

BRIEFING

JULY 2019

Regulatory pathways for zero-emission vehicle mandates

1 INTRODUCTION

Governments around the world are acknowledging the importance of zero-emission vehicles (ZEVs) in achieving their climate, air quality, energy security, and economic development goals.¹ Many are now considering what combination of regulatory policies, incentives, infrastructure investment, and consumer campaigns can help propel a complete transition to ZEVs.² While governments in all of the leading ZEV markets are developing a holistic approach to promoting these vehicles, they are also relying on key, landmark policies to enable transformational market shifts.

ZEV mandates are at the heart of policies driving early uptake in key regions. While mandates on manufacturers are strong policy measures that ensure the widespread supply of ZEV models, it is important to note that leading ZEV markets globally are also deploying a host of more-targeted policies that can stimulate demand for vehicle electrification. The top 25 metropolitan ZEV markets in the world account for only 12% of global light-vehicle sales, but they were 44% of the global ZEV market through 2017. What distinguishes these “EV Capitals of the World” from the rest is that these cities, and the states in which they are located, have implemented bold measures such as mandates for electric vehicle procurement in public fleets, preferential registration and licensing policies for ZEVs, and planned zero-emission zones.³

In this briefing, we summarize a number of regulatory pathways that have been used globally to deploy ZEV mandates or comparable policies. To aid in implementing

1 The term ZEV refers to vehicles that are primarily powered by electric drive, including battery operated electric vehicles, fuel cell electric vehicles, and plug-in hybrid electric vehicles. The terminology for ZEVs varies across markets. For example, zero-emission vehicle (ZEV) in California, zero low-emission vehicle (ZLEV) in the EU, and new energy vehicle (NEV) in China. We use these terms interchangeably in this briefing.

2 See Zero-Emission Vehicle Alliance. <http://www.zevalliance.org/international-zev-alliance-announcement/>

3 Dale Hall, Hongyang Cui, and Nic Lutsey, *Electric vehicle capitals: Accelerating the global transition to electric drive*, (ICCT: Washington, DC, 2018). https://www.theicct.org/sites/default/files/publications/EV_Capitals_2018_final_20181029.pdf

such targeted policies in India, a forthcoming companion piece will describe enabling regulatory frameworks.

2 REGULATORY PATHWAYS FOR ZEV MANDATES

Based on our research regarding international practices, we summarize regulatory pathways linked primarily to efforts to reduce local air pollution, and efforts to reduce vehicle fuel consumption or greenhouse gas (GHG) emissions (Figure 1). Of course, air quality and climate-related co-benefits are produced by following any of these pathways. Some of the regulatory pathways directly push ZEVs into the market. While others are not explicit ZEV mandates, they have proven to have similar effects on the market as ZEV mandates. Additionally, the regulated parties vary. In some cases they are vehicle manufacturers, and in others they are fleet operators, fleet or vehicle buyers, or vehicle users. Examples of each regulatory pathway are provided below.

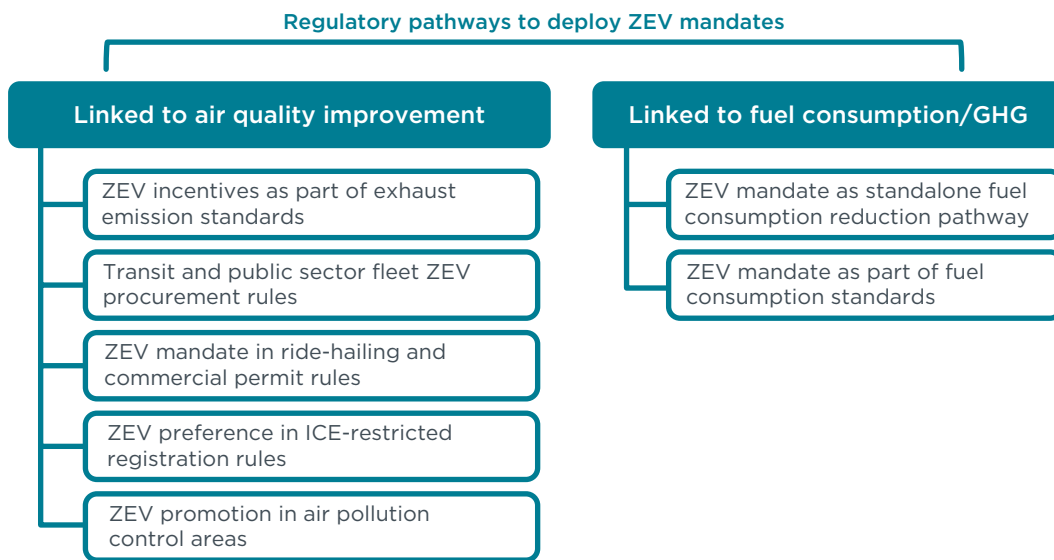


Figure 1. Summary of regulatory pathways to deploy ZEV mandates.

2.1. PATHWAYS LINKED TO AIR QUALITY IMPROVEMENT

2.1.1. ZEV INCENTIVES AS PART OF EXHAUST EMISSION STANDARDS

California was the first market in the world to implement a ZEV mandate program. It applies to manufacturers and was part of the state’s exhaust emission standards for light-duty vehicles.⁴ Since adoption in 1990, California’s ZEV mandate program has continuously evolved, and it is now an independent regulation under the Advanced Clean Cars (ACC) package of regulations.⁵

The U.S. Environmental Protection Agency (EPA)’s Tier 2 fleet average exhaust emission standards included a Bin 1 corresponding to ZEVs. From 2001 to 2005, each Bin 1 vehicle received a multiplier of two, which meant that each ZEV counted twice toward meeting the average fleet emissions target. While subsequent Tier 2 and present Tier 3 standards do not include a multiplier for ZEVs, these vehicles are included in the calculation of fleet average. As a consequence, manufacturers who deploy ZEVs can do less to reduce

4 1990 California LEV I standards simply stated that, “While meeting the fleet average standards, each manufacturer’s sales fleet shall be composed of at least 2% ZEVs in the model years 1998 through 2000, 5% ZEVs in 2001 and 2002 and 10% ZEVs in 2003 and subsequent.”

5 <https://ww2.arb.ca.gov/index.php/our-work/programs/advanced-clean-cars-program>

the tailpipe emissions from conventional vehicles and still meet an otherwise stringent standard. This approach is not applicable to markets such as India, where exhaust emission limit values are set instead of a fleet average. However, such markets can choose to offer manufacturers who deploy a certain number of ZEVs other flexibilities in meeting the emissions standards as an incentive.

Back in 1985, Beijing became the first city in China to ban motorcycles in the city due to air quality concerns. As of August 2015, 185 other cities in the country had replicated this approach.⁶ Since lightweight, low-speed electric two-wheelers (e-bikes) were designated as bicycles and thus were exempt from the ban, this policy effectively spurred the growth of electric two-wheelers in Chinese cities.⁷

2.1.2. TRANSIT AND PUBLIC SECTOR FLEET ZEV PROCUREMENT RULES

In 2000, CARB issued the Fleet Transit Rule, which specified fuel pathways, fleet-average NO_x emission limits, and PM emission reduction requirements for urban buses and other transit fleets in California. Since 2008, the rule has also subjected operators of large urban bus fleets to minimum ZEV quotas in new bus purchases made. In December 2018, CARB proposed replacing the Fleet Transit Rule with the Innovative Clean Transit (ICT) regulation.⁸ The ICT regulation requires that, starting in 2023, 25% of new bus purchases made in a calendar year by large transit agencies shall be zero emission. This percentage requirement increases to 50% by 2026, and 100% by 2029. While smaller transit agencies are subject to the 100% zero emission for new purchases by 2029 criteria, they are allowed a more relaxed interim goal.

Following transit buses, fixed route airport shuttles serving California's 13 largest airports will be required to transition to 100 percent ZEVs by 2035.⁹ California is also evaluating the regulatory feasibility of mandating ZEVs across all types of public and commercial fleets, including rental cars, large employers, delivery vehicles, and ride-hailing fleets.¹⁰

The State Council of China has provided guidance that at least 30% of new procurement should be zero emission for all categories of vehicles in public service in ZEV promoting cities since 2014.¹¹ The guidance was then translated into mandated purchase of electric public service vehicles at the city level.¹² Such mandates are now commonplace at the province level in China.¹³ For example, Guangdong Province has mandated that at least 80% of bus fleets be zero emission by 2020, and there are 100% targets for some

6 "The sadness of riders: the history of 'motorcycle ban' in China cities," *Ifeng News*, April 8, 2016, http://news.ifeng.com/a/20160408/48391617_0.shtml

7 Christopher Cherry, "Electric Two-wheelers in China: Progress, Promise and Potential," *Access*, fall 2010, <http://www.accessmagazine.org/fall-2010/electric-two-wheelers-china-promise-progress-potential/>

8 "Innovative Clean Transit," California Air Resources Board, accessed February 2019, <https://www.arb.ca.gov/msprog/ict/ict.htm>.

9 "California Air Resources Board approves comprehensive effort to clean up airport shuttles," California Air Resources Board, accessed June 2019, <https://ww2.arb.ca.gov/news/california-air-resources-board-approves-comprehensive-effort-clean-airport-shuttles>

10 "Governor's letter regarding zero-emission fleet rules," California Air Resources Board, accessed February 2019, <https://ww2.arb.ca.gov/resources/documents/governors-letter-regarding-zero-emission-fleet-rules>.

11 "Guidance on accelerating the promotion and application of new energy vehicles," Office of the State Council, accessed February 2019, <https://baike.baidu.com/item/%E5%85%B3%E4%BA%8E%E5%8A%A0%E5%BF%AB%E6%96%B0%E8%83%BD%E6%BA%90%E6%B1%BD%E8%BD%A6%E6%8E%A8%E5%B9%BF%E5%BA%94%E7%94%A8%E7%9A%84%E6%8C%87%E5%AF%BC%E6%84%8F%E8%A7%81/15038718>.

12 Dongguan Government. Dongguan15th Five-year-plan of New Energy Vehicle Industry Development. July 14, 2017, <http://zwgk.dg.gov.cn/007330010/0202/201707/f4afc460317847d0aacba917ded010be.shtml>

13 "Chinese government support for new energy vehicles as a trade battleground," The National Bureau of Asian Research, accessed February 2019, <https://www.nbr.org/publication/chinese-government-support-for-new-energy-vehicles-as-a-trade-battleground/>.

advanced cities.¹⁴ In addition to buses, Guangdong Province requires that at least 50% of new purchases for taxis and ride-hailing cars be zero emission and there are more rigorous 100% targets in some advanced cities.

The EU has also created ZEV targets for public procurement.¹⁵ The targets vary by member state and go as high as 38.5% for light-duty vehicles, 45% (2025) to 65% (2030) for buses, and 10% (2025) to 15% (2030) for trucks.

2.1.3. ZEV MANDATE IN RIDE-HAILING AND COMMERCIAL PERMIT RULES

London has set emission standards for all new private-hire vehicle licenses issued in the city, and these standards include phased requirements for transitioning to ZEVs.¹⁶ (London's vehicle licenses are equivalent to permits issued in India.) Effective January 1, 2023, all new private-hire vehicle license issuances can only be toward ZEVs.¹⁷ In the interim period between January 1, 2019 and December 31, 2022, private-hire vehicles less than 18 months old must be ZEVs to qualify for a new license. If the private-hire vehicle is more than 18 months old in the interim period, it must meet at least Euro 6 emission standards to obtain a license. Ride-hailing platforms such as Uber are supporting London's directive with their own electrification targets and initiatives that provide monetary support to drivers.¹⁸ Uber is aiming to make all cars registered on its app in London electric by 2025.

The New York City Council stopped issuing new for-hire vehicle licenses in late 2018, effectively capping the number of vehicles available in app-based ride-hailing fleets. Though the city is now proposing to make the cap on such vehicles permanent, battery electric vehicles are excluded from this cap for the time being.¹⁹

The 2018 California Clean Miles Standard and Incentive Program (SB 1014) will result in a new regulation that requires ride-hailing companies to reduce their GHG emissions. The regulation includes, but is not limited to, targets on increasing passenger miles traveled using zero-emission means.²⁰

Starting in mid-2018, Shenzhen no longer issues road transport permits to ride-hailing taxis and light commercial vehicles that are not powered by electricity.²¹ This action effectively stops the sale of internal combustion engine (ICE)-powered taxis and light-commercial vehicles in Shenzhen.

14 "Opinions of the people's government of Guangdong Province on accelerating the innovation and development of new energy automobile industry," People's Government of Guangdong Province, accessed April 2019, http://zwgk.gd.gov.cn/006939748/201806/t20180613_769686.html.

15 "Directive of the European Parliament and of the Council amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles," accessed July 2019, <http://data.consilium.europa.eu/doc/document/PE-57-2019-INIT/en/pdf>

16 "Emission standards for PHVs," Transport for London, accessed March 2019, <https://tfl.gov.uk/info-for/taxis-and-private-hire/emissions-standards-for-phvs>.

17 The term ZEV here refers to Zero Emission Capable (ZEC) vehicles as defined in London. For a vehicle to be ZEC, it must have a zero-emission range of at least 20 miles and a tailpipe CO₂ emission value less than 75 g/CO₂.

18 "Uber's clean air plan to help London go electric," Uber, accessed March 2019, <https://www.uber.com/en-GB/newsroom/uber-helps-london-go-electric/>.

19 New York City Taxi and Limousine Commission and Department of Transportation, "Improving efficiency and managing growth in New York's for hire vehicle sector," Final report June 2019, https://www1.nyc.gov/assets/tlc/downloads/pdf/fhv_congestion_study_report.pdf.

20 "Clean Miles Standard", California Air Resources Board, accessed June 2019, <https://ww2.arb.ca.gov/our-work/programs/clean-miles-standard/about>.

21 "'Shenzhen Blue' 4.5T combustion vehicle is forbidden to get road transport permit, except for electric logistic vehicles," accessed Jun 2019, https://www.sohu.com/a/237864320_443199

2.1.4. ZEV PREFERENCE IN ICE-RESTRICTED REGISTRATION RULES

Registration-related interventions tied to ZEV promotion have been successfully implemented in China. For example, eight major cities—including Beijing, Shanghai, Shenzhen, and Guangzhou—limit the sale of conventional vehicles through registration restrictions. Such mechanisms typically fix a quota for the maximum number of vehicle registrations allowed in a year, and these registrations are granted either through monthly/bimonthly lotteries or expensive auction mechanisms. ZEVs, on the other hand, are either exempt from such restrictions altogether or treated preferentially. As a result, ZEVs are significantly cheaper and/or faster to register than conventional vehicles. For perspective, six out of the eight Chinese cities with such measures in place accounted for 40% of ZEV sales in China in 2017, and 22% of global ZEV sales that same year.²²

2.1.5. ZEV PROMOTION IN AIR POLLUTION CONTROL AREAS

Low-emission zones (LEZs) have proven to be successful and have been established in more than 200 cities across Europe.^{23,24} While the design and regulation of such zones varies across different cities, they all work on the principle of prohibiting or levying heavy fines on polluting vehicles, while granting preferential access to approved vehicles. Many cities are now in the process of tightening the emissions criteria enforced across LEZs, with the ultimate goal of large-scale electrification. For example, much of London has been a LEZ since 2008, and it is in the process of implementing “ultra-low emission zones” (the first began in April 2019) that require stricter emission control conformity from diesel vehicles.²⁵ London has also recently implemented two zero-emission zones that prohibit the entry of gasoline and diesel vehicles during peak traffic hours, while allowing access to ZEVs at all times.²⁶ The city is also evaluating proposals to roll out a larger zero-emission zone in Central London by 2025, and city-wide by 2050.²⁷ In addition to London’s example, more than 25 other large cities globally have committed to transforming some or all of their space into zero-emission areas in the 2025–2030 timeframe.²⁸

2.2. PATHWAYS LINKED TO FUEL CONSUMPTION POLICIES

ZEV targets can be issued as a standalone regulation to achieve similar objectives with or without GHG standards. ZEV mandates on manufacturers can be powerful in overcoming critical barriers to electrification such as insufficient model availability. ICCT analysis shows a statistical correlation between ZEV model availability and uptake.²⁹ For example, in California, where there is a ZEV mandate on manufacturers, there are more than 40 ZEV models on the market—more than three times the U.S. average. As a result,

22 Bloomberg New Energy Finance, “These six Chinese cities dominate global electric vehicle sales,” 2018. <https://www.bloomberg.com/news/articles/2018-05-22/these-six-chinese-cities-dominate-global-electric-vehicle-sales>.

23 Urban access regulations in Europe, accessed November 2018, <https://urbanaccessregulations.eu/>.

24 “European low emission zones,” Automobiles Association Developments Limited, accessed November 2018, <https://www.theaa.com/european-breakdown-cover/driving-in-europe/european-low-emission-zones>.

25 “Urban access regulations in Europe - London,” accessed November 2018, <http://urbanaccessregulations.eu/countries-mainmenu-147/united-kingdom-mainmenu-205/london>.

26 *ibid.*

27 Will Date, “Mayor sets 2020 timetable for London ‘zero emission zones,’” *Air Quality News*, May 14, 2018, <https://www.airqualitynews.com/2018/05/14/mayor-sets-2020-timetable-for-london-zero-emission-zones/>.

28 “Fossil fuel free streets declaration,” C40 Cities, accessed May 2019, <https://www.c40.org/other/fossil-fuel-free-streets-declaration>.

29 Peter Slowik, Nic Lutsey, *The continued transition to electric in U.S. cities*, (ICCT: Washington, DC, 2018). https://www.theicct.org/sites/default/files/publications/Transition_EV_US_Cities_20180724.pdf.

the state, which accounts for about 12% of the U.S. market for light-duty vehicles, is where nearly half of the ZEVs sold to date in the United States were purchased.³⁰

2.2.1. ZEV MANDATE AS STANDALONE FUEL CONSUMPTION REDUCTION PATHWAY

California and several other states in the United States, China, and the Canadian province of Quebec all have credit-based mandate programs that require passenger car manufacturers to put more ZEVs on the market. An ICCT policy briefing summarizes the key structural elements of ZEV mandate programs on manufacturers in key global markets.³¹

In China, the ZEV mandate is a separate policy for passenger vehicles. The regulatory agency that administers the ZEV mandate in China is the Ministry of Industry and Information Technology, which is also responsible for setting fuel consumption standards for vehicles. Even though a ZEV mandate is separate from fuel consumption standards, there are interconnections in determining compliance with the two regulations³².

The aforementioned ACC regulations are designed to reduce both exhaust and GHG emissions from light duty vehicles, and to increase ZEVs as a share of the market, all by 2025. As a result of the ACC regulations, the California Air Resources Board (CARB) estimates that by 2025, cars in California will emit 75% less smog-forming pollutants and 40% less GHGs than in 2012, and ZEVs will reach 8% of the market.³³ Due to a strong ZEV program, and an aligned set of policies, the share of ZEVs in California was already at 7.8% in 2018.³⁴

In May 2019, the Canadian province of British Columbia legislated the world's first 100% ZEV mandate for passenger vehicles. The Zero-Emission Vehicles Act of 2019 enacted 10%, 30%, and 100% ZEV sales targets by 2025, 2030, and 2040, respectively.³⁵

2.2.2. ZEV MANDATE AS PART OF FUEL CONSUMPTION STANDARDS

As a compliance flexibility mechanism in post-2021 corporate average CO₂ standards for passenger vehicles, the European Commission specified voluntary ZEV targets of 15% market share by 2025 and 35% by 2030. Manufacturers who over-comply with ZEV targets are eligible to receive a corresponding relaxation in their corporate average CO₂ compliance values. Manufacturers receive an incentive to beat their ZEV targets by as much as 5%. Although these targets are non-binding, the mechanism for integrating ZEV quotas into stringent corporate average CO₂ standards makes for an innovative approach to achieve rapid CO₂ reduction while increasing ZEV share. ICCT analysis indicates that if the EU's voluntary targets are converted to binding mandates, achievement of 100%

30 Nic Lutsey, *Update: California's electric vehicle market*, (ICCT: Washington, DC, 2017). https://www.theicct.org/sites/default/files/publications/CA-cities-EV-update_ICCT_Briefing_30052017_vF.pdf.

31 Shikha Rokadiya, Zifei Yang, *Overview of global zero-emission vehicle mandate programs*, (ICCT: Washington DC, 2019). <https://www.theicct.org/publications/global-zero-emission-vehicle-mandate-program>.

32 Hongyang Cui, *China's new energy vehicle mandate policy (final rule)*, (ICCT: Washington, DC, 2018). <https://www.theicct.org/publications/china-nev-mandate-final-policy-update-20180111>.

33 "Advanced Clean Cars Program," California Air Resources Board, accessed May 2019, <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/about>.

34 California New Car Dealers Association, "New Vehicle Registrations Remained Above 2 million Units in 2018" (February 2019), <https://www.cncda.org/wp-content/uploads/Cal-Covering-4Q-18.pdf>.

35 "Bill 28-2019 Zero-emission vehicles Act," Legislative Assembly of British Columbia, accessed June 2019, <https://www.leg.bc.ca/parliamentary-business/legislation-debates-proceedings/41st-parliament/4th-session/bills/third-reading/gov28-3>.

ZEV adoption can be accelerated by five years.³⁶ Previous papers also discussed the EU's proposed standards and the integration of ZEV targets in detail.^{37,38}

The EU has also agreed on CO₂ standards for heavy-duty vehicles. Notably, these standards contain, for the first time anywhere in the world, a flexible mandate for zero-emission trucks.³⁹ Until 2025, the standards will incentivize ZEVs through a super-credit mechanism whereby ZEVs can receive a multiplier value of up to two in the calculation of corporate average compliance values. From 2025 onward, the super-credit mechanism will be replaced by a sales benchmark mechanism. The ZEV sales benchmark after 2025 is set at a value of 2%. While there are no penalties for not meeting the benchmark, manufacturers who over-achieve will be rewarded with a less-stringent CO₂ standard. Under both the super-credit and sales benchmark mechanisms, ZEV incentives can lower a manufacturer's average emissions by up to 3%.

3 IMPLICATIONS FOR INDIA

Whether at the national, state, or local level, governments in leading ZEV markets around the world are using various types of mandates as centerpieces of their strategies for stimulating both the supply of and the demand for ZEVs. The use of such programs is flourishing, and several governments have already legislated or regulated a 100% transition to ZEVs for specific market segments within the next two decades. Leading policies targeting the purchase of fleets operating largely in urban areas—i.e., taxis, ride-hailing vehicles, transit buses, and urban delivery vehicles—are requiring full electrification of new vehicles within the next decade. Policies affecting the production and sale of an entire category of vehicles (e.g., all light-duty vehicles) are phasing in full electrification over a longer time period, and these often offer flexible compliance pathways for smaller fleets and low-volume manufacturers while setting faster timelines for public procurement. Finally, explicit targets are being complemented by implicit targets that impose restrictions and fees on ICE-powered vehicles and offer exemptions for ZEVs.

As India considers options to ensure the rapid electrification of its new vehicle market, existing ZEV requirements from around the world offer a variety of feasible pathways and concrete examples that can be tailored and adapted for the Indian market and legal situation. Any ZEV mandate adopted in India will need to have sound legal backing, a well-defined timetable for intermediate goalposts, adequate lead time for manufacturers and fleet managers of all sizes to plan a smooth transition, and a credible strategy to deter non-compliance. While mandates are necessary, global experience suggests that these need to be complemented by continued investment in charging infrastructure, and fiscal and non-fiscal incentives for ZEVs.

36 Nic Lutsey, *Modernizing Vehicle Regulations for Electrification*, (ICCT: Washington, DC, 2018), <https://www.theicct.org/publications/modernizing-regulations-electrification>.

37 Peter Mock, *CO₂ emission standards for passenger cars and light-commercial vehicles in the European Union*, (ICCT: Washington, DC, 2019), <https://www.theicct.org/publications/ldv-co2-stds-eu-2030-update-jan2019>.

38 Shikha Rokadiya, Zifei Yang, *Overview of global zero-emission vehicle mandate programs*, (ICCT: Washington, DC, 2019), <https://www.theicct.org/publications/global-zero-emission-vehicle-mandate-program>.

39 Felipe Rodriguez, *CO₂ standards for heavy-duty vehicles in the European Union*, (ICCT: Washington, DC, 2019), https://www.theicct.org/sites/default/files/publications/CO2%20HDV%20EU%20Policy%20Update%202019_04_17.pdf.