Just Transitions to Decarbonisation in the Asia-Pacific

All Change: Equitably Decarbonising India's Transportation Sector

June 2022

Subhes Bhattacharyya
Daniel Kerr
Nupur Ahuja
Nehal Gautam
Naman Agarwal
John Rowlatt
Sukanya Das
Gopal K Sarangi
Andrew Mitchell

The British Academy

About the authors

Professor Subhes Bhattacharyya is Professor at the Centre for Environment & Sustainability at the University of Surrey. Mr Daniel Kerr is a Research Associate at the Institute of Energy and Sustainable Development at De Montfort University. Ms Nupur Ahuja is a Research Associate at the Department of Policy and Management Studies at the TERI School of Advanced Studies. Ms Nehal Gautam is a Research Associate at the Department of Policy and Management Studies at the TERI School of Advanced Studies. Mr Naman Agarwal is a Research Associate at the Department of Policy and Management Studies at the TERI School of Advanced Studies. Mr John Rowlatt is a Research Associate at the Institute of Energy and Sustainable Development at De Montfort University. Dr Sukanya Das is Associate Professor and Head of Department at the Department of Policy and Management Studies at the TERI School of Advanced Studies. Dr Gopal K Sarangi is Assistant Professor at the Department of Policy and Management Studies at TERI School of Advanced Studies. Dr Andrew Mitchell is Senior Lecturer at the Institute of Energy and Sustainable Development at De Montfort University.

About Just Transitions to Decarbonisation in the Asia-Pacific

Working in partnership with teams from the UK Science & Innovation Network, the programme examines how just transitions whilst tackling climate change and biodiversity is key to supporting inclusive economies and societies in the future. Through the programme, the Academy awarded funding to seven research projects exploring the actions required in the Asia-Pacific to tackle climate change and biodiversity loss, to identify opportunities for decarbonising economies and societies, and to recommend options and pathways for communities, workers, businesses, policymakers and the wider public. The programme was funded by the UK's Department for Business, Energy and Industrial Strategy.

Executive summary

Key findings

- **There is limited focus on just transitions in the transport sector:** in both academic literature and policy to date, technical solutions have received policy and research priority, but there is limited focus on how end-users will be affected by transport transitions, and whether these transitions will be equitable, inclusive and just. Several factors should be addressed under this: ensuring that transitions lead to affordable mobility solutions for all users is a key point, as is ensuring that job losses from high-carbon mobility services are compensated for by job creation in low-carbon mobility. From our key informant interviews, policymakers are focused on the supply-side when considering transport transitions, contrasting with users' concerns of demand-side support and downstream services, particularly for electric vehicles and charging infrastructure. These tensions need to be addressed in policy.

- **There is potential for significant socio-economic impacts from the transition:** this research has investigated the potential pains and gains of the transition to electric mobility, particularly electric road transport, in the Indian transport sector. There is potential for job losses both in the downstream oil sector and the downstream mobility services sector as the EV transition progresses due to reduced petroleum product consumption and a lesser burden of maintenance for electric vehicles compared to ICE vehicles. This also has the potential to impact government revenues from fuel taxation and place a higher burden on the government purse from increased electricity subsidy outlay.

- **Just transition alternatives exist:** from the scenarios presented in this research, it is clear the current policy trend does not foreground justice and equity in the low-carbon transport transition, and this will lead to significant negative impacts for disadvantaged sectors of society. Policy alternatives exist to foreground justice in the transport transition, including participatory co-development of policy with end-users, and engendering greater coordination between transport and energy sectors and within the transport sector to ensure users are targeted equally across socio-economic strata with low-carbon mobility solutions.

Transport sector in India and its evolving trends

The importance of the transport sector cannot be under-estimated as there exists a very strong nexus between the transport sector and socio-economic development of any country. Road transport, a major form of transport in India, is responsible for carrying over 80% of passenger traffic, and more than half of the freight traffic.[1] It is important to highlight the significance of the transport sector in the larger context of SDGs. The role of the transport sector in meeting SDGs assigns further importance to the sustainable growth and development of the transport sector.

1 ITF (2021), 'Decarbonising India's Transport System: Charting the Way Forward', International Transport Forum Policy Papers, No. 88, OECD Publishing, Paris

One of the major challenges of the urban mobility sector in India is the dramatic rise in the number of vehicles. In fact, growth of vehicles has surpassed the growth of population in the country. More importantly, there has been a declining share of the public transport sector in India. The share of public transport is projected to decrease from 75% in 2000-01 to 44.7% in 2030-31.[2] Current patterns of transport energy consumption hold significant socio-economic and environmental implications for the country. The transport sector is a heavy user of crude oil in the country, almost all of which is imported. Looking at recent government commitments, to achieve both Net Zero by 2070 and the pledge to have 50% renewable energy by 2030 in the energy mix, we see additional pressure to transit to a new transport system that is both more environmentally friendly and addresses the growing threats of energy security of the country. Considering all of these, it is obvious that the current type and volume of energy used in the transport sector is no longer sustainable and that transformative actions are required to help meet the larger climate and economic goals set by the country.

Policy level initiatives for a sustainable transport sector consist of a variety of approaches. These approaches can largely be classified into four different types, such as:

1. Through the use of alternative combustion fuels such as biofuel, compressed natural gas (CNG) liquefied natural gas (LNG), and hydrogen.

2. By transitioning to a regime of modal shift, for instance the shifting to public transport systems.

3. By implementing higher fuel economy standards such as improved Bharat Stage Emission Standards (BSES) and,

4. By increasing the penetration of electric vehicles (EVs) to the end user marketplace.

Out of the above options, electric vehicles (EVs) received much policy priority and are placed high on the agenda. In fact, EVs have emerged as a technical solution worldwide to address the sustainability challenges of the transport sector. In the Indian context, the use of EVs could be part of the green growth strategy of the country as well. There has been a range of policies and programmes announced to promote the electric vehicles in the country in recent years. The most important of them is the Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme declared in 2015. The scheme got further push through declaration of FAME II and a host of state specific electric vehicle policies. More than 20 states in India have declared their state specific EV policies. Various financial and non-financial incentives have been offered to accelerate the EV penetration in the country. India is also part of the Global EV 30 @ 30 (https://www.cleanenergyministerial.org/campaign-clean-energy-ministerial/ev3030-campaign) campaign showing policy level solidarity for EVs.

In addition to FAME-II and the EV 30 @ 30 campaign, the Indian government in collaboration with NITI Aayog has launched the E-AMRIT web portal (https://www.e-amrit.niti.gov.in/home). The Bureau of Energy Efficiency (BEE) has also recently launched the "Go Electric" campaign to spread awareness on the benefits of using electric vehicles, electric vehicle charging infrastructure development and the

2 CSE (2018), 'Towards clean and low carbon mobility: addressing affordability and scaling up of sustainable transport.'

benefits of electric cooking for households. E-vehicles also feature in the smart city proposals of 12 of the 20 Lighthouse smart cities in India. For the National Capital Territory (NCT) and Delhi specifically, Chief Minister Arvind Kejriwal launched the "Switch Delhi" campaign in February 2021 to raise awareness on EVs and inform the public of the benefits of switching to electric vehicles. The 'Switch Delhi' campaign also encourages residents and organisations to take a pledge to switch to an EV or install a charging point in the coming 3 years. All these policy initiatives and actions led the acceleration of EV adoption in the country. EV related statistics reveal that 0.9 million and close to 1800 charging stations were installed by December 2021, with about 450 EV manufacturers firms in India. For the first time, the percentage of EV sales in the mix of total vehicle sales in the country is set to cross the 1% mark by the close of FY 2021-22.

Electric vehicles as a pathway to decarbonise India' transport sector

Though the drive to push EVs has been well intended and is expected to make the transport sector more sustainable, the process adopted so far has been mostly on technology and infrastructural oriented. The approach followed in the policy spheres is largely outcome oriented. Within technology and infrastructural development context, there still remain several socio-economic challenges, which have not received adequate policy attention and policy priority. The preference for ICE vehicles has been slow to change, given the complexities with the EV technologies and peripheral systems.[3] Questions around the range of battery powered vehicles still come up in general discourse, as the dependability of ICE vehicles in terms of travel distance remains a concern of users. The available secondary data on numbers of charging stations in the country reveals that most charging stations are clustered in only 5 states (Andhra Pradesh, Telangana, Karnataka, Delhi, Maharashtra, with miniscule representation from other areas).

More important considerations are the issues around socio-economic aspects of this transition, for example employment opportunities. EVs require fewer maintenance and repair activities compared to ICE vehicles, creating a smaller number of jobs.[4] The job losses can be attributed to the reduction in oil consumption in the transport sector. More importantly, there has been limited information and analysis on such socio-economic implications of transitions to EVs. There has also been limited understanding of consumers perceptions about EVs. TERI (2019) study highlights that people continue to consider EVs as a secondary vehicle due to inadequate EV infrastructure in the country. Similarly, concerns were also raised as far as the environmental benefits of EVs are concerned. While research carried out by CEEW has shown that there would be positive environmental benefits of EVs, these benefits depend on how the energy mix is going to be in the country in future. EV adoption could provide local benefits in terms of direct environmental and health related benefits, however, it may fail to address larger country level CO_2 emission issues, if the energy mix supplied through grid continues to rely on fossil fuel sources. This highlights the systemic nature of the problem and the need to decarbonise the power generation along with EV adoption. Hence, there is a need to ensure that the transition considers all socio-economic and environmental issues together in a more inclusive and holistic manner. Besides, instead of only focusing on the outcome of EV adoption alone, there is a need to identify and map the effects of EV adoption processes. One example of this may be asking if the transition to renewable power is fast enough and in sync with the targeted goal of EV transition. If not, where are

3 TERI (2019), 'Faster adoption of electric vehicles in India: Perspective of consumers and industry'
4 CEEW (2019), 'India's Electric Vehicle Transition: Impact on Auto Industry and building the EV ecosystem'

the current (and possibly new) power stations located that rely on fossil fuels? Are they in locations that cause injustice to sub-urban or rural poor, increasing localised pollution outside the wealthier inner-city areas? Looking at this transition from a Just Transition perspective would imply that social inclusion and a 'leave no one behind' approach should be at the forefront of all policy implications.

Study goals and approach

The main aim of this study is to explore and assess the needs, impacts and implications of transitions for decarbonisation of the transport sector in India from a social inclusion point of view. It aims:

- To explore and map the understanding/perception/expectation of a just transition by different stakeholders (e.g., policy makers, employees, communities, businesses, service providers, users and beneficiaries etc.) in relation to decarbonisation of the transport sector in India.
- To evaluate the impacts of a just transition from a socio-economic and environmental perspective using Delhi as a case study.
- To suggest just transition options for decarbonisation pathways in the transport sector in the country, which is inclusive, sustainable, and futuristic (considering the growth of the transport sector in future).
- To undertake a Developmental Evaluation of learnings from the research for strategic deployment of lessons.

The focus of the study is limited to the motorized transport sector of India with a specific geographical focus on the National Capital Territory (NCT) of India, one of the most polluted cities worldwide. Both qualitative and quantitative research approaches were employed to derive the key findings. Reviews of existing studies are supported by primary surveys with a range of stakeholders such as users of EVs and non-users, EV manufacturers, EV charging station owners and managers, inputs collected from key informant interviews (KIIs), inputs gathered through stakeholders' engagement workshops. Additionally, a detailed screening and reviewing of policy documents, policies declared by Central Government as well as state level EV policies, were carried out. A total of 200 primary surveys and 20 key informant interviews (KIIs) were conducted to capture the required data. A key stakeholder's workshop was conducted on 20th January 2022 to elicit inputs on the key focus areas of the project. Close to 50 participants (from organizations such as ICCT, RMI, Ola Mobility Institute, SVSU, TERI, CEEW, CESP, WTI etc.) attended the workshop, and speakers were drawn from organizations working closely with EV issues in India.

Besides, available secondary data analysis was carried out to find out impacts of EV adoption on employment and the public exchequer. Secondary data estimations are based on the three hypothetical policy scenarios such as 1) business as usual (BAU) scenario; 2) Optimistic policy scenario (OPS); and 3) pessimistic scenario (PES) drawing from the study by Pohit et al. (2021).[5] These scenarios are applied in the Delhi EV projections contexts. The key results are presented in the following sections.

5 Pohit, S. R. Singh, and Chowdhury S. R. (2021), 'Role of Policy Interventions in Limiting Emissions from Vehicles in Delhi, 2020–2030', ADBI Working Paper 1297, Tokyo: Asian Development Bank Institute

Are EV policies in India comprehensive and inclusive?

More than 20 states in India have either declared the state specific EV policies or drafted the policies. The key findings from the assessment of EV policies are:

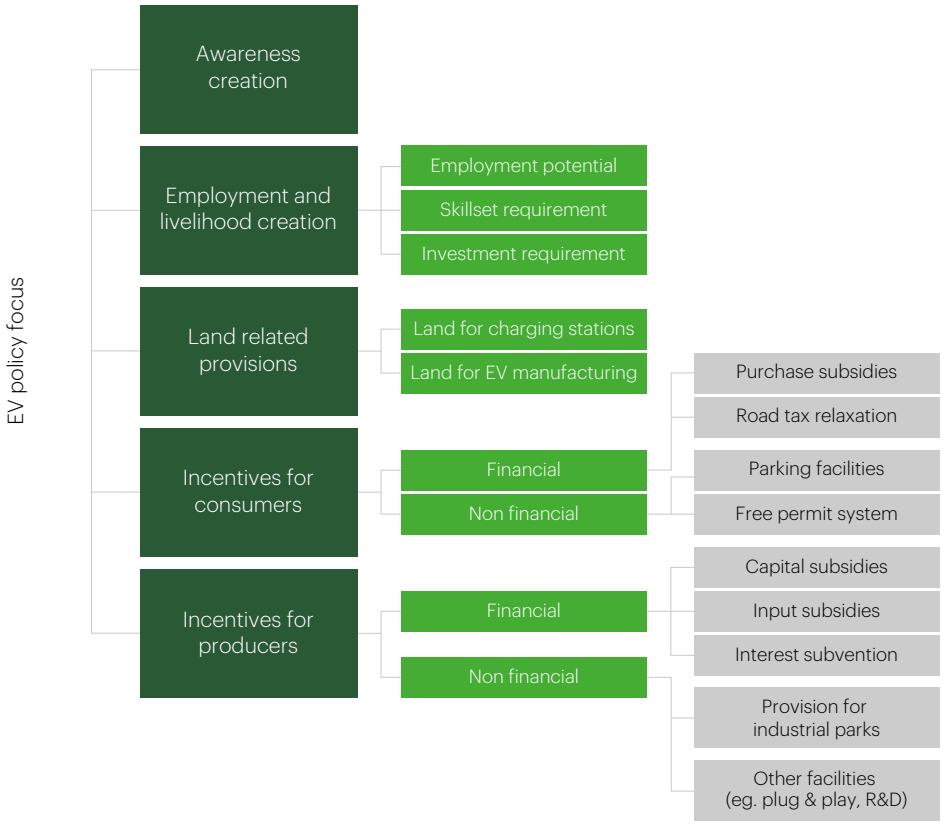
- The objectives of the major state EV policies are found to be twofold: the first is to increase the adoption of electric vehicles by incentivising consumers and producers in some cases, and the second is the emphasis on accelerating domestic production of electric vehicles and their components.
- The emphasis in many of these state policies is on generating jobs or creating employment opportunities in various segments of Electric Vehicles, supply chains. In addition, these policies have also made provisions for skill training and development programs.
- Several policies have made provisions for battery recycling, setting up waste/effluent treatment plants, and encouraging charging infrastructure operators to generate renewable power.

These policies would benefit from:

- Considering the social aspects of EV adoption such as a gender inclusive approach to employment generation and issues of managing land.
- Focusing on behavioural aspects for a larger uptake of EVs.
- A greater focus on the public EV transport sector.
- A clear strategy for the use of renewable energies for charging stations.
- Integrating SDGs within these policies.

A schematic representing the policy mapping is presented below (Figure 1).

Figure 1. EV policy mapping at the sub-national scales



Source: Compilation by the project research team

Key findings

A number of key findings are drawn from the range of activities conducted as part of this project such as stakeholder engagement workshops, key informant interviews, and stakeholder surveys.

On the socio-economic front, the stakeholders raised various points regarding the need for of EV transition, speed of transition and its costs, impacts, and the perception of the change from a social inclusion and justice point of view.

- It was put forward that while transition to EV is mainly seen from a moral push factor, the perceived usefulness of the technology option and the ease of use are also important pull factors for vehicle users.

- On the speed of transition, it was pointed out by stakeholders that the transition should be incremental in nature rather than radical. This could be helpful in making the process of transition smooth. Necessary policy level course corrections can be made as and when required. This finding was further strengthened by similar observations drawn from the survey of stakeholders as well. Survey findings on the speed of transition has shown that 71% of surveyed users and non-users were in favour of an incremental change.

- One of the major findings that emerged from the key informant interviews is about the nature of the EV transition in the country. Stakeholders opined that there two different types of transitions taking place in the country. The first is the business-as-usual approach, which largely neglects inclusivity and is more techno-economic in character. The other one is more participatory in nature, where some degree of trade-offs exists among involved parties. This approach is also much more complex where gains accrued by a party lead to losses by the other party. Since the transition is at the nascent stage, there is a need for careful scrutiny of gains and losses to make it widely acceptable to the community at large. It must be ensured that these gains and losses are weighed properly to maintain the balance.

- While inclusivity and 'leaving no one behind' is identified by stakeholders as one of the important aspects of the process of transition, the process of transition should also consider other low-carbon transport pathways, such as walking, bicycling and the greater usage of public transport systems. Along with EVs, there is a need to include other such options of decarbonisation. The "reduce, shift, and improve" strategy was cited as an important aspect of the transition, where the focus should be on improving the effectiveness of transport streams, such that the personal use of vehicles can be reduced.

- It was also highlighted by the stakeholders that the process of transition should also draw from the earlier experiences of similar transitions undertaken in the country. For instance, the transition to CNG vehicles in Delhi could provide lessons for making the current transition smoother.

- Key informant interviews revealed that information availability is a key factor that guides consumer choice and has a significant impact on EV adoption. Stakeholder surveys have also shown similar trends, with more than half of the EV users, and a fourth of non-users agreeing that poor information about EVs acts as a major barrier to EV adoption.

- Furthermore, understanding the acceptability of EV is found among stakeholders as a crucial factor for EV transition in India. Survey findings on such acceptability of transition, have shown that more than half of ICE vehicle owners surveyed are inclined to have their next vehicle be an EV. Again, this acceptability is highlighted despite the fact that the stakeholders were aware of the perceived barriers to EVs. It emerged from the survey that these perceived barriers would be overcome as the EV market matures.

- Another important finding is related to the debate over public versus private transport systems in the country. It emerges from the surveys and key informant interviews that the challenges associated with electrifying the public transport sector is significant and the upfront cost of introducing electric shared modes of transportation, like buses, remains high. Policy incentives are more biased towards private transport systems, which would further worsen the public transport systems. Given that the public road transport sector serves lower to middle-income groups in urban centres, there is a need to make a structured policy push for public transport sector.

- Importantly, it emerged that the impact of EV transition on rural areas is unclear and has received less policy attention. The rural electricity network is unlikely to be sufficient to support EV charging. Though policies are responding to the need for deploying charging stations in national highways, there is no specific policy drive to support EVs to rural areas.

- The cost of EVs has appeared repeatedly as an economic driver in all our stakeholder engagements, particularly the cost of batteries. Stakeholder surveys also unfolded similar observations on cost of EVs. 75% of EV users and 55% of non-users cited high initial cost as a barrier. However, it is more or less agreed by the stakeholders that the operational cost of running the EVs is cheaper as compared to ICEVs, especially with increasing fuel prices. But, due to behavioural challenges and the often myopic behaviour of prospective consumers, high initial costs override the long-run cost benefits.

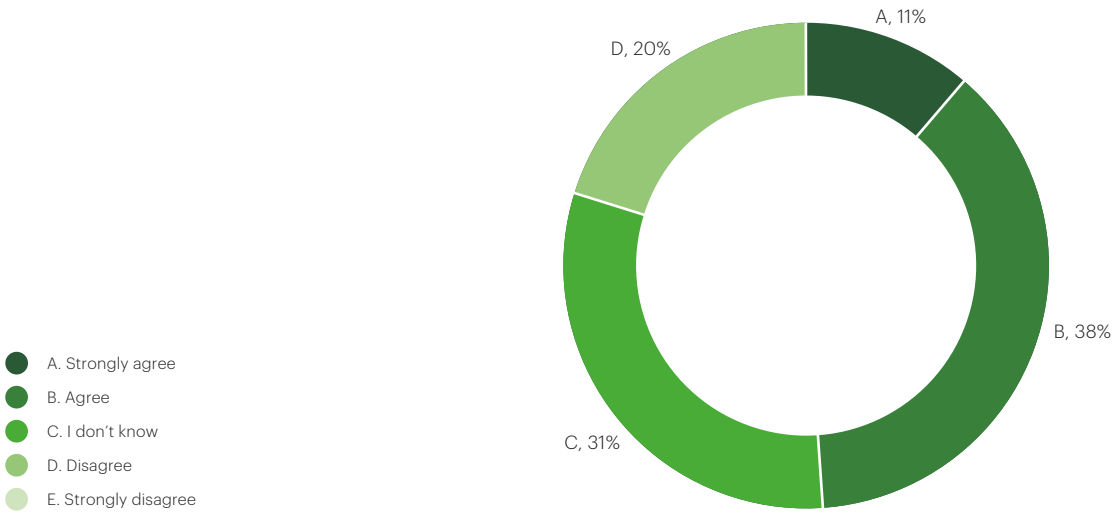
- The other crucial socio-economic impacts identified from the responses was whether owning an electric vehicle translated into economic savings for the users. There is a clear understanding that EVs can be cost effective overall, though the upfront cost is high. Close to two-thirds of the electric vehicle users reported that higher savings were an enabling factor that motivated them to buy an electric vehicle, which can be a perceived impact of transitioning to EVs. However, the impact is different in the case of prospective EV buyers.

On the technology and environmental front, the stakeholders highlighted a number of key technology considerations, which have implications for EV adoption in the country.

- One of the key considerations for buyers when making the choice to buy an EV is availability of home charging infrastructure. Given that Indian cities are marked with shared housing facilities and face space constraints, poor facilities for home charging can act as a deterrent to choosing EVs. With EVs having a significant commercial use factor, this is especially a consideration for consumers whose use of EV is not limited to a personal vehicle (Figure 2).

Figure 2. Difficulties in home charging such as availability of charging points, power supply disruptions

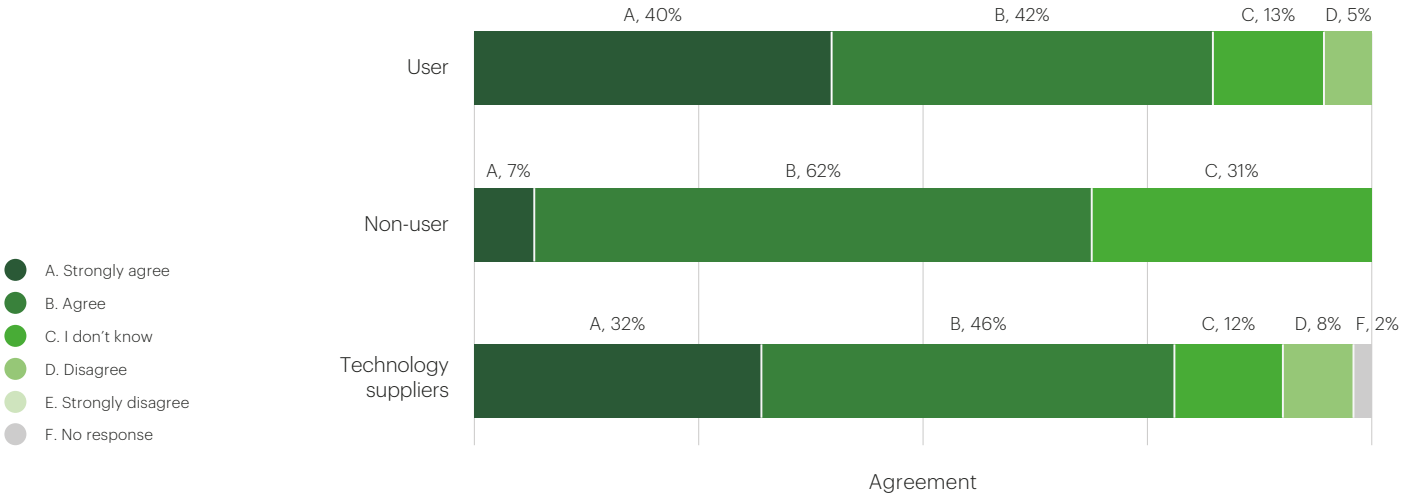
Source: Analysis by the project research team using data from primary survey



- Key informants agreed that development of charging infrastructure can be considered a "chicken and egg situation" for EV adoption in the country. While inadequate charging infrastructure is cited as a deterrent for low uptake of EVs, the opposite can also be true where lower adoption of EVs has slowed down the installation of changing stations in the country. A related concern is the inadequate public charging stations. This could generate adverse impacts for EV adoption in the country.

- It emerged from the survey that close to 80% of users believed that charging infrastructure was either absent or inadequate to meet the growing charging requirements. Moreover, 69% of non-users and 78% technology suppliers also backed this perception about inadequacy in charging infrastructure, which is perceived as a deterrent for purchasing EVs (Figure 3).

Figure 3. Charging infrastructure is either not available or not adequate



Source: Analysis by the project research team using data from primary survey

- The deployment of changing stations is also connected with land issues, primarily in urban areas. The deployment of large-scale public charging stations requires addressing land procurements issues for such charging stations. Given that land scarcity in large cities in India is a major challenge, necessary policy efforts and efficient planning is required by scoping and demarking dedicated land patches within cities and along country roads. If appropriate provisioning of land is not made for charging stations, given the land scarcity problem and high rent value of land, it could escalate the cost of new charging stations leading to high unit cost of charging. This could be beyond the cost of electricity.

- Several stakeholders pointed out that charging infrastructure, inconsistent charging plug design, lack of cohesive mobility system and lack of a skilled workforce are issues facing the EV industry. Consumer anxiety is arising from the hesitation of the industry and negative word of mouth. It emerged from the discussion that there is a lack of a long-term vision and a road map for the automobile industry. Despite the incentives, leading two-wheeler manufacturers have not launched any EV models and unless this happens, the EV penetration in the 2Wheeler segment is unlikely to progress as anticipated.

- The absence of reliable and replicable technology can act as a constraint for consumers from purchasing an electric vehicle, as emerged from this study. From KIIs, it further emerged that the Indian EV market currently lacks maturity, and until adequate commercialisation of the sector has been achieved, there are trust deficit issues with battery swapping cases. It clearly emerges from the stakeholder's engagement issues that as long as standardisations schemes are not floated by the government, battery swapping will be difficult.

- The need for proper planning and phased approach to scrapping and integrating existing ICE vehicles is a major challenge. It emerged from our interaction with interviewees that adequate regulatory measures to this effect are not addressed in current policies. There exists inadequate information for ICE vehicle owners about the scrapping policies of the government.

- Given the poor financial health of the electricity distribution utilities (called as DISCOMS), extending grid infrastructure for EVs may further deteriorate the financial health of these utilities and can lead to poor supply of electricity to other consumers. Hence, it may require additional financial support from state governments.

- One of the important environmental dimensions is the role of EVs in reducing local air pollution and road congestion. This has been highlighted as an important rationale for EV adoption in the country. Respondents said that switching to electric cars will allow them to be environmentally friendly. Although some users and non-users were unaware of the environmental benefits of EV, 97% users and 69% of non-users considered EVs to be environmentally friendly. The stakeholder engagement workshop findings suggested that in order to accrue the environmental benefits, it would be more appropriate to promote public transport more widely. This will reduce the vehicle ownership costs and reduce the energy demand. The discussion on policy, institutional and governance dimensions of transition specifically brought out several key policy related matters related to EV transition. The EV duty cycle or usage is an important element often ignored in the EV policy discussion. The average user travels much less and this affects the cost per kilometre. In addition, the tax and duties on electricity are different from petroleum products and electricity for EV is being subsidised. Given that India's grid is coal dependent, the effect of EV on emission depends on when the vehicle is being charged. At night, coal is the fuel being used and overnight charging does not reduce emissions. The other issue is the grid capacity – particularly at the local grid network whether there is headroom for all EV integration. The capacity expansion and infrastructure development are capital intensive in nature and if this is used by a selected few, they should pay for this. Infrastructure pricing is key. The small 2Wheelers and 3Wheelers would not have any major environmental impact but the freight segment holds promise and through local manufacturing and content supply, India can make a contribution to emission reduction targets.

- The importance of proper governance structure for EV adoption was highly emphasised by stakeholders. The governance structure should bring the required coordination across different scales such as central government, sub-national government as well as city governments. Often city governments have their own specific governance systems, which contrasts with the prevailing systems of governance at state and central level. Hence, adequate policy measure are required for integrating city governments in the larger EV governance of the country. More importantly, the governance systems and structures should also consider the transport and electricity sector together.

- The opinions of stakeholders on the preparedness of the policy makers and planners to such a change were sought to reflect on the governance of EV adoption in the country. More than half agreed that the country showed preparedness for transport decarbonisation in this regard.

Figure 4. Preparedness of India's EV policy and programmes

54%

of the respondents agree that EV policy and programmes of the country show effective preparedness for transport decarbonisation

14%

of the respondents disagee that EV policy and programmes of the country show effective preparedness for transport decarbonisation

32%

of the respondents did not have an opinion on whether EV policy and programmes of the country show effective preparedness for transport decarbonisation

Source: Analysis by the project research team using data from primary survey

- Another important consideration of this transition is about identifying the beneficiaries and losers from the transition. This has implications for the "inclusive and equitable" aspect of decarbonisation of the transport sector, which hold crucial importance for a country like India. Both users and non-users were of the opinion that EV transition will benefit the poor and middle sections of the society the most. As per KIIs, while these sections of society are not believed to be the centre of this transition, an integrated approach to improving the transport sector, especially with a focus on public transport and non-motorised transport, can greatly benefit the socio-economic "masses". Additionally, the KII believed that the benefits of this transition shall extend to the informal sector in India, with an upskilling and training program from the government to raise the capacity of the EV ecosystem.

- Stakeholders also highlighted that while government will gain in terms of its reduction in import bill as EVs penetration would lead to less import of oil and gas, and will result in huge economic savings, at the same time, if indigenous technologies and manufacturing units are not developed for EV products, equipment and batteries, it might generate negative macro-economic impacts in terms of import of products, equipment and raw materials.

- It was highlighted by the stakeholders that impact on jobs is not uniform – the job opportunities are different for oil production, power generation and battery manufacturing activities. The transition will lead to job losses in the oil sector and in conventional vehicle production industry, but battery recycling, telematics and new vehicles will create new opportunities as well. There will be significant trade-offs and they have to be managed well. Additionally, issues relating to job loss, the need for reskilling, building of indigenous manufacturing units, poor economics of coal, are identified by the informants as a few decisive factors in this transition, and are yet to be experienced.

- Evidence from secondary data analysis on EV adoption and its impacts on employment has brought out interesting findings. In the case of the manufacturing sector, the projected reduction in jobs will amount to 37,960. The second important segment where impacts on employment would be high is the oil sector, and this is primarily due to less oil consumption. It can be observed that job numbers would be high in the BAU scenario, compared to the OPS and PES scenarios. In comparison to the BAU scenario, a total of 734 job losses is predicted in the oil sector in the OPS scenario. Similarly, the estimated employment loss under the PES scenario will amount to 439.

- Government may also lose not only terms of disbursing the subsidies, but also in terms of providing other financial incentives such as tax and non-tax waivers and relaxations. The impact on the public exchequer would be due to loss of revenue in sales taxes on petrol and diesel, reductions in cess fee on diesel sale for private four-wheeler and reductions in road taxes for EVs. The total loss of revenue for Delhi government is expected to be INR 81,414 million in the optimistic scenario, whereas a total loss of INR 20,009 million would be borne by the government in the pessimistic scenario during the estimation period. These scenarios show that revenue impacts from the transition to EVs in Delhi will be significant, as are the potential employment impacts under different levels of EV penetration. Government, at a national and city level, needs to take these factors into account in their policy planning for transport transitions to be socially, economically and environmentally just.

While the findings from the primary surveys were supported by key informant interviews, a few distinct points regarding costs and financial incentives and non-financial incentives of EVs were observed:

- Banks and financial institutions are still unwilling to finance EVs, as they are considered risky investments. Battery life also degrades after a few years of use, which does not instil confidence in investors and consumers alike.

- Financial incentives are key in driving demand for EVs, especially in the 3W and 4W segments. Without subsidies, the uptake of EVs will remain low, at least in the coming years.

- Subsidies can be considered a sustainable alternative for creating market driven solutions for increasing EV demands.

- While all such fiscal incentives are in place, the key informants also advocate for the necessity of non-fiscal incentives involving skill training that would inherently improve the informal sector in India. They also highlight the urgency to bring such initiatives from a local level.

Suggesting a Just Transition pathway

Based on the findings from the literature review, stakeholder engagements, and impact assessments, three individual pathway scenarios are suggested as follows.

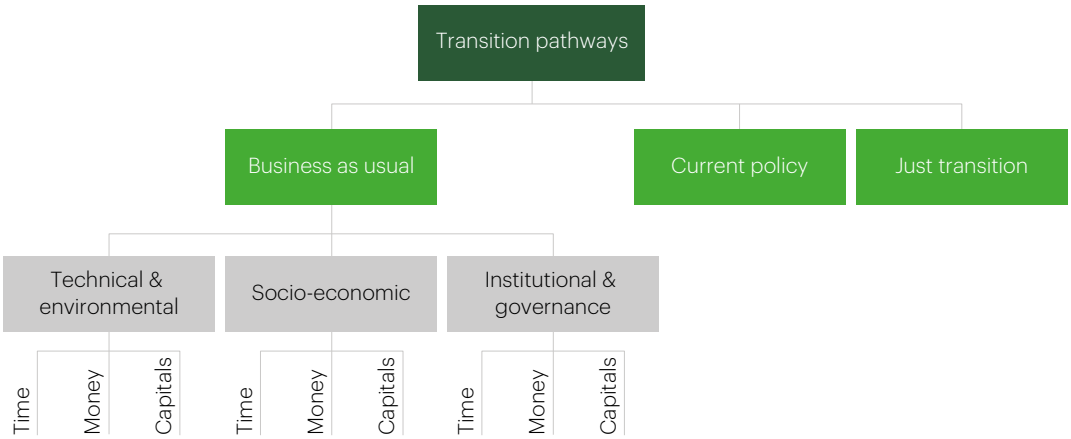
The Business-as-Usual (BAU) pathway is built on taking the view that the Indian Government decides to step away from actively pursuing the current accelerated pathway, and leaves product diffusion and transitions to market forces.

The Current Policy pathway follows the current trends of looking to decarbonise the transport sector from a technocratic solution-driven perspective, with this scenario focusing on an EV transition in the spirit of FAME II.

Finally, the Just Transition pathway builds on top of the current trends and views the transition more holistically as a connected system, most importantly through the direct lens of a just transition. This means that while all stakeholders are naturally considered as part of the design, more importantly, their lived experience is taken into account, with the transition designed to be actively attractive to them, thereby engendering their support.

The transition has a particular focus on people and communities, with key considerations being maintaining employment and job creation, increasing local prosperity, redressing of past harms and removing future harms, and promotion of a healthy environment for citizens. These areas may include addressing gender divides in employment, a need for promoting the public transport sector, a greater focus on urban design and planning and a delivery plan to facilitate the systemic changes required to meet these goals.

Figure 5. Transition pathways showing lenses through which they are considered



Source: Author's own work

The government at all levels plays a key role in enacting just transition principles in new and existing policies. As we have seen from the literature review and primary research through this project, the scale of systemic change needed to enact just transitions in the Indian transport sector is significant, and requires coordination with multiple sectors of government to achieve the required outcomes in parallel.

Decarbonisation of the transport sector requires sectoral change outside of transportation technology: grid decarbonisation, spatial planning and transport network planning for intermodal connectivity are all contributing factors to a decarbonised transportation system. New infrastructure for decarbonised transport modes also requires development, rapidly and at scale. Government is ideally positioned to meet these national, regional and local-scale challenges and enact transitions to decarbonise transport.

Table 1. Features of three pathway scenarios for just transitions

Business as usual	Current policy	Just transition
Passive governance	Assisted Pathway	User-led Assisted Pathway
Natural diffusion curve of new technology with slow progress as benefits accrue	Specific planned interventions with an accelerated diffusion curve as greater benefits accrue	Planned interventions with faster systemic diffusion due to high end-user engagement and desire.
Poor long term infrastructure design and planning	Systemic infrastructure considerations made from a practical perspective	Holistic system built for the benefit of all driven by from a grass roots perspective
Market forces prevail resulting in sub-optimal outcomes re equity and inclusion	End result is guided by governance focused solely on desired carbon targets; some equity ensues	End result is guided by inclusive design to achieve greatest co-benefits, equity is built in to the process

Source: Author's own work

Project evaluation lessons

Through the project Developmental Evaluation, we have identified three key lessons to take forward into future research projects:

- **Multi-disciplinarity:** the research benefited significantly from the multi-disciplinary nature of the research team, these kinds of approaches that benefit from different perspectives, disciplines and skill sets are to be encouraged wherever possible. Complex challenges cannot be responded to by the unitary focus and traditions of one discipline only.

- **Participatory methods:** participatory methods and working across socio-economic sectors and strata is to be endorsed, and mirrors the emphasis and value added by the use of multi-disciplinary team working.

- **Communication:** intra-team communications are essential, and more systematic efforts should be undertaken by project leads and members to overcome challenges in managing online team working and the division of tasks.

Key policy recommendations

- It clearly emerges from the findings that stakeholders prefer an incremental transition above a radical one. This incremental approach would also provide the needed breathing space for manufacturers as well as consumers to transit smoothy and will offer opportunities to policy makers to make the necessary course corrections.

- Decarbonising the transport sector should not be limited to adoption of EVs. Other options such as dedicated cycling tracks, promotion of walking and changes in building bye laws, so that the benefits are optimised. The EV policies should also take all these into consideration while framing options for decarbonising the transport sector.

- Socially inclusive EV policies, while most desirable, involve often complex trade-offs. There will be winners and losers in the process. It is pertinent that a proper assessment is done to identify these individuals so that the necessary policy level course corrections are made. This is clearly missing in most of the policies.

- The debate over public versus private transport systems in the country requires more policy attention. It emerges from the analysis that policy incentives are more inclined to promote the private transport sector rather than the public transport sector. Given that the public road transport sector largely serves lower to middle income groups in urban centres, there is a sector need to make a structured policy push for public transport.

- Importantly, it emerged from the project that the impact of EV transition on rural areas is unclear and has received less policy attention. Policies should draw out plans for effective integration of rural areas in their EV adoption plans.

- Upfront costs are found to be a major barrier for EV uptake. However, the policy so far has been disproportionately focusing on pecuniary benefits for cost reduction, rather than non-pecuniary aspects. Most of demand side incentives are financial in nature unlike other countries where non-financial benefits such as priority parking facilities, special road lanes etc are provided to EVs. There is need for policies to integrate these non-pecuniary benefits in driving the EV adoption.

- Though incentives are laid down for home charging stations, the uniform approach of incentives and lack of focus on non-monetary measures are major deterrents for its uptake. Policies should devise appropriate financial and non-financial incentives for home charging stations. Necessary city specific considerations are to be considered while designing such incentives.

- Trust deficit issues are emerging as a major challenge for uptake of EVs. In particular, the battery swapping arrangement is an area where trust deficit problems are acute. Given that there is lack of standards for batteries, a battery swapping scheme may face some hurdle. There is a need to develop and implement regulatory standards for EV batteries.

- If EV charging stations are drawing their energy from the grid, it may further deteriorate the financial health of electricity distribution utilities. It might require policy actions considering both electricity sector and transport sector together. Policy push in this direction is missing and needs to be accelerated.

- On the governance front, the coordination across central, state and city level governments are to be strengthened. It emerged from the study that often city governments have their own specific governance systems, which is in contrast to the prevailing systems of governance at state and central level. Hence, adequate policy measures are required to align these policy goals.

- While India will benefit in terms of its reduction in import bill, hence empowering itself in terms of better energy security, if indigenous technologies and manufacturing units are not developed for EV products, equipment and batteries, it might generate negative macro-economic impacts in terms of import

of such products, equipment and raw materials. Though policy schemes such as production linked incentives (PLI) are designed to promote such indigenous technologies, there is need to accelerate the PLI scheme and give further policy push for indigenous development of requires resources.

- While impacts on jobs are found to be quite disturbing due to job losses in the oil sector and in conventional vehicle production industry, structured policy push to develop battery recycling, telematics and new vehicles could address job problems and create new opportunities for new jobs over long-run.

- Finally, the revenue loss for the public exchequer due to EV subsidies and due to reduction in various taxes and cess requires alternative approaches to compensate the loss. Government should impose additional taxes on oils and gas, at least in the short run.

References

AEEE and Shakti (2019), Charging India's Bus transportation: A guide for Planning Charging Infrastructure For Intra-city Public bus fleet, Report by Chandana Sasidharan, Anirudh Ray, Retrieved from https://www.researchgate.net/publication/338254096_CHARGING_INDIA'S_BUS_TRANSPORT_-A_Guide_for_Planning_Charging_Infrastructure_for_Intra-city_Public_Bus_Fleet, Accessed on 25th February, 2022.

AEEE and Shakti (2020), Charging India's Two- and Three-Wheeler Transport, Available at https://aeee.in/projects/charging-indias-two-and-three-wheeler-transport/

AEEE and Shakti (2020), EV- A New Entrant to India's Electricity Consumer-basket, Retrieved from https://shaktifoundation.in/report/ev-a-new-entrant-to-indias-electricity-consumer-basket/, Accessed on 25th February, 2022.

Assocham and PWC (2019), Towards eMobility: Putting the consumer at the wheel, Retrieved from https://www.pwc.in/assets/pdfs/research-insights/2019/towards-emobility.pdf, Accessed on 25th February, 2022.

Brezina, V., Weill-Tessier, P., & McEnery, T. (2020). #LancsBox v.5.x. Lancaster. Retrieved from http://corpora.lancs.ac.uk/lancsbox

CEEW (2019), India's Electric Vehicle Transition: Impact on Auto Industry and building the EV ecosystem, *Report by Soman, Abhinav, Karthik Ganesan, and Harsimran Kaur*, New Delhi: Council on Energy, Environment and Water.

CEEW (2020), Financing India's Transition to Electric Vehicles, A USD 206 Billion Market Opportunity (FY21 - FY30), *A report by Vaibhav Pratap Singh, Kanika Chawla, and Saloni Jain*.

CEEW and Shakti (2021), Laying the Groundwork for Electric Vehicle Roaming in India: Interoperability of Electric Vehicle Charging, CEEW-EDRV *Report by Sidhartha Maheshwari and Meghna Nair*, New Delhi: Council on Energy, Environment and Water.

CEEW. (n.d.). Electric Mobility Dashboard. Retrieved from https://cef.ceew.in/intelligence/tool/electric-mobility

Chaturvedi, B.K. A. Nautiyal, T.C. Kandpal, and M. Yaqoot (2022), 'Projected transition to electric vehicles in India and its impact on stakeholders', *Energy for Sustainable Development*, 66, pp. 189-200

Clean Energy Ministerial (n.d.), Increasing Uptake of Electric Vehicles. Retrieved from https://www.cleanenergyministerial.org/campaign-clean-energy-ministerial/ev3030-campaign

Climate Chance (2018), Road Transportation Policies for low carbon pathway and role of non-state actors in India.

Climate Justice Alliance (n.d.), Just Transition- A Framework for Change, Retrieved from https://climatejusticealliance.org/just-transition/

CUTS International. (2020), Ease of E-Mobility in India, *Policy Brief*.

CUTS International. (2020). Exploring the impact of electric mobility on the jobs ecosystem, *CUTS International*, Retrieved from https://cuts-ccier.org/pdf/literature-review-greenJobs.pdf, Accessed on 24 March 2022

EY and BEE (2019), Propelling Electric Vehicles in India: Technical study of Electric Vehicles and Charging Infrastructure.

EV Reporter (2020), Accessed January 26, 2022, https://evreporter.com/karnataka-ev-policy-2/.

Government of India (n.d.), Charging Station Locator, *Niti Aayog*, Retrieved from https://e-amrit.niti.gov.in/charging-station-locators

Goverment of Haryana (2020), 'Electric Vehicle Policy-Draft,' https://haryanatransport.gov.in/sites/default/files/Electric%20Vehicle%20Policy_2.pdf.

Government of Andhra Pradesh (2018), 'Electric Mobility Policy 2018-23,' Policy, https://www.acma.in/uploads/doc/AP%20Policy_final.pdf.

Government of Assam (2021), 'Electric Vehicle Policy of Assam 2021,' https://www.transportpolicy.net/wp-content/uploads/2021/08/Assam_EVpolicy_2021.pdf.

Government of Bihar (2019), 'Draft Bihar Electric Vehicle Policy 2019,' http://www.investbihar.co.in/Download/Draft_for_e_vechile.pdf.

Government of Delhi (2020), 'Delhi Electric Vehicle Policy, 2020,' Policy, Government of Delhi, https://transport.delhi.gov.in/sites/default/files/All-PDF/Delhi_Electric_Vehicles_Policy_2020.pdf.

Government of Goa (2021), 'Goa Electric Mobility Promotion Policy-2021,' https://www.goa.gov.in/wp-content/uploads/2021/07/draft-of-Goa-Eletric-mobility-promotion-policy-2021.pdf.

Government of Gujarat (2021), 'Gujarat State Electric Vehicle Policy 2021,' https://www.transportpolicy.net/wp-content/uploads/2021/06/Gujarat-State-EV-Policy-2021.pdf.

Government of Karnataka (2017), 'Karnataka Electric Vehicle and Energy Storage Policy 2017,' https://www.transportpolicy.net/wp-content/uploads/2019/10/Karnataka_EV_Policy_20170925.pdf.

Government of Kerala (2019), 'Electric Vehicle Policy,' https://anert.gov.in/sites/default/files/inline-files/go20190310_Trans-24-Ms_e_vehicle_policy_.pdf.

Government of India (1962) The Delhi Motor Vehicles Taxation Act, 1962. Available at: https://legislative.gov.in/sites/default/files/A1962-57.pdf

Government of Madhya Pradesh (2019), 'Madhya Pradesh Electric Vehicle (EV) Policy 2019,' http://mpurban.gov.in/Uploaded%20Document/guidelines/1-MPEVP2019.pdf.

Government of Maharashtra (2021), 'Maharashtra Electric Vehicle Policy, 2021,' Policy, https://jmkresearch.com/wp-content/uploads/2021/07/Maharashtra_EV_Policy_2021_final-1.pdf.

Government of Meghalaya (2021), 'Meghalya Electric Vehicle Policy 2021,' https://haryanatransport.gov.in/sites/default/files/Electric%20Vehicle%20Policy_2.pdf.

Government of Odisha (2021), 'Odisha Electric Vehicle Policy 2021,' https://www.transportpolicy.net/wp-content/uploads/2019/09/Orissa2021.pdf.

Government of Punjab (2019), 'Punjab Electric Vehicle Policy 2019,' http://punjabtransport.org/Punjab%20EV%20Policy_Final%20Draft%2015112019_Upload.pdf.

Government of Tamil Nadu (2019), 'Tamil Nadu Electric Vehicle Policy 2019,' https://powermin.gov.in/sites/default/files/uploads/EV/Tamilnadu.pdf.

Government of Telangana (2020), "Telangana Electric Vehicle and Energy Storage Policy," https://tsredco.telangana.gov.in/Updates_2020/Telangana_EVES_policy_2020_30.pdf.

Government of Uttar Pradesh (2019) 'Uttar Pradesh Electric Vehicle Manufacturing and Mobility Policy 2019,' Policy. http://investup.org.in/wp-content/uploads/2021/04/UP-EV_2019.pdf.

Government of Uttarakhand (2019), 'Uttarakhand EV Policy,' Policy, mycii.in/KmResourceApplication/61853.ElectricVehiclePolicyUttarakhand.pdf.

Government of West Bengal (2021), 'Electric Vehicle Policy 2021,' https://www.transportpolicy.net/wp-content/uploads/2021/08/West-Bengal-EV-policy-June-2021.pdf.

IBEF (2021), Automobile industry in India, *India Brand Equity Foundation (IBEF)*, Available at https://www.ibef.org/industry/india-automobiles.aspx#:~:text=Domestic%20automobiles%20production%20increased%20at,vehicles%20being%20sold%20in%20FY20.

ICCT (2021a), Electrifying India's four-wheeler ride-hailing vehicles: Policy experiences from abroad, *Briefing prepared by Nibedita Dash and Sandra Wappelhorst*, Retrieved from https://theicct.org/sites/default/files/publications/electrify-india-ride-hailing-ldvs-sept21.pdf, Accessed on 25th February, 2022.

ICCT (2021b), Battery capacity needed to power electric vehicles in India from 2020 to 2035. *Working Paper 2021-07*.

ICE360 Insights (2016) One in three households in India owns a two-wheeler. Available at: https://www.ice360.in/product/one-in-three-households-in-india-owns-a-two-wheeler/?type=lightbox [Accessed 28.02.22]

ICRIER and Shakti (2019), Exploring cost-reduction strategies for Electric Vehicle (EV) Batteries

IISD (2019), Available at https://www.iisd.org/articles/just-transition-examples

IIHS (2014), Urban Transport in India moving towards equity and sustainability, *Policy brief*, Retrieved from https://iihs.co.in/knowledge-gateway/wp-content/uploads/2015/07/9_Urban-Transport.pdf, Accessed on 25th February 2022.

ITF (2021) Decarbonising India's Transport System: Charting the Way Forward, *International Transport Forum Policy Papers*, No. 88, OECD Publishing, Paris.

Michie, S., Van Stralen, M.M. & West, R. (2011) The behaviour change wheel: A new method for characterising and designing behaviour change interventions. Implementation Science, Vol. 6, Article 42

MoPNG (2021), PPAC's Snapshot of India's Oil and Gas Data, Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Government of India.

Nitesh Desai and Associates (2019), E-Mobility: A Sustainable Automotive Future, *Nishith Desai Associates*.

Niti Aayog (2017), India Leaps Ahead: Transformative Mobility solutions for all.

NITI Aayog (2018), Transforming India's Mobility: A Perspective, retrieved from https://www.niti.gov.in/writereaddata/files/document_publication/BCG.pdf, Accessed on 25th February, 2022.

NITI Aayog and RMI (2019), India's Electric Mobility Transformation, Progress to date and future opportunities. https://rmi.org/wp-content/uploads/2019/04/rmi-niti-ev-report.pdf, Accessed on 27th February, 2022.

Niti Aayog and GIZ (2021), Status quo analysis of various segments of electric mobility and low carbon passenger road transport in India, retrieved from https://www.niti.gov.in/sites/default/files/2021-04/FullReport_Status_quo_analysis_of_various_segments_of_electric_mobility-compressed.pdf, Accessed on 25th February, 2022.

NITI Aayog et. al. (2021), Handbook of electric vehicle charging infrastructure implementation Version-1, Retrieved from https://www.niti.gov.in/sites/default/files/2021-08/HandbookforEVChargingInfrastructureImplementation081221.pdf, Accessed on 25th February, 2022.

ORF (2020), Policymaking Towards Green Mobility in India, *ORF Occasional Paper 277 by Amruta Ponkshe*, Retrieved from https://orfonline.org/wp-content/uploads/2020/10/ORF_OccasionalPaper_277_GreenMobility_NEW.pdf, Accessed on 25th February, 2022.

Patton, M. Q. (2011). Developmental evaluation: Applying complexity concepts to enhance innovation and use. New York: The Guildford Press.

Pohit, S. R. Singh, and Chowdhury S. R. (2021), 'Role of Policy Interventions in Limiting Emissions from Vehicles in Delhi, 2020–2030', *ADBI Working Paper 1297, Tokyo: Asian Development Bank Institute*, Available: https://www.adb.org/publications/role-policyinterventions-limiting-emissions-vehicles-delhi-2020-2030.

Ramanyya, T.V. and V. Nagadevera, (2009), 'Role of unorganised enterprises in transportation services in Indian Institute of Management (IIM), Bangalore', Available @ https://repository.iimb.ac.in/bitstream/2074/12091/1/Nagadevara_IJBR_2009_Vol.9_Iss.2.pdf. Accessed on 30 September 2021.

Renner, M (2017), 'Rural renewable energy investment and their impact on employment', *Working Paper No. 1, 2017*, International Labour Organisation.

Rokadiya, Shikha (2021), The International Council on Clean Transportation, October 19, Accessed January 26, 2022. https://theicct.org/electrifying-indias-two-wheelers-supply-side-incentives-and-beyond/.

RMI (2017), https://rmi.org/insight/india-leaps-ahead-transformative-mobility-solutions-for-all/ , Accessed on 25th February, 2022.

Samantray, Shilpi, and Sreelakshmi R (2020), News18, January 3, Accessed January 26, 2022, https://www.news18.com/news/opinion/opinion-creating-new-ev-jobs-for-an-economy-on-the-move-2444871.html.

SCL, (2018), Retrieved from What is the Global Decarbonization Movement (sclubricants.com) on February 1st, 2022

Serohi (2021), E-mobility ecosystem innovation – impact on downstream supply chain management processes, Is India ready for inevitable change in auto sector? Supply Chain Management, in-print.

SESEI (2017), Indian Automobile Industry, Standard European Standardisation in India (SESEI), Retrieved from https://www.sesei.eu/wp-content/uploads/2018/12/Automotive-Sector-Report_-Final.pdf, Accessed on 25th February, 2022.

Shakti (2018), Developing a business case for integrated transport sector budgeting in states. https://shaktifoundation.in/wp-content/uploads/2018/06/Final-report_Integrated-Transport-Budgeting_web-version.pdf

Shakti (2020) Performance Evaluation Framework for electric buses in India. Retrieved from https://shaktifoundation.in/report/performance-evaluation-framework-for-electric-buses-in-india/, Accessed on 25th February, 2022.

SIAM (2017), Adopting Pure Electric Vehicles: Key Policy Enablers, A White Paper on Electric Vehicles, Retrieved from https://www.siam.in/uploads/filemanager/114SIAMWhitePaperonElectricVehicles.pdf, Accessed on 25th February, 2022.

TERI (2019), Faster adoption of electric vehicles in India: Perspective of consumers and industry, Retrieved from https://www.teriin.org/sites/default/files/2019-11/Faster%20adoption%20of%20electric%20vehicles%20in%20India.pdf, Accessed on 24th February, 2022.

TFE (2018), The case for Electric Mobility in India, A report by TFE Consulting.

UITP and Shakti (2019), Fiscal Incentives to Scale-up adoption of Electric Buses in Indian cities Final Report: Volume - I.

UK Electric Vehicles Database (n.d.) MG ZS EV Long Range. Available at: https://ev-database.uk/car/1541/MG-ZS-EV-Long-Range [Accessed 28.02.22]

United Nations. (n.d.). Sustainable Development Goals. Retrieved from https://www.un.org/sustainabledevelopment/climate-change/

WEF (2019), EV-Ready India Part 1: Value Chain Analysis of State EV Policies, A white paper by World Economic Forum and Ola Mobility Institute.

WRI (2021), A Review of State Government Policies for Electric Mobility.

World Bank and ESMAP (2021), Electric mobility in India: Accelerating Implementation, Working Paper retrieved from https://openknowledge.worldbank.org/handle/10986/35655, Accessed on 25th February, 2022.

WWF (2020), Perception Study on Sustainable Mobility in Bengaluru. Retrieved from https://wwfin.awsassets.panda.org/downloads/perception_study_on_sustainable_mobility_in_bengaluru.pdf

About the Academy

The British Academy is an independent, self-governing corporation, composed of almost 1,000 UK Fellows and 300 overseas Fellows elected in recognition of their distinction as scholars and researchers. Its objectives, powers and framework of governance are set out in the Charter and its supporting Bye-Laws, as approved by the Privy Council. The Academy receives public funding from the Science and Research budget allocated by a grant from the Department for Business, Energy and Industrial Strategy (BEIS). It also receives support from private sources and draws on its own funds. The views and conclusions expressed here are not necessarily endorsed by individual Fellows but are commended as contributing to public debate.

The British Academy is the UK's national academy for the humanities and social sciences. We mobilise these disciplines to understand the world and shape a brighter future.

From artificial intelligence to climate change, from building prosperity to improving well-being – today's complex challenges can only be resolved by deepening our insight into people, cultures and societies.

We invest in researchers and projects across the UK and overseas, engage the public with fresh thinking and debates, and bring together scholars, government, business and civil society to influence policy for the benefit of everyone.

The British Academy
10–11 Carlton House Terrace
London SW1Y 5AH

Registered charity no. 233176

thebritishacademy.ac.uk
Twitter: @BritishAcademy_
Facebook: TheBritishAcademy

Published June 2022

To cite this report: British Academy (2022), *All Change: Equitably Decarbonising India's Transportation Sector*, The British Academy, London

doi.org/10.5871/just-transitions-a-p/S-B

Design by Only

The British Academy