



INTRODUCTION OF ELECTRIC MOBILITY: KOCHI - CHALLENGES IN IMPLEMENTATION

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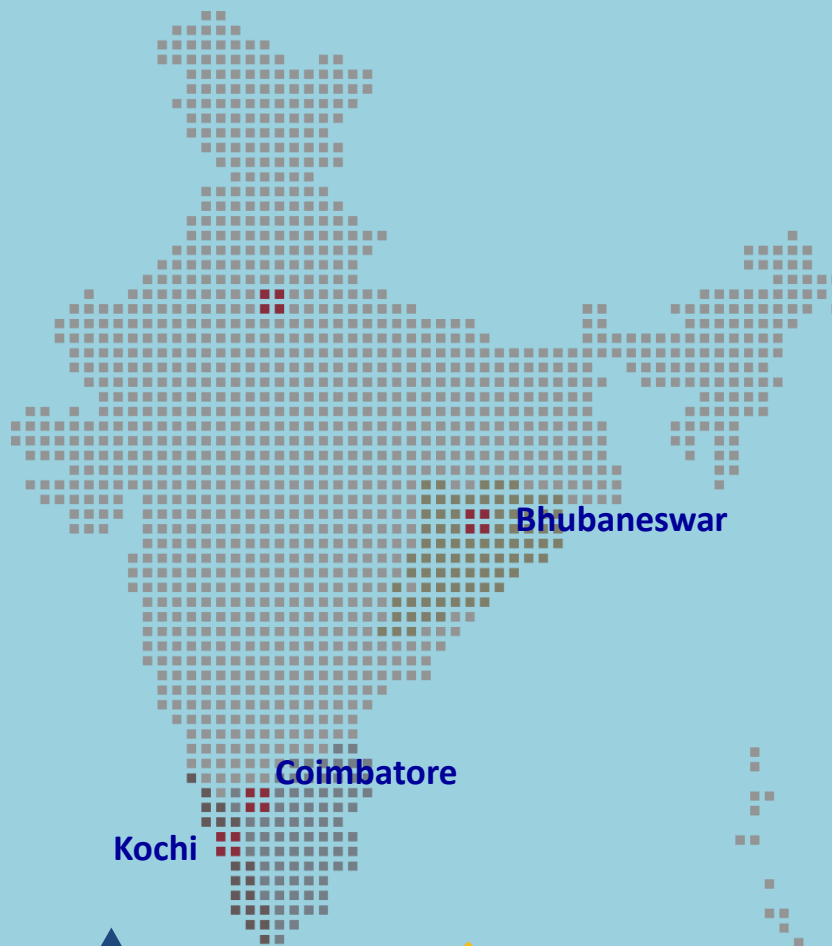


Integrated Sustainable Urban Transport Systems for Smart Cities (SMART-SUT)

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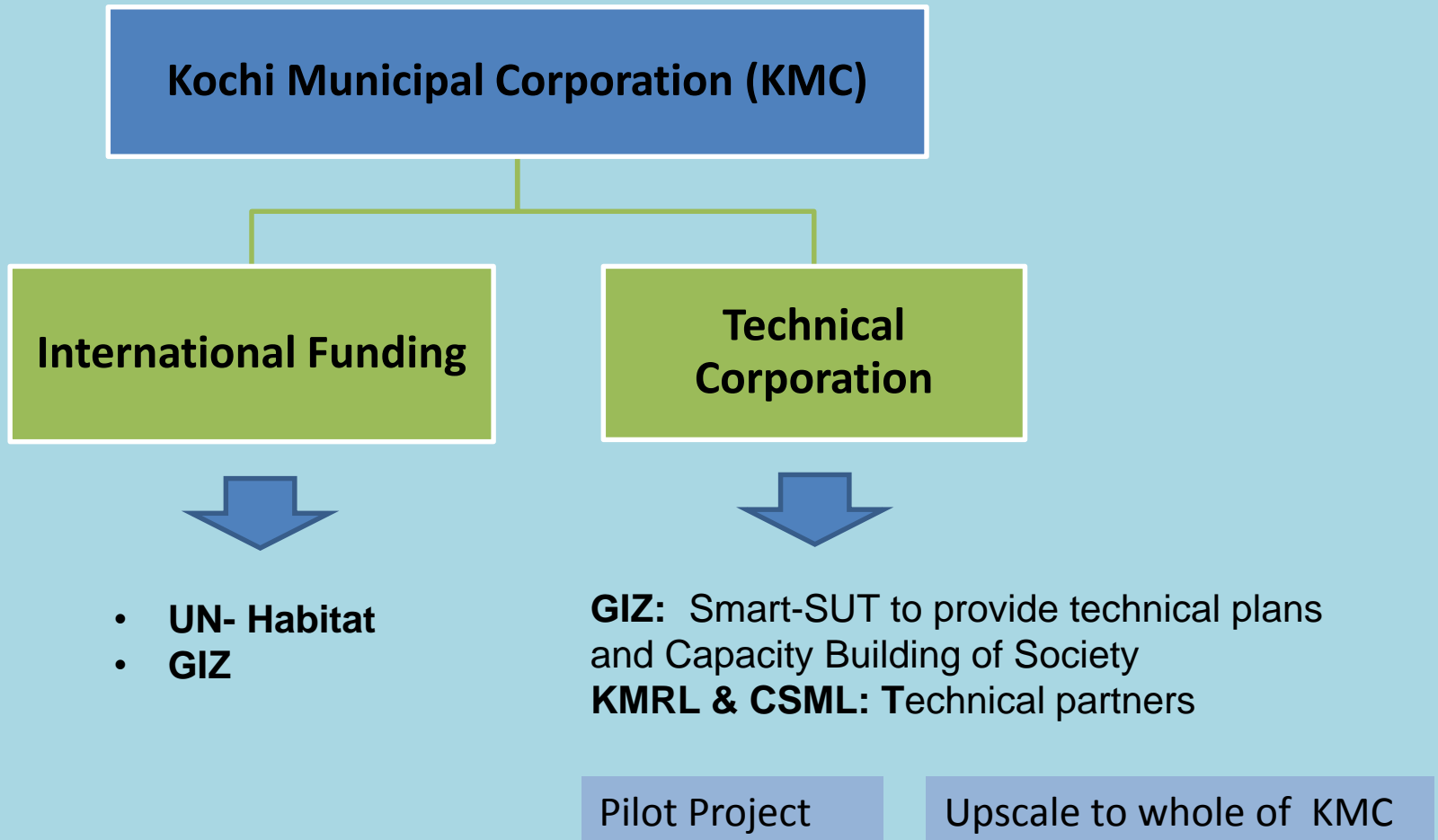


The 3- year long project is
being jointly implemented
by GIZ and the consortium
comprising GFA, WRI India
and Wuppertal Institute.

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Project Formulation and Support

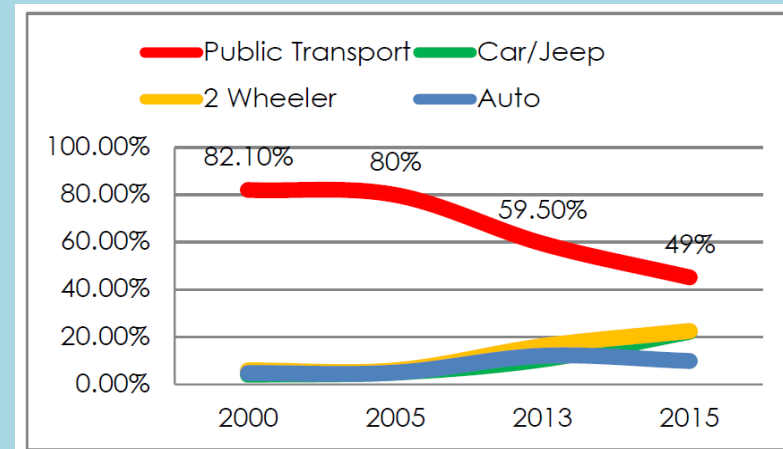


Kochi: Existing Para Transport Patterns

- Current PT modes- Metro, railways, Pvt and public Buses, and Autos.
- It is seeing a declining share of Public Transport.
- Total autos in Kochi city area: 4,500 autos
- Total autos in Greater Kochi Region – 15,000 autos
- Total autos in Ernakulum district – 23,000 autos
- With efforts of KMRL, Auto Driver Unions have been brought under one umbrella and 'Ernakulam District Auto Driver's Society' was formulated in Feb 2019.
- Advantages of considering E-auto:
 - Suitable to Kochi's narrow streets and lower densities.
 - Supplements other modes like Metro as feeder
 - Can substitute the need for a two wheeler
 - As shared mode, can accommodate more passengers
 - Augments income of auto drivers
 - A solution to increasing emissions : eventually retain sensitive eco systems of Kerala.



Modal share in Kochi



Source: CMP for Greater Kochi Region, 2017; A Roadmap for Implementing Kerala's Electric Vehicle Policy, Transport Department, Government of Kerala

Choice of Business Models

Model 1



Only charging/
parking
infrastructure
provided by Govt.

Model 2



Society Purchases E Autos
through subsidy as down
Payment. Land for
Charging by KMC

Model 3

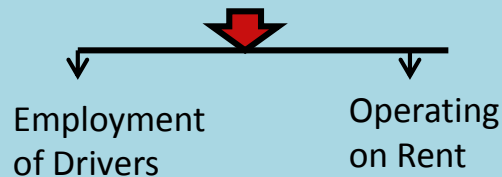


Rent Model where
OEM provides autos
(as Kochi Metro)

Model 4



OEM/ Aggregator
operates its own
autos in clusters



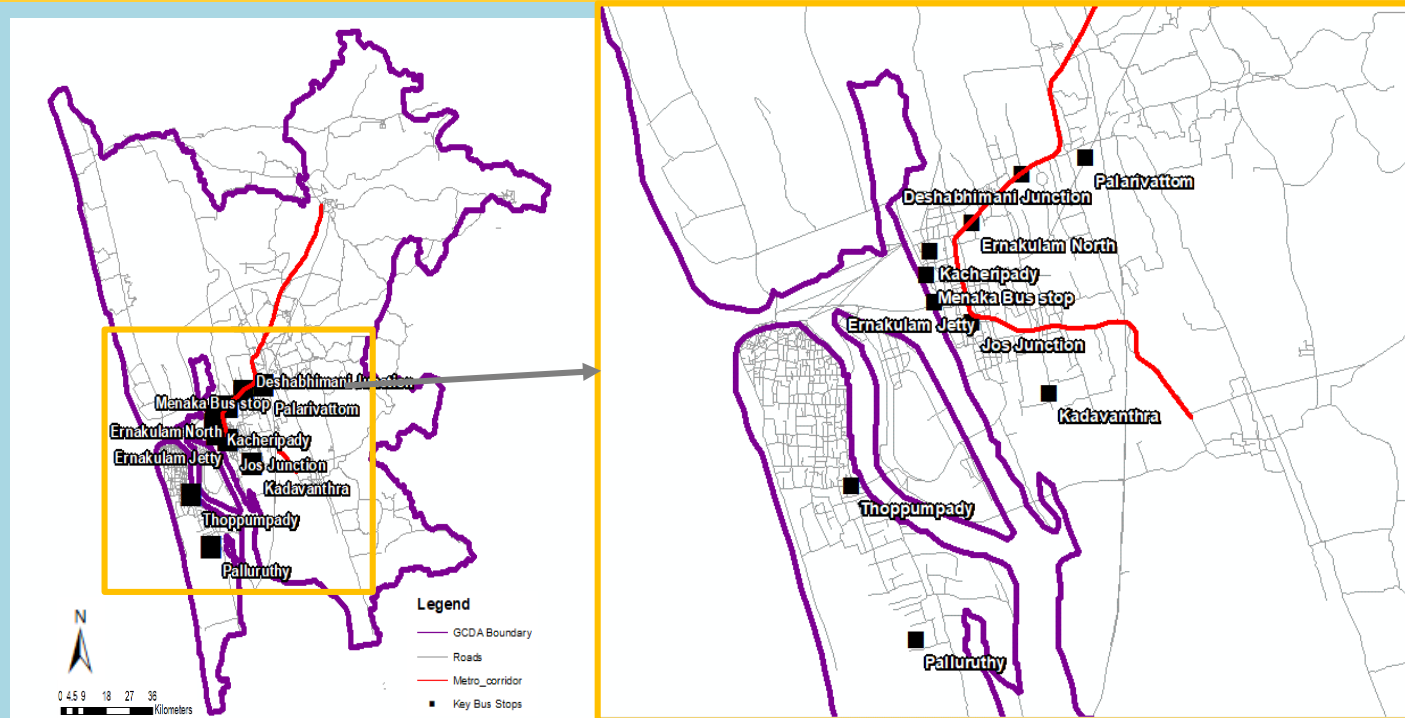
Role of Stakeholders

Stakeholder	Roles
Kochi Municipal Corporation	<ul style="list-style-type: none"> • Government nodal agency for Project • Engaging the stakeholders such as the society, Motor vehicles department, traffic police etc. • Providing clear land for charging and parking infrastructure • Supporting for any civic infrastructure like signage and queuing space • Providing promotion and outreach support and tie up with any special groups like tourists.
Auto Drivers Society	<ul style="list-style-type: none"> • Agreement with KMC • Tying up with a bank for a loan • Purchasing and ownership of E autos and RTO registration • Tying up with app/ITS service provider • Identification of auto drivers for deployment of autos on salary/rental basis. • Broad route planning and auto stand identification, queuing location and signage at auto stands including signage inside the vehicle. Correction of routes based on experience and seasonal demand. • Ensuring operationalization of E autos on selected routes • Major maintenance of the E autos • Centralized monitoring and coordination of E-autos for route planning • Maintaining a charging and parking infrastructure on land provided by KMC • Institutional Strengthening of the Society and Capacity Building of Board Members, Staff and Drivers

Role of Stakeholders

Stakeholder	Roles
GIZ	<ul style="list-style-type: none"> • Planning the intervention and roll out strategy for Pilot Launch • Funding the subsidy assistance per vehicle and the charging infrastructure • Analysing the pilot operations during pilot runs and submit a performance assessment report to KMC • Preparing up scaling plan for introducing E autos in KMC area based on experience of Pilot • Initiate branding and communication strategies • Conduct institutional assessment of Society and capacity building for auto drivers/ members
E-Auto Manufacturer	<ul style="list-style-type: none"> • Supplying of e-auto on down payment directly by GIZ at competitive negotiated bulk rate • Supplying required chargers of 2 KW and if possible of 4 KW. • Establish charging infrastructure at given locations and handing over to Society • Providing training to Society / Drivers for maintenance and servicing e-auto fleet • Establishing service centres and supply spare parts in the city
Beneficiary: Driver, passengers, Government, general public	<ul style="list-style-type: none"> • Rent/hire E auto from Society and operate at prescribed fares on broadly identified routes • Minor maintenance of vehicles • Co-operate with society and civic authority for route discipline, vehicle cleanliness, training • No fuel consumption

Location Selection

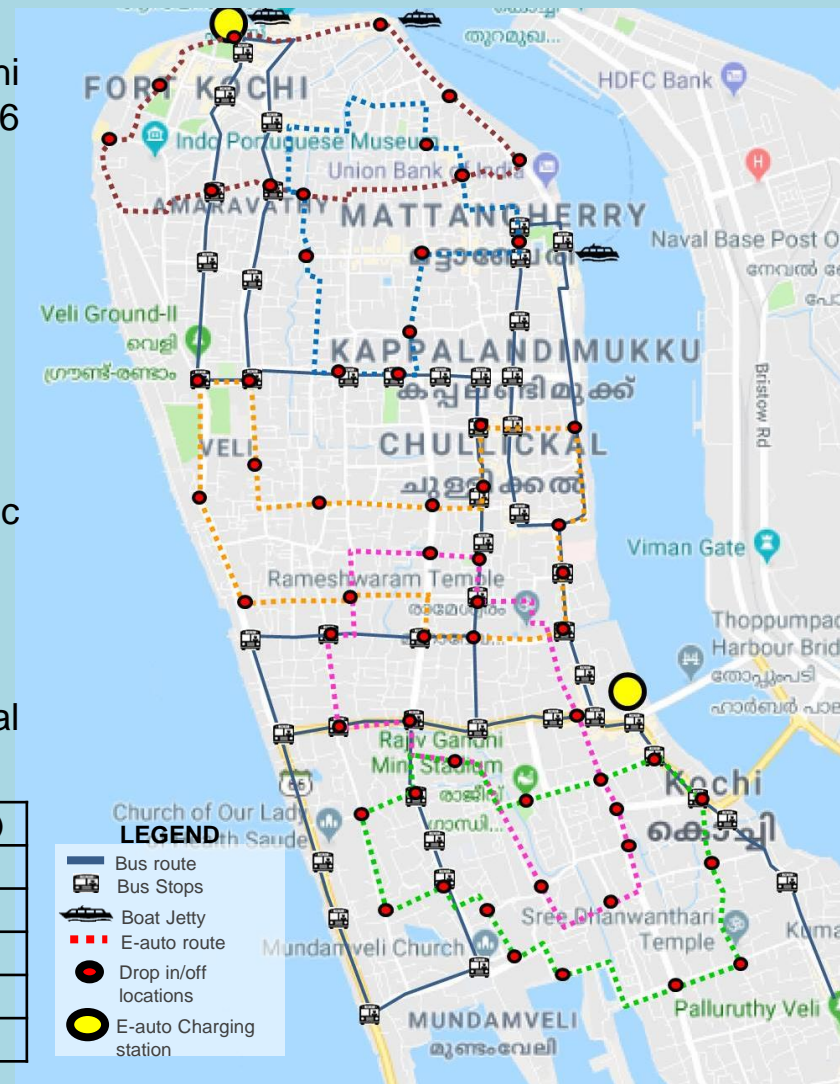


- The first level screening : major bus stops having high boarding and alighting.
- Top ten bus stations in KMC area with highest boarding + alighting selected
- Further bus stops in buffer area of 2 km from metro stations eliminated to avoid duplication with existing E Auto operations
- After filtering areas that emerged were: (i) Fort Kochi, (ii) Thoppumpady, (iii) High court, (iv) Palarivattom, (v) Kadavanthra.

Service Configurations

- Autos could run in loop or point to point service in Fort Kochi Island. Charging and nodal points at two locations (gap : 5-6 km) are proposed as follows:
 - (1) Near Ro-Ro jetty service
 - (2) Near Thoppumpady junction
- Routes proposed:
 - To provide last mile connectivity
 - To provide accessibility in the unserved areas by Public transport (Accessible within 500 m radius)
- Map shows proposed areas that could be covered
- Final routes could be developed by Society based on actual experience over a period of 1-2 months

Route	Distance (km)
Route – 1 (■ ■ ■ ■ ■)	5.5
Route – 2 (■ ■ ■ ■ ■)	4.5
Route – 3 (■ ■ ■ ■ ■)	7
Route – 4 (■ ■ ■ ■ ■)	5.8
Route – 5 (■ ■ ■ ■ ■)	6.2



Is the Ownership Model Viable ?

Auto Driver Society will own Autos as the Aggregator

Estimate of Financials for Society

Particulars	Estimate(Rs)
Capital Cost of E Auto at FAME II prices	160,000
Subsidy /Down Payment for loan	25,000
Loan Amount	135,000
Interest Rate for loan (% pa)	10%
EMI on loan (36 months) (A)	4356
Rental per day per auto (Rs)	250
Earning of Society through rentals (Rental per day x 26 days) (B)	6500
Net Surplus to Society (B-A)	2144

Estimate of Financials for Auto Drivers

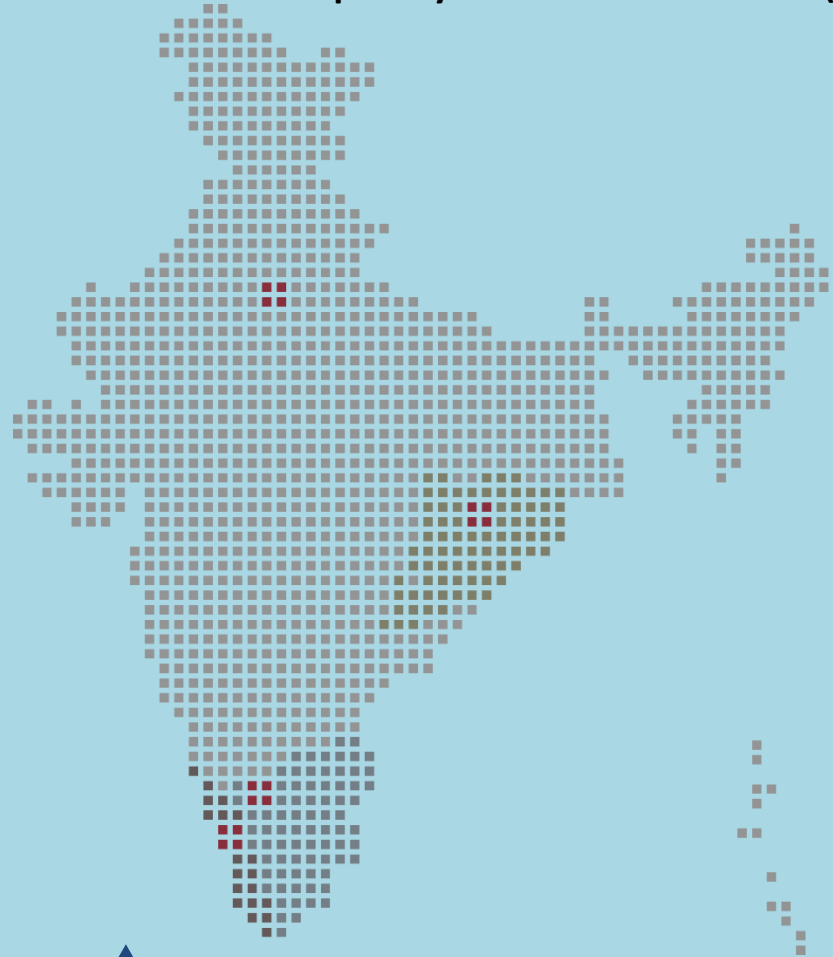
Particulars	Estimate (Rs.)
Earnings per month	17628*
Charging Cost @Rs. 30 per day (90 km per day will require 6 kwh@FE of 15 km /kwh x Rs 5 per kwh) for 26 days	780
Maintenance cost pm	500
Surplus	16848
Rental @ Rs 250 per day x 26 days	6500
Net Surplus	10348

**Average income of Diesel and Petrol auto drivers in Kochi area used where daily km is below 90 Km per day.*

- Society is likely to generate a surplus of around **Rs 2150 per auto per month**. For 25 autos, it could generate about **Rs. 50,000** which could be used to hire a manager and meet other administration expenses of the scheme.
- The cost of O&M of the charging points could be recovered from service charges permitted on sale of electricity as per the new Ministry of Power policy.
- The ICE Auto driver will double his income by switching to E Auto.



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Thank You

Survey of Auto Drivers

	Diesel	CNG	Petrol	Electric **
Earnings (A)	17992	23946	17082	17628
Fuel Costs (B)	5902	6032	6266	780
Maintenance Costs (C)	858	702	520	500
EMI (for self-owned) (D)*	4660	5147	4500	4840
Total Costs (E=B+C+D)	11420	11881	11286	6120
Net surplus (For self-owned) (A-E)	6572	12065	5796	11508
Rental (For Rented autos) (R)	6318	7462	-	6500
Net Surplus (for Rented) (E-B-R)	5772	10452	-	10348

- Survey of Auto Drivers was conducted in several locations
- It showed that by Diesel and Petrol Autos earned almost half of CNG
- **A diesel /petro auto driver could double his income by switching to Electric / CNG.** However scope for CNG is limited due to poor CNG availability (Only 2-3 pumps in Kochi)

Business Model for ITS

Model 1

- **OEM** to incur one-time cost for ITS fitment and application development software whereas Society to bear recurring expenditure.
- For 25 autos, the cost of E-Auto shall increase by around Rs 36,000 per unit making it unviable proposition.
- Owing to above reason, this **model is ruled out.**

Model 2

- **ITS service provider** to implement project on **Own and Operate (BOO) basis.**
- ITS service provider shall install ITS equipment and application on BOO basis and shall take back equipment at the end of the Contract Period.
- As against ITS services, it will charge monthly charge for its services.
- Market inquiries points to the monthly charge in the range of Rs 600 to 800 per E-Auto. This would have viability implications and hence **this model is also ruled out.**

Model 3

- **Collaboration with App based aggregators**
- App based aggregators such as Zophop Technologies Pvt. etc. who provide mobility solutions can be invited for collaboration for Pilot project.
- App based aggregators have economies of scale and hence it could provide cost effective mobility solutions.
- For instance, zophop technologies through its free “CHALO” app provides tracking and timetables to commuters. **This model can further explored.**

Overall, 3 models were explored and Model 3 is selected.

Battery disposal and Exchange schemes for old autos

- End of life batteries must be given to manufacturers of batteries at replacement time for scientific disposal.
- Discount should be offered for exchanging the old battery with a new one.
- OEMs to follow regulations similar to The Battery (Management and Handling) Rules, 2001 (for Lead Acid Batteries) are notified by the Central Government (Similar rules can be made for Lithium-ion batteries).
- If a driver selected as a beneficiary by the Society is switching to an E Auto by scrapping an old diesel/petrol auto, then he /she may be offered a discount of 10% on rentals or an extra 10% in salary as an incentive by the Society. (evidences to be presented)
- Given the financial viability, it is expected that the society will be able to bear the small loss of income on this account.

Regulations and Policy Framework for Electric 3 Wheelers

Sr. no.	Regulations / Policy	Description
1.	Motor Vehicle Act	<ul style="list-style-type: none"> Prior to 2014, E Three wheelers not recognized under MV Act and not subject to regulations such as type approval, registration, licensing etc. Through notification dated 8th Oct. 2014 by MORTH amending CMVR, e-rickshaw and e-carts were categorized as transport vehicles requiring driving license and safety standards In 2015, definition of e-rickshaws changed to 'special 3 wheeler vehicle of power not exceeding 4000 Watts' Any vehicle offering higher power than 4000 watts and speed upto 25 km/hr considered as E Auto.
2.	FAME India Policies	<ul style="list-style-type: none"> Fiscal support would be offered depending on the size of the battery with an incentive of ₹10,000 per kilowatt hour (kWh) for two-, three- and four-wheelers.
3	Kerala Electric Vehicle Policy	<ul style="list-style-type: none"> Exemption from road tax to EVS for initial three years (for new registration). Incentive of ₹30,000 or 25 per cent of Vehicle Cost for Electric three-wheelers. Subsidies on charging stations and DC Chargers Subsidy for first 50 swapping stations, (25% of capex capped at Rs 10 lakh) Manufacturing of e-auto proposed by Kerala Automobiles Ltd (KAL)
4	Ministry of Power	<ul style="list-style-type: none"> Domestic Charging allowed, Sale of power de-licensed. Tariff for Public Charging Stations not more than average cost of supply + 15 percent..

Evaluation and Selection of Electric 3 Wheeler Technology

	E Rickshaw	E Auto
Battery	Lead Acid (Mostly)	Lithium Ion
Battery Life	>12 months	2-3 years
Max Speed	25 Km	Higher
Battery Size	4000 w (Earlier 2000 w)	4000 w +
Range in Single Charge	40-50 km	70-80 km
Body	Light body with uncovered or fibre glass top	Hard covered metal body
Licensing for operation	With Municipal Corporation or as per State Policy	With State Transport Dept. like any Auto
Safety Features	Required as per design and safety standards by four approved agencies	Higher stability, approved designs by stipulated Agencies for all vehicles
Price Range per Auto	Rs. 80,000/- to Rs. 1,20,000/-	Rs. 1,50,000/- to Rs. 2,00,000/-
Battery Warranty	Usually one year	Three years in most cases. (Vehicles taking FAME Benefit must mandatorily have 3 year warranty).
Life cycle cost	Approx. Rs. 2,35,000	Approx. Rs. 4,00,000
Environmental Implications	<ul style="list-style-type: none"> - Lead Acid requires comparatively more raw material to achieve the same energy storage as Lithium-ion - Lead processing industry is highly polluting 	<ul style="list-style-type: none"> - Li- Ion requires less raw materials - Lithium mining is resource intensive, but lithium is only minor portion of battery mass.

E-Rickshaw

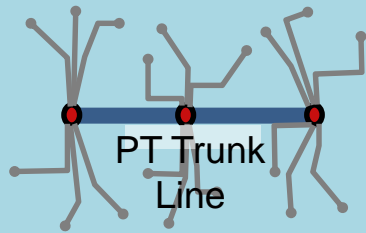


E-Auto



Based on above, Kochi has selected Lithium Ion based Charging Vehicles. Also, Swap Model is still in nascent stage of development. It can be considered for advanced phases.

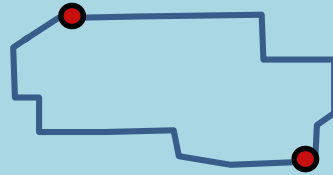
Selection of Service Configuration



Feeder

Services as feeder to transit nodes such as railway station, bus station, metro station or ferry station.

Charging points are placed at the main transit node



Loop

Services in fixed loops and can also operate under shared arrangement. E.g.: Hop on Hop off service for tourists in Fort Kochi.

Charging points are placed at one or two places on the loop.



Point to Point

A service joining two specific, high frequency points.

Charging station may be placed at both locations.



Corridor

A corridor over a major trunk route can be developed.

Charging stations can be placed at regular distance intervals of 5-8 km.

It can facilitate long distance transit role for e autos.

- **Combination of Loop and Feeder selected for use at Kochi Metro Stations**
- **Loop Selected proposed for use at Fort Kochi area**

Overall Roll out Strategy

- Roll out 50 autos under Pilot Project in Fort Kochi Area
- Scale up strategy for KMC area

	Existing metro feeder model	Proposed Model
Nodal Agency	Kochi Metro Rail Limited	Kochi Municipal Corporation
Area	Metro Influence Area (2 km)	Non metro area starting with Fort Kochi as a Pilot
Business Model	OEM owned Vehicles offered on Rent to Driver Society members	Vehicles to be owned by Society purchased using GIZ Assistance
Vehicle	Lithium Ion based E Rickshaw / E Auto (Choice left to OEM and Society)	
Charging Space	Provided by KMRL.	Provided by KMC
Charging Cost	OEM	Auto Driver Society
Training	By KMRL	GIZ will support with help of KMC

Kochi Metro Experience in Electric Three Wheelers

- KMRL has worked to introduce E-autos at metro stations; the autos operate as feeder service in the buffer area of 2 km from the metro station on rental basis - Rs. 200 per day.
- Agreement signed between KMRL and OEM. Another agreement between Auto Driver Society and OEM. Fares fixed as per these agreements.
- Autos operate on shared basis
- Around 14-15 operational E autos around Maharaja make more money than regular auto drivers. At other stations, where it seems difficult to find passengers to the metro station while returning, the auto drivers less enthusiastic.

1	Daily Rental paid for Charged Auto	Rs. 200 per day (initially Rs. 150 per day)
2	Ownership and Maintenance	Responsibility of OEM
3	Daily Income per auto	Rs. 700-1300 per day
4	Fare Charged (up to 2 km trip only)	Rs. 10 - Shared basis Rs. 30 – Private hire
5	Charging Location	At Maharaja and Aluva Stations
6	Charger type	2 kw charger operating on 230-240 V mains supply
7	Charging Time	2-3 hours for full charge, 30 min for top up.
8	Hours of operation	6 am to 10 pm
9	Parking at night	At the metro station parking area
10	Capital Cost of Auto in open Market	Around Rs. 2,00,000 on road price
11	Auto Type	Fixed Battery of 4 kwh, 4 seater, two speed operation



Capacity Building

Capacity Building and Institutional Strengthening of the Auto Drivers Society will be required with following features:

- Recruitment of Professional Managers
- Continuous Drivers training: Driver should be given training prior to him operating an e- Auto. A fresher training should also be arranged to veteran drivers periodically if required. The training modules can be updated periodically with experience during operation. The driving training of the auto drivers will consists of:
 - Basic auto operation training
 - Driving habits
 - Behavioral training
- Further, training for repair and maintenance of the E-auto will be offered to the drivers; also safety training will also be offered.
- The Auto Driver's Society will be required to appoint a competent Third Party Agency (TPI) for inspection, testing and trials of E-Autos.

Proposed GLZ Assistance

Sr.no.	Item/Activity	Total Cost (INR)	Total Cost (Euro)
1	Subsidy for purchase of 50 E Autos	1250000	16250
2	No. of Electric Chargers (Min 4-8 KW) with 2 guns each	By OEM	By OEM
3	Electric infrastructure for Charging	200000	2600
4	Paved Area and Parking at Charging Location	250000	3250
5	Charging bays with roof at Charging Location	800000	10400
6	Utility Room at Charging Location	250000	3250
7	Communication and Branding:	36000	468
8	Signage designating e-auto pick up points/stands in Fort Kochi	40000	520
9	Capacity Building auto drivers	65000	845
10	Capacity building Auto Driver Society.	139000	1807
Total For Pilot		3,030,000	39,390
Total Budget		6,240,000	80,000
Remaining funds for Scale Up		3,210,000	40,610