

Accelerating ZEV Transitions in India

Role of State-level Action

September 2022

Briefing Paper

Global Clean Energy Action Forum 2022

Aditya Ramji, Riddhi Kankaria

Institute of Transportation Studies, University of California, Davis

Suggested Citation: Ramji, A., Kankaria, R. (2022). Accelerating ZEV Transitions in India: Role of State-level Action. Institute of Transportation Studies, University of California Davis.

Copyright 2022 ©

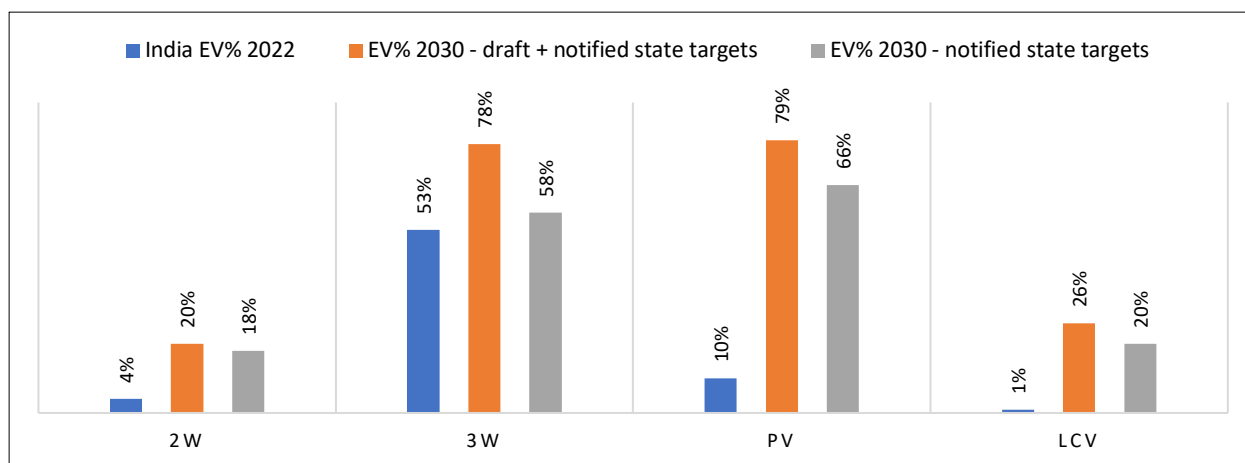
Peer reviewers: Dr Lewis Fulton (ITS, UC Davis), Swati Dsouza (Lead Consultant and India Coordinator, International Energy Agency)

Executive Summary

While international cooperation is key to addressing transport decarbonization including electrification, it will require strong domestic action, especially at the sub-national level. The National Mission on Transformative Mobility and Battery Storage along with the national demand incentives scheme for electric vehicles (FAME) and the recently introduced Production-Linked Incentive (PLI) scheme for EV and cell manufacturing have provided a broader framework for national action.

About 25 States and Union Territories (from a total of 36) in India have either a draft or notified State EV Policy, that focus on both demand side incentives including vehicle purchase subsidies, tax benefits and incentives for charging infrastructure, as well as supply side incentives that promote investments in EV manufacturing.

While India has not set a national EV target, various states have set targets with varying ambitions. Of 25 states that have either a draft or notified EV policy, 21 states have specified some target for electrification. The objective of this analysis is to provide a bottom-up view of what the cumulative EV ambitions of states add up to, and its role in defining potential electrification scenarios for India, including target setting and other supporting regulations. The figure below provides an overview of the 2030 scenario building on state EV targets.



If the targets of only those states that have a notified EV policy are accounted for, India can achieve about 18% electrification of new two-wheeler sales in 2030, about 58% of new three-wheeler sales, 66% of PV sales and 20% of LCV sales. A higher ambition scenario which includes the EV targets of states with draft policies as well sees a 20% electric share in two-wheelers, 78% in three-wheelers, 79% in PV and 26% in LCV.

The total cumulative incentives being provided by states totals about USD 1.1 billion by 2030. Along with the FAME-II incentives, this amounts to over USD 2.4 billion proposed in demand incentives for EV purchases across India.

A key finding is that state level policies can play a very important role in guiding India to high ZEV adoption. While the national EV policy framework in India aims to provide demand incentives and encourage manufacturing for cells and electric vehicles, **the state policies can provide an important market signal for demand creation and enable a strong environment for capital flow towards the EV ecosystem including both manufacturing and charging infrastructure.**

Introduction

Rapid economic growth in developing countries has also seen greater demand for transportation, and an increase in motorization rates. While motorization rates in the decade of 2005-15 have increased by about 6-9% in North America and the European Union, the global south, which is largely constituted of emerging economies, have seen a more rapid increase: 60% in South America, 35% in Africa and 140% in Asia (OICA, 2022¹). This also means a rapid growth in potential transport emissions in the coming decade.

Globally, road transport emissions contribute to about 78% of transport emissions in 2020 (IEA, 2021²). Of this while Light and Heavy-Duty Vehicles (LDV and HDV) contributed to 90% of the emissions, it should be noted that in emerging markets where two and three-wheelers play a key role in mobility, the contribution of these segments to transport emissions will be more pronounced in these markets. While electrification is seen as a key strategy towards decarbonizing road transport, only 18% of NDCs set CO₂ reduction targets for transport (ITF, 2022³).

While electrification can provide significant benefits in terms CO₂ emissions reduction, it can also provide strategic co-benefits of improved air quality through reduced local air pollutant emissions from vehicle tail-pipes, especially in emerging economies where local air pollution is a significant challenge. In India, which is the world's fourth largest automotive manufacturer, air pollution impacts are significant. In 2017, the loss of labor income due to fatal illnesses from excess exposure to PM 2.5 was estimated to be about 0.3-0.9% of India's GDP (World Bank, 2020⁴).

While international cooperation is key to addressing transport decarbonization including electrification, it will require strong domestic action, especially at the sub-national level. We have seen significant participation and commitments towards climate change and vehicle electrification from various sub-national actors. In the US, the State of California has pioneered vehicle electrification through adopting more stringent standards than federal requirements, twelve U.S states that are part of the Section 177 Coalition have adopted the more stringent California vehicle emission standards compared to US EPA, the Pacific Coast Collaborative is a regional agreement between California, Oregon, Washington and British Columbia (Canada) to align policies to reduce GHG emissions and promote clean energy.

In addition to state actors, various cities have also set policies to promote vehicle electrification, especially across public transport as well as introducing low emission zones. These include coalitions such as the C40 Cities network which works with the mayors of member cities to further climate action. The network includes cities from the US, India, South America, Europe, Africa and South Asia.

¹ <https://www.oica.net/category/vehicles-in-use/>

² <https://www.iea.org/reports/tracking-transport-2021>

³ <https://www.itf-oecd.org/ndc-tracker/en>

⁴ <https://www.worldbank.org/en/country/india/publication/catalyzing-clean-air-in-india>

India's sub-national action on EV transition

Transportation policy in India, as defined by the Constitution of India, is listed as a concurrent subject, that involves the role of both the central and state government, but in practice, transportation policies, including some vehicle and fuel taxes, as well as public transportation, are controlled by the state. Given the diverse needs of the population across the country, states are well positioned to design and implement policies that impact its local population.

While India has set a net zero goal by 2070, it has not set any sector specific targets, and more specifically, with respect to road transport electrification, it has promoted state level action as a key driver of EV adoption. The National Mission on Transformative Mobility and Battery Storage along with the national demand incentives scheme for electric vehicles (FAME) and the recently introduced Production-Linked Incentive (PLI) scheme for EV and cell manufacturing have provided a broader framework for national action.

About 25 States and Union Territories (from a total of 36) in India have either a draft or notified State EV Policy, that focus on both demand side incentives including vehicle purchase subsidies, tax benefits and incentives for charging infrastructure, as well as supply side incentives that promote investments in EV manufacturing. Of these, about 18 states have notified their policies, most of them notified between 2019-2021. The State of Karnataka was among the first to notify a state EV policy in 2017, followed by the two states Maharashtra and Andhra Pradesh in 2018.

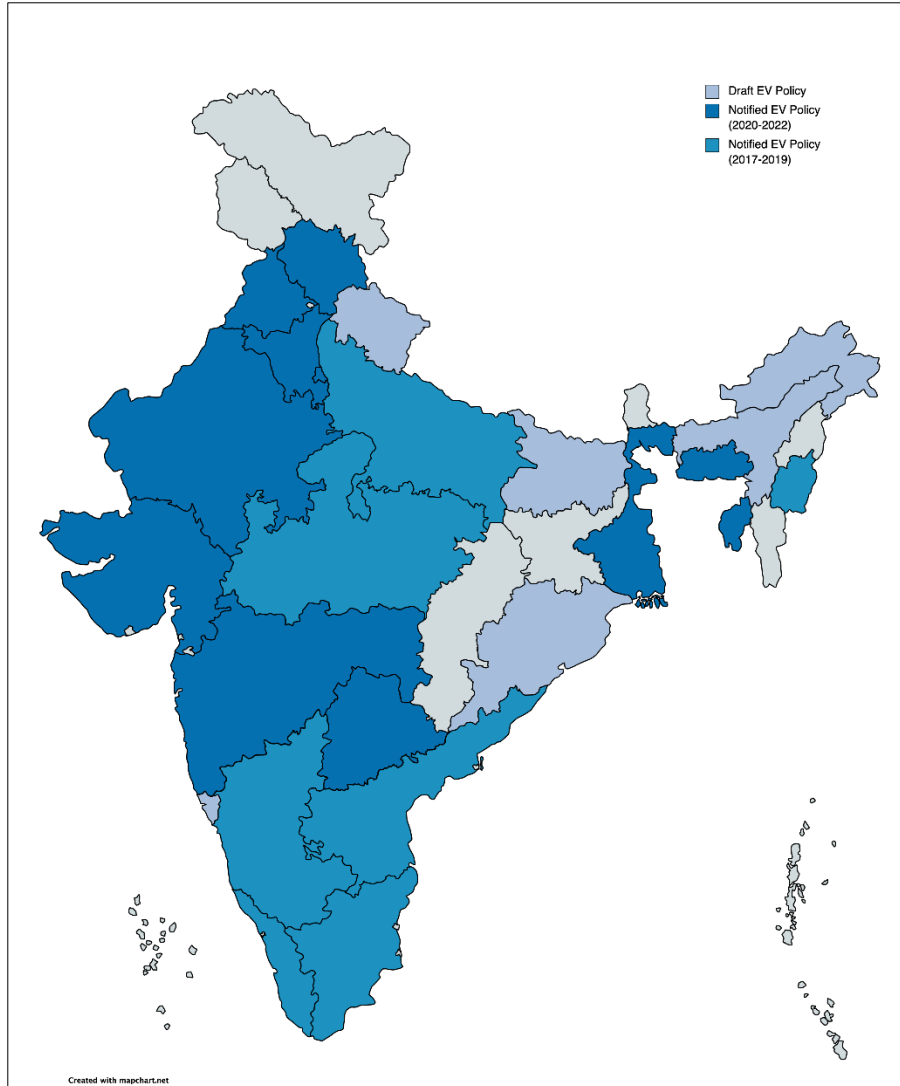


Figure 1: State-level EV policy status and timeline

At the national level, India has seen rapid adoption of electric vehicles among three-wheelers, achieving over 53% share of e-3Ws in new registrations in 2022, followed by electric two-wheelers, that have achieved a share of 3.8% in 2022 (MoRTH, 2022). The support of the FAME subsidy as well as technology maturity in electric three-wheelers has provided scale benefits, not just making it competitive on a Total Cost of Ownership (TCO) basis but also reducing the purchase price gap to under 1.3 times of a comparable ICE model, resulting in rapid adoption. As in Figure 2, the share of electric vehicles in new registrations for CY 2021 and CY 2022 (YTD: Jan – Sep) shows an increase in EV shares across all segments, although India still lags in electrification of Passenger Vehicles (PV) and Light Commercial Vehicles (LCV).

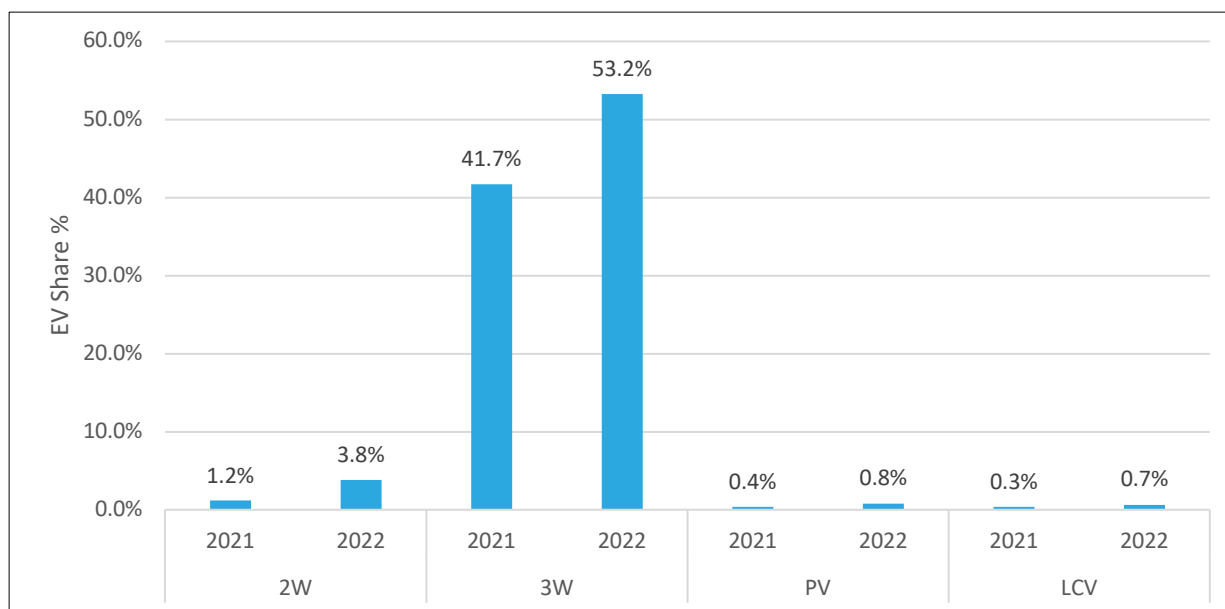


Figure 2: EV share of new registrations in India for CY 2021 and CY 2022 (YTD: Jan -Sep)

Analyzing EV adoption at the state level for CY 2022 (YTD: Jan – Sep) with data for 34 out of 36 states, we find that states with notified EV policies have higher EV adoption shares across segments when compared to states that have either a draft EV policy or no policy (Table 1).

Table 1: Average EV share in new registrations between states with notified EV policy and others

Segment	Notified EV policy	Draft/No EV policy
Two-wheeler	4.0%	1.3%
Three-wheeler	34.9%	28.8%
Passenger Vehicles	0.5%	0.3%
Light Commercial Vehicles	1.1%	0.4%

*Note: EV shares are for CY 2022 (YTD: Jan – Sep)

As can be seen in Table 2, leading states are achieving around 7-9% in two-wheeler electrification, about 2-5% in passenger vehicle electrification, and about 4-9% in LCV electrification. In case of three-wheeler electrification, leading states have crossed over 83% electrification in new registrations, indicating the significant potential in that segment.

Table 2: Leading three states in CY 2022 (YTD: Jan–Sep) by EV shares in new registrations

State Rank	Vehicle Segment (2022 EV % of new registrations)			
	2W	3W	PV	LCV
1	Delhi (2020): 9.1%	Uttarakhand: 88.3%	Goa (2021): 4.5%	Delhi (2020): 8.6%
2	Madhya Pradesh (2019): 8.3%	Chandigarh (2022): 85.5%	Maharashtra (2018): 2.1%	Andhra Pradesh (2018): 6.2%
3	Karnataka (2017): 7.6%	Assam: 83.2%	Kerala (2019): 1.8%	Goa (2021): 4.1%

*PV or Passenger Vehicles are equivalent to LDVs in other global markets

In the electric three-wheeler segment, among the top ten states, the lowest share of electrification is 53.7%, and six of the ten states have a notified EV policy. In case of electric two-wheelers, among the top ten states, the lowest electrification share is 4.3% in Tamil Nadu, and nine of the ten states have notified EV policies, indicating the potential role of policy frameworks in driving adoption in this segment. In passenger vehicle segment, the lowest electrification share is around 0.3% in Chhattisgarh, and of these states, seven have notified EV policies, and two states have no state EV policy. In LCV electrification, we find that the lowest electrification share is 0.1% (Chhattisgarh) among the top ten states, with five states having a notified EV policy, and three states having no policy. The role of state EV policies in driving adoption is key especially in segments such as two-wheelers and passenger vehicles where the upfront price differential between EV and ICE models is still significant in spite the current demand incentives being provided. In case of three-wheelers and LCVs, where the dominant applications are commercial use cases, the upfront price differential is not as critical as the overall economics, thus leading to EV adoption even in states where policy frameworks are not yet in place.

Table 3 further highlights the role of state EV policies in driving adoption across segments. For two-wheelers and passenger vehicles, all states except one that have EV shares higher than the national average have notified EV policies. In case of three-wheelers, of the ten states with higher EV shares than national average, six states have notified EV policies. For LCVs, except two states, all have notified EV policies where the EV shares are higher than national average.

Table 3: States with higher than national EV share in CY 2022 (YTD: Jan – Sep) by segment

State	Policy Status	2W	3W	PV	LCV
Puducherry	Draft	2.81%	23.00%	0.03%	2.16%
Uttarakhand	Draft	3.25%	88.30%	0.08%	0.02%
Bihar	Draft	0.90%	60.50%	0.16%	0.01%
Odisha	Draft	4.54%	20.00%	0.05%	0.01%
Assam	Draft	0.05%	83.20%	0.01%	0.01%
Manipur	Draft	0.02%	12.10%	0.00%	0.00%
Arunachal Pradesh	Draft	0.00%	0.00%	0.00%	0.00%
Daman & Diu / Dadra Nagar Haveli	No Policy	0.72%	30.90%	0.33%	0.44%
Jharkhand	No Policy	1.46%	40.15%	0.15%	0.14%
Chhattisgarh	No Policy	3.50%	79.30%	0.32%	0.10%
Jammu & Kashmir	No Policy	2.28%	29.22%	0.09%	0.00%
Ladakh	No Policy	1.00%	0.00%	0.00%	0.00%
Mizoram	No Policy	0.09%	0.00%	0.00%	0.00%
Nagaland	No Policy	0.07%	0.00%	0.00%	0.00%
Sikkim	No Policy	0.00%	0.00%	0.00%	0.00%
Andaman & Nicobar	No Policy	0.00%	0.00%	0.00%	0.00%
Goa	Notified	1.01%	22.80%	4.47%	4.11%
Delhi	Notified	9.10%	72.44%	1.53%	8.60%
Andhra Pradesh	Notified	4.47%	2.53%	0.65%	6.18%
Haryana	Notified	3.01%	53.70%	0.01%	1.53%
Karnataka	Notified	7.60%	15.60%	0.08%	1.24%

State	Policy Status	2W	3W	PV	LCV
Maharashtra	Notified	6.49%	13.60%	2.11%	0.39%
Uttar Pradesh	Notified	0.91%	76.50%	0.04%	0.10%
Gujarat	Notified	6.00%	3.90%	0.79%	0.08%
Tamil Nadu	Notified	4.28%	15.50%	0.08%	0.03%
West Bengal	Notified	0.09%	22.80%	0.07%	0.02%
Rajasthan	Notified	5.60%	64.84%	0.05%	0.01%
Punjab	Notified	1.99%	63.96%	0.00%	0.01%
Kerala	Notified	5.32%	12.10%	1.76%	0.00%
Chandigarh	Notified	2.70%	85.50%	0.73%	0.00%
Tripura	Notified	0.43%	45.90%	0.45%	0.00%
Himachal Pradesh	Notified	1.54%	6.66%	0.01%	0.00%
Meghalaya	Notified	0.01%	2.37%	0.01%	0.00%
Madhya Pradesh	Notified	8.28%		0.06%	
India		3.80%	53.40%	0.80%	0.60%

State EV targets setting the national agenda

While India has not set a national EV target, various states have set targets with varying ambitions. Some states have set overall targets aiming for a certain EV share in total registrations for a given year, while others have set targets focusing on commercial and last mile fleets including two-wheelers, three-wheelers and LCVs. Of 25 states that have either a draft or notified EV policy, 21 states have specified some target for electrification. The objective of this analysis is to provide a bottom-up view of what the cumulative EV ambitions of states add up to, and its role in defining potential electrification scenarios for India, including target setting and other supporting regulations.

As can be seen in Table 4, of the states with a draft EV policy, only two states, Odisha and Assam have specific EV targets across all segments, while Bihar has a target only for electric three-wheelers. Of the states with notified EV policies, only three states do not have EV targets for all segments, i.e., Haryana has no target for two-wheelers and passenger vehicles, Tamil Nadu has no targets for two-wheelers and LCVs, Kerala has no targets for passenger vehicles, and Madhya Pradesh has no targets for LCVs.

Table 4: Segment EV targets across state EV policies

State	EV Policy Status	2W	3W	PV	LCV
Puducherry	Draft				
Uttarakhand	Draft				
Bihar	Draft				
Odisha	Draft				
Assam	Draft				
Manipur	Draft				
Arunachal Pradesh	Draft				
Goa	Notified				
Delhi	Notified				
Andhra Pradesh	Notified				
Haryana	Notified				
Karnataka	Notified				
Maharashtra	Notified				
Uttar Pradesh	Notified				
Gujarat	Notified				
Tamil Nadu	Notified				
West Bengal	Notified				
Rajasthan	Notified				
Punjab	Notified				
Kerala	Notified				
Chandigarh	Notified				
Tripura	Notified				
Himachal Pradesh	Notified				
Meghalaya	Notified				
Madhya Pradesh	Notified				

Based on a historical sales data from 2013 onwards from the VAHAN database (MoRTH, 2022), we have estimated the overall CAGR for each vehicle segment, based on 2013-2022 (YTD: Jan-Sep) before estimating the EV share based on specific targets. Table 5 provides an overview of the 2030 scenario building on state EV targets across different segments.

Table 5: 2030 EV share based on cumulative state-level targets as specified in respective EV policies

		2W	3W	PV	LCV
2030	India Total Sales	16.9 mn	0.6 mn	0.4 mn	0.8 mn
	Cumulative EV sales (all states with targets)	3.4 mn	0.5 mn	0.3 mn	0.2 mn
	Cumulative EV sales (notified policies only)	3.1 mn	0.4 mn	0.2 mn	0.2 mn
	Share of EV in national sales (all state targets)	20%	78%	79%	26%
	Share of EV in national sales (notified policies only)	18%	58%	66%	20%
	India EV share in 2022 (Estimated)	4%	53%	10%	1%

If the targets of only those states that have a notified EV policy are accounted for, India can achieve about 18% electrification of new two-wheeler sales in 2030, about 58% of new three-wheeler sales, 66% of PV sales and 20% of LCV sales.

A higher ambition scenario which includes the EV targets of states with draft policies as well sees a 20% electric share in two-wheelers, 78% in three-wheelers, 79% in PV and 26% in LCV.

Based on current EV share for 2022 across segments, it is expected that two-wheelers achieve 4% EV share, three-wheelers will achieve about 53%, PV will reach about 10% and LCV about 1%. In the case of three-wheeler electrification, current trajectory indicates that India will likely meet the 2030 cumulative state-level target of 58% in 2023, which puts India on the path to achieving the high ambition EV share of 78% in 2030 among three-wheelers. In case of two-wheelers, from 4% EV share in 2022 to achieving 18-20% by 2030 should be feasible given the large market opportunity and the demand incentives.

In states such as Delhi, where electrification of last mile delivery and city logistics fleets is being pushed, there is potential to achieve higher rates of LCV electrification, and as more states replicate similar measures, India can achieve the base ambition scenario of 20% LCV electrification by 2030.

In case of passenger vehicles, both the base and high ambition scenarios indicate that states have strong goals for electrification, with their targets achieving at least 66% PV electrification in 2030. But the pathway such high levels of electrification in the next eight years will require strong support in terms of demand incentives, more stringent fuel economy and emission regulations as well as manufacturer requirements for CAFE norms compliance, and even possibly a ZEV sales mandate that can drive adoption in this segment.

Financing the transition

Availability of finance is key to sustaining any transition. India has allocated about USD 1.3 billion in demand incentives (FAME-II Scheme) for electric vehicle purchase. As seen in Table 5, if India were to meet the targets set by state EV policies, additional financial resources will be key in ensuring the transition to vehicle electrification is equitable.

While various states have set EV targets in their policies, some states have provided additional demand incentives over the FAME-II incentives, while others are providing relief on vehicle taxes. We review the purchase incentives that have been provided by states to estimate the total additional funding proposed

by states in addition to central government support. Fifteen states have proposed purchase incentives of which thirteen states cover all four segments including two-wheelers, three-wheelers, passenger vehicles and light commercial vehicles.

As seen in Table 6, the total cumulative incentives being provided by states totals about USD 1.1 billion by 2030. Along with the FAME-II incentives, this amounts to over USD 2.4 billion proposed in demand incentives for EV purchases across India.

Table 6: Total state-level purchase incentives for electric vehicle segments

	2W	3W	PV + LCV	Total
USD mn	364	492	258	1114

Conclusion

A key finding is that state level policies can play a very important role in guiding India to high ZEV adoption. While the national EV policy framework in India aims to provide demand incentives and encourage manufacturing for cells and electric vehicles, the state policies can provide an important market signal for demand creation and enable a strong environment for capital flow towards the EV ecosystem including both manufacturing and charging infrastructure.

India has shown continued global climate leadership announcing a net zero goal and joining the ZEV Transitions Council among others to advance adoption of electric vehicles and promote international cooperation. As state governments create frameworks for EV policies, significant capacity development is needed to align an enabling transportation policy ecosystem, as various issues regarding transport and energy are under the jurisdiction of multiple levels of government, especially, state, and local government bodies. There is a need for greater open-source data that will facilitate a more comprehensive analysis of potential ZEV transition pathways for India, leveraging sub-national action. This briefing paper while highlighting the key role of state action in enabling EV transitions in India, aims to build this further, creating ZEV champions at the state level.

The detailed analysis will focus on identifying the key elements of state EV policies that are likely to drive higher EV adoption rates and aim to further strengthen state EV frameworks that can enhance electrification while balancing state revenues from vehicle and fuel taxes. More importantly, it will focus on identifying potential states that can serve as ZEV champions for India and be model states for global sub-national action.