India_Kochi
UEMI_SOLUTIONS
2018

EV READINESS ASSESSMENT

Wuppertal Institut

UN HABITAT
FOR A BETTER URBAN FUTURE

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This publication is part of UEMI_SOLUTIONS and
the EU funded project Future Radar

The graphic design was prepared by Barbara Lah (UEMI)

Berlin, 2018

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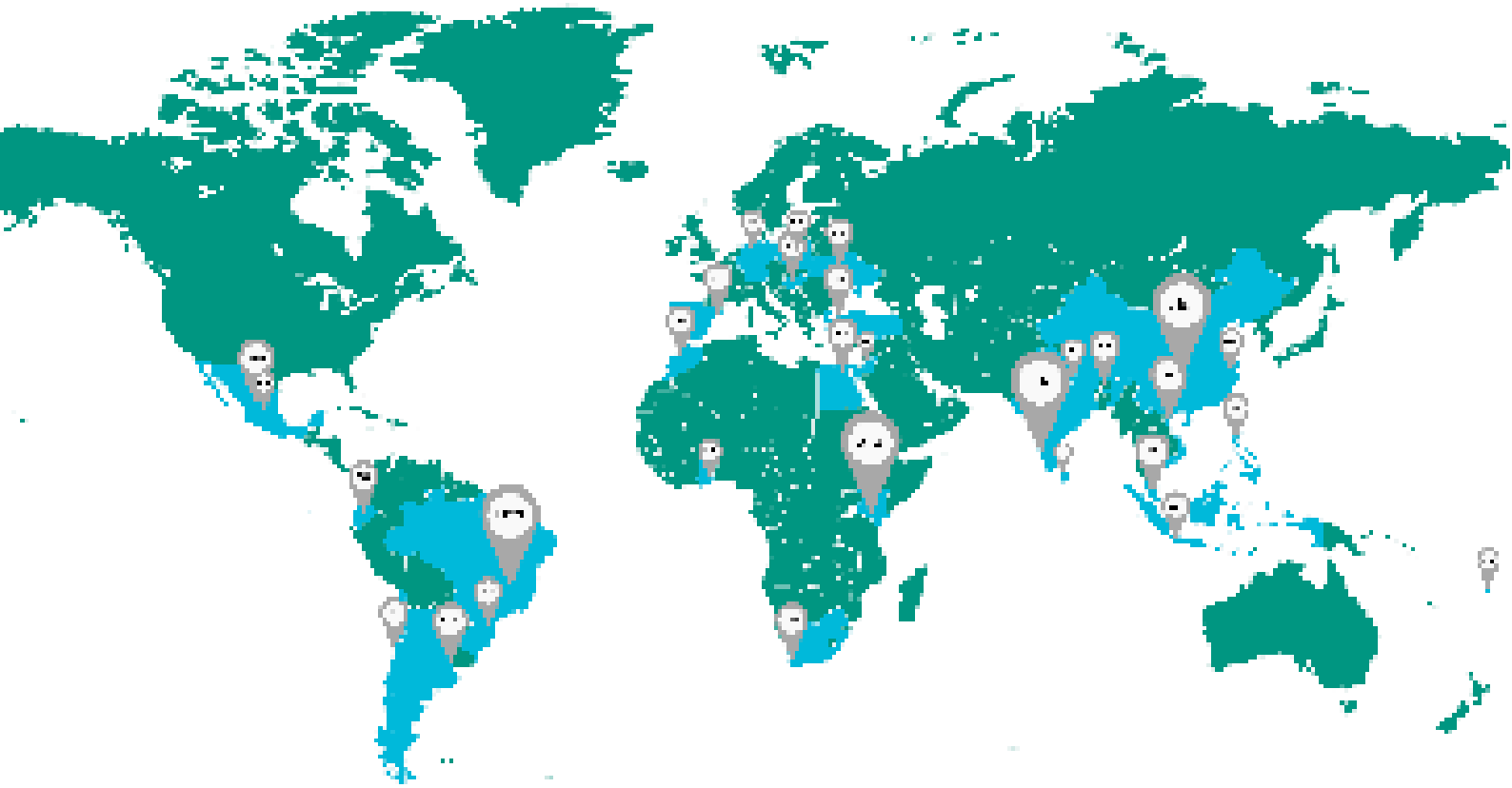
The project has received funding from the European Union´s Seventh Framework Programme and Horizon 2020 under the grant agreements no 604714 (SOLUTIONS) and no 723970 (FUTURE RADAR)



KEY FACTS & FIGURES

GDP 3,200 USD

KOCHI

CITY

Kochi is located in the state of Kerala on the south-western coast of India. The city's economy mainly relies on its industrial and port activities. The city has a population of 612,343, and a metropolitan population of 2.1 million, making it the largest urban agglomeration in Kerala.

For 2018-19, The State of Kerala's GDP per capita is estimated at Indian Rupees (INR) 220,826 (**3,200 USD**) (Pre Legislative Research, 2018). Ernakulam, the district in which Kochi is located, has the highest GDP per capita in the State. In 2011-12, while the average State GDP per capita was 82,750 INR (1,200 USD), that of Ernakulam was 85,070 INR (1,243 USD) (Central Statistics Office, 2017).

CO_2 EMISSIONS

In 2004, the State of Kerala's annual Road Transport CO_2 emissions were estimated to be in the range of 14.45 to 19.26 million metric tonnes (Ramachandra et al., 2009). For the city of Kochi, the road transport sector contributes 233 tons of CO_2 emissions per day or 85,0000 tons annually (Rao Ghorpade et al., 2014). These emissions are estimated to be more than double to approx. 230,000 tons by 2030 in the absence of effective sustainable transport measures (CDM Smith & KMRL, 2013).

Public transport – Buses and Ferry 42% (without the Metro system, which was projected to account for 30%), Private cars – 10%, Two-wheelers – 26%, Auto-rickshaws – 7%, Bicycles – 3%. Walking trips are estimated to be 12% as compared to 88% of the total vehicular trips (Rao Ghorpade et al., 2017).

88% of the trips are made by cars

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E-RICKSHAWS IN KOCHI

The Indian e-mobility sector has seen steady growth in momentum, especially since the central government of India has a target to electrify vehicles more than 30% by 2030. This paper gives an overview of e-mobility in India, on the status of electric vehicles (EVs) in the country, its potential impact, and political and technical support on its implementation. Understanding the EVs overview, the paper then discusses the implementation feasibility and framework concept for e-rickshaws in the city of Kochi.

DESCRIPTION & MEASURES

Status of EVs in India

India plans to make a shift to electric vehicles with an ambitious target to electrify vehicles more than 30% by 2030. But currently it's market penetration is low due to the high price of around 2-2.5 times more than a comparable conventional vehicle, low level of consumers' acceptance (i.e. lack of demand), low level of electric vehicle manufacturing activities (i.e. lack of supply), lack of comparable products (especially in the 2 Wheel category), non-existent public charging infrastructure etc. But EVs offer a significant advantage on operating cost compared to a conventional vehicle (lower by one-fourth) (SIAM, 2017). The per kilometre cost for an electric car in India is just 0.85 Indian Rs. against 6.5 Indian Rs. for normal cars (Indian Ministry of Power, 2018). The passenger vehicle segments which have achieved maximum EV adoption have been two-wheelers and three-wheelers.

1. Currently, around 210,000 electric two-wheelers are running on India's road (compared to more than 18 million gasoline 2 wheelers) – more than 98% of electric two-wheelers are low powered and low speed variants (maximum power not exceeding 250 watts and the maximum speed not exceeding 25 kilometres per hour). They are still a niche market segment (SIAM, 2017).

2. Three-wheelers or Auto-Rickshaws are one of the most used public transportation in India for intra-city movement. Electric 3-wheelers have a good opportunity in India to move pure electric vehicle technology (SIAM, 2017). The current growth of the e-rickshaws market has also attracted investments from established app-based cab services. In March 2018, Ola – one of India's largest app-based transport service aggregators, declared its plans to launch a fleet of 10,000 e-rickshaws in three cities (Kochi not included yet) (Shu, 2018).

3. One of the reasons are less use of electric private cars or four-wheelers in India is due to the moderate mileage (40 or 50 km per day).

4. Electric buses in India is considered expensive with the gap in technology and maintenance (SIAM, 2017)

The proposed measure broadly aims at expanding the adoption of electric mobility in Kochi and focuses on improving the city's first and last-mile connectivity. The pilot initiative shall comprise of establishing a fully-operational Intermediate Para-transit (IPT) system with a fleet of 10 to 15 e-rickshaws. This fleet is planned to be operated in either the Fort Kochi or Mattancherry area. The system will also include charging stations powered by clean energy, generated by solar photovoltaic (PV) panels installed within local school premises. Additionally, the measure shall also consist of recycling stations located in the selected school.

CURRENT POLICY PROCESS

2030

The Indian e-mobility sector has seen steady growth in momentum, especially since the central government of India has a target to electrify vehicles more than 30% by 2030. Accordingly, the Central Government has pursued multiple action plans, including subsidies on sales of e-vehicles, as well as setting up charging infrastructure. These efforts have moderately improved Electric Vehicles (EV) uptake across the country. Between 2012 and 2016, the share of EV purchases for all passenger vehicles sold grew from 0% to 1.3% (TERI, 2018).

E-RICKSHAWS

The passenger vehicle segments which have achieved maximum EV adoption have been two-wheelers and three-wheelers. It is estimated that the number of electric two-wheelers presently plying on Indian roads is 450,000 while that for electric rickshaws is over 500,000 (Rai, 2018). The current growth of the e-rickshaws market has also attracted investments from established app-based cab services. In March 2018, Ola – one of India's largest app-based transport service aggregators, declared its plans to launch a fleet of 10,000 e-rickshaws in three cities (not including Kochi) (Shu, 2018).

DRAFT KERALA

In January 2018, the Kerala State Government declared a preliminary draft of the policy to promote the use of 'eco-friendly electric vehicles'. Under its first phase, the State Government is targeting to electrify bus services and auto-rickshaws, currently being fueled by petrol or diesel. Additionally, the State Government also plans to issue future taxi-permits to only e-rickshaws in order to reduce the number of conventional three-wheelers. As a means to promote this initiative, there will be no hike in power tariffs during the first four years of e-rickshaw operations. Towards this, the State Government has even commenced talks with major e-vehicle manufacturers in India such as Mahindra and Gogoro (Manoramaonline, 2018).

EV POLICY

KEY RECOMMENDATIONS

1. **Setting up** of battery-swapping kiosks at fuel stations in cooperation with Bharat Petroleum (one of the largest state-owned oil and gas companies) and Kerala State Electricity Board (primary power utility)
2. **Low-cost** programmes to convert conventional Auto-rickshaws into e-rickshaws
3. **Tax incentives** for e-vehicles
4. **Avoidance** of monopoly prices and agreements with auto manufacturers in the initial phase
5. **Convert** the existing vehicles operating in ecologically-fragile areas into electric vehicles in a time-bound manner and create 'e-vehicles only' zones

The State Government of Kerala also plans to halt increasing power tariffs during the first four years and started holding talks with major e-vehicle manufacturers in India (Manoramaonline, 2018). In order to encourage a shift to eco-friendly fuels, the Kerala government has allowed 29 companies to market e-rickshaws, e-cars and e-bikes in the state and offer after-sales service. The decision has also been made to exempt such vehicles from possessing permits (The New Indian Express, 2018).
Other states in India, such as Karnataka state government has approved state's Electric Vehicle and Energy Storage policy 2017, the first Indian state to roll out an Electric Vehicle Policy (Agarwal, 2017). Tamil Nadu State has signed an agreement with C40 Cities, the first Indian city to join the initiative. With the agreement, the state declared a commitment to move towards zero-emission public transport vehicles. This would help the state government to procure electric buses at cheaper rates than conventional buses and create the infrastructure to operate them (The Times of India, 2018). Kochi Municipal Corporation (KMC) drafted its Comprehensive Mobility Plan (CMP) in 2007 which recommends several short- and long-term sustainable urban transport proposals. These include – pedestrian infrastructure upgrade, intersection improvement, Mass Rapid Transit Systems planning as well as improving the existing bus services.

POLICY ENVIRONMENT

With the objective of decarbonising the transport sector, the Central Government of India has made promoting of electric mobility as one of its major priorities along with a declaration to achieve 100% EV sales by 2030. This was reiterated by the premier federal think tank NITI (National Institute for Transforming India) Aayog through its landmark report – 'India Leaps Ahead: Transformative Solutions for All' to guide all national e-mobility-related policymaking. The NITI Aayog has also proposed the formation of a committee for 'Zero Emissions Vehicles' and has submitted a draft Cabinet note to the Parliament proposing steps to promote Electric Vehicles (EVs) in India towards the Centre's aim of complete electrification by 2030. Further, the NITI Aayog has proposed the formation of six committees to consider various aspects required to create a sustainable business ecosystem for EVs in India. The draft also recommends green number-plates to designate EVs, incentives such as free parking, a country-wide toll-waiver, as well as 10% of reserved parking space in residential and commercial complexes (NDTV, 2018). Following the directives of NITI Aayog, the Central Government's current policies which address electric mobility and particularly, the e-rickshaw sector are elaborated as follows –

NATIONAL ELECTRIC MOBILITY MISSION PLAN (NEMMP) 2020

The Minister of Heavy Industries and Public Enterprises launched its flagship National Electric Mobility Mission Plan (EMMP) 2020 in 2013. The programme aimed at addressing the demand side of EVs by creating a favourable entrepreneurial environment for their indigenous manufacturing. The programme targets rolling out up to 7 million units of a wide range of EVs such as hybrids and full-electric (TERI and Yes Bank, 2018). The plan also has the objective of establishing India's leadership in EV production as well as expanding the domestic market. The NEMMP has four key principles to achieve its objectives:

- Create consumer acceptability for EVs
- Develop infrastructure to support ownership and use of EVs
- Development and acquisition of EV battery technology
- Create local manufacturing capability

DRAFT NATIONAL ENERGY POLICY 2017

This policy drafted by NITI Aayog governs India's foreseeable energy roadmap. It emphasises scaling up emerging energy technologies such as EVs. It also addresses setting up charging infrastructure and creating measures for Renewable Energy (RE) to support electric mobility, as well as the inclusion of hybrid and EVs in India's future transportation systems.

NATIONAL E-MOBILITY PLAN 2018

This programme was launched by the Ministry of Power in 2018 and is being implemented by the Energy-efficiency Services Limited (EESL), a public company under the Ministry. It aims to provide an impetus to the entire e-mobility ecosystem including vehicle manufacturers, charging infrastructure companies, fleet operators and service providers. This is aimed to be achieved mainly by purchasing EVs in bulk from the private sector and intended for governmental use. A set of national guidelines for charging infrastructure and related policy framework has also been declared by the Ministry of Power with an intention that, by 2030, more than 30% of India's total passenger vehicles are EVs. Recently, the Ministry also declared that charging stations would not require a license, stating that charging e-vehicles should be considered as a 'service' and not a commercial sale of electricity (Business Today, 2018). The Ministry also aims to release a set of guidelines for power distribution companies (DISCOMs) and EV charging service providers by the end of 2018. Lower power tariffs for charging stations are also being considered (Ganguly, 2018).

FAME INDIA SCHEME 2015

Under the directives of the NEMMP, the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) scheme was launched in 2015 with a budget of 795 INR (116 million USD). This is a national programme focused on promoting e-mobility across the country through four focus areas – technology development, demand creation, pilot projects and charging infrastructure. FAME India is aimed at incentivising the sale of all vehicle segments, including two-wheelers, three-wheelers, four-wheelers, light commercial vehicles and buses. The current FAME subsidy offered for e-rickshaws is in the range of 3,300 to 6,000 INR. Among other initiatives, FAME also earmarked a funding of Indian Rupees 437 Crores (64 million USD) for 11 selected cities (excluding Kochi) to subsidies electric public transport with e-buses, e-taxis and e-rickshaws. Projects under this initiative are currently being implemented. FAME's pilot Phase I was planned for a duration of only two years from 2015-2017 and was recently extended up to March 2018. Consequently, a Phase II is also being planned by NITI Aayog (The Economic Times, 2017).

EV ACTION PLAN 2018

In 2017, with the intent of banning of fossil-fueled cars by 2030, the Minister of Road Transport and Highway had indicated that a draft policy was being put forth for the Cabinet to consider. However, it was subsequently decided by the Ministry and NITI Aayog to not create a policy but instead an action plan. This was widely perceived as a turnaround by the media, civil society and especially, the automobile manufacturers. Lack of federal funds for creating an expensive policy has been stated as a major reason for this decision. While the Central Government's initiatives have resulted in facilitating an entrepreneurial ecosystem, India's Manufacturers' Associations (for e.g., the Society of Indian Automobile Manufacturers or SIAM), have expressed an urgent need for a clear policy direction for creating a viable business roadmap without uncertainty.

NATIONAL GREEN MOBILITY SCHEME 2017

In 2017, the Ministry of Urban Development (MOUD) launched its 'Green Mobility Scheme' which funds municipalities (with over 1 million population) for shifting to electric/hybrid vehicles for public transport as well as transitioning to non-fossil fuels for public transport projects (MOUD, 2017). The regional Urban Metropolitan Transit Authority (UMTA) is the nodal agency for acquiring and disbursing these funds at the city level.

POTENTIAL CONTRIBUTION SDG NUA CO2 EMISSION REDUCTION

The adoption of EVs in India will reduce dependence on oil imports and promote power capacity addition in India, that enhances energy security (NITI Aayog and Rocky Mountain Institute, 2017) of the country and will also lead to the reduction in GHG emissions from the transport sector (NITI Aayog and Rocky Mountain Institute 2017). The plan to make India's passenger mobility 'shared, electric, and connected' can cut its energy demand by 64% and carbon emissions by 37% in 2030. It can reduce 156 metric ton in diesel and petrol consumption for that year & at USD 52/barrel of crude oil, this would imply a net savings of roughly 60 billion USD in 2030 (NITI Aayog and Rocky Mountain Institute, 2017). With the procurement of 20,000 EVs through Energy-efficiency Services Limited (EESL), a public company under the Ministry of Power, India is expected to save over 5 crore litres of fuel every year leading to a reduction of over 560,000 tonnes of annual CO_2 emission (Indian Ministry of Power, 2018).

ACCESS & MOBILITY

The NUTP also emphasises the critical role of Intermediate Para-transit (IPT) with an organised mass-transit network and its potential to provide 'clean mobility, low emissions and improved safety'. Towards this, the policy also recommends adopting e-rickshaws and regulating their ownership, driver's license, routes and fare structure (Ministry of Urban Development, 2014). With their passenger capacity and technical specifications, e-rickshaws are especially suited to provide such last-mile connectivity and thereby increase the efficiency of Kochi's public transportation.

Studies have indicated that Kochi's modal share of public transport is declining at 5.6% annually. Increased ownership of personal vehicles is a major reason for this (Rao Ghorpade et al., 2014). To counter this situation, KMRL is rapidly expanding the Metro network and has also identified 40 routes for providing feeder services (Krishna, 2017). The proposed pilot could align with one of these feeder corridors.

The transport sector in India accounts for 142 million tons of CO_2 emissions, making it 7.5% of the country's cumulative emissions. Facilitating the transport sector's clean energy transition would not only address India's mitigation objectives but also potentially save USD 27.8 billion of foreign exchange annually by 2030. Estimates also suggest that 30% adoption of e-rickshaws would result in a 7% reduction of India's CO_2 emissions while 100% electrification would result in cutting 75% of the same (Figure 2) (TERI and YES Bank, 2018). This especially applies to Kochi where Auto-rickshaws are the largest contributor to the city's transport-related emissions at 93 tons per day. Conversely, e-rickshaws are a clean mode which emits zero on-site CO_2 emissions.

CO2 EMISSION REDUCTION

SAFETY & SECURITY

India has the second highest number of accident fatalities in the world surpassed only by China (WHO, 2015). Of the 141,500 road fatalities that occurred in India in 2014, urban areas accounted for a significant share of 40%. While most victims of rural and highway crashes are motorists, collective figures indicate that 75% of traffic-related deaths in Indian cities comprise of vulnerable users such as pedestrians, bicyclists and motorcyclists (NCRB, 2015). Municipal authorities in India presently rely on conventional road safety policies such as enforcing traffic rules and promoting helmet or seatbelt usage. However, evidence indicates that fewer fatalities occur at places which require lesser distance travelled in private vehicles and more with public transport, including last-mile connectivity through IPT (Duduta et al., 2012). Thus e-rickshaws in Kochi serving first and last-mile increases safety and security in the city.

The transport sector in Kochi accounts for 20.2% of the Particulate Matter 2.5 concentration, which is known to cause multiple physiological damages (APNA, 2017). At present, Kochi's IPT segment mostly comprises of petrol/diesel-fuelled rickshaws operating at an average distance of 63 km per day. This mode is also responsible for emitting significant amounts of harmful pollutants daily – carbon monoxide (3.1 million gm), Particulate Matter 2.5 (148,000 gm) and nitrous oxide (384,000 gm) (Rao Ghorpade et al., 2014). On the other hand, e-rickshaws release zero pollutants and their large-scale adoption could result in significant air quality improvement for the city.

petrol/diesel-fuelled rickshaws

e-rickshaws release zero pollutants

AIR QUALITY

IMPLEMENTATION PARTNERSHIPS

FOCAL POINT

Centre for Heritage, Environment and Development (C-HED) (http://www.c-hed.org) and the Municipal Corporation, headed by the Mayor

CITY LEVEL

Kochi Municipal Corporation: Town Planning Department (headed by Town Planning Officer)/Engineering Department (headed by Superintendent Engineer)

The implementation of the proposed measure would also require collaborating with the following stakeholders at the city level:

1. Kochi Metro Rail Limited (KMRL)
2. Urban Metropolitan Transport Authority (UMTA)
3. Greater Cochin Development Authority (GCDA)
4. Kochi City Police - Traffic Unit
5. Sub-regional Transport Office (RTO), Mattancherry
6. Private sector: Cochin Chamber of Commerce
7. Private sector: Local Industries Associations (especially, regional e-rickshaw manufacturers, dealers and suppliers)

IMPLEMENTATION

1. These may include the following stakeholders at the city level:
Parastatal authorities with the budget and objectives of implementing EV-related projects (such as the Port Authority of India).

2. Private companies currently promoting EV and transition in India. These could include the regional or national solar panel companies and automobile manufacturers launching e-rickshaw models. The Corporate Social Responsibility (CSR) units of these organisations could also serve as potential partners.

3. National schemes (for e.g., the 'Green Mobility Scheme') being locally implemented by State/local authorities such as the UMTA

POTENTIAL FINANCE PARTNERS

FINANCE REQUIREMENTS

Total initial cost for implementing the proposed measure (for first year of operations) would be approx. 142,500 EUR for a fleet of 12 e-rickshaws (Lead Acid battery model), 3 charging stations and solar panel installations of 180 kW capacity.

PILOT PROJECT LEVEL

10.000 - 100.000 EUR

In addition to a larger fleet and more charging stations, a scaled-up project would also ensure solar energy back-up through battery storage for the selected schools and e-rickshaw charging stations. Moreover, a larger budget would also aid in procuring Lithium-ion battery models for e-rickshaws. Although this is presently cost-intensive compared to Lead Acid models, the technology is beneficial in terms of - (a) lesser environmental impacts of recycling, and (b) lesser charging time of 3 hours compared to 8 hours for Lead Acid models."

IMPLEMENTATION PROJECT

3 - 300 MILLIONS

Total cost for implementing the proposed measure (for first year of operations) for a fleet of 480 e-rickshaws (Lead Acid battery model), and 120 charging stations and solar panel installations of 180 kW capacity would be 5,700,700 EUR (for first year of operation)

TECHNOLOGY REQUIREMENTS

TECHNICAL BARRIERS TO THE PROJECT

The Indian government is now focusing on creating charging infrastructure and policy framework so that by 2030 more than 30% of vehicles are electric vehicles (Business Today, 2018). However, India currently has about 350 charging stations compared to around 57,000 petrol stations (Bloomberg, 2018). This restricts the distance one can travel in an EV, which impacts on the use limitation. From EV manufacturers' perspective, a lack of charging infrastructure has been a major concern to hinder promoting EVs in India.

India's Electricity Act has not allowed entities other than licensed DISCOMs to sell power. The recent release of national guidelines for charging infrastructure is expected to make a distinction between the sale of electricity and vehicle charging services (Ganguly, 2018). As mentioned in the draft policy, charging stations would not require a license (Business Today, 2018). The government has also initiated talks with state-owned power companies like NTPC (India's largest power utility) and Power Grid to set up charging stations along identified routes and in large metropolitan cities. With the increase in the supply of electric vehicles, DISCOMs could bid out infrastructure creation to private players in the future (Ganguly, 2018).

The white paper on Electric Vehicles by SIAM (2017) also analysed that mass adoption of electric vehicle will ultimately depend upon two major attributes – buyer's Preference (determined by affordability, performance and durability) and user-friendliness (ease of charging and ease of upkeep).

350 charging stations

India´s Electricity Act

The higher cost of battery pack for electric vehicle (an average 40-50% of the cost of a typical mass segment electric vehicle) is also hindering EVs in India (SIAM, 2017). For hassle-free and efficient operations of e-rickshaws or e-buses, provision of support infrastructure is a critical requirement. While charging stations are integrated in the proposed pilot, there are some project components which KMC will need to facilitate. These include – designated parking spots for charging (rickshaw stands), a shelter for waiting areas, lighting, garbage-bins and signage along the selected routes. This could be challenging since – firstly, space is premium (especially in commercial and touristic areas), and secondly, Kochi's old areas are dense with extremely narrow streets and parking provision may entail acquiring land from private properties. Additionally, basic facilities such as walkable sidewalks along many roads are presently missing. This may hinder pedestrian accessibility to the electric public transport services. Because of low output power, technical limitation and legal specifications, an e-rickshaw's maximum speed 25 km/hour. When fully loaded with 4 passengers this speed reduces to 20 km/hour and even lower while climbing sloped terrains. Comparatively, a conventional Auto-rickshaw can reach a maximum speed of 60 km/hour and better-suited for long distance trips. Due to these factors, the assessment of e-rickshaw projects in other Indian cities indicates a negative public perception and avoidance of e-rickshaws (CapaCITIES, 2017). The proposed pilot will have to devise ways to overcome this bias through careful route selection and outreach efforts.

Long distance trips

Public perception

ELECTRICITY MIX & RELIABILITY OF THE GRID

India's NDC establishes an ambitious aim of creating 175 GW of renewable energy capacity by 2022. However, the future trajectory of India's energy consumption continues to be both projected and planned to be reliant on fossil-fuels. Coal power presently meets 60% of total energy demand of the country, particularly in the industrial sector, which accounts for over 50% of total usage. The number of coal-fired power plants in India is estimated to grow 2.5 times by 2040, which would make India the world's second largest emitter (International Energy Agency, 2015).

Furthermore, India's Draft Energy Policy specifies the intent of doubling coal capacity by 2040 (NITI Aayog, 2017). Despite of increased capacity, India also faces an energy deficit both in rural and urban areas and one of the major concerns is the frequently planned power-outages in order to regular supply. The Kerala State Electricity Board (KSEB), the state's largest power utility, is currently implementing large-scale transmission infrastructure projects worth 14,000 Crore Rupees (2 billion USD) to ensure uninterrupted power supply by 2022 (Times of India, 2018).

POLICY & GOVERNANCE REQUIREMENTS

SUPPORT FROM THE LOCAL, STATE AND NATIONAL POLICY LEVELS

To clear legal hurdles in purchasing and operating e-rickshaws, the Central Government has taken two important steps. Firstly, the Ministry of Transport has decided that e-rickshaws would not require a conventional permit to ply on Indian roads (The Economic Times, 2016). Secondly, to clarify what constitutes an 'e-rickshaw' the Ministry has laid down clear guidelines. These define an e-rickshaw as a 'special purpose battery-operated three-wheeler' which provides last-mile connectivity, carries 4 passengers (excluding the driver), with a maximum net power of 2000 Watts and a maximum speed of 25 km/hour (The New Indian Express, 2018).

In order to encourage a shift to eco-friendly fuels, the Kerala government has allowed 29 companies to market e-rickshaws, e-cars and e-bikes in the state and offer after-sales service. The decision has also been made to exempt such vehicles from possessing permits (The New Indian Express, 2018).

KEY STAKEHOLDERS

In order to realise India's vision to electrify more than 30% of vehicles by 2030, the industry, government and various stakeholders will need to collaborate and invest, mainly the long-term plan is required to be implemented with full conviction, full commitment and total perseverance (SIAM, 2017).

National-level governmental stakeholders

1. Ministry of Power
2. Ministry of Roads Transport & Highways
3. Ministry of New & Renewable Power
4. NITI (National Institute for Transforming India) Aayog

Major national industry stakeholders

1. Society of Indian Automobile Manufacturers (SIAM): The 'apex Industry body representing leading vehicle and vehicular engine manufacturers in India' which includes Nissan, BMW, Skoda, Scania, TATA Motors, TVS, Honda, Chevrolet, Ford, Hero MotoCorp etc.
2. Society of Manufacturers of Electric Vehicles (SMEV): Includes the biggest auto companies such as Hero Electric, Okinawa Scooters, Mahindra and Mahindra and Tata Motors

Kerala State-level governmental stakeholders

1. Power Department
2. Transport Department
3. Kerala State Electricity Board (KSEB)
4. Kerala State Electricity Regulatory Commission (KSERC)
5. Agency for Non-conventional Energy and Rural Technology (ANERT), Department of Power, Kerala State Government
6. Research/advisors: Indian Institute of Technology (IIT), Chennai

STEPS TOWARDS IMPLEMENTATION

FEASIBILITY OF THE IMPLEMENTATION

The Central Government launched its flagship Smart Cities Mission in 2015. This competitive programme offered an earmarked funding to 100 Municipal Corporations (with over 1 million population) to implement their strategic urban development proposals. Kochi was selected as one of the top ten cities and was approved to receive a grant of 1,000 Crore Rupees (approx. 147 million USD) over 5 years. Transport and EV-related projects are key components of KMC's official proposal. These include – seamless multimodal connectivity to Metro and other mobility hubs via 4 km of waterways, 110 km of non-motorised transport (NMT) friendly streets and EV services. Therefore, the proposed pilot aligns with these 'Smart City' initiatives and could be instrumental in facilitating their scaling up.

While conventional Auto-rickshaws form the largest section of the market, India also has a substantial network of e-rickshaw manufacturers. There exist 340 e-rickshaw companies only in the city of Delhi (TERI and YES Bank, 2018). Such regional entrepreneurial ventures in the sector are presently being undertaken across multiple Indian states, including Kerala and in Kochi. Such a decentralised supply of e-rickshaws would not only help meet the increasing future demand, but also provide the proposed project with a range of models to choose from at competitive prices.

Likely timeframe for take-up and implementation

The proposed pilot project envisions a timeframe of 1.5 years for the implementation. The large-scale initiative with additional project components is expected to be completed in 3 years.

Summary of the key issues of assessment

With growing and competitive automobile industry in India i.e. the automobile and automobile component manufacturers have the capability and the commitment to achieve the target to electrify vehicles displacing fossil fuelled vehicles. India's automotive industry also has a vast pool of skilled engineers and significant incubation centres for gestating and maturing new technologies. India currently has a good expertise with Electric Drive trains and Power Electronics for non-automotive applications. India needs to leverage this expertise to establish research and manufacturing in India for Automotive applications much faster with a right mix of policy (SIAM, 2017). Some of the research and development activities are also carried out by Automobile industries. For example, Maruti Suzuki India (MSI), India's one of the largest car manufacturer, plans to conduct a survey of the Indian market to see how feasible the idea of electric vehicles is in the country. The company sees an importance to understand what the people want for the success of electric vehicles in India. The collaboration activities within the carmakers are also going on in India to develop EVs and batteries (Rakshit, 2017). The importance of the establishment of collaboration activities with manufacturer consortium for batteries, common components, and platforms to develop battery cell technologies and packs and to procure common components for Indian original equipment manufacturers was highlighted in the paper by NITI Aayog and Rocky Mountain (2017).

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SOLUTIONS

The project has received funding from the European Union´s Seventh Framework Programme and Horizon 2020 under the grant agreements no 604714 (SOLUTIONS) and no 723970 (FUTURE RADAR)

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