Creating an ecosystem for Electric Vehicles Charging in India

Subash Dhar
Talat Munshi

Enabling policies

Strong enabling national policies

Focus Area	Action/Target	Policy
Fuel quality standards	Phase in Euro V fuel standards from 2019 onwards	Auto Fuel Vision and Policy 2025
Emission norms for cars	Euro IV (2017) Euro V (2021) Euro VI (2024)	Auto Fuel Vision and Policy 2025
Promoting Electric Vehicles	Subsidies for EV, charging infrastructure and R & D	National Electric Mobility Mission Plan, 2020
Vehicle Fuel Efficiency Program	Passenger vehicle fuel efficiency standards, labelling and penalties	In process of implementation

Enabling state level policies

State	Action/Target
Maharashtra	• **Charging :** ✓ First 250 charging stations to get a 25% capital subsidy ✓ OEMs can create charging stations at petrol pumps ✓ Special Tariff for EVs (same as residential) • **Vehicle :** ✓ First 100,000 EVs eligible for incentive upto 15% of vehicle cost ✓ EVs exempted from road tax and registration fees
Other states	Karnataka, Uttar Pradesh & Andhra Pradesh

Source: Dhar, S., Pathak, M., & Shukla, P. R. 2017. Electric vehicles and India's low carbon passenger transport: a long-term co-benefits assessment. *Journal of Cleaner Production*, 146: 139-148.

Analysing the enabling environment

Achievement for EVs

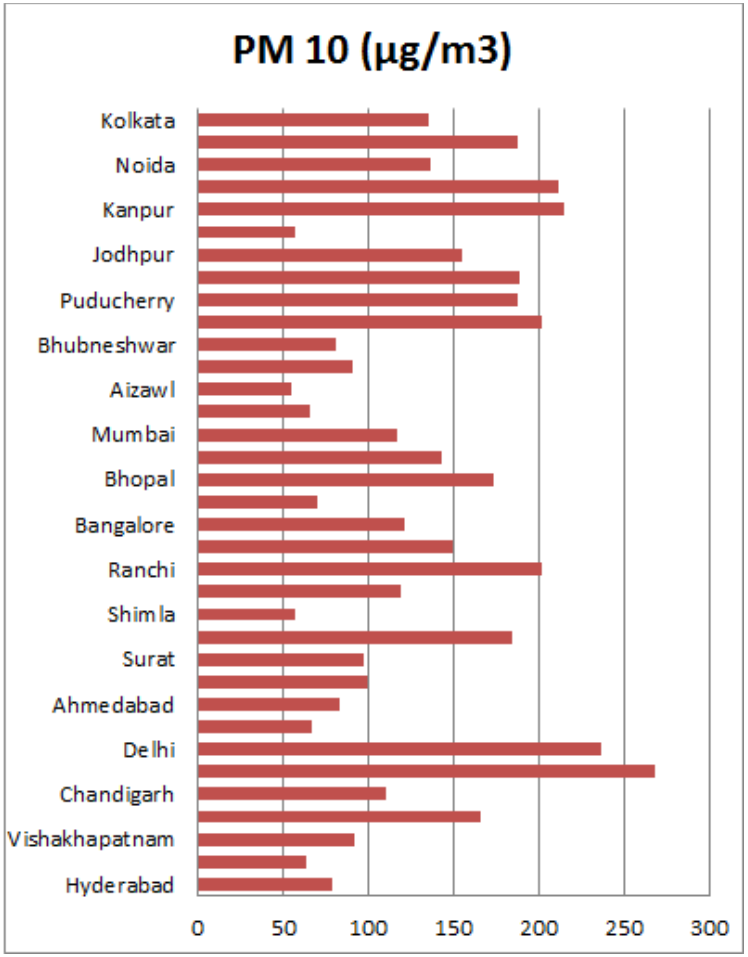
Country	Stock	Market Share
China	648,770	1.4 %
US	563,710	0.9 %
Norway	133,260	28.8 %
India	4,800	0.0 %

Source: IEA. 2017. Global EV Outlook 2017: Two million and counting. Paris: International Energy Agency.

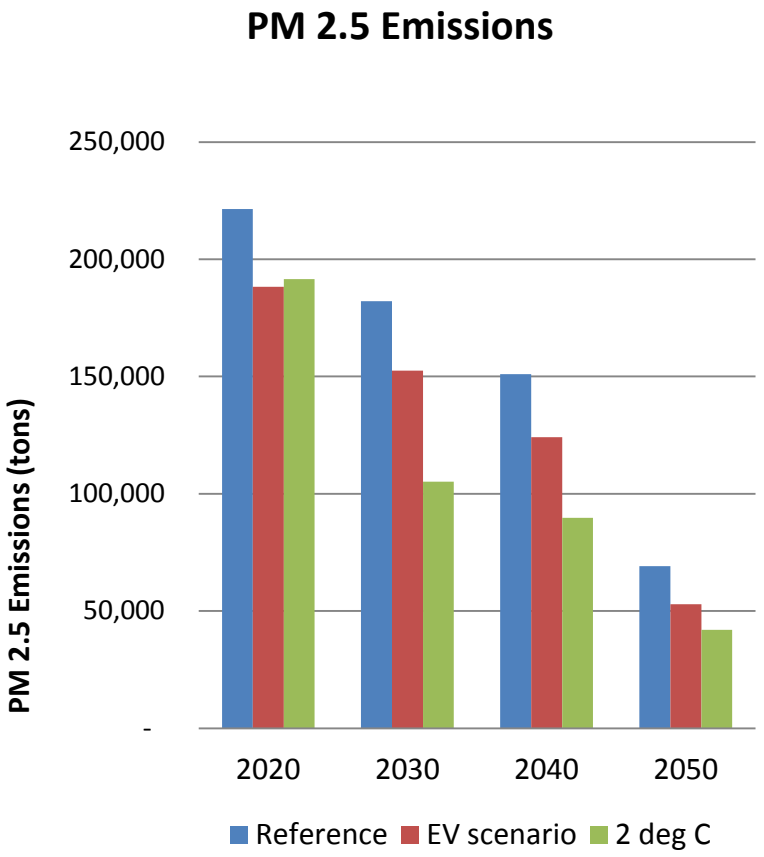
UN Environment / UDP Studies

- Roadmap for EVs (2014)
- Barriers for EVs (2017): Hyderadad
- EV Charging (2018): Pune
- Delhi Agra EV Corridoor

Environment and EVs



Source : Central Pollution Control Board



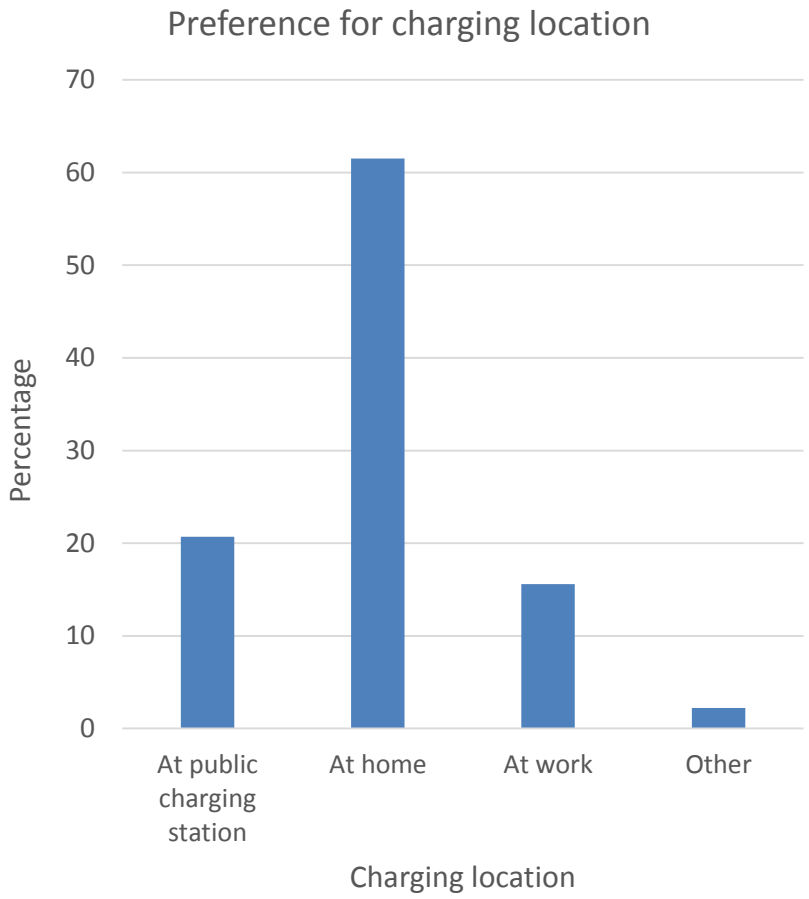
Source: Dhar, S., Pathak, M., & Shukla, P. R. 2017. Electric vehicles and India's low carbon passenger transport: a long-term co-benefits assessment. *Journal of Cleaner Production*, 146: 139-148.

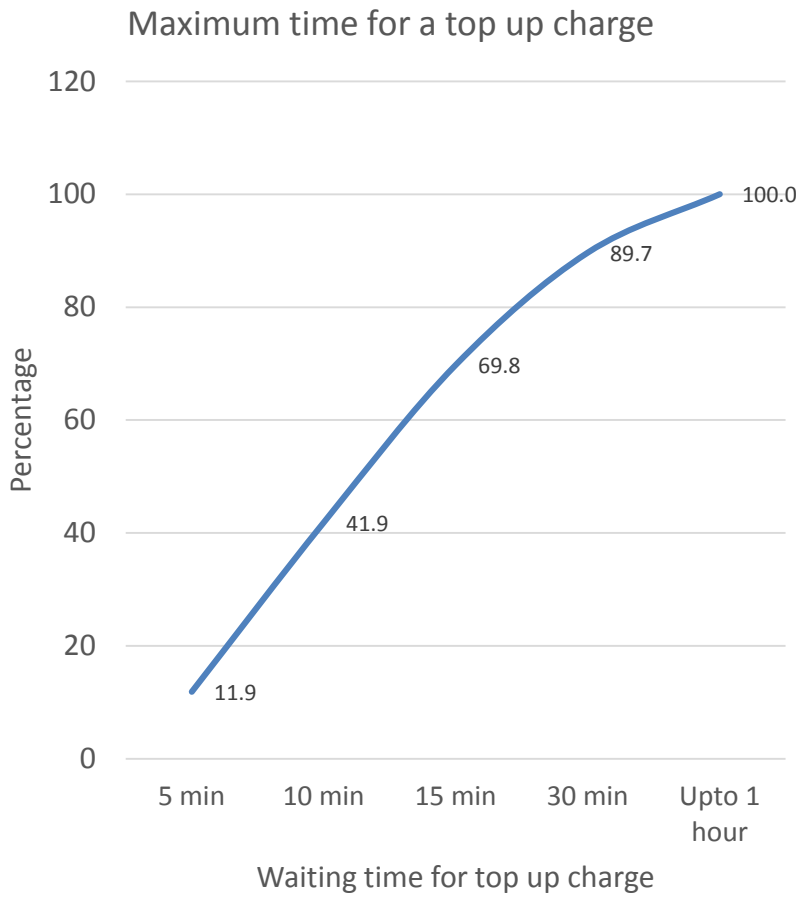
Results – Purchase Criteria

1	Availbility of Charging stations
2	Initial purchase cost
3	Driving range per full charge
4	Top Speed / Acceleration / Performance
5	Maintenance cost / Servicing costs
6	Running cost
7	Look and feel / Styling
8	Re-sale value
9	Environmental benefits
10	Vehicle Variant and Segment(Hatchback/Sedan/SUV)

Source : Srinivas Cherla & Amit Garg, 2017, Study on Electric Mobility in India, UNEP DTU Partnership

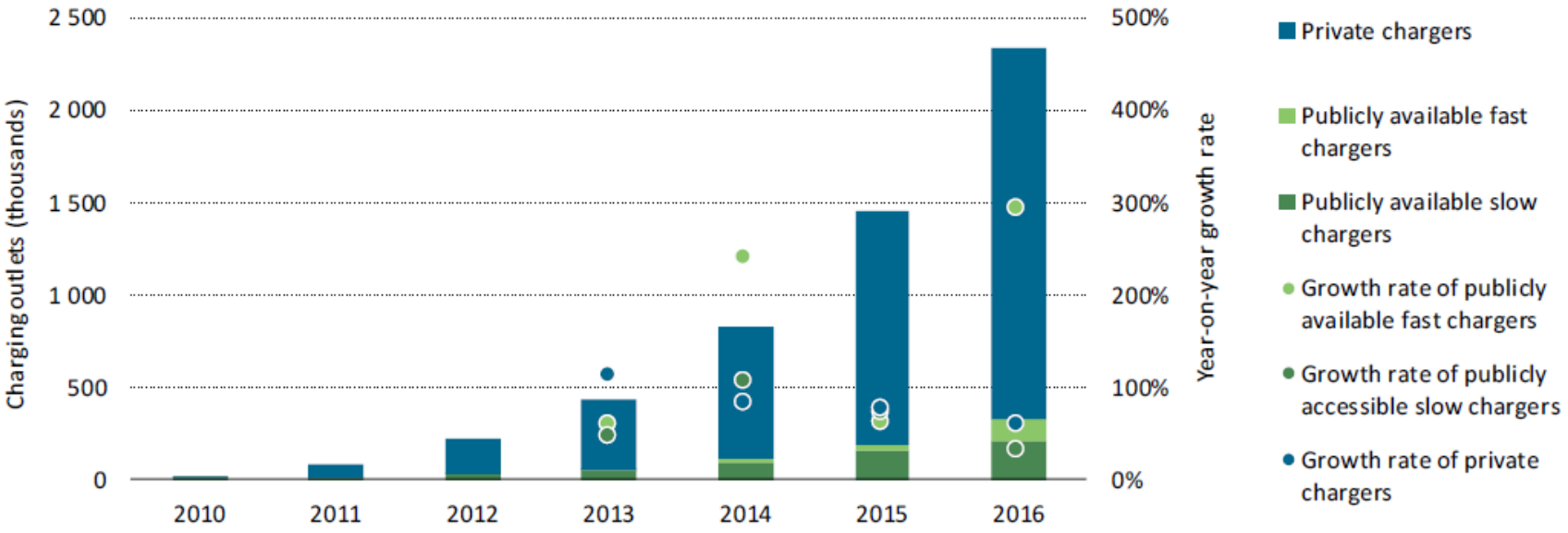
Charging Infrastructure





Source : Srinivas Cherla & Amit Garg, 2017, Study on Electric Mobility in India, UNEP DTU Partnership

Global Experience



- Most drivers primarily rely on private (home or office) charging
- However, public chargers a pre-requisite for EV diffusion
- Trend for public chargers is towards fast charging

Source: IEA. 2017. Global EV Outlook 2017: Two million and counting. Paris: International Energy Agency.

Charging models and their costs

	Home Charging	Society Common Charging	Office/ Private Charging	On-street / Public Parking + Charging	Public Charging Stations (ex. Petrol pump)	Mall Charging
2 Wheeler	1.2 Kw battery 60 km range					
Slow Charging (4-5 hours)	12	26	30	22	29	36
Fast Charging (1-2 hours)	NA	36	43	34	43	37
Rapid Charging (<30 mins)	NA	NA	NA	43	57	49
4 Wheeler	12.5 Kw battery 100 km range					
Slow Charging (5-8 hours)	110	220	270	170	260	230
Fast Charging (1-2 hours)	NA	240	300	190	290	240
Rapid Charging (<30 mins)	NA	NA	NA	220	330	270

Source: Business Models Report from Pune Study prepared by UMTC and pManifold

Vehicle Costs

2 Wheeler Costs (Rs Lacs)

	60 kms per charge	90 kms per charge	120 kms per charge
Slow Charging (4-5 hours)	0.61	1.05	1.48
Fast Charging (1-2 hours)	0.67	1.16	1.62
Rapid Charging (<30 mins)	0.89	1.58	2.27

4 Wheeler Costs (Rs Lacs)

	75 kms per charge	100 kms per charge	200 kms per charge	300 kms per charge
Slow Charging (5-8 hours)	7.20	8.20	12.10	17.00
Fast Charging (1-2 hours)	7.50	8.60	12.60	17.70
Rapid Charging (<30 mins)	9.10	11.10	18.70	28.30

Source: Business Models Report from Pune Study prepared by UMTC and pManifold

Preferences for Charging 2 Wheelers

Utility Estimate	Without Cost	With Cost
Intercept	6.667	24.703
Range-60	-0.373	**0.922**
Range-90	-0.052	0.488
Range-120	**0.424**	-1.410
Charging Time-Slow	-0.441	0.186
Charging Time-Fast	0.053	**0.552**
Charging Time-Rapid	**0.388**	-0.738
Cost-Low		0.922
Cost-Medium		0.305
Cost-High		-1.227

Source: Business Models Report from Pune Study prepared by UMTC and pManifold

Preferences for Charging 4 Wheelers

Utility Estimate	Without Cost	With Cost
Intercept	9.526	33.232
Range-75	-0.376	-0.638
Range-100	0.349	1.342
Range-200	-0.207	0.232
Range-300	0.234	-0.936
Charging Time-slow	-0.748	-0.736
Charging Time -fast	0.496	0.867
Charging Time -rapid	0.251	-0.130
Cost-low		1.163
Cost-medium		-0.572
Cost-high		-0.591

Source: Business Models Report from Pune Study prepared by UMTC and pManifold

Conclusions

- Electricity Tariffs:
  - Create a big difference in terms of where one would charge
- Preference for vehicles and charging
  - 2W – A range of 60 km and fast charging
  - 4W - A range of 100 km and fast charging
- Trade offs between range, charging time and cost
- Innovative solutions such as Battery swapping, range extension

Thanks to Panelists and Participants

Survey Link:

http://bit.ly/india-ev-user-survey