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POLICY BRIEF

REGULATORY MECHANISMS FOR ELECTRIC THREE-WHEELERS

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ACKNOWLEDGEMENTS

The Project "Switching to a sustainable auto-rickshaw system" is an endeavor to reduce CO2 emissions and air pollution (caused primarily by PM 10 and NOx) from auto rickshaw sector by accelerating the transition of older ICE based auto-rickshaws to clean technology versions. Additionally, the project also looks at promoting sustainable lifestyles and reducing poverty. The Project (Commonly referred as the Namma Auto Project) is expected to directly improve the income of thousands of auto rickshaw drivers and the comfort of lakhs of residents of Bangalore and Chennai. The project is being implemented by consortium of ACRA, ENVIU Foundation, Women Health and Development (WHAD) and The Energy and Resources Institute (TERI), and is funded by the European Union, under the Switch Asia Programme.

Under this intervention, a pilot service of electric autos feeder (for first and last mile connectivity) was launched in Chennai in collaboration with Chennai Metro Rail Ltd (CMRL) from January 2019. In Bengaluru, the project has launched a ride booking application that is focussed on offering first and last mile service of auto-rickshaws to regular metro users, through pre-fixed fares and routes. It is being piloted in one station at present. In Bengaluru, the project has collaborated with over 30,000 auto-drivers, trained over 5000 drivers under a code of conduct, and has mobilised several of them in to a state level cooperative society. In addition, through a Social Enterprise it promotes, it is financing auto-drivers to switch to electric auto-rickshaws.

One of the main objectives of this project is to promote a policy and regulatory framework in cities for Sustainable Mobility

We would also like to extend our thanks to all the project stakeholders and partners including Karnataka State Transport Department, Karnataka State Finance Corporation (KSFC), Bangalore Metro Rail Corporation Limited, Chennia Metro Rail Limited , Indian Institute of Science Bangalore, Indian Institute of Technology, Chennai.

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Background

Electrification of auto-rickshaws plays an important role in meeting the transport requirement of many large and medium Indian cities, and is critical for reducing air pollution and providing clean mobility solutions. The auto-rickshaws, generally three-wheelers, with both four- and two-stroke internal combustion engines are fuelled by Diesel, Compressed Natural Gas (CNG) and Liquefied Petroleum Gas (LPG). According to a recent study by TERI, an average conventional LPG auto emits approximately 0.005 tonne of Particulate Matter-10 (PM10) in a year and about 3.72 tonne of carbon dioxide in a year (TERI, 2018)[1]. On the other hand, electric auto-rickshaws (e-autos) provide zero tailpipe emission and no-noise solution while meeting mobility needs of people.

The auto-rickshaws with carrying capacity of three to seven people provide mobility solutions for short trips up to 10–12 km, for first and last mile connectivity and as feeder services to the main haul public transport. The electrification of auto-rickshaws may result in lower operation and maintenance costs as compared to Internal Combustion Engine (ICE) vehicles making them economically viable for the owner / driver.

Despite many initiatives and programmes of the government, such as the Faster Adoption of Manufacturing Hybrid and Electric Vehicles (FAME) in India, the growth of electric vehicles (EVs) is still not able to pick up pace. The transition to electric three wheeler have high consumer acceptance. In spite of that it is facing several regulatory and policy challenges.

This study thus aims to understand the policy and regulatory barriers for adoption of electric auto-rickshaws in India, and though each state has different transport policies and regulatory structure but the underlining principal remains the same.

Role of three-wheelers in Indian cities

The urban transportation system in India includes various modes, with private transport (cars, two-wheelers and cycles), public transport (metro, rail and city buses) and intermediate public transport, IPT, (auto rickshaws and taxis) that serve an important role in the transportation systems of the city. Within the urban transport framework, IPT contributes 3 to 8% of the daily trips (EMBARQ). Within the IPT segment, auto-rickshaws in particular act as cost and time effective mode of travel, especially in cities where there is inadequacy or absence of public transport. As illustrated in Table 1, the modal share of auto-rickshaws in the three metropolitan cities of India is above 10% despite the share of auto-rickshaws being low within total registered vehicles. In the current scenario, despite the rise of app-based taxi services, auto-rickshaws continue to serve as a crucial mode to meet the mobility demand.

The auto-rickshaws provide unparalleled personalised door-to-door services and last mile connectivity within the cities. They also serve as a preferred transport mode for short trips in small and medium cities, and as feeders to the public transportation system in the metropolitan cities. This mode bridges the mobility gap created by inadequate public transport system in Indian cities.

However, there are certain environmental issues related to the ICE-based auto-rickshaws. These ICE-based auto-rickshaws deteriorate the urban air quality through their exhaust emissions. Different fuel-engine combinations are prevalent in different cities for a variety of reasons. For example, Delhi is dominated by CNG-fuelled four-stroke auto-rickshaws due to a government fuel mandate,

Table 1: Modal share of auto-rickshaw sector

City	Population (Million) 2011	Auto's mode share (among motorised road transport)	Auto's share as % of total registered motor vehicles
Mumbai	13.8	20 %	11%
Pune	3.5	11%	3%
Bengaluru	5.4	13%	3%

Source: (WRI, 2012)

while Hyderabad, Pune, and Bengaluru are serviced by LPG-fuelled two- and four-stroke auto-rickshaws. In most small and medium cities, the auto-rickshaw population is dominated by two-stroke vehicles, despite causing high pollution, primarily because of their light weight and mechanical simplicity, except in cases where policy has favoured or mandated the adoption of four-stroke engines (Conor Reynolds, 2009). Passenger three-wheelers contribute to 7% of the total vehicular emissions in Delhi (Rahul Goel, 2015). Due to presence of CNG as fuel type, 9% NOx (nitrogen oxides) and 1% $PM_{2.5}$ is contributed by auto-rickshaws in Delhi (Rahul Goel, 2015). In Bengaluru, an average annual carbon emission from an LPG auto-rickshaw is 3.72 tonne (TERI, 2018). Thus, to reduce tailpipe emissions transition to electric auto-rickshaws is crucial.

DIFFERENCE BETWEEN ROLE OF E- RICKSHAW AND ELECTRIC AUTO RICKSHAW

E rickshaw has recently emerged as an intermediate public transport (IPT) mode to meet the mobility demand. They are often considered to be similar with electric auto rickshaws, but their operational role varies significantly. The differences in their role as an IPT mode are given below:

S. no	Parameter	E rickshaw	Electric auto rickshaw
1	Battery Technology	Both Lead Acid and Lithium	Lithium
2	Load bearing capacity	Low- speed decreases with increase in load	Comparatively high
3	Braking system	Normal	Regenerative braking system
4	Speed	Slow speed Less than 25 km/hr	Speed more than 25km/hr
5	Occupancy	4	3
6	Type of service	Shared- operates only with full occupancy	Personalized
7	Routing Fixed	They are usually not allowed on arterial roads	Area based- no restrictions
8	Fare	Not fixed fare	Regularised fare system
9	Trip length	Mostly short trips less than 5 km	Both short and long trips

Three-wheelers – the front runners for mobility transition

As per a TERI (2017), the three-wheelers are among the front runners for electric mobility transition. Among the various vehicle segments, the electric three-wheeler segment has recorded the maximum adoption since 2009–10. The maximum localisation of the EV manufacturing which is critical for EV uptake is also available in the three-wheeler segment. Manufacturers such as Mahindra & Mahindra and Lohia Auto have been flooded with sale enquiries for lithium-ion electric passenger three-wheelers (Money Control, 2019). India being the largest market for three-wheelers (ICRA, 2016), has shown huge demand even for electric three-wheelers (both electric rickshaws and three wheelers). As per data shared by the Society of Manufacturers of Electric Vehicles (SMEV), the apex lobby body for EVs, sales of electric three-wheeler segment grew 21 % during 2018-19 to 630,000 as against 520,000 sold in 2017-18 (Money Control, 2019). This is primarily due to popular acceptance for last mile connectivity, though the numbers include both electric auto rickshaws and e- rickshaws. The increase in market share is not only due to the fact that electric three wheelers contribute to superior savings and cheaper operating costs, but also due to immense support provided by the Government. The Government initiatives are listed is in the next section.

Government initiatives

The Government of India has been responsive in recognizing the need for transitioning to electric mobility and has developed policies and schemes time and again to direct the growth in this direction. These policies and schemes highlight the relevance of electric three-wheelers to achieve last mile connectivity. Some of the key policies directed towards promoting electric three-wheelers in India are as follows:

National Urban Transport Policy (NUTP), 2006

The NUTP was adopted by the Government of India in 2006, and was further revised in 2014. The policy promotes use of cleaner technology and aims to ensure quick, safe, comfortable, reliable and sustainable access for consumer demands. It recommends that clean vehicle technologies, should be promoted to address the problem of vehicular pollution in cities.

National Electric Mobility Mission Plan (NEMMP), 2020

In 2013, the Ministry of Heavy Industries and Public Enterprises launched the NEMMP 2020, as a roadmap to upscale the demand for environment-friendly EV technologies. In 2015, to achieve the objectives laid out in the NEMMP, the Government of India announced an incentive scheme which provides subsidies on purchase of EVs – the FAME scheme.

Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME - India)-I &II

The scheme provides financial incentives for the purchase of electric and hybrid technology vehicles. With a financial outlay of `795 crore, it was initially launched for two years (2015-17) – Phase I, which was further extended till March, 2019. The Phase I of the scheme provided subsidies for the purchase of eight models electric three-wheelers L5 category[1] ranging from `25,000 to `61,000. The subsidies are availed by buyers upfront at the point of purchase and the same is reimbursed to the manufacturers from the Department of Heavy Industries (DHI) on a monthly basis. In January 2018, realising the potential of pilot projects in boosting the adoption of EVs, DHI sanctioned `437 crore for pilots across 11 cities, for the purchase of 390 electric buses, 370 electric taxis and 720 electric autos, out of which `40 crore was allotted towards the provision of charging infrastructure. In Phase II of FAME, a uniform subsidy of `10,000 per Kilo Watt Hour has been allocated to support five lakh three- wheelers.

Apart from the above policies, government efforts towards promoting EVs include placement of EVs in a lower GST slab of 5% in comparison to a GST of 12% for conventional ICE vehicles, and lowering the GST on lithium ion batteries from 28% to 18% from July 2018. Furthermore, to ease the installation of charging infrastructure, the Ministry of Power (MoP) recently amended the Electricity Act, 2003, to legalise resale of power (at regulated tariffs) to allow the DISCOMs/Electricity service providers to set up charging infrastructure. The MoP has also come up with a roadmap for installation of adequate charging stations. The roadmap suggests the installation of charging station (with at least 2 charging ports) at every 3 – 5 km in urban agglomerations and at least one charging station every 25 km on a highway (PIB, 2018).

1 Three wheelers defined category as per ARAI

State EV policies

Apart from the measures at the national level, several state governments are also committed towards promoting electric three-wheelers in their states, as mentioned in Table 2 .

Based on the Table 2, it could be summarised that though all the states have considered electric auto rickshaws to be an integral mode for the electric transition. The approach to the same varies from state to state. Most of the states have adopted a target-based approach to induce penetration of electric auto rickshaws. They have also given provisions of focused subsidy on charging infrastructure. However, Delhi EV policy is a stand-alone policy which provides comprehensive support towards electric transition. It provides life cycle support and includes aspects of scrapping and integration. Thus, a more holistic methodology can enhance adoption of electric three wheelers. The government's push for EVs has shown a positive drift for three-wheeler owners and fleet operators. As per statistics given by SMEV, sales of electric three-wheelers have gone past that of fossil fuel-powered three-wheelers already. However, most of such electric three-wheelers are electric from the unorganised market and are considered as an assembly of cheap parts imported from China. These electric rickshaws are low speed vehicles and tend to cater to short trips of not more than 5 km and are largely running on lead acid batteries. This is unlike auto-rickshaws, which serve mobility requirement of 15-20 km. In most of the states, e-autos are not registered, and therefore there are regulatory and safety concerns. As per the central motor vehicle regulations, e-autos do not fall under the L5 category of three wheelers.

Presently, electric three-wheeler has high upfront costs, but post BS-VI the lower price gap is anticipated (Money Control, 2019). However, the running cost of electric three-wheeler is `0.5 per km which is very low in comparison to that of petrol-powered three-wheeler which runs at `4 per km. Despite overall lower cost of electric auto-rickshaws and tremendous efforts by the governments, the adoption is not happening at a desired pace. Some reasons for the same have been listed below:

- High upfront cost for the three-wheelers
- Lack of availability of charging infrastructure
- Range anxiety among the drivers

Table 2 : Incentives for three wheelers in the State EV policies

State	Electric Three-Wheelers Incentives
Draft Delhi EV policy, 2018	• An open permit system application to approve e-autos, with no limits on the number of Auto Rickshaw permits ('e-auto Permits') is discussed to be issued. • Road tax, registration charges, MCD one-time parking fee and Auto Rickshaw permit fees to be waived for e-autos. • Grant for down payment and interest subvention to individual drivers for vehicles with swappable batteries (50,000 per vehicle over a 3-year-period). • Electricity tariff applicable for charging stations for e-rickshaws/e-vehicle on single point delivery. • App-based aggregators and ride hailing service providers who provide mobility solutions are invited to participate in the "App-based e-cab/e-auto user incentive scheme". • Scrapping Incentive of up to `15,000.
Karnataka Electric Vehicle and Energy Storage Policy, 2017	• The Karnataka EV policy 2017 encourages retrofitting of the existing auto rickshaws in the city and aims 100% electric mobility in three-wheeler segment by 2030. • EV-three wheelers in Bengaluru are encouraged to replace their fleet of three wheelers to EVs in a phased manner with an intention to achieve 100% electric mobility by 2030. • All fast charging stations for electric three-wheelers are offered capital subsidy of 25% on the equipment /machinery subject to a maximum of `10,00,000 per station for the first 100 fast charging stations in the State. • All EV battery switching/swapping stations for electric three-wheelers are offered capital subsidy of 25% on the charging equipment/machinery subject to maximum of `3,00,000 per station for the first 100 battery switching/swapping stations in the state.
Maharashtra Electric Vehicle Policy,2018	It offers a subsidy up to `12,000 on three-wheelers. • Commercial public EV charging stations for three-wheelers are eligible for 25% capital subsidy on equipment/machinery (limited up to `10 lakh per station) for first 250 commercial public EV charging stations. • First 20,000 three-wheeler registered in the state to get end-user subsidy over policy period of 5 years.
Telangana Draft Electric Vehicle Policy, 2017	• A time bound mandate for all auto rickshaws within GHMC to switch to EV, followed by other cities. • Permission for corporate ownership of e-auto rickshaws/e-rickshaws to enable entrepreneurship and create jobs for the economically backward segments. • Extension of transport department retrofitment rule for existing vehicles to cover Electric kits for passenger vehicles, Auto Rickshaws and e-rickshaws. • Permission for ARAI certified e-rickshaws in fringe areas at the periphery of GHMC limits in predefined zones and routes. Similar permission will be granted in other cities across the state.
Draft Kerala Electric Vehicle Policy, 2018	• The first priority is to convert to three-wheelers; aiming for 50,000 three-wheelers by 2020. • For initial period of one year, early adoption support scheme is implemented which provides an incentive of Rs 30,000 or 25 percent of the EV (whichever is lower) for three wheelers..
Uttar Pradesh Electric Vehicles Manufacturing Policy, 2018	• Auto rickshaws will be targeted to achieve 100% electric mobility by 2030 in five cities - GB Nagar, Ghaziabad, Lucknow, Kanpur, and Varanasi.
Andhra Pradesh Electric Mobility Policy 2018	• Andhra Pradesh EV policy proposes policy interventions such as waiving off registration and road tax on the sale of EVs, tendering three-wheeler fleet licences to companies. • Plying of low power electric rickshaws restricted to certain areas or outside major cities to avoid congestion. • Permits on priority for electric autos.

- Unawareness about the technology
- Unawareness about the regulatory procedures
- Lack of financing sources

International best practices

Globally, several policies, implementation mechanisms and approaches are being promoted for the growth and uptake of EVs. Thus, it is important that global best practices in the EV three-wheeler spaces are identified and translated to the Indian context to address the associated challenges around the adoption of EVs.

Sri Lanka

- *Branding the electric tuk tuk* – Under the 2018 budget, the concept of 'tourist-friendly tuk-tuk' was conceived in collaboration with the hospitality industry. This program provides for existing three-wheeler drivers to register with the Sri Lanka Tourism Development Authority (SLTDA) so that a three-wheeler would not only be a mode of transportation, but enable the driver to serve as a local tour guide as well.
- *Increasing the import taxes on diesel tuk tuk* – As per the 2018 budget proposal, import taxes on a diesel three-wheeler will rise by around `50,000 in order to encourage the transition to environmentally friendly electric three-wheelers.
- *Scrapping* – The government will discard and sell as scrap the non-roadworthy three-wheelers.

Philippines

- *Collaborations* – One private sector gave e-jeepneys to operators for free in exchange for advertising rights.
- *Pilots* – Joint venture between Department of Energy and Asian Development Bank (ADB) to put 100,000 electric powered tricycles on roads.
- *Financial Institutions* – The government networked with Land Bank of the Philippines (LBP) and other financial conduits, such as rural banks, transport cooperatives, multi-purpose cooperatives to provide loan facilities to drivers of the electric three-wheelers.

Thailand

- *Charging Infrastructure* – The charging pump dot.com is a large centralised management system and online/ offline data warehouse. For users driving general EVs, the system will recommend the nearest charging pump and are available for service from the user's current location first.
- *Partnerships based Pilots* – The Singapore-headquartered Decacorn's, Grab (which is on its way towards becoming a 'super app' to provide everything online) has announced to partner with the owners of eco-friendly three-wheeler vehicles (EVs), electric tuk tuks , in Chiang Mai city, a tourist and cultural center in northern Thailand.[2]

The key takeaways from the above mentioned international best practices that can be adopted in Indian cities for uptake of electric three wheelers are listed below:

- The electric three wheelers can be given edge to ply in tourist destinations and institutional areas.
- Regulatory restrictions on the diesel three wheelers can push adoption of electric auto rickshaws.
- Scrapping subsidy to old vehicles can compensate the price difference between electric and ICE autos
- Additional benefits such as advertising incentive will attract more buyers
- The initiatives and pilots of electric auto rickshaws within the city will make them more visible and reliable.
- Ease in financial assistance will strengthen the adoption process
- Establishment of charging stations at the major terminals or metro station will also encourage electric three wheelers.

Regulatory Mechanisms

As discussed in the previous sections, three-wheelers are the front runners for electric transition and there are several incentives provided by the government for both demand and supply creation under the various national and state policies and schemes. However, it is important to boost the ground- level initiatives to achieve the EV transition. Certain urgent actions can give the desired push to boosting the existing initiatives and efforts towards the promotion of EV three-wheelers in Indian cities. The study recommends following regulatory mechanisms to overcome barriers:

Despite various subsidies and incentives available with national-and state-level policies, high upfront cost persists to be an issue hindering immediate demand

2 "Best Practices Related to Intermediate Public Transport System, 2017"- TERI report can be referred for detailed case studies.

creation in electric three-wheelers sector. This is primarily because mainstream financers such as banks and non-banking finance companies (NBFCs) do not provide financing to electric auto rickshaw drivers as they are unable to meet lending requirements like self-funding for a minimum of 30% of the initial cost of auto rickshaws and collateral of about 1.5 times the amount financed (Singh, 2018). The other sources are informal channels and microfinance institutions (MFIs) which have their own limitations, as MFIs cannot finance more than `60,000 in the first loan cycle, which is about one-third of the cost of an electric auto-rickshaw and informal channels charge high interest rates. Thus it becomes essential to bring down the cost of electric three-wheelers through strategies and measures that will increase the demand. The following are some regulatory interventions that can help in increasing the demand for electric autos:

- Scrapping of old three-wheelers – In India, about 64 lakh registered auto- rickshaws (MoRTH, 2016) ply on roads. These auto-rickshaws provide IPT services for both urban and rural areas. They can operate for 15 years, and after that their fitness certificate or permit expires. Since the stringent rules and checks are prominent in metros, the old autos usually ply at the fringes of large and smaller cities or rural areas but do not go out of the system. There is no regulated procedure or policy to scrap old vehicles. As per Motor Vehicles Act, 1988, there is no clear mandate for deregistering a vehicle(MoRTH, 1988). Without deregistration, no vehicle can qualify as an end-of-life of vehicle, and unless it is declared so, it cannot be traded as scrap (CPCB, 2015). In case of Bengaluru, cancellation of registration takes place by submission of an application and photographs of the vehicle in the regional transport office (RTO) office. Thereafter, the RTO will issue a letter of permission to scrap the vehicle. The duration for scrapping after getting the permission from RTO is seven days. During the period of permission issuance till the actual scrapping, the vehicle is strictly prohibited to be driven on the roads. Scrapping is done exclusively at the city scrapping unit referred by the RTO. Before scrapping, valuation of the vehicle will be done by the unit. After scrapping, on the basis of the scrapping relevant documents, the RTO will approve the purchase of new auto. This is a very cumbersome procedure and is present in limited cities like Bengaluru. In most of the cities, there are no formal scrapping centres for auto-rickshaws but there are informal markets for scrapping of the vehicles. Since the auto-rickshaws are not getting out of the system, regional transport offices are unable to bring in the e-autos into the system. Thus, at both the state-and national-levels, scrapping/transition plans should be developed.

Additionally, for future disposal of used batteries of e-autos, the original equipment manufacturer (OEM) should be held responsible. Currently in Delhi, batteries are being purchased by the drivers from authorised dealers and then they are fitted in garages. On exceeding battery life these batteries are returned at garages where they are dismantled unscientifically causing pollution and even accidents.

- **Permits –** A permit is an instrument issued by a state or regional transport authority authorising the use of a motor vehicle as a transport vehicle in a specified manner as per the relevant provisions of Motor Vehicle Act. The types of permits that apply for auto-rickshaws as commercial vehicles include contract carriage. In most of the metropolitan cities, closed permit is issued for the auto-rickshaws to avoid road congestion. However, in smaller cities with absence of public transport, open permits system is practiced. The permits get renewed annually in case of ICE auto-rickshaws. Presently, the regulatory authorities are unclear about the permit provision to electric auto-rickshaws. Though there were announcements at the central level that no permits will be required for clean fuel-based auto-rickshaws, the implementation timeline of the decision is unclear. Some state policies have given fee waiver or have derived open permits system for e-autos, but the permit is still required.

In order to push the adoption of e–autos, following amendments in the permit system can take place:

- As per the age of ICE-powered auto-rickshaws permit renewal should be restricted (at least in highly polluted cities)
- For the initial one year, open permit system for e-autos should be practised

- The e-autos should have no or reduced permit fees
- Permit renewal period for e-autos can be increased in comparison to ICE auto-rickshaws
- A flexible carriage system for e-autos can be adopted

Financing Instruments

Though some of the state EV policies have declared subsidy, the drivers are unaware about the subsidy and the procedure to avail it. The subsidy amount currently prevalent on submission of auto is very less in comparison to the cost of an e-auto. Apart from the FAME subsidy, additional subsidy/incentives by the RTO such as lowering the permit fees, road tax exemption and reducing registration cost will also boost the e-auto adoption. Additionally, low interest rates on loans for e-autos by the financial institutions will also promote adoption of e-autos.

Safety Standards

The market currently has huge amount of variants of e-rickshaw which do not fall under the category of L5 three-wheelers. Thus, there has to be proper safety checks prior to the approval of the vehicle as this may lead to accidents.

Planning Zones

Electric vehicles zones within cities can be identified/ demarcated for plying of e-autos. These could be tourist centres or parks.

Charging Infrastructure

Charging infrastructure serves as a crucial factor apart from the regulations impeding the growth of e-three-wheelers. Though the electric autos can have home based charging infrastructure but dedicated public charging infrastructure needs to be developed to support charging needs of e-autos. Apart from the provision of public charging stations, provision of charging points should also be there at parking spots in places like office buildings, malls, and market places. Pilot initiatives with the public transport authorities to promote first and last mile connectivity can further provide the charging infrastructure.

Consumer Awareness

Though electric rickshaws have flooded Indian cities, but the e-autos are still a nascent and there is a lack of awareness amongst consumers about the technology and the benefits it offers. There should be awareness programs and campaigns which will guide consumers on aspects such as purchase of EVs, available subsidies, performance of EVs and location of charging stations. Apart from sensitising consumers, it is also important to build capacities of relevant government officials, consultants and practitioners in transport departments and urban local bodies for smoother adoption and facilitation of EVs by different users.

Chennai Experience

NAMMA auto with an aim to switch to cleaner fuel-based auto rickshaws initiated its Chennai project in 2019. Initially based on the reconnaissance survey it was observed that both two-and four-stroke auto rickshaws were plying in Chennai. During the interactions with the transport department, it was discovered that two-stroke auto rickshaws were banned in Chennai. Thus, switching to electric is the best option for switching to clean fuel technology and for the same, a pilot of electric autos as feeder to metro was introduced in collaboration with Chennai metro rail Ltd (CMRL) on January 10, 2019. The selected pilot corridor was from Alandur metro station to DLF IT Park. Three charging stations with each having capacity to charge ten electric wheelers at a time were installed by CMRL. But when it came to plying of vehicles, some regulatory hurdles were witnessed by the pilot. Due to absence of State EV policy in Tamil Nadu, there was lack of clarity on registration of the electric autos. After rigorous discussions with the Chennai Transport department retro fitment solution was adopted for the pilot. The already registered autos were identified and their permit from combustion engine to electric was transferred through an endorsement letter along with government order issued by the transport department of Chennai. Initially three retrofitted autos were plying on a flat fare of Rs10 per passenger. These autos ply on shared basis from 7:00 am to 9:00 pm. Since the autos are retrofitted, they faced frequent breakdown and required high maintenance. The operational cost further was impacted by the rains as frequency of the breakdowns went up during monsoon for the retrofitted autos. Since the drivers had limited exposure to the technology they were not able to optimally utilise the charging. Thus the key takeaway identified during the pilot project was that despite demand and supply, regulatory unpreparedness was a major road block in penetration of electric auto rickshaws.

Karnataka Experience

As a preliminary kick off activity and examining the regulatory issues and policy gaps faced by the auto rickshaw sector, TERI had conducted a workshop in Bengaluru during Jan, 2017. The analysis was expected to help identify policy barriers that need to be addressed in order to make the sector sustainable. The discussion was to deliberate upon the key regulatory issues concerning the sector. A multi- stakeholder interaction comprising all key actors like auto rickshaw unions, financers, manufacturers and regulating authorities had helped identifying the key issues and potential solutions.

The Energy and Resources Institute (TERI), released a research paper titled 'Estimating Vehicular Emissions from auto rickshaws plying in Bengaluru city' during the International Seminar on 'Switching to Sustainable Intermediate Public transport modes'. The research paper discusses the various scenarios to reduce the tail pipe emissions and derives the phase wise penetration of electric vehicles as the most recommended policy solution for the reduction of vehicular emissions.

In Bengaluru, the project has launched a ride booking application that is focused on offering first and last mile service of auto-rickshaws to regular metro users, through pre-fixed fares and routes. It is being piloted in one station at present. In Bengaluru, the project has collaborated with over 30,000 auto-drivers, trained over 5000 drivers under a code of conduct, and has mobilised several of them in to a state level cooperative society. In addition, through a Social Enterprise it promotes, it is financing auto-drivers to switch to electric auto-rickshaws

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About TERI

The Energy and Resources Institute (TERI) is an independent non-profit organization, with capabilities in research, policy, consultancy and implementation. TERI has multi-disciplinary expertise in the areas of energy, environment, climate change, resources, and sustainability.

With the vision of creating innovative solutions for a sustainable future, TERI's mission is to usher in transitions to a cleaner and more sustainable future through the conservation and efficient use of the earth's resources and develop innovative ways of minimizing waste and reusing resources.

TERI's work across sectors is focused on:

- Promoting efficient use of resources across sectors
- Increasing access and uptake of sustainable practices
- Reducing the adverse impact on environment and climate

TERI works with a diverse range of stakeholders across governments, both at the National and State levels, international agencies, and civil society organizations to help deliver research-based transformative solutions. Headquartered in New Delhi, TERI has regional centres and campuses in Bengaluru, Gurugram, Guwahati, Mumbai, Nainital, and Panaji.

Currently, TERI's work is structured around seven sectors namely:

- Agriculture
- Climate
- Energy
- Environment
- Habitat
- Health and Nutrition
- Resources

TERI brings out Discussion Papers on key contemporary issues in these sectors with multi-disciplinary and multi-sectoral implications for use by policy makers, legislators, researchers and practitioners. Discussion Papers are recommended for publication by a sub-committee of Distinguished Fellows at TERI. This Discussion Paper has been brought out by the Water Resources Division as a part of TERI's work on environment. A list of Discussion Papers of the Water Resources Division and other divisions is given overleaf.

For more information, please visit: **http://www.teriin.org/**