some are handled in joint governance by both the central and state governments. This is known as the Concurrent list. Electricity is a concurrent subject, and as such under the jurisdiction of both the centre and respective state. As can be seen from the table of *Ministries and Associations involved in EV rollout* at the Central Level, there are a number of Ministries engaged with policy development and deployment in the EV sector. Combine this with a similar number of state level actors, including utilities, road transport authorities, and municipalities. There will need to be a high degree of stakeholder engagement and consensus building in order to achieve deployment.

'Missions' in the Indian context are vision documents, laying out ambition and policy direction at the central level. Missions are then reflected in policy at the state level. Should Missions detail out subsidies and incentives, that are available with Central Ministries, this will then be rolled into state level policy budgets. FAME is one such central level policy, with incentives for manufacturing of electric vehicles, that states have rolled into their electric vehicle policy offerings.

## GOVERNANCE OF THE ELECTRICITY SECTOR

India's EV rollout ambition has been a very 'outside in' operation. The discussion on vehicles and charging infrastructure have taken place before the discussion about grid stability, distribution efficacy and capacity to engage with grid integration. This is somewhat understandable when looking at the operational efficiency of the

state level distribution companies. Only 20 per cent of India's state level distribution companies are private.

Generation of electricity is a monopoly activity by the Central Government. States are responsible for transmission of electricity and state-owned distribution companies (discoms) undertake last mile distribution of electricity. State Electricity Regulatory Commission are autonomous bodies with the mandate to set tariffs across generation, transmission and distribution, facilitate interstate transmission and act as final arbitrator for disputes within the sector in the state.

Transmission and distribution losses have been a chronic concern for discom management. The average T&D loss, in 2016 stood at 23 per cent[10]. The state of the grid is a concern for electromobility rollout, and a lot of attention has been focused on trying to help state actors to improve their technical and financial management and the local level with schemes such as The *Ujwal Discom Assurance Yojana* which focuses on restructuring debt and targets management practices.

## MAIN POLICY ACTIONS TOWARDS ELECTROMOBILITY ROLLOUT

### NATIONAL ELECTRIC MOBILITY MISSION 2020 (NEMMP 2020)

The National Electric Mobility Mission Plan launched in 2013[11] set out the long-term roadmap for India's move to electric. It set out the ambition to have 6-7million hybrid and electric vehicles on the road by 2020. The NEMMP 2020 was developed around, and extended from, the Automotive Mission Plan, that aimed to make India a global automotive hub by 2026. The stated reasons for the focus on electrical mobility were; reducing the import dependence on fossil fuels, increasing cost of crude, and the positive impacts on climate change. The NEMMP 2020 focused on overcoming the barriers of EV adoption through demand side incentives, policy subsidies for manufacturing and R&D, and developing collaborative bureaucratic processes at the central level. This was to be the basis to guide all subsequent initiatives and schemes.

**FASTER ADOPTION AND MANUFACTURING OF (HYBRID) & ELECTRIC VEHICLES I (FAME I)**

As part of the NEMMP 2020, FAME I[12] put forward a structured set of incentives to support the development of both hybrid and electric vehicles. FAME I focused on 4 areas i.e. Technology development, Demand Creation, Pilot Projects and Charging Infrastructure. Demand creation was to be developed by providing subsidies to OEMs for the upfront purchase prices of vehicles. OEMs that met the eligibility criteria, were able to sell at subsidized prices from April 1, 2015. Benefits were available to all manufacturers of electric and hybrid vehicles.

Most notably, Mahindra & Mahindra, one of the country's largest vehicle manufacturers, seized the FAME I subsidy for its e20 electric car. From April 15, 2015 the e20 was available at a 16 per cent reduced price, due to the incorporation of FAME.

**FASTER ADOPTION AND MANUFACTURING OF (HYBRID) AND ELECTRIC VEHICLES II (FAME II)**

FAME II, launched in March 2019[13] is proof that Government policies are not written in stone, but rather works in progress. FAME II is the outcome of learning from market feedback and government objectives. The revised policy puts emphasis on barriers to demand. The subsidies available are linked to battery size, localization of the product to both reduce costs and increase indirect socio-economic benefits. Subsidies are not available for lead-acid batteries and only lithium-ion.

FAME II increased the budget focus on electrical vehicles. Compared to a government outlay for FAME I of $ 74. 7 million, FAME II has a budget of $1.4 billion. FAME II has the same overarching objectives as its predecessor but with some specific changes. A focus has been placed on 2-wheeler and 3-wheeler vehicles and public buses.

## OVERVIEW OF FAME II

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|---|---|
| National Electric Mobility Mission Plan - 2020[14] | Overarching vision document for Electromobility rollout<br>Aim to have 7 million EVs by 2020<br>Put in place demand incentives to create consumer willingness for electric<br>Emphasis on the importance of Pilots to develop consumer confidence |
| Faster Adoption and Manufacturing of (Hybrid) and Electric Vehicles in India – April 2015[15] | Market Road Map for deployment of electromobility through; technology development, demand creation, pilot projects, charging infrastructure<br>Phase I FY 2015-2017 and extended after review<br>2015-16; $10.6 million<br>2016-17; $20.3 million<br>2017-18; $23.3 million<br>2018-19; $20.5 million<br>Focus on all EVs including Hybrid<br>Push for standard setting for charging Infrastructure and discoms to provide priority charging infra for electric vehicles |
| Faster Adoption and Manufacturing of (Hybrid) and Electric Vehicles in India Phase II – March 2019 | April 2019 – April 2022- $1.4 billion<br>Demand incentives;<br>• 2w - $28 for 1 million vehicles<br>• 3w - $705 for 500,000 vehicles<br>• 4w - $2117 for 35,000 vehicles<br>• Bus - $70,600 for 7000 vehicles<br>OEMs eligible will need to have domestic manufacturing, and subscribe to localization requirements that will be notified by the government<br>Auto component parts have also been notified for phased localization and import tax as part of Phased Manufacturing Programme – includes batteries. |
| July 2019 Budget Allocation[16] | • GST on EVs reduced from 18 % to 5 %<br>• Income tax reduction of up to $2118 on the interest paid on EV loads<br>• Import duties reduced for batteries<br>• Increase in price of diesel and petrol to enhance demand incentive for EVs |

## MINISTRIES INVOLVED WITH EV ROLLOUT IN INDIA AT THE CENTRAL LEVEL

**PRIME MINISTER'S OFFICE**

**NITI AAYOG**

Formerly the Planning Commission, Niti Aayog is tasked, in an advisory capacity, to develop integrated roadmaps for effective rollout of EVs including Zero Emission Vehicles; towards a policy framework; India's electric mobility transformation. Chair of Energy Storage Mission Executive Committee of National Mission on Transformative Mobility and Battery Storage

| MINISTRY OF ROADS, TRANSPORT AND HIGHWAYS | MINISTRY OF HEAVY INDUSTRIES & PUBLIC ENTERPRISES | MINISTRY OF FINANCE | MINISTRY OF POWER & RENEWABLE ENERGY |
|---|---|---|---|
| Responsible for formulation and administration of the rules, regulations and laws relating to road transport, transport research and in also to increase the mobility and efficiency of the road transport system in India | Administers public sector enterprises (PSEs) and assists them in their effort to improve capacity utilization and increase profitability | Handles financial oversight and budget setting on all questions | Ministry of Power handles generation, transmission, distribution of grid infrastructure.<br><br>The Ministry of New and Renewable Energy is the nodal Ministry of the Government for matters related to renewable energy. Owns and deploys the country's 175 GW renewable ambition |
| Contributory to NEMMP | Framework Ministry for National Electric Mobility Mission Plan, 2013 (NEMMP) | Contributory to NEMMP | Contributory to NEMMP |
| Part of FAME Exec Committee | Ministry in charge of the overarching FAME I and II policies to promote EV ecosystem in the country. | Part of FAME Exec Committee | Part of FAME Exec Committee |
| Part of Energy Storage Mission Executive Committee | Part of Energy Storage Mission Executive Committee | Part of Energy Storage Mission Executive Committee | Responsible for development of National Energy Storage Mission to facilitate EV rollout, June 2019. Focus on; integrating renewable energy with distribution and transmission grids; setting Rural micro grids with diversified loads or stand-alone systems; and developing Storage component of electric mobility plans |

## ASSOCIATIONS INVOLVED WITH EV ROLLOUT IN INDIA

| | |
|---|---|
| Society of Indian Automobile Manufacturers (SIAM) | National Membership Association for market promotion and organizer (together with ACMA and CII) of Annual AutoExpo.<br><br>As representative of main ICE vehicles, SIAM has pushed back on Niti Aayog's recommendation to be all electric by 2026. National slowdown in the autosector and the move from Bharat Stage IV to VI has created a wary domestic auto industry.<br><br>Executive Committee made up of industry representatives. Current Chairman from Mahindra&Mahindra |
| Automotive Research Association of India (ARAI) | Autonomous but affiliated with Ministry of Heavy Industries & Public Enterprise.<br><br>Assists with certification / standardization of vehicles as per Government of India norms.<br><br>Publishes Auto Industry Standards<br><br>As per rule 126 of the Central Motor Vehicles Rules 1989 (CMVR) ARAI is an approved entity for the certification of new vehicles on the road, including electric. |
| Automobile Component Manufacturers Association (ACMA) | National Membership Association for auto component manufactures.<br><br>Focus on business development, government regulations and advocacy, Skilling, and international alliances.<br><br>Headquartered in Delhi but has regional offices in the North, South, East and West of the country.<br><br>With the auto component sector accounting for 3 million jobs in 2018, and $55 billion, ACMA is focused on a gradual transition to electric that will not cause short term shocks to the robust domestic sector.<br><br>Executive Committee made up of industry representatives. |
| Society of Manufacturers of Electric Vehicles (SMEV) | National Membership Association for the promotion of electric vehicles.<br><br>Focus on policy engagement with government and business development.<br><br>Pushing for Electric Policy at the Central Level to help provide reassurance to ecosystem stakeholders. |
| Bureau of Indian Standards (BIS) | National agency for standards.<br><br>Standards developed for chargers (BSJJ), Lithium-ion batteries, and ongoing work being done with Department of Science Technology for upcoming standards in charging infrastructure<br><br>Part of Energy Storage Mission Executive Committee |

# 4
# EV GOVERNANCE LANDSCAPE AT THE STATE LEVEL

India's electromobility ambition relies fundamentally on the uptake of the private sector. While policy actions are being taken to create an enabling environment, the role of market aggregators and enablers will be fundamental to affect vehicle rollout. Policies that are developed at the Central level will need to be mirrored by actions taken at the state level. Pan National actors like Energy Efficiency Services Limited (EESL) have been able develop tenders and pilots that help push the market forward.

The five states selected have been first movers in the electric vehicle space. They all have policies for electric vehicle rollout and see the strong market opportunities in developing a localized ecosystem for component parts and battery development. Each state has an investment facilitation cell, that provides support for interested actors looking to understand the opportunities that can be provided. Special economic zones (SEZs) are present in all states. Given the somewhat complex regulatory and clearance structure for registration and setup in India, SEZs provide one-stop clearances, periods of lower taxation and a number of incentives to help business develop.

When looking at engaging at the state level, the role of the state distribution companies will need to be taken into account. Most states have more than one discom serving different geographies. Credit worthiness ratings are now in place, as part of the financial and management rehabilitation package offered to public discoms. This also acts as an incentive for discoms to encourage investments and partnership.

## ANDHRA PRADESH

The South Indian state of Andhra Pradesh[17] has 49.6 million people and covers an area of 160,205 square kilometers. Its Electric Vehicle policy was introduced in May 2018 with an objective that, by 2030, all commercial vehicles will be electric. The state government has estimated that the incentives offered across the EV ecosystem will create investment opportunities of up to $ 23 billion.

The Invest Arm of the state; the Andhra Pradesh Economic Development Board has signed Memorandums of Understanding with Kia Motors for the manufacturing of 300,000 vehicles per year, as with EESL for the deployment of 100,000 vehicles over 5 years with a support of $520 million[18]. Tecchren Batteries, a subsidiary of US based Tecchren Inc. has committed to establishing 200 MWh battery manufacturing units in Sri City, Andhra Pradesh, with an annual unit production ambition of 700,000 lithium ion batteries per year. Tecchren's investment to date has been $ 62 million[19].

In 2014 the state of Andhra Pradesh was divided, creating Telangana and Andhra Pradesh. This very recent division has been an economic setback for the state. This can make AP an attractive option for engagement, as the state agencies and departments are aggressive in their desire to bring in investment in a supported and stable manner.

There are three discoms[20] in AP and all are public, serving the central, eastern and southern regions. All have an A credit rating.

A CASE TO STUDY

## ENERGY EFFICIENCY SERVICES LTD. (EESL)

## DEBUNKING MYTHS WITH MARKET DESIGN!

Set up in 2009, EESL[21] is a joint venture of four National Public Sector Enterprises – NTPC Limited, PFC, REC and POWERGRID, and was set up under Ministry of Power. EESL is a Super Energy Service Company (ESCO) and the world's largest ESCO.

In India, EESL has been a key player in moving the electromobility market forward by i) identifying gaps in market confidence ii) establishing pilots to shift market mindset iii) providing long-term financing to develop pilots for new energy market projects iv) developing tenders through opportunity analysis for state governments with a commercial market mindset.

**Vehicles –** In order to address the need to build consumer confidence in electric vehicles, with specific focus on the concern about range anxiety, EESL took on the role of buying and leasing cars, on a hire purchase agreement for 6 years for government officials in Delhi. EESL provided operations and maintenance of the vehicles and set up charging infrastructure in government offices.

The vehicles for the leasing pilot were obtained through an international competitive bid for 10,000 electric vehicles. This is the largest bid, globally, for electric vehicles.

**Charging Infrastructure –** In addition to consumer anxiety about electric vehicles on offer, the second issue often raised, is the need for effective charging infrastructure in order to run private electric vehicle. In order to address this concern, EESL undertook a full-scale pilot in the upscale shopping district of Khan Market in Delhi.

The land for the charging station was provided by the municipality with no commercial rent. Any civil work to be done for the stations were undertaken at the cost of the municipality. EESL is paying the municipality for use of land from income earned from charging, for a period of 10 years.

EESL will work with all states that want help with pilots to strengthen consumer confidence on electric vehicles.

## DELHI

Delhi is a Union Territory, and as the country's capital of special significance. It has a population of approximately 19 million and covers a land mass of 1484 square kilometers. Its EV Policy was introduced in 2018 and has the main objectives of all new vehicle registrations to be electric by 2023, an increase on fees for ICE vehicles to incentivize electric, and for there to be a dedicated EV cell within the state transport department[22].

Perhaps the strongest backing for Delhi's EV expectations is its strong discoms. All the Union Territories 3 discoms are private and have far exceeded the national average with respect to reductions in transmission and distribution losses. Most notably Tata Power Delhi Distribution Limited has reduced losses from 53 per cent in 2002 to 8.6 per cent in 2018, which is a cumulative savings of $ 4.2 billion[23]. All discoms are profit making and forward looking. MGM Motors India, Panasonic India, and Tata Power will all be entering the Delhi / National Capital Region market with charging stations and infrastructure


A CASE TO STUDY

## TATA POWER DELHI DISTRIBUTION
## BRINGING EFFICIENCY BACK

Tata Power DDL is a role model distribution utility in the Indian context[24]. Tata Power DDL started operations in 2002, as a majority stakeholder in a joint venture with North Delhi Power Limited. It serves north and northwest Delhi, with a customer base of 2 million. In 2002, the discom's transmission losses stood at 52 per cent. By 2018, this had been brought down to 8.5 per cent. Through a process of 'tata parenting' and under the Tata Business Excellence Model, the loss-making company was put through a series of management training steps, work on business ethics and corporate social responsibility.

With the release of Delhi Electric Vehicle Policy in 2018, Tata Power DDL commented on the lack of incentives put in place for distribution companies to take ownership of charging infrastructure. But this is something that Tata has done, at its own cost. It has an e-vehicle fleet of 125, including 2 wheelers, 3 wheelers and electric cars. The company also has its own charging stations in place, at office locations.

Tata has had a long-standing policy of corporate social responsibility, and Tata Power DDL has been committed to reducing the country's reliance of fossil fuels. The company also acts as a business mentor for a number of public discoms across the country. As a front runner in the discussion on electric mobility, in August 2019 Tata Power is conducting a study, in partnership with the International Finance Corporation to understand the way in which storage can support the ongoing shift to renewable energy grid integration and electric vehicle deployment.

## KARNATAKA

With a population of approximately 64 million and covering an area of 191, 791 square kilometers, the south Indian state of Karnataka was the first to have an Electric Vehicle Policy, introduced in 2017. The state capital of Bengaluru is the fourth largest tech hub in the world and is home to many of the electric OEMs across the 2wheeler to 4 wheeler spectrum.

The state EV policy aims to create investment opportunities valued at $4.3 billion and creating employment for up to 55 000. The state will develop EV clusters to encourage and support vehicle and battery manufacturers[xvi]. With a mini ecosystem already in place, and home to some of the fastest growing startups in the electric vehicle and data management space, Karnataka is well poised to deliver on its ambitions.

The state has 5 public discoms, all with A ratings, except for the Bangalore Electricity Supply Company (BESCOM) which has an A+[25].

## KERALA

The southern state of Kerala[26] has approximately 34.8 million people over an area of 38,863 square kilometers with 600 km of coastline. Kerala approved its EV Policy in 2019 with an objective of having 1 million EVs on the road by 2022, including ferry boats. The state has one discom, that is public with a B+ rating[27].

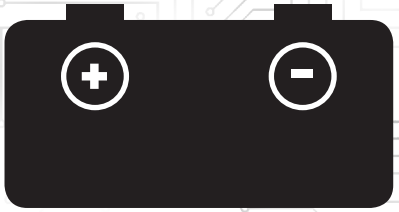
Although the state is relatively new to this arena, it is working to attract investment. An MoU has been signed between HESS and State govt. for E-bus development. The State government has committed 8000 electric 3 wheelers to be produced by state run Kerala Neem G. A Charging infrastructure partnership is in place with Indian Oil Corporation for multipurpose landuse of existing petrol stations[28].

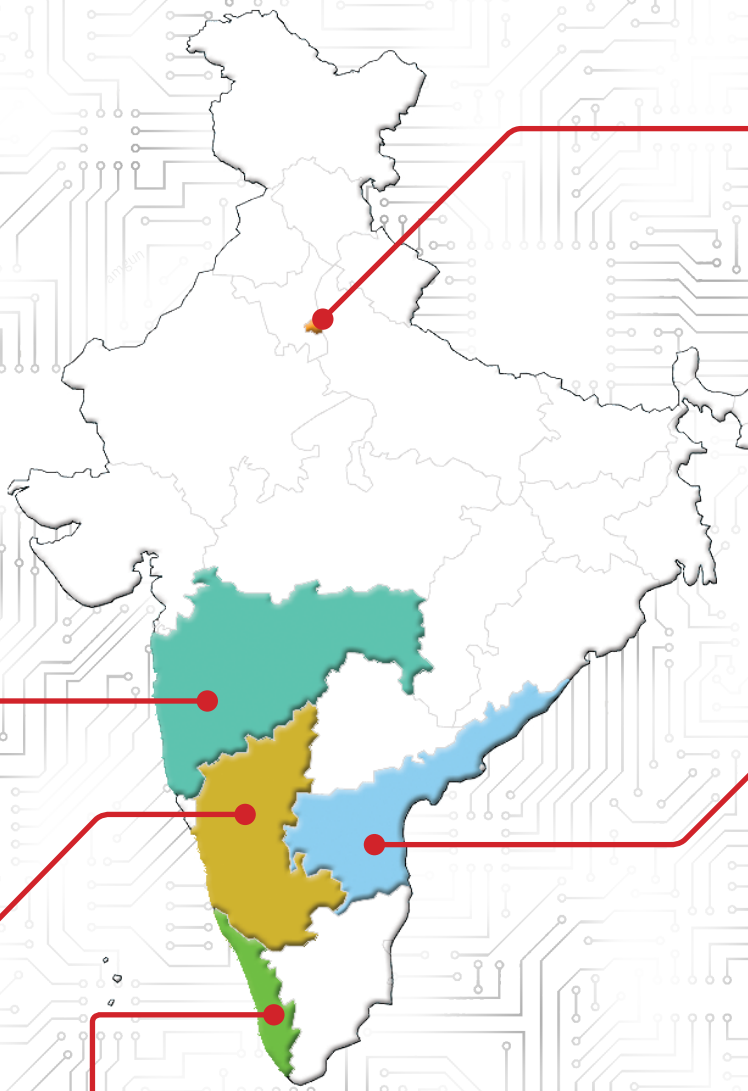
## MAHARASHTRA

Home to the country's financial capital, the state has a population of approximately 114.2 million people covering an area of 307,713 square kilometers. Its EV Policy was introduced in 2018, with an objective of having 500,00 EVs by 2023. The state has four discoms, with MahaDiscom being the second largest public distribution utility in Asia, serving over than 25 million customers.

Maharashtra is home to one of India's auto-clusters with Volkswagen, Daimler, Bajaj, JCB and Jaguar being based around Pune, Pimpri-Chinchwad and Chakan, close to Mumbai. It is also home to some of the country's innovative mobility pilots. Fleet operator Ola set up its full-scale electric pilot up in the city of Nagpur.

# BATTERIES





## MAHARASHTRA

- Promote manufacturing and export of batteries

## KARNATAKA

- R&D support for manufacturing of battery

## KERALA

- Strong focus on localised manufacturing for all aspects of EV value chain including battery pack assembly

## DELHI

- Bids for battery swapping operators (BSOs) with applicable charging tariff
- End of life and recycling included

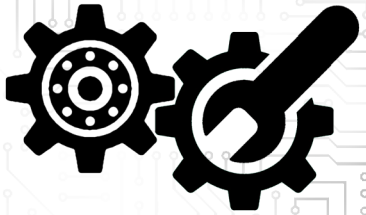
## ANDHRA PRADESH

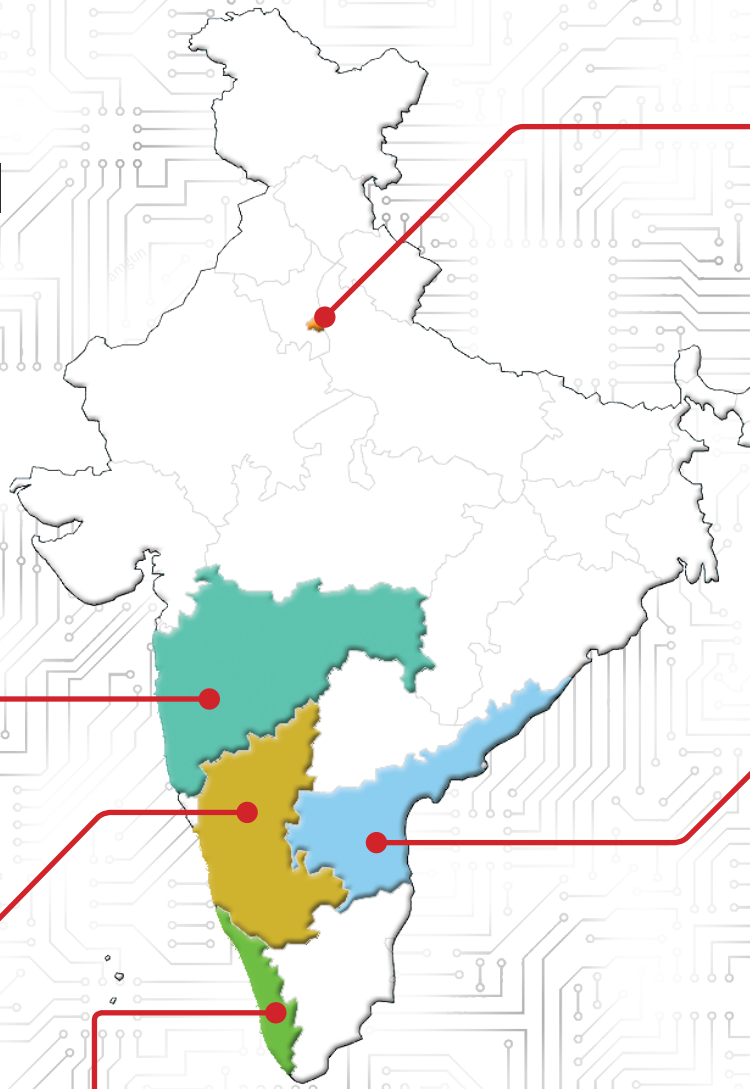
- support for startups in battery technology
- focus to enable battery swapping business infrastructure

# STATE LEVEL POLICIES

Andhra Pradesh, Delhi, Kerala, Karnataka and Maharashtra all have electric vehicle policies in place. Each state has specific key objectives for policy development. Employment and skilling are cross cutting amongst all policy measures. But in addition, each state policy reflects the main stakeholders in the discussion of EV rollout mainly batteries, charging infrastructure, vehicles, and building integration

# BUILDING INTEGRATION





## MAHARASHTRA

- EV charging at residential rate across state

## KARNATAKA

- Building codes to be modified to promote charging infra
- charging tariff to be set for residential charging

## KERALA

- Load balancing and grid stability a focus. Role of the state utility to be emobilty stakeholder for baseload and power tariffs

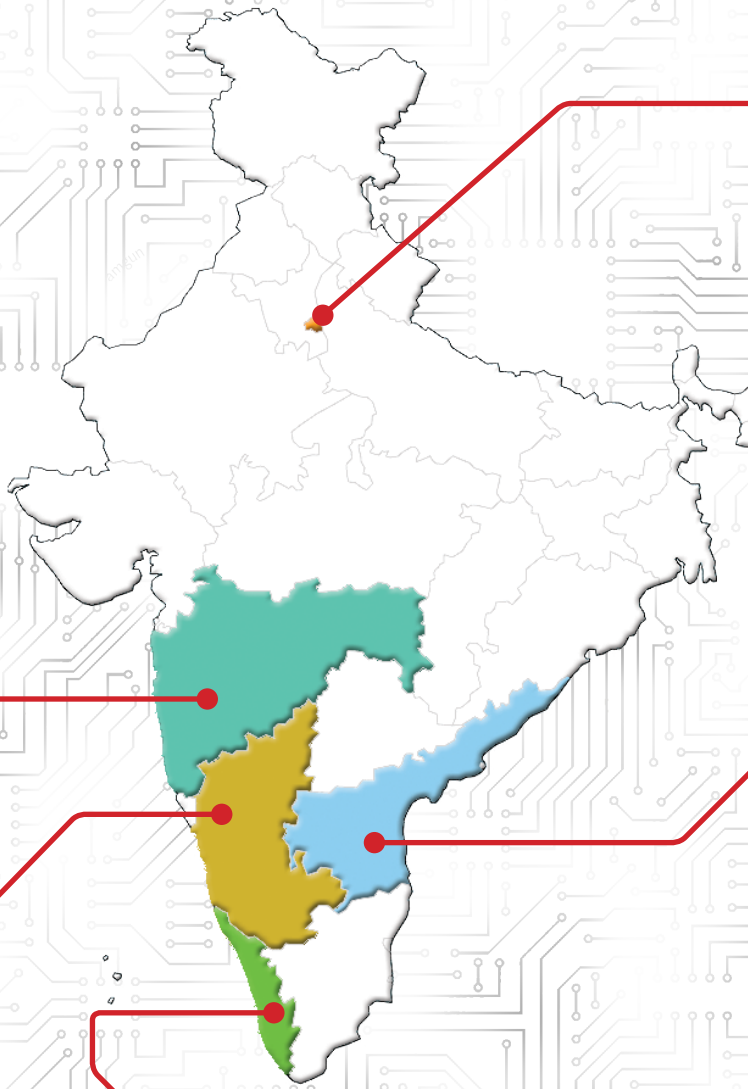
## DELHI

- Special EV charging tariff in place

## ANDHRA PRADESH

- New construction for commercial complexes, housing, townships with have charging stations
- Discoms to release supply to charging infra / battery swapping plants within 48 hours of application
- City and building codes to be modified for making provisions for battery swapping and charging infra.
- ULB regulations to be modified for setting up charging infra and battery swapping
- Discom to develop tariff structure for V2G sale of power
- Energy operators also able to set up RE mini-grids (only for EV charging)

# VEHICLES



## MAHARASHTRA

Public Transport focus in Mumbai, Pune, Aurangabad, Thane, Nagpur, Nashik

- First 1000 EV public / private bus buyers to receive 10% subsidy on base price (up to ₹20,00,000 per vehicle)
- First 100000 EVs (2 wheelers – 70,000; 3 wheelers 20,000; 4 wheelers 10,000) 15% subsidy per vehicle (differing ceiling for 2,3,4)

## KARNATAKA

- Exemption from all taxes
- 1000 EV buses during policy period
- 100 % EV by 2030
- Exemption from stamp duty
- Reimbursement of land conversion fee from agriculture to commercial / industrial
- Local tax exemption
- Incentives for EV / battery development manufacturing

## KERALA

- Road tax exempt for 3 years
- Only EV permits being given in 3 regions
- ₹30000 or 25% of EV costs for 3 wheelers
- Free parking

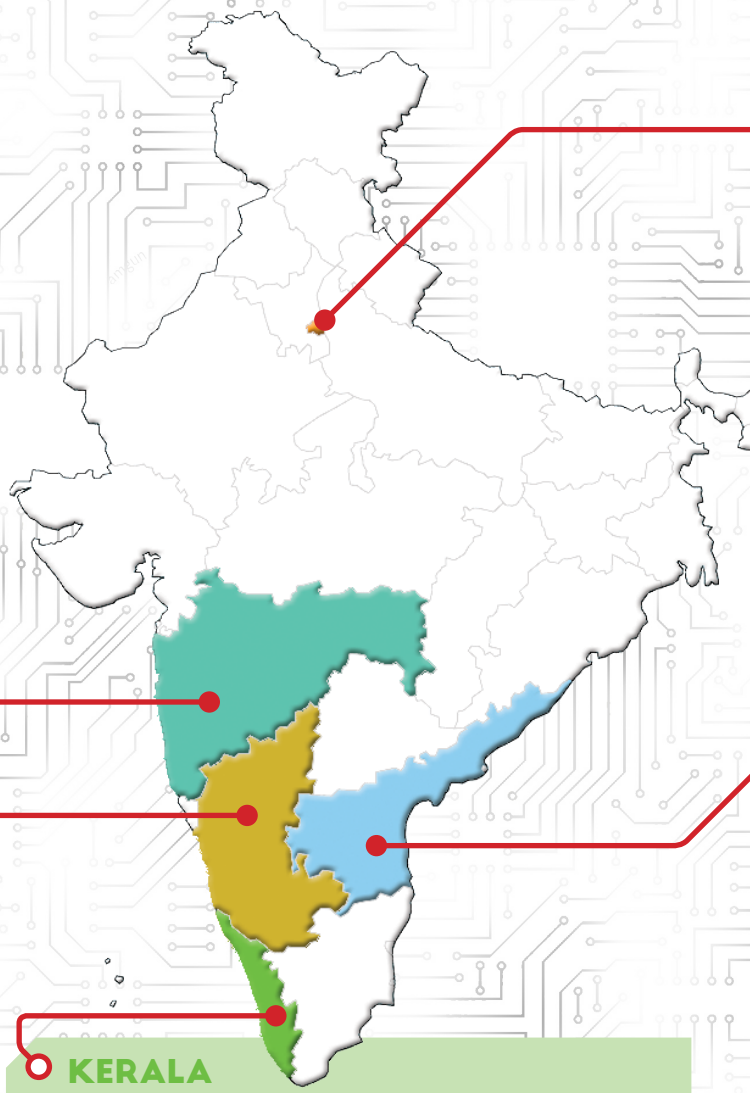
## DELHI

- Focus on 2 wheelers (2/3 of purchases in the city) and public / shared transport
- Top up incentive for swappable batteries (3 years from notification)
- Fleet managers to get approval for 2 wheelers in fleet
- No road tax,
- 5% interest subvention to loan amount up to `250000 for 3 years
- ₹15,000 incentive to scrap ICE TSRs by existing owners
- Buses – 50% of all new buses to be Electric by 2023

## ANDHRA PRADESH

- Convert 100% state buses into electric by 2029, first phase in top 4 cities by 2024
- All govt vehicles to be EV by 2024
- Manufacturers given 50% of fixed capital investment in infrastructure, up to ₹200 million
- Provide water supply and setting up of water treatment plants around auto hubs and 50% discount for private plants
- 100% local tax reimbursed for 7 years

# CHARGING INFRA



## MAHARASHTRA

- 15 days permit
- Petrol pumps free to set up charging infra (meeting national standards)
- 25% capital subsidy for public charging stations (up to ₹10,00,000 per station) for 250 stations

## KARNATAKA

- BIS standards for CI
- GoK to map land opportunities for CI
- Investment subsidy for first 100 fast charging stations
- Heavily trafficked routes / highways to have charging station / battery swapping every 50km

## KERALA

- State utility to set up charging infra and take responsibility for providing power. 20 each in pilot districts and 150 swapping stations for 2,3,4w. buses to be depot charging.
- Petrol pumps to be given swapping station options
- Incentives for local manufacturing of EV component value chain; electric drive train, motor controller, vehicle control unit
- ₹5-5.50 per unit

## ANDHRA PRADESH

- 100000 slow and fast charging stations by 2024
- Charging Infrastructure to be provided every 50km on highways
- DISCOM tasked with setup of charging infrastructure
- Public bus terminals to have charging infrastructure
- 25% capital subsidy for first 100 stations (≥ 100V)
- 25% capital subsidy for first 300 stations (≤ 100V)
- Hydrogen stations specifically mentioned for open private market development

## DELHI

Public Charging

- Facilities to be available every 3km
- 11 travel districts with bids made for energy operators to set up charging infra and allowed 20 per cent of space to be retail. Bid winners to have rights for 10 years and capital subsidy to be provided.

Private charging

- 20% of all new space for ev charging for non residential buildings with conduits

New / renovated / Coop and group housing

- Residential Welfare Associations to make charging infra for all parking if they have more than 10 spaces with conduits installed

Existing residential

- building with more than 10 ECS to have at least one EV space with BEVC-AC001 charger for every three spaces
- 100% subsidy to be provided up to ₹30,000 for up to 10,000 charging points

# 5
# MARKET ENGAGEMENT

Discussions with over 30 key stakeholders in the electromobility marketplace, including OEMs, fleet operators, and utilities made clear that there is no challenge to the fact that electromobility will be India's future. The question is rather, how will it roll out and when will be the tipping point. The Government of India has issued multiple policies between 2017 – 2019 and although they have been inconsistent with regard to the focus for support, moving from hybrid vehicles to cars and now settling at public buses, 2 and 3 wheelers, they have continued to reconfirm that Government's focus and commitment on moving electric. In order to move new energy markets such as electromobility, there will be a need for predictability. Standards for ecosystem components will help direct market expansion and build confidence.

The role of market aggregators and enablers are an important part of India's evolving electromobility sector. The Energy Efficiency Services Limited (EESL) is one strong example of this. EESL has been responsible for pushing the market forward by creating pilots in cities like Delhi and supporting the rollout of charging infrastructure at the state level. Supported by multilateral financiers such as the World Bank, Asian Development Bank, and KfW ensures that the credit line EESL has access to can be longer term, backed by a Sovereign Guarantee. Given the Indian financial scenario at this time, with large-scale bank debt, and new lending being very low risk with little patience for longer timelines on returns on investment, having actors like EESL with the capacity for market patience, will be a very big part of the success of the EV market. Multi-lateral financial institutes contribute to this calm, and in the stakeholder engagement dialogue process, EESL was not the only stakeholder in the renewable energy sector that had benefitted from the longer-term loan / grant agreements with financial players such as The World Bank.

The cost of domestic capital in the Indian marketplace remains high, and expectations on timelines on returns on investment are short; within 3-5 years. Domestic interest rates are between 10-12 per cent, and access to debt funding is increasingly difficult. There is strong potential leverage for international actors, with

the ability to borrow at much cheaper rates. In addition, the Government of India has recognized the value of international finance to push areas such as new energy markets. The decision taken in July 2019 to reduce the tax on electric vehicles to 5 per cent, along with the action to remove customs duties from electric vehicle component parts, are positive signs for international actors looking at the India market to gauge willingness to partner[29].

## VEHICLES: ELEGANT SOLUTIONS WANTED

The price of any electric vehicle is at least 30 per cent higher than their ICE variants. With this increase in cost, and for private vehicle buyers, it is the higher income bracket that would be considering going electric. In the stakeholder discussions undertaken, the lack of options given the cost of the product was raised more than once. Pilots are being undertaken to allay fears of the consumer with regard to range anxiety and cost of charging. Their success will lead to the next question on the part of the private buyer; the higher unit cost of the purchase should be visible in the elegance of the product.

The Indian automotive sector has been put through a number of hurdles in the past few years. In order to align with European emission control norms, the Bharat Stage emissions norms were introduced with comparable standards. This was started in 2000. In February 2016 the decision was made to move from Euro Stage IV to Euro Stage VI (Bharat Stage IV and VI respectively in India), leapfrogging on Bharat Stage V and introducing much more stringent emissions standards. In August 2019, this recommendation to leapfrog was made mandatory by a Supreme Court decision. The major difference between the norms is the level of Sulphur in the fuel from approximately 50 parts per million to 10 parts per million. As a result, costs of leapfrogging, although being unequivocally positive for health and environment, will be very high for Indian OEMs and have a number of downstream costs and supply chains that will be directly impacted. The transition will also impact current sales of Stage IV vehicles being sold in a soon-to-be Stage VI world[30].

Hyundai has launched India's first Electric SUV, the Kona. Audi will be bringing in its E-tron at the end of 2019 with a 400km range and at a price of $132,000. Kia has committed to bring in 6 high end electric models in the next five years. Kia have also reconfirmed their interest in working with the top end of the customer base. With the new incoming fleet of high-end electric options, the extent of consumer price sensitivity versus performance quality and aesthetic choice will be tested.

Vehicle manufacturers have pushed back at the regulatory inconsistencies that are impacting both the electric and ICE vehicle sectors. Many of these ICE manufacturers are also expanding their portfolio offerings in the EV space. The Central EV subsidy incentive programmes lean heavily on locally manufactured component parts, which has led to retrofitting of vehicle models and a slowdown of production and sales as an immediate impact of policy direction.

The main impact of changes in focus between FAME Phase I and Phase II on vehicles is the emergence of purchasing, piloting and rollout of electric public buses. The Department of Heavy Industries & Public Enterprises has approved the procurement of 5595 buses for 64 cities, under Fame Phase II. Of these, the states of Andhra Pradesh, Delhi, Karnataka, Kerala, and Maharashtra will get 300, 300, 350, 250, 725 respectively[31].

## A FEW UPCOMING MODELS[32]

### FOUR WHEELER

| Maker | Model | Charge Range | Battery | Price | Manufacture Base |
|---|---|---|---|---|---|
| Mahindra Electric | Everito c6 Available for private purchase | 110km | 72V lithium ion battery • 3 Phase AC Induction motor • @ 25 degrees Celsius Standard Charging – 8hrs 30mins • Fast Charging – 80 per cent in 80mins | Starting at USD 19,000 | Bengaluru, Karnataka |
| Mahindra Electric | E20 P4 | 110km | 210 Ah Lithium-ion battery • 3 Phase AC Induction motor • Standard Charging – 6hrs • DC Fast Charging – NA | Starting at USD 11,400 | Bengaluru, Karnataka |
| Tata Motors | Tigor EV | 200km | Lithium-ion battery • 3 Phase AC Induction motor • Standard AC Charging – 6 hours • DC Fast Charging – 80 per cent in 90 mins | Starting at USD 17 500 | Pune, Maharashtra |
| Hyundai | Kona Electric | 452km | Lithium-ion battery • Standard Charging – 6h 10mins • Fast Charging – 80 percent 57 minutes | Starting at USD 35, 242 | Chennai, Tamil Nadu |

### THREE WHEELER

| Maker | Model | Charge Range | Battery | Price | Manufacture Base |
|---|---|---|---|---|---|
| Bajaj | Auto | 120km | Lithium-ion | USD 2800 | Pune, Maharashtra |
| Mahindra Electric | Treo | 100km | Lithium-ion | USD 1900 | Bengaluru, Karnataka |

### TWO WHEELER

| Maker | Model | Charge Range | Battery | Price | Manufacture Base |
|---|---|---|---|---|---|
| Revolt | RV300 | 80km | Lithium-ion | USD 1200 | Manesar, Haryana |
| Ather | S450 | 107km | Lithium-ion • 1.5hr charging time | USD 1737 | Bengaluru, Karnataka |
| Greenvolt Mobility | Mantis | 50km | Lithium-ion | USD 488 | |
| TVS | Creon | 80km | Lithium-ion • 60mins fast charging • 4hr normal | USD 975 | Kannampalyam, Tamil Nadu |
| Ampere | V48 | 65-70km | Lithium-ion • 65 mins fast charging • 4-5hrs normal | USD 445 | Chennai, Tamil Nadu |


OLA
ELECTRIC VEHICLE


A CASE TO STUDY

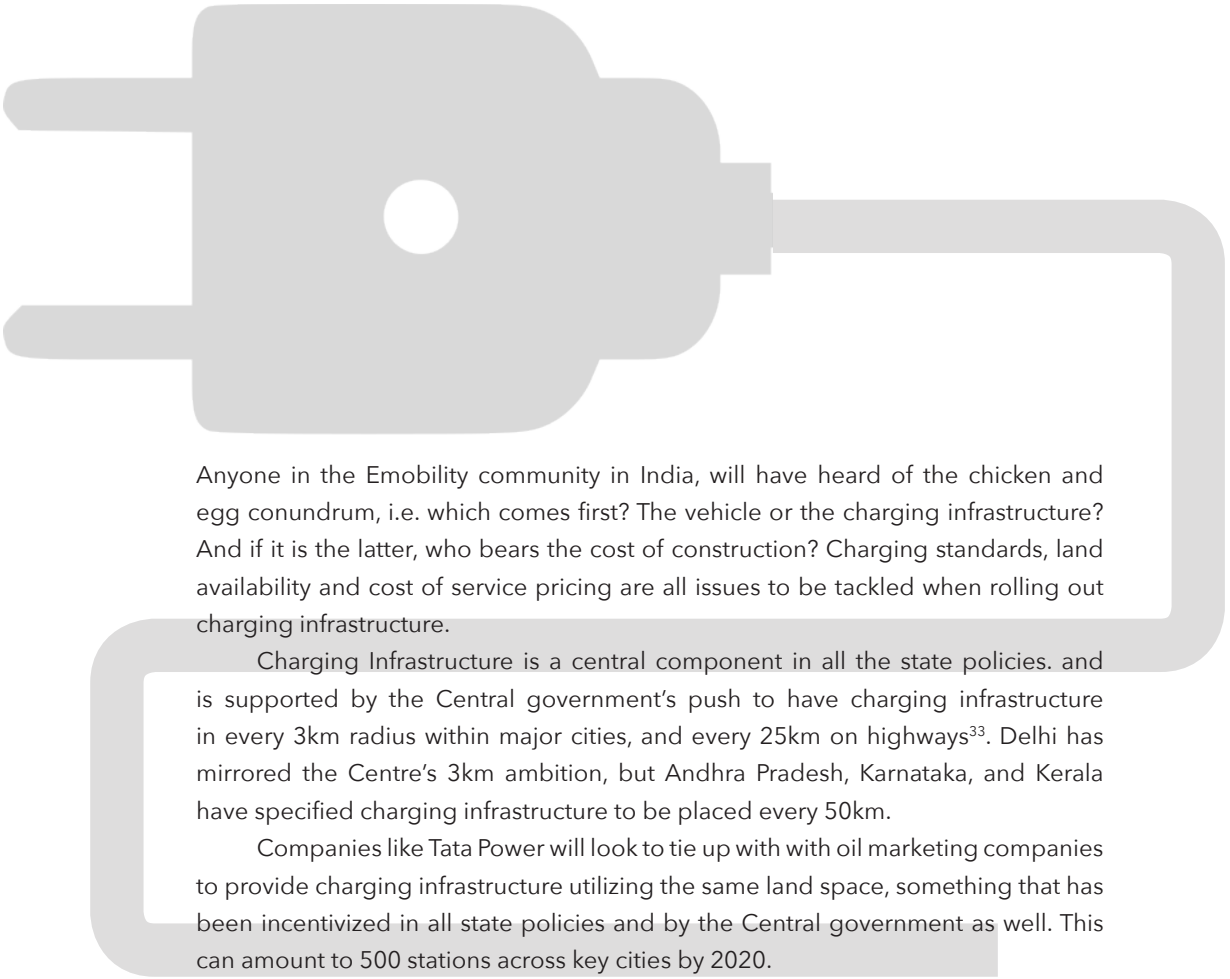
## OLA ELECTRIC MOBILITY

# DRIVING ENERGY CONFIDENCE

Energy Infrastructure company Ola Electric Mobility (OEM) was borne out of successful initial venture undertaken by India's domestic fleet operator Ola Cabs with 200 EVs in May 2017. OEM's Mission:Electric aims to have 1 million EVs on the road by 2021, with 10,000 e-rickshaws deployed by Dec 2019. Ola rolled out a full-scale pilot in Nagpur, Maharashtra, to showcase the viability of electric mobility. This was India's first multimodal electric vehicle pilot project. The Ola story is a clear indication of what is possible when you have a long-term view. Ola invested $6.96 million to build charging infrastructure and develop its data management platform.

- May 2017 – Ola launches 200 electric vehicle fleet
- April 2018 – Launch of Mission Electric with an aim to have 1 million EVs on the road by 2021
- March 2019 – OEM spun off as a separate energy infrastructure company
- March 2019 – OEM raise $56 million from Tiger Global and Matrix India
- March 2019 – Hyundai and Kia Motors invest $300 million
- May 2019 – Rata Tata, Chairman Emeritus of Tata Sons, invest undisclosed amount in OEM's Series A funding round
- July 2019 – Japan VC fund SoftBank invests $250 million into OEM, putting it at a valuation of over $1 billion.

## CHARGING INFRASTRUCTURE: CHICKEN AND EGG



Anyone in the Emobility community in India, will have heard of the chicken and egg conundrum, i.e. which comes first? The vehicle or the charging infrastructure? And if it is the latter, who bears the cost of construction? Charging standards, land availability and cost of service pricing are all issues to be tackled when rolling out charging infrastructure.

Charging Infrastructure is a central component in all the state policies. and is supported by the Central government's push to have charging infrastructure in every 3km radius within major cities, and every 25km on highways[33]. Delhi has mirrored the Centre's 3km ambition, but Andhra Pradesh, Karnataka, and Kerala have specified charging infrastructure to be placed every 50km.

Companies like Tata Power will look to tie up with with oil marketing companies to provide charging infrastructure utilizing the same land space, something that has been incentivized in all state policies and by the Central government as well. This can amount to 500 stations across key cities by 2020.

But this is a drop in the ocean of what will be required to shift the consumer. It is estimated that Delhi alone will need 300,000 fast chargers by 2030[34], if 30 per cent of vehicles are to be electric. Time of day pricing will be relevant now, as part of policies, to shift charging to off-peak loads. This will be the case for for standard charging, over 6 hours, being done at home.

The Bureau of Indian Standards (BIS) has issued specifications for both standard AC and rapid DC charging infrastructure, AC-001 and DC-001 respectively at 3.3 kW and 15kW. While state policies give preference to BIS approved chargers, many charging stations still have multiple international standards as well including CHAdeMO, CCS and Chinese GB/T, which promotes an expanded range of vehicles and improve customer willingness to purchase[35].

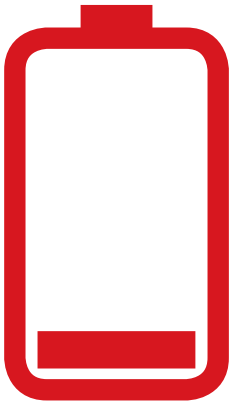
To provide solutions to the challenge of land availability, oil and gas giants such as Indian Oil Corporation (IOC)and Bharat Heavy Electricals Limited (BHEL) are moving into the electric charging infrastructure space because of the opportunity this provides to diversify profit.

The FAME II policy has 'delicensed' the setting up of charging infrastructure. This effectively means that any individual can set up charging points. The cost of the infrastructure development will be borne by the charging point operator, but access to energy can be done through open access and tariffs will be set according the Electricity Act 2003[36].

The Government of India has seemingly made their call on the chicken and egg issue by bringing in the Bureau of Energy Efficiency (BEE) an independent government authority, under the Ministry of Power, to be the central nodal agency for charging infrastructure and incentives. BEE has been a very strong market enabler with a focus on supply side management incentives.

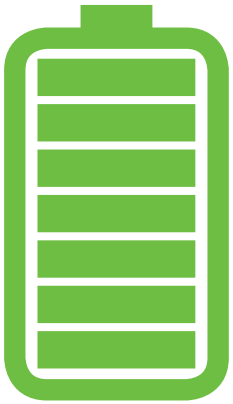
Public Charging Infrastructure will be an important aspect of expanding the confidence in electric vehicles. There will be a growing need for solutions to be provided for private residential charging to allow for effective integration of vehicles into dense urban spaces. The role of the residential sector, building integration and vehicle to grid technologies are still largely missing in the India EV framework. BEE is responsible for the country's Energy Conservation Building Code, as has specified that all new buildings have to provide 20 per cent of parking space for electric charging. The introduction of BEE into the stakeholder community, signals a recognition of the need to address these issues as India's EV ambition rolls out[37].

## BATTERIES: SWAPPING FOR THE WIN



With the cost of batteries making up the majority of the cost of the vehicle, and with limited domestic access to manufacturers, a strong part of the Indian EV market rollout is to work around the battery. India currently imports all batteries used for the electric vehicle industry and has no domestic lithium reserves. As part of its EV rollout, the country has plans to explore access to reserves in countries like Bolivia, where a March 2019 trade agreement has been signed for access to lithium mines[xlviii].

With a recognition of the need to address the battery block, for any systemic push for EVs, in March 2019 the Government of India approved The National Mission for Transformative Mobility & Battery Storage (Battery Storage Mission) chaired by Niti Aayog and with an inter-ministerial Steering Committee made up of Ministry of Road Transport and Highways, Ministry of Power, Ministry of New and Renewable Energy, Department of Science and Technology, Department of Heavy Industry Bureau of Indian Standards and Department for Promotion of Industry and Internal Trade. The objective of the Battery Storage Mission is to develop, over a phased five-year timeline, battery manufacturing such that the country has 'tesla sized' giga plants. The focus here is to develop lithium-ion battery capacity, with an estimated market value of $3 billion over the next five years[38].



One of the main triggers for moving to electric vehicles for India was the need to look for energy alternatives that allowed the country to energy secure, without

relying on imports. Given the lack of domestically available lithium, and the lack of locally available battery manufacturers, it would seem that the move to EVs has not yet solved the initial issue of energy security.

As the battery ecosystem unfolds, pilots have reconfirmed the value of battery swapping as the strongest business model. Most notably fleet operator Ola's pilot in Nagpur, Maharashtra (see A Case to Study; Driving Confidence by Breaking the Mould) reconfirmed that short-term business models will need to focus on battery swapping in order for the issues of scale and total cost of ownership to be best resolved.

India's electric vehicle vision, combined with renewable energy integration, places considerable stress on an already aging grid. High transmission and distribution losses on the part of the distribution utility add pressure on electricity grids. The role that batteries can play to act as stabilizers for grid volatility, storage, and balancing is a way to alleviate these bottlenecks.

There is varying uptake on the potential that batteries can play in helping utilities manage shifting demand cycles. Private utility Tata Power Delhi Distribution Limited have developed India's first grid scale battery-based energy storage system of 10 MW[39]. This is done with a focus on reducing grid instability and increasing the capacity of stable renewable energy grid integration. In August 2019, Tata Power extended its commitment to understanding and deploying battery storage potential, by partnering with International Finance Corporation (IFC) to develop business models for storage deployment. This is done a view to preparing for an electric vehicle future, and the demands this will place on distribution.

Battery Projects / Pilots

In August 2019, a mere five months after FAME II was announced, the city of Ahmedabad in the state of Gujarat, was the first to convert its entire public bus fleet electric. OEM Ashok Leyland has partnered with energy systems operator, Sun Mobility to develop a battery swapping platform in Ahmedabad for its electric buses. The swap will take 2.5 minutes, and with provide a running cost of INR 7.2/km compared to INR 18/km for a diesel bus.

## SMART MOBILITY: DEVELOPING A NETWORKING SUPERSTRUCTURE

Electromobility in India is currently being led by fleet operators for reasons of access to scale of use / total cost of ownership. Behind success cases operators like Ola electric is the use of customer service tools that create a seamless, hassle-free mobility experience. Over 25 per cent of India's 1.3 billion population has access to smart phones, and this is estimated to grow to over 800 million users by 2025, with falling costs of data. With fleet operators like Ola committing to have one million vehicles on the road by 2021, the initial challenge to create ease of use of mobility applications and customer interface is fast being resolved. Smart mobility, led by the numerous digital solutions available, opens up for faster, safer, and more convenient options.

Smart mobility solutions however also require digital infrastructure. India's average mobile and fixed broadband download speeds have been 10.71 Mbit/s and 29.25 Mbit/s respectively. India's network infrastructure will need to be upgraded to meet the demands that largescale EV smart mobility rollout will require. India's 2015 Smart City Mission had a software focus as well as a hardware one. It was understood that developing robust digital management would be needed to move India forward.

Data privacy and cybersecurity are also areas for consideration as India evolves both its electromobility ambition and its digital development. The present legal framework on data privacy in India is limited in nature. It consists of the Information Technology Act, 2000 (IT Act) and the Information Technology (Reasonable Security Practices and Procedures and Sensitive Personal Data or Information) Rules, 2011 (SPDI rules) issued under Section 43A of the IT Act. Norms relevant to data protection and privacy are also dispersed across statutes pertaining to diverse sectors such as taxation and health, leading to the lack of a coherent regulatory framework[40].

# 6
# KEY TAKEAWAYS WITH A VIEW ON INDIA

Despite the strong reforms made by the BJP led government, challenges continue to exist at the ground-level when doing business in India. This is specifically true for foreign actors looking to engage. The barriers could be summarized as follows; Access to information and Local Presence; Operational Capacity; Export Bandwidth; Negotiating Bureaucracy; Vested interest; Business Culture and Financing.

The Government is taking strong steps to remove challenges on the ground. In 2017, India was ranked 100 on the World Bank's Ease of Doing Business Report . This was a jump up of 30 places from the previous year. In 2019, this has moved to 77[41]. India's move up the rankings is seen to be as a result of a number of aggressive reforms the Modi led government has taken to increase transparency, regulatory ease, and protect investors. The Goods and Services Tax (GST) has introduced a system of 'One Country, One Tax' which removes the individual 29 state specific taxes that were levied on businesses and movement of goods . Reallocating debt on non-performing loans is another way the country has improved investment opportunities. India has also introduced a Bankruptcy and Insolvency Code and to add single window clearances for business processes[42]. These all work to unlock bad debt and improve confidence in the system.

Sweden and India have agreements in the areas of Environment, Energy, MSMES, Startups and Skilling. With these in place, there is a strong framework for engagement at all level of government. A number of local Indian actors are already engaged with Swedish partners to perform the role of government interlocutor and local cultural and business translators.

## DOING BUSINESS IN INDIA: DEVELOP A STATE STRATEGY

As important as it is to find the right partner, of equal importance is to select a geography with which to work. Each state has its own socio-economic agenda that underpins the direction of policy. The need to develop, leverage, grow existing markets as well the employment opportunities that policy focus will afford all play into how to address state selection. Combing the focus on policy and existing market ecosystem, a review of the 5 selected states provide a preliminary indication of areas of focus.

| | Policy Address Charging Infrastructure rollout | Policy addresses battery development | Existing auto ecosystem in place | Policy addresses role of residential development for EVs and home charging | Policy addresses role of Distribution company in electric vehicle rollout | Discom strength and credibility |
|---|---|---|---|---|---|---|
| Andhra Pradesh | | | | | | |
| Delhi | | | | | | |
| Karnataka | | | | | | |
| Kerala | | | | | | |
| Maharashtra | | | | | | |

**KARNATAKA** ✪✪✪✪✪

The strongest state for electromobility engagement. It has a vibrant existing automotive manufacturing base, both for ICE vehicles but also for electric vehicles across the vehicle spectrum. Tax concessions have been stipulated for land conversion for charging infrastructure, and interest free loans for electric vehicle manufacturing. The focus of the policy is to encourage private sector development to drive electric vehicle development.

**ANDHRA PRADESH** ✪✪✪✪

The electric vehicle policy stands out, both with its ambitious targets but also because of its focused actions along the value chain of development. Starting with developing a skilled workforce, investment into manufacturing and innovation, and the need for updating building codes to make provisions electric vehicles. Breaking out of a traditionally grid centric national development regime, the Andhra Pradesh policy makes explicit mention of the openness to bring in mini-grids for EV charging.

**MAHARASHTRA** ✪✪✪✪

Maharashtra is one of India's long-standing automotive hubs and with some of the country's most comprehensive pilots being established here. The policy is a little scant on details, but the strength of the existing vehicle ecosystem will play a large part in driving deployment forward.

**DELHI** ✪✪✪✪

Has dedicated policy criteria for actions targeting air pollution reduction, with a cess on ICE vehicles. This fund will be channelled into promoting electric. Delhi also focuses on buses and taxi fleets, with a view to discourage private ownership. With very strong distribution companies, Delhi is one of the strongest states in terms of its policy recommendations and opportunities to realise them. While the state of Delhi does not have an automotive base, nearby states of Haryana and Uttar Pradesh do.

**KERALA** ✪✪✪

Has traditionally had a focus on developing tourism as the states' main source of income. But its electric vehicle policy makes clear the intention to develop a strong

manufacturing and industrial base for electric ecosystem stakeholders. The only reason this has resulted in three stars is that the market development desired still has a way to go before being able to deliver on policy ambition.

**SUMMING UP**

All policies are less than two years old. Ambition is still perhaps more evident that ground level results. The confidence of the private sector is growing, with new actors coming into the country, as well as fleet operators setting the pace for EV rollout. Market aggregators like Energy Efficiency Service Limited (EESL) provide case study examples of commercial viability, and ecosystem leaders like Tata Power Delhi Distribution Company make clear the bottom-line benefits of planning ahead. The electromobility story in India is still in its introductory phase. But its pace is picking up fast in the face of the domestic challenges of crude oil prices, growing urbanization and the positive correlation this has on energy demand, and air pollution. Internationally, this move towards decarbonized mobility is underscored. This process of learning and developing the market is the strongest time to enter the market, for SME companies who can move fast, be flexible and have patience.

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# NOTES

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The report was written by Arati Davis, with inputs and peer review from Maria Sandqvist, Albin Carlén, Rittwika Sharma, Sreya Majumdar, Kuhoo Saxena.