ELECTRIC MOBILITY

BEST PRACTICES

Smart City
MISSION TRANSFORM-NATION

Ministry of Housing and Urban Affairs
Government of India

ROCKY MOUNTAIN INSTITUTE

Ministry of Housing and Urban Affairs
Government of India

ABOUT MINISTRY OF HOUSING AND URBAN AFFAIRS (MoHUA)

The Ministry of Housing and Urban Affairs is the apex authority of Government of India to formulate policies, coordinate the activities of various central ministries, state governments and other nodal authorities and monitor programs related to issues of housing and urban affairs in the country. The Smart Cities Mission was launched by the Ministry in 2015 to promote sustainable and inclusive cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions.

ABOUT ROCKY MOUNTAIN INSTITUTE (RMI)

Rocky Mountain Institute (RMI)—an independent nonprofit founded in 1982—transforms global energy use to create a clean, prosperous, and secure low-carbon future. It engages businesses, communities, institutions, and entrepreneurs to accelerate the adoption of market-based solutions that cost-effectively shift from fossil fuels to efficiency and renewables. RMI has offices in Basalt and Boulder, Colorado; New York City; Washington, D.C.; and Beijing. RMI has been supporting India's mobility and energy transformation since 2016.

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सत्यमेव जयते

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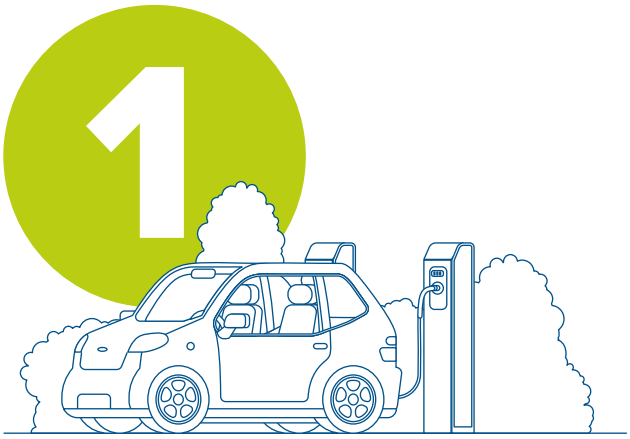
Document outline

The best practices compendium is the fourth and final document under the electric mobility component. It is focused on informing the city managers of measures/policies that have helped cities promote electric mobility. The best practices highlight policies and regulations, business models, institutional frameworks and financial models that enabled cities to increase uptake of electric vehicles.

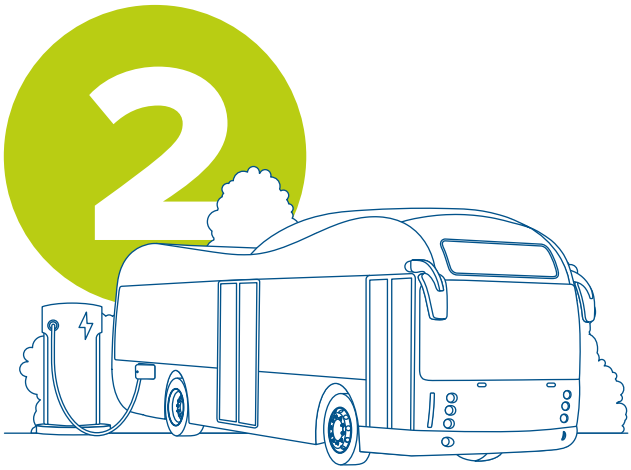
The case studies discussed are in line with the measures/ policies discussed in the workbook document. While the conditions in India are unique, the experience of EV uptake in different parts of the world can provide important learning for EV adoption in India.

1.0 Electric vehicle adoption, Norway

Norway is a world leader in terms of EV market share, with EVs constituting more than 50%. Norway started promoting EVs as a solution to its local air quality concerns and as a means to promote industrial development. Later, however, the shift to electric mobility became integral to larger climate and environmental policies in the country. Norway has set a goal of:



100% EV sales in passenger light duty vehicles, light commercial vehicles and urban buses by 2025



75% EV sales in long-distance buses and 50% in trucks by 2030

Fiscal incentives

EVs are exempted from progressive vehicle registration tax, value added tax, annual road tax and company car tax.

Non-fiscal incentives

Electric vehicles are provided various indirect incentives such as access to free parking, access to bus lanes and free charging at public charging stations.

The fiscal and non-fiscal exemptions convert into substantial savings for the EV users. Operationally, EVs offer a more economic choice than similar ICEVs. Annual charging costs is estimated to be at £264 as compared to an average £1,293 for petrol driven vehicles.[2] In addition, the ICEVs are heavily taxed, at an exorbitant 100%.

Incentives offered to EVs

NEW RULES ALLOW LOCAL AUTHORITIES TO LIMIT THE ACCESS TO ONLY INCLUDE EVS THAT CARRY ONE OR MORE PASSENGERS

FREE MUNICIPAL PARKING

Exemption from 25% VAT on leasing

NO ANNUAL ROAD TAX

Exemption from 25% VAT on purchase

NO PURCHASE/IMPORT TAXES

Parking fee for EVs was introduced locally with an upper limit of maximum 50% of full price

No charges on toll roads

50% reduced company car tax

ACCESS TO BUS LANES

CHARGES WERE INTRODUCED ON FERRIES WITH UPPER LIMIT OF MAXIMUM 50% OF FULL PRICE

50% REDUCED COMPANY CAR TAX

NO PURCHASE/ IMPORT TAXES

Exemption from 25% VAT on purchase

Company car tax reduction was lowered to 40%

50% reduced company car tax

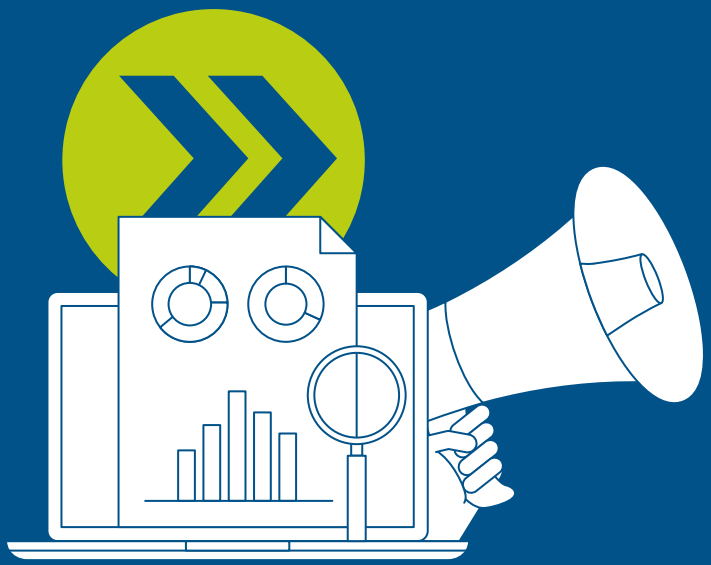
ACCESS TO BUS LANES

No annual road tax

Free municipal parking

Parking fee for EVs was introduced locally with an upper limit of maximum 50% of full price

CHARGES WERE INTRODUCED ON FERRIES WITH UPPER LIMIT OF MAXIMUM 50% OF FULL PRICE



Key takeaways

The success of EV adoption can be attributed to wide range of incentives adopted by the government to reduce the cost of buying and operating EVs. With a network of charging infrastructure in place, the government has also been able to take care of the range anxiety.

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For more details refer to the webpage on the Norwegian EV policy: www.elbil.no/english/norwegian-ev-policy/

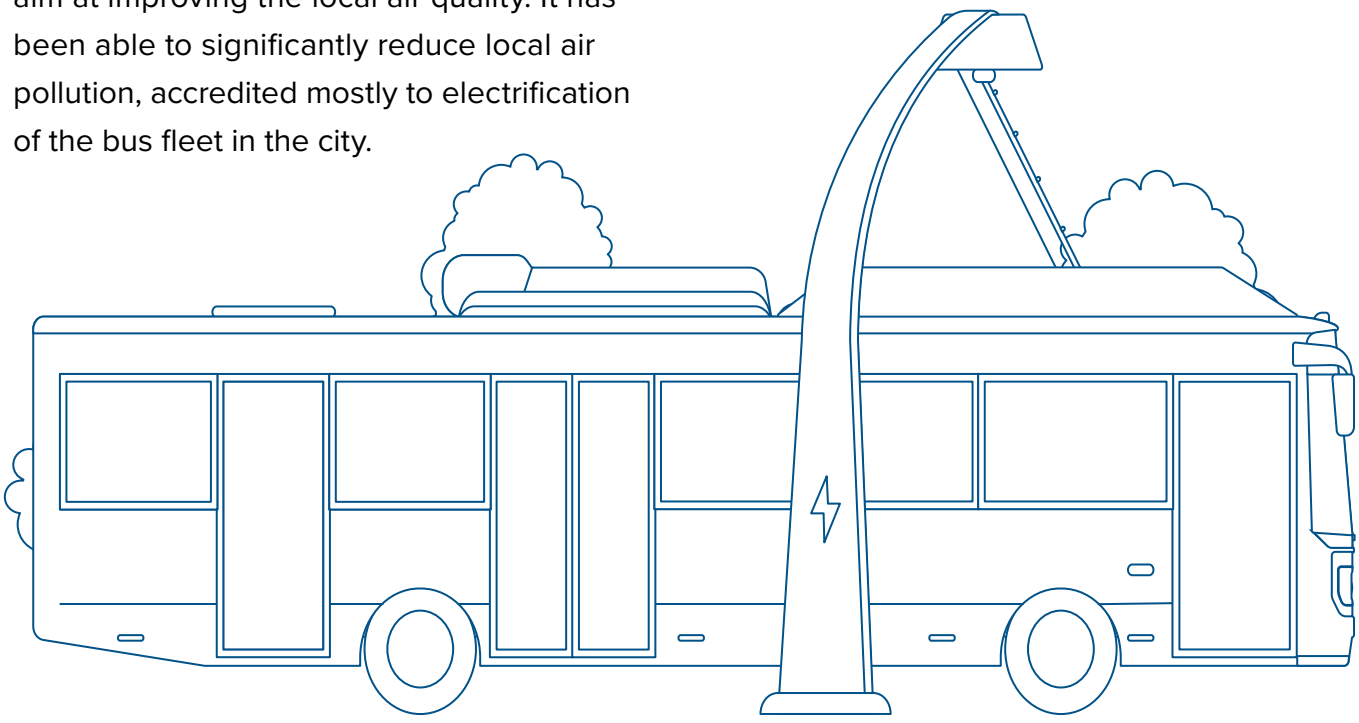
2.0 Electric bus fleet, Shenzhen, China

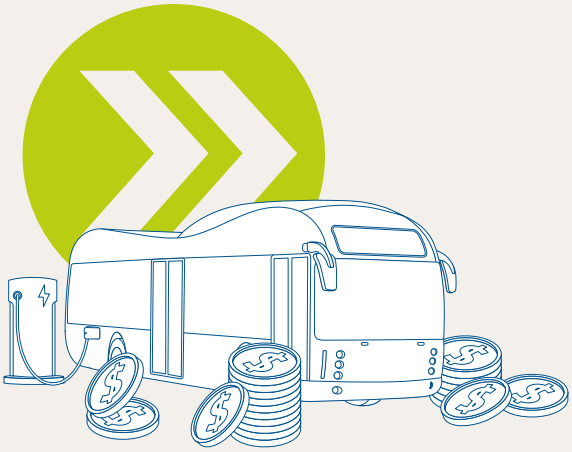
In 1980s, Shenzhen was declared a Special Economic Zone (SEZ). From a small fishing village, it has become a booming metropolis housing around 12 million people. Shenzhen has transformed massively over the years and has also been leading the electric mobility transition in China.

» Shenzhen is the first city in the world to have an entirely electric public bus fleet with more than 16,000 such buses. «

Shenzhen is also in the process of electrifying its entire taxi fleet. The city started the electric mobility transition in 2009 with an aim at improving the local air quality. It has been able to significantly reduce local air pollution, accredited mostly to electrification of the bus fleet in the city.

The shift to electric technology is supported by government incentives aimed at closing the cost gap between ICE and electric buses. A 12 meter e-bus in Shenzhen received a $150,000 government incentive, more than half of the vehicle's price. In order to overcome the barrier of high upfront cost, the city also adopted innovative business models for uptake of e-buses. It employed a cooperative commercial model, which is basically a leasing model facilitated through strategic partnership. Under the model, the local government arranges a financial leasing model for city's bus companies. The state-owned enterprises Potevio New Energy venture and China Southern Grid Ltd. help bring down the acquisition cost of e-buses.





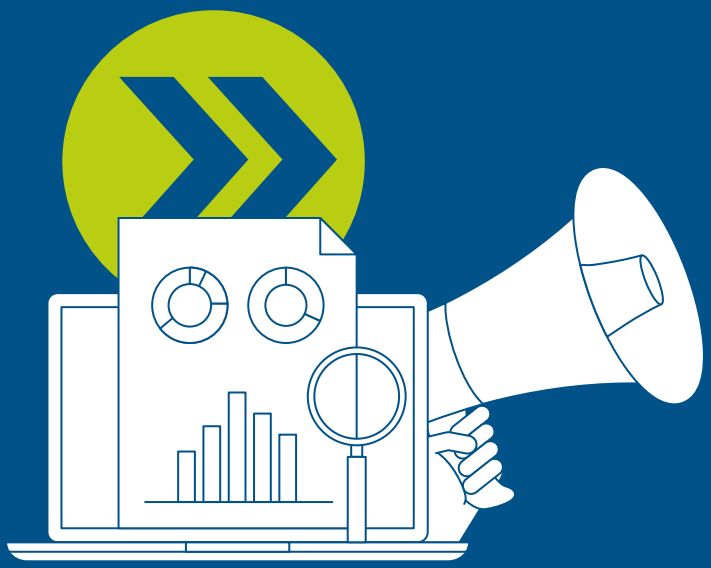
» Cost of e-bus: $320,000
» Central and local government incentives: $160,000 ($80,000 from each)
» Cost of a conventional ICE bus: $80,000

» Shenzhen employed a cooperative commercial model, which is a leasing model facilitated through strategic partnership for the uptake of e-buses. «

Potevio's leasing model reduces the capital cost of a bus by separating the cost of the battery ($56,000). Ownership of the battery remains with Potevio and it leases the battery to Shenzhen Bus Company. Potevio also offers a loan guarantee on the remaining amount of $104,000. With support from the local government and battery manufacturer BYD, Potevio is able to buy batteries at a subsidized price.

In addition, policies such as 'National Electric Vehicle Industry Base' (in 2011–15 five year plan) which mandates the city of Shenzhen to invest USD 7.9–9.4 billion in the EV industry, 'new energy bus and car system standards', 'Shenzhen's new energy bus operation monitoring system standard', have also been contributing towards pushing the uptake of EVs in the city.

The city has also invested in developing charging infrastructure. The city has constructed and integrated more than 100 large-scale public bus charging stations with bus interchange stations. To promote EVs in Shenzhen, the local power utility, China Southern Power Grid Co. Ltd. (CSG), offers a discounted price for charging EVs during the non-peak hours. Shenzhen has capitalised on these incentives and has been able to optimize its costs by following practices such as charging during the off-peak hours to take advantage of low electricity tariff. To improve the financial viability of charging infrastructure, the charging facilities are also open to private car users.



Key takeaways

In Shenzhen, EV deployment is driven by high levels of incentives. Hence, strong government support is required at local and national levels to drive electric mobility.

Shenzhen met its ambitious air quality goals in 2016 and 2017 and has not only demonstrated the economic viability of operating a large electric fleet but also the positive impact that electric mobility can create.

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For more details refer to ISGF Report on electric bus revolution of Shenzhen City, China, 2016: www.indiasmartgrid.org/reports/ISGF%20-%20Visit%20to%20Shenzhen%20Eastern%20Bus%20Company%20Ltd%20on%2016th%20April%202018.pdf

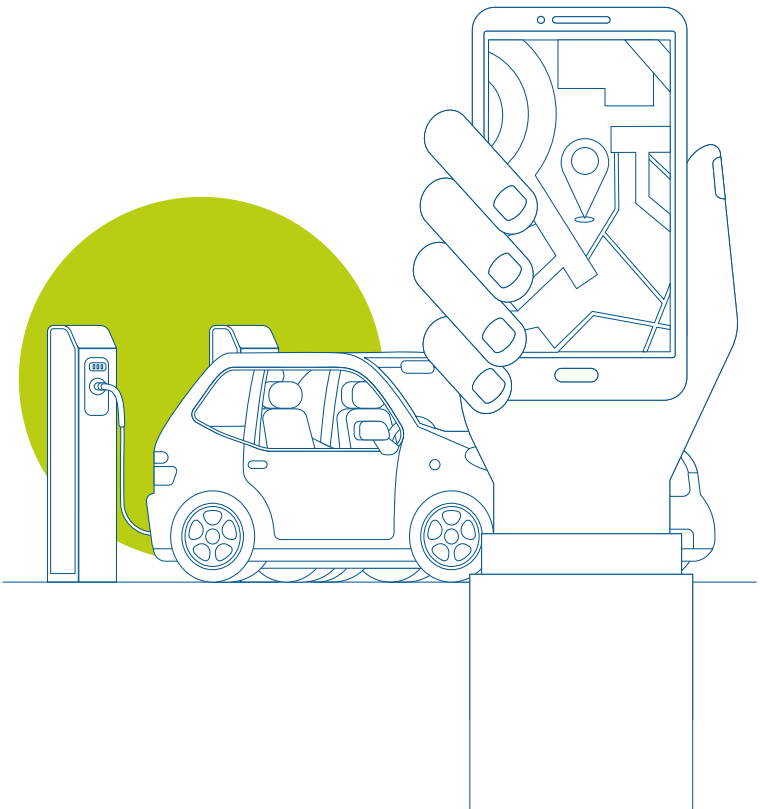
WEF web article on Shenzhen just made all its buses electric, and taxis are next, 2018: https://www.weforum.org/agenda/2018/11/shenzhen-just-made-all-its-buses-electric-and-taxis-are-next/

3.0 Electric mobility driven by OEMs, Japan

Japan is aiming at a 20–50% passenger electric vehicle market share by 2020. Japan already has the third largest global stock of EVs and second largest stock of public fast chargers. Japan also has the highest density of fast chargers—0.016 per sq. km. Japan presents an interesting case study on electric vehicles as its market is driven by voluntary involvement by automotive firms.

Japan's progression to electric mobility can be attributed to early investment by the auto industry into electric mobility technology, in addition to policies implemented by the federal government. The average aggregate cost of Passenger Light duty Vehicles (PLDVs) is the lowest in Japan as compared to China, US or anywhere in Europe. Lower EV prices have been the key drivers of EV uptake in the country. A demand for EVs in turn has propelled setting up of charging infrastructure.

» The government focuses on providing direct consumer incentives, building public charging infrastructure and investing in research and development of EVs. «



Despite, upfront cost not posing a significant barrier, the government still offers a wide variety of incentives to promote the uptake of EVs in Japan. The government focuses on providing direct consumer incentives, building public charging infrastructure and investing in research and development of EVs. In terms of direct consumer benefits, the government has been offering tax exemptions and vehicle subsidies to EVs since 1999.

Vehicles that display 10–20% higher efficiency as compared to Japanese vehicle standards, are eligible for a 5–10% reduction in VAT. Higher fuel efficiency vehicles not only include EVs but also higher efficiency ICEVs. However, from 2009 onwards, the government has been offering 100% VAT exemption to EVs. EVs are also exempted from annual tonnage tax for the first year and can obtain 50% exemption in the second year. The government also offers a financial subsidy of 10,000 Yen on purchase of an eco car (vehicle that met 2015 fuel efficiency standards).

The government has also been making investments on installation of charging stations. The government has fixed a goal of installing two million chargers and 5,000 quick chargers by 2020. The government has been promoting Public-Private Partnership (PPP) wherein automobile manufacturers are encouraged to participate and install charging infrastructure in selected model towns. Today, Japan has more charging stations than petrol fueling stations. The government has also been supporting research and development of EV technology. The New Energy and Industrial Technology Development Organization and R&D programs on vehicle battery such as BES-ITS program have also been beneficial in promoting research on EVs.

» The government offers 100% VAT exemption to EVs, and financial subsidy of 10,000 Yen on purchase of an eco car, among other perks. «

Key takeaways

Governments must support EV uptake through wide variety of policy instruments. Attractive upfront cost remains a key to EV uptake. A network of charging infrastructure is also important to ensure usage of EVs.

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For more details refer to www.ihsmarkit.com/research-analysis/japanese-auto-makers-investment-to-develop-advanced-technologies-rises-to-usd256-bil.html

Report on financial innovation in clean mobility, 2018: http://www.eib.org/attachments/pj/access_to_finance_study_on_innovative_road_transport_en.pdf

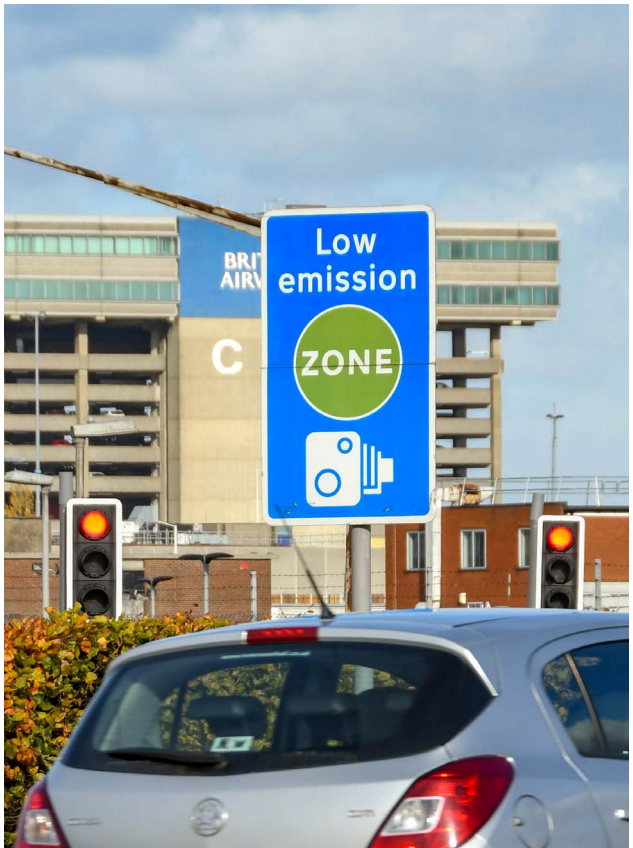
4.0 Ultra Low Emission Zone (ULEZ), London

London has been aggressively pursuing a low-emission policy with an aim at transitioning to zero emission road transport system by 2050. London is in the process of implementing Ultra Low Emission Zone (ULEZ) from 2019 onwards. ULEZ is a traffic management and emission reduction scheme with an aim at improving local urban air quality. ULEZ will be implemented in a phased manner. It will first be implemented within the same area as the current Congestion Charge Zone and will be in place in central London. From 2021 onwards, the ULEZ will include the inner London area.

Most vehicles, including cars and vans will need to meet new, tighter exhaust emission standards (ULEZ standards) or pay a daily charge to travel within the area of the ULEZ.

Towards this effort, the city is aiming at converting its entire taxi fleet and private hire vehicles to zero emission by 2033 and its entire bus fleet by 2037.

The vehicles, which will not adhere to the new emission standards, entering the ULEZ would need to pay a daily charge of:



£12.50
vehicles under 3.5 tons such as cars, motorcycles and vans

£100
vehicles over 3.5 tons (lorries, buses/coaches) which are over 5 tons

» The revenue generated from the T-Charge will be allocated to Transport for London for undertaking clean-up and maintaining a greener transport fleet in London. «

This charge will be an additional one over the weekday congestion charge and the Low Emission Zone (LEZ) charge and will replace the T-Charge (emission surcharge).[4] It is anticipated that such a charge will encourage people to shift to vehicles that meet the new emission standard. The revenue generated from this charge will be allocated to Transport for London (TfL) for undertaking clean-up and maintaining a greener transport fleet and reducing pollution across the transport network in London.

In order to meet the vehicle emission standards of ULEZ, London is already procuring hybrid, electric and hydrogen buses. In terms of private vehicle fleet, the city will allow only electric cars, the newest hybrids, hydrogen vehicles and bikes or e-bikes to operate within the ULEZs. The city is also working towards designing a diesel vehicle scrappage scheme to encourage polluting vehicles get off roads.

To improve the uptake of zero emission vehicles, the government is also investing in setting up of charging and refuelling infrastructure both in London and across the UK. The Mayor has committed to install 1,500 standard charging points across London. £4.5 million of funding from the Office for Low Emission Vehicles (OLEV) has been allocated towards installation of these charging points. The government is also developing a network of rapid chargers with the support of £18 million from TfL capital investment. However, much of this rapid charging network will be reserved for black cabs.

1200
EV registrations: 2012

12000
EV registrations: 2017

10x
growth in EV demand

The sale of EVs has surged in London, especially in the last 4–5 years. There are almost 12,000 EVs registered as of 2017 in London, over ten times as many as in 2012. However, there seems to be a shortfall of charging infrastructure vis-à-vis growing EV demand. In order to bridge the demand gap for charging infrastructure, the government is also offering a grant of up to 75% of the cost of home charging point, up to a maximum saving of £500 to citizens. It is estimated that 60% of Londoners do not have a private parking space and use public streets for parking. To cater to this segment, the government has stipulated that 20% of all new parking spaces created in London must be equipped with charging facility.

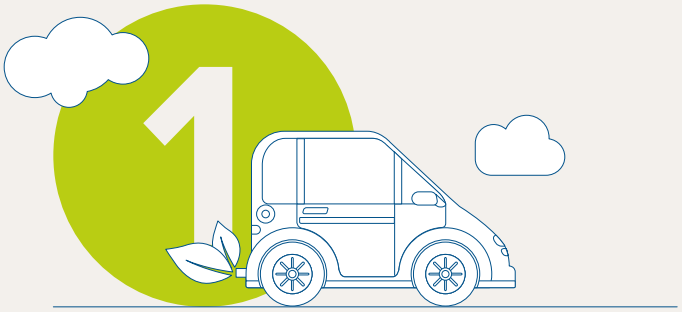
» 20% of all new parking spaces created in London will be equipped with charging facility. «

In order to encourage uptake of zero emission vehicles, the government is also providing financial incentives in the form of grants for plug-in vehicles. The government is offering a grant of up to £4,500 for cars, £1,500 for motorcycles, £8,000 for vans and £7,500 for taxis. Zero-emission capable vehicles are also eligible for an exemption on vehicle tax (VED) or are required to pay a reduced rate depending on their CO_2 emissions, vehicle list price and year of registration. The government also offers a range of tax incentives for business users. Some London boroughs offer free or reduced-charge parking for electric vehicles.

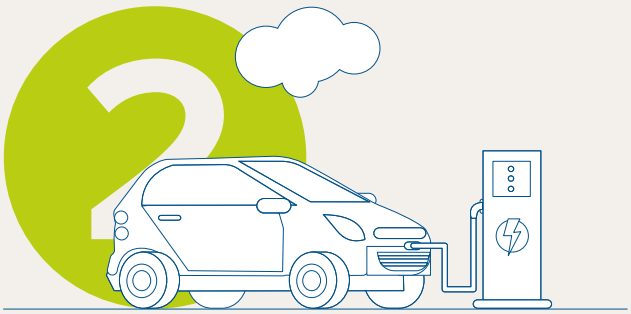
London has been successful in accruing advantages from implementing the low-emission zone in the past. The scheme not only improved the local air quality but also successfully induced a shift towards low-emission vehicles. It is anticipated that the ULEZ scheme will also be equally instrumental in improving the uptake of EVs and improving the air quality and imparting related benefits in London, in the near future.

Zero-emission capable

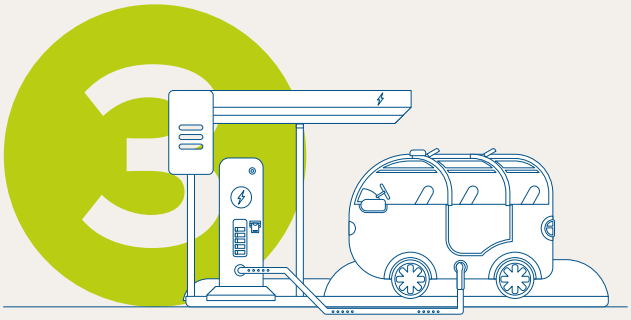
As per TfL, Zero-Emission Capable (ZEC) is the collective term used for vehicles that can operate with zero exhaust emissions. Most car and van manufacturers have ZEC models available, with more due to come to market in the next few years. There are three types of ZEC vehicles:



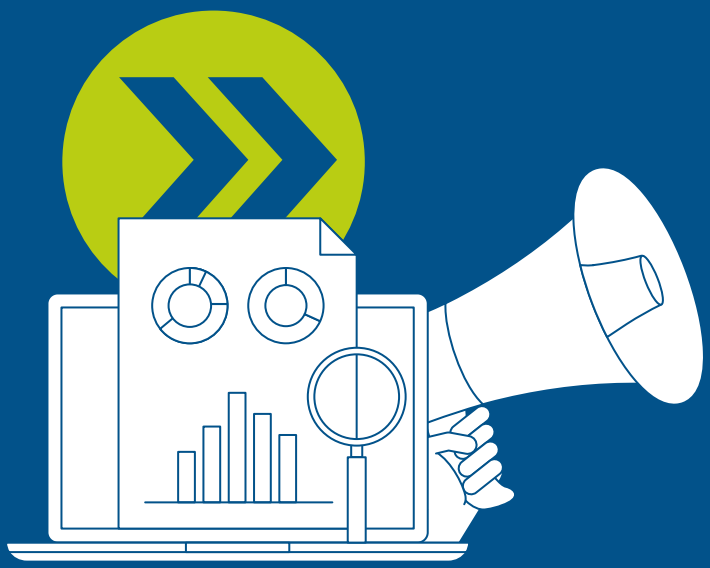
100% pure electric vehicles are powered by a battery which drives the electric motor. They have no exhaust emissions. Battery electric vehicles typically have a range of around 80 miles but some can achieve up to 300 miles



Plug-in hybrid and range-extended electric vehicles also have a conventional diesel or petrol engine, meaning they have a longer range than those with a battery alone



Hydrogen fuel cell electric vehicles have a fuel cell which uses hydrogen to produce electricity which powers the wheels of the vehicle. They typically have a range of around 300 miles



Key takeaways

Regulations such as ULEZ scheme can be an effective instrument to induce shift to cleaner mobility solutions. However, even within such a regulatory environment, benefits such as financial incentives on upfront cost and tax exemption remain important. Also, non-financial policies such as free parking increase the attractiveness of EVs among consumers.

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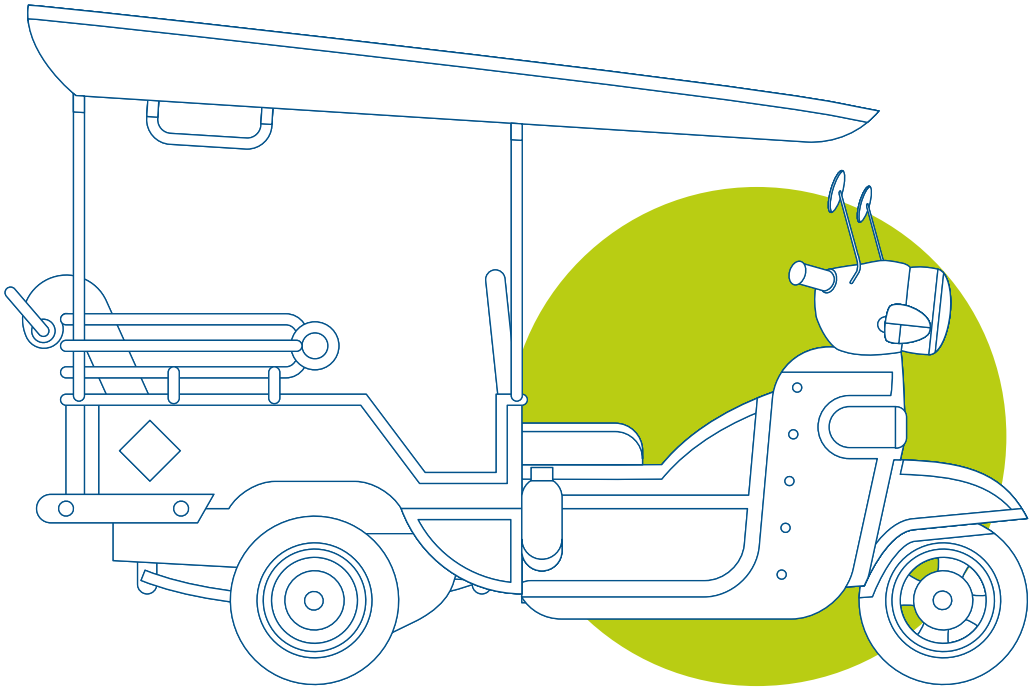
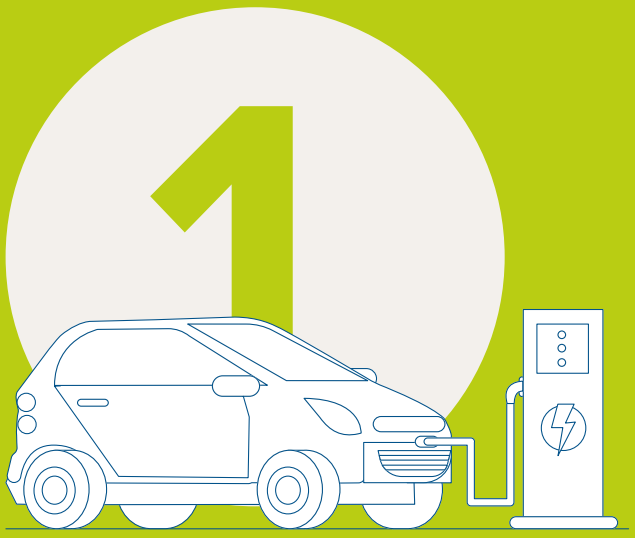
For more details, refer to official website of Transport for London (TfL); https://tfl.gov.uk/modes/driving/ultra-low-emission-zone

5.0 Electric mobility in India: learning from national experiences

India has started focusing on electric mobility much recently as compared to Europe, U.S or China. The electric mobility agenda was mainstreamed with the adoption of the National Electric Mobility Plan (NEMMP) in 2013. The policy laid down vision and road map for EV penetration in the country. The plan has been taken forward through the faster adoption and manufacturing of (hybrid &) electric vehicles in India (FAME) scheme. The FAME scheme has been instrumental in creating demand for EVs in the country, especially in the public transport segment.

FAME facilitates pilot projects for operation of EVs in 11 cities for public transport purposes. The scheme is offering 60% subsidy to buses, 20% to three-wheelers and 10–15% to four-wheelers. Almost 10% of the total subsidy is being budgeted towards installation of charging stations. Beyond NEMMP, there have been a few initiatives to promote e-mobility; these have been described in this section.





EESL Procurement Model

In August 2017, the Energy Efficiency Services Limited (EESL), a joint venture of the public-sector units of the Ministry of Power and the Government of India, floated a tender for procurement of 10,000 electric cars. This effort was aimed at creating demand, providing an impetus for Indian vehicle manufacturers, charging infrastructure companies, fleet operators, service providers, and the industry to gain efficiencies of scale and drive down costs. The tender required an international competitive bidding. Tata Motors and Mahindra & Mahindra won the tender to supply electric cars. A price of INR 11.2 lakh (inclusive of GST) along with a comprehensive 5-year warranty was quoted by TATA Motors. This price was almost 25% below the market price of a similar e-car, which came with a warranty of three years. The procurement was planned in a phased manner. In the first phase, 500 e-cars were to be supplied by November 2017. The procurement was aimed at replacing conventional fuel vehicles across government institutions.

» EESL aims at creating a demand for EVs, encouraging local manufacturing facilities and improving technical competencies for the long-term growth of the EV industry. «

OLA e-Taxi Pilot, Nagpur

Nagpur is a city with 2.5 million people, located in central India, in the state of Maharashtra. Nagpur has emerged to be one of the front runners in encouraging and adopting electric mobility in the country. It has become India's first city with an electric fleet of 200 electric vehicles, including taxis, buses, e-rickshaw and autos; including 100 of Mahindra's new e20 plus. Ola, a cab aggregator service, invested $8 million for a fleet of 200 electric cars with support from the Softbank and in partnership with Mahindra.

» Nagpur is the first city in India with an electric fleet of 200 EVs, including taxis, buses, e-rickshaws and e-autos. «

Other initiatives:

As discussed in the Framework Document, a number of bus pilot projects have also been launched in various Indian cities. Some of the key e-bus initiatives have been described in the following section.

Status of sanctioned e-mobility projects

Navi Mumbai Municipal Transport (NMMT)

» NMMT has ordered procurement of Volvo 8400 Hybrid City Bus; 5 of these buses have already been delivered.

—

Mumbai Metropolitan Region Development Authority (MMRDA)

» MMRDA is procuring 25 hybrid buses from Tata Motors (which do not require external charging).

—

BEST Mumbai

» BEST has ordered retrofitment of buses with AV Motors and Impact Automotive Solutions Limited (a subsidiary of KPIT) with funding from its municipal corporation.

» It is also procuring 30-seater six electric feeder buses from BYD-Goldstone.

—

Himachal Road Transport Corporation (HRTC)

» HRTC is operating 25 full electric buses. It is offering exemption from token tax, registration charges and value-added tax (VAT) to all electric vehicles.

—

Bangalore Metropolitan Transport Corporation (BMTC)

» BMTC has submitted a proposal to procure 150 electric buses on PPP model.

—

Thane Municipal Transport (TMT)

» Thane is planning to operate 100 electric buses on PPP model. The private operator will purchase and operate the buses for 10 years on self-selected routes. The fare level of electric and other buses would be same and will be fixed by Metropolitan Transport Authority.

—

Pune Mahanagar Parivahan Mahamandal Ltd. (PMPML)

» Pune has floated a tender of 500 electric buses.

—

West Bengal Housing Infrastructure Development Corporation Ltd.

» Running electric pilot in New Town, Kolkata

Electric bus pilot in New Town, Kolkata

Kolkata is India's seventh most populated metropolis with a population of almost 4.5 million as per the 2011 Census. With an aim at reducing pressure on Central Kolkata, New Town, a satellite town was developed in the Greater Kolkata region. This satellite town has a population of more than 100,000 people. To cater to the mobility needs of New Town, West Bengal Housing Infrastructure Development Corporation Ltd. (WBHIDCO) aimed at developing smart and sustainable public transport solution. With this aim, WBHIDCO has started pilot operation of electric buses. Coal India Limited is supporting WBHICO through offering funding for procuring electric buses under its CSR initiative.

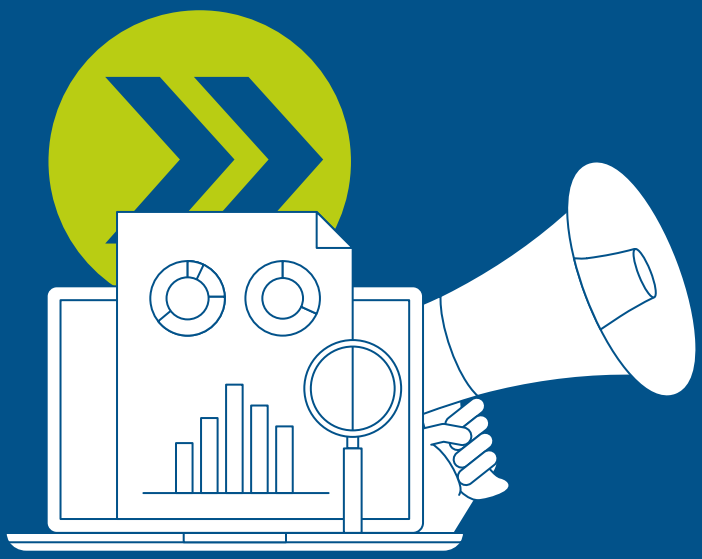
» These buses not only operate with zero tailpipe emissions, but are also noise-free and offer a better riding experience, as they are vibration-free. «

The pilot operations include three 32-seater battery electric buses. These buses are manufactured by Eicher and retrofitted by KPIT to run on electric propulsion. These buses are air-conditioned, equipped with Intelligent Transport System (ITS) and also offer wi-fi connectivity to its passengers. The electric buses have a top speed of 80 kmph. In their daily operation, however, they do not exceed 50 kmph, the usual traffic speed in the area.

The buses have a range of around 180 kmph on a single charge with the air-conditioning working throughout.

The buses can regenerate almost 36% of the power from braking and use only 0.8 electricity unit/km. The buses take six hours to charge completely. The buses are charged at New Kolkata Development Authority (NKDA) bus stand which has a charging station and workshop. There is also a provision for en-route charging at some of the bus stops. The buses are typically charged overnight and operated between 8 a.m. to 12 p.m. and 4 p.m. to 8 p.m. They are again charged between 12 p.m. and 4 p.m. in the daytime. The bus fare is Rs. 10.

WBHICO and CIL are planning to further increase the fleet of electric buses and expand operation of these buses to other parts of Kolkata. As per their estimate, the operation of an electric bus over a year offers benefits equalling diesel savings worth INR 1 million and CO_2 reduction of 42,000 kg. The positive experience of operating electric buses has encouraged the state government to further expand electric mobility and it is planning to add a fleet of electric ferries.



Key takeaways

Bulk purchase models and competitive bidding can be helpful strategies to reduce upfront cost of EVs. Charging infrastructure will be a prerequisite to promoting EVs in Indian cities, particularly in case of commercial operations such as cab services, where the per day vehicle utilization rates are higher.

For more details refer to www.cleantechnica.com/2018/03/10/olas-ev-taxi-pilot-program-india-reportedly-facing-significant-problems/

www.auto.ndtv.com/news/government-officials-reject-using-electric-cars-under-eesl-scheme-1874251

www.india.uitp.org/articles/electric-bus-market-in-india

6.0 Setup of charging infrastructure in cities: Chinese experience

Local policy instruments remain critical to promoting setting up of charging infrastructure in cities. IEA, 2018 identifies four measures through which cities around the world are deploying charging infrastructure. These measures are:

» **Policies:** Setting up targets for installation of charging infrastructure and driving development of such infrastructure

» **Building codes:** Mandatory requirement for installation of electric charging infrastructure for EVs in residential and commercial buildings/areas

» **Financial incentives:** Subsidy on setting up charging points

» **Direct deployment:** Developing parking facilities specifically for EVs, on-street charging facilities and by enabling residents to raise request for charging infrastructure to be installed

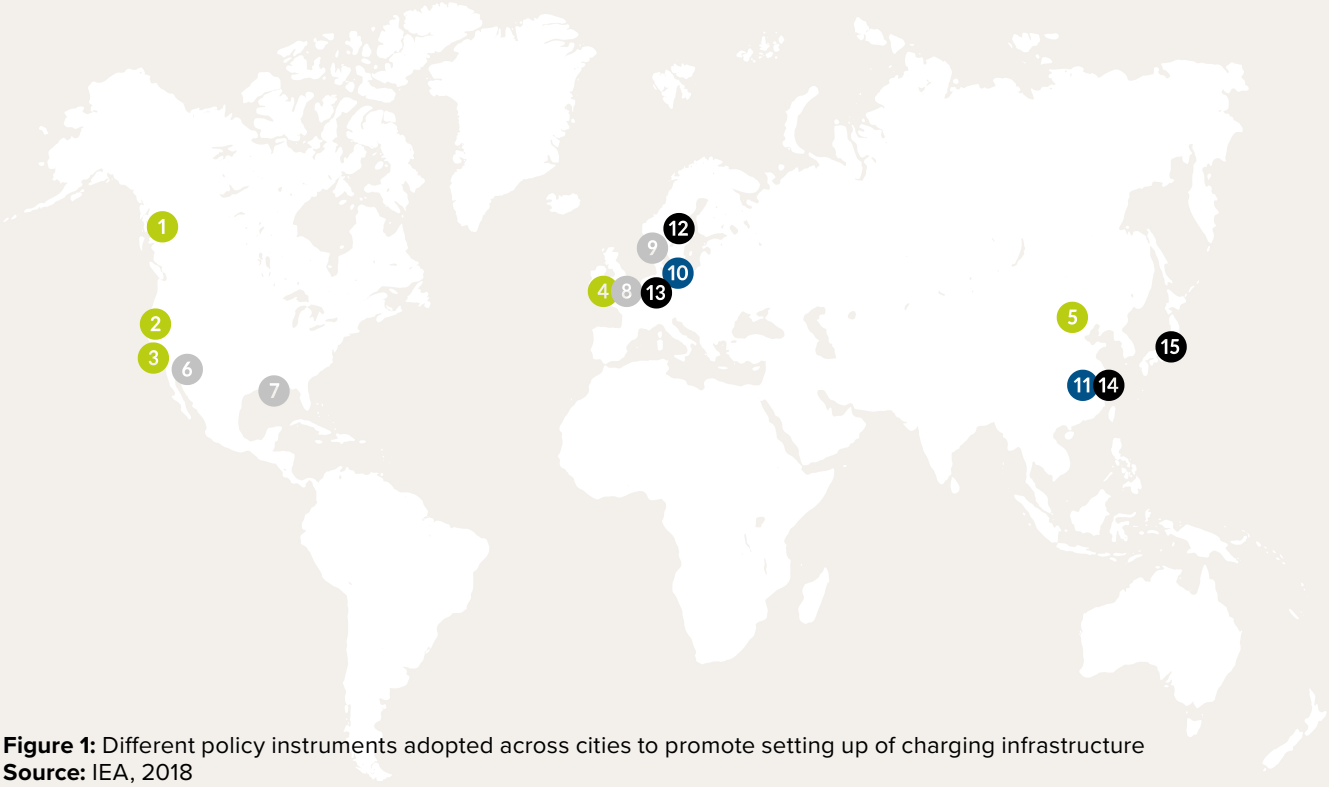


Figure 1: Different policy instruments adopted across cities to promote setting up of charging infrastructure
Source: IEA, 2018

Building codes

1 Vancouver (Canada): 20% of the parking stalls in multifamily buildings must be equipped with wire conduits

2 San Francisco (USA): 10% of parking spaces in new constructions must have Level 2 chargers

3 San Jose (USA): Simplify local charging permitting process

4 London (UK): Charging point planning requirements for all new real estate developments

5 Beijing (China): 100% of new residential buildings and 15–25% of new commercial buildings required to be fitted with wire conduits

Direct EVSE deployment

6 Los Angeles (USA): Deploying charging stations on streetlights

7 New Orleans (USA): Residents can apply for permits to install electric vehicle charging stations on the road in front of their homes

8 London (UK): Residents can request that charging stations be installed on the road in front of their homes by Ubitricity

9 Oslo (Norway): Building two large parking garages for electric vehicles

Target number of charging points to be built

10 Copenhagen (Denmark): 500–1000 publicly available charging stations and 5000 semi-public charging stations by 2025

11 Shanghai (China): Plan to build 28,000 publicly available and private charging pointsby 2020

Financial incentives

12 Utrecht & Amsterdam (The Netherlands): 1000 EUR subsidy for semi-publicly accessible charging points

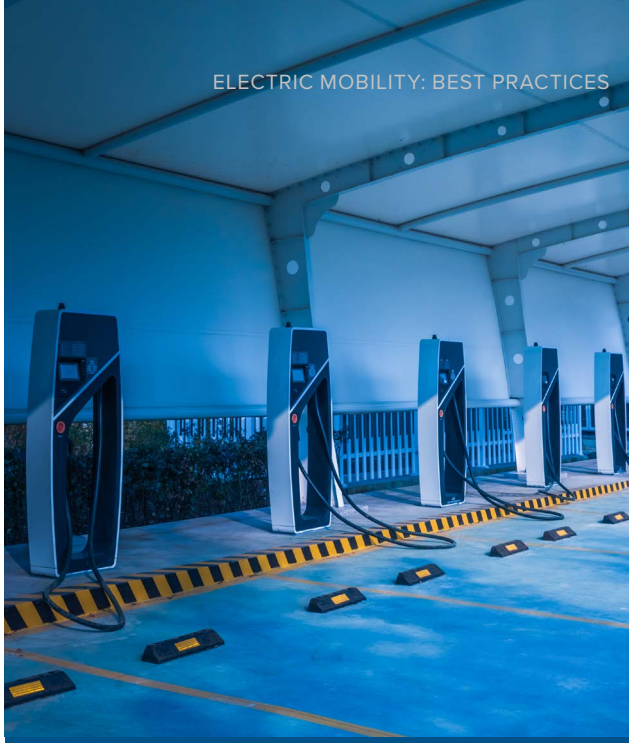
13 Oslo (Norway): Grants for up to 60% of installation cost of a charging point

14 Shanghai (China): 30% capital subsidy for businesses for charging infrastructure

15 Tokyo (Japan): Subsidy of approximately JPY 1.5 million for charging points in condominiums

The case of China is extremely interesting. China rapidly expanded its charging infrastructure, reaching 107,000 public charging outlets by 2016, witnessing an increase of 118% year-on-year (McKinsey, 2017). As per another source, the number of installed charging stations across China stood at 450,000 units in 2017. This included 210,000 public charging stations, up 51% year-on-year (Renewable Energy World, 2018).

In China, the deployment of charging infrastructure is primarily driven by central and state governments and utilities. The government has set up a target of deploying 120,000 fast charging stations and 500,000 total public stations by 2020. The eighty-eight pilot cities for EVs, funded by central government, are required to provide one charging point for every eight EVs. The charging stations are recommended to be set up within a 1 kilometer distance in the city center (ICCT, 2017). Many municipal governments provide funding for local stations, in support with the national utility state grid. The state grid is also setting up fast chargers in the city center and along major intercity corridors (ICCT, 2017).



Key takeaways

Relying on the four identified strategies is expected to help cities deploy charging infrastructure in Indian cities as well.

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For more details refer to Electric Vehicle Outlook, IEA, 2018; www.webstore.iea.org/global-ev-outlook-2018

White paper on Emerging Best Practices for Electric Vehicle Charging Infrastructure, 2017; www.theicct.org/sites/default/files/publications/EV-charging-best-practices_ICCT-white-paper_04102017_vF.pdf

7.0 Quick case studies

CO_2 emission-based feebate (malus–bonus) system in France

» In France, the government offers substantial direct and indirect incentives to EVs. Direct incentives include purchase subsidy for EVs and subsidy for installation of chargers while indirect benefits range from tax breaks to access to reserved lanes and parking spots

» In addition, France offers an CO_2 emission-based feebate system, which subsidizes electric vehicle purchase while penalizing higher-emission vehicles

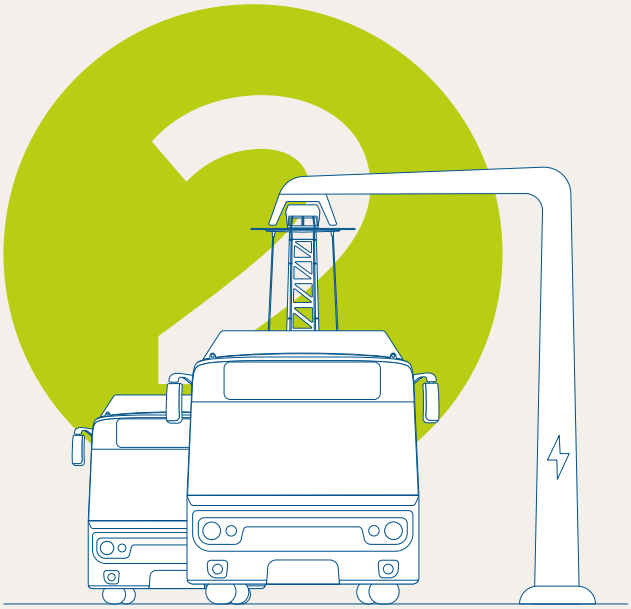
» The feebate system was introduced in 2008 and required a car buyer to either pay a fee (malus) for vehicle with CO_2 emissions above certain level or receive a rebate if the emissions were below certain limits

For more details refer to www.globalfueleconomy.org/transport/gfei/autotool/approaches/ economic_instruments/fee_bate.asp

» Recognizing the benefits of public procurement as an initiator of the electric mobility transition and its potential to contribute to air quality and climate goals, eight major countries signed and launched the Government Fleet Declaration at the Marrakech COP22 in 2016. These eight countries are—Canada, China, France, Japan, Norway, Sweden, United Kingdom and United States

» The countries committed to the target of minimum thresholds of 50% low-emission vehicles for fleet renewals at the national level and 20% for local authorities, both established in 2015, as well as a target of full electrification of new buses by 2025

For more details refer to Global Energy Outlook, IEA, OECD, 2018; www.webstore.iea.org/global-evoutlook-2018



Public procurement programs to stimulate the initial rollout of EVs

Phasing out ICE vehicles to promote higher efficiency vehicles

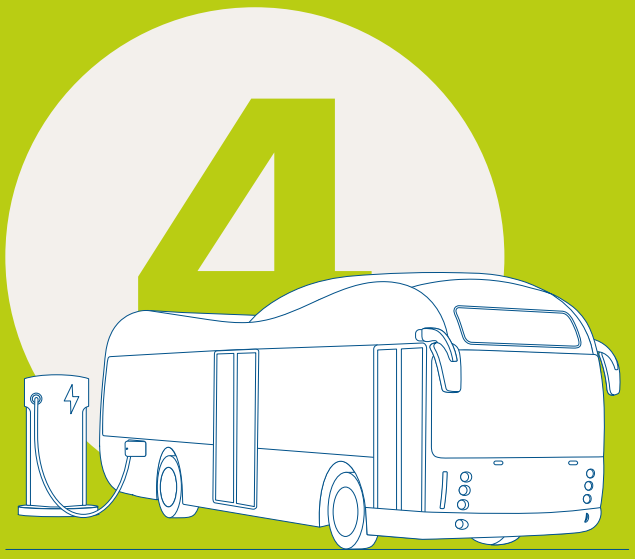
» A number of countries are banning or planning to phase out ICE vehicles to promote the use of higher efficiency and cleaner vehicles. Some of the targets set by countries are:

» **China:** In September 2017, China considered a national ban on the production and sales of ICE cars running on gasoline and diesel. The announcement does not specify details on the timeline of such a ban

» **France & U.K.:** No new ICE vehicle sales after 2040

» **Netherlands:** No new ICE vehicles sold after 2030, phase-out begins 2025

For more details refer to Survey of Global Activity to Phase Out Internal Combustion Engine Vehicles, 2018; www.climateprotection.org/wp-content/uploads/2018/10/Survey-on-Global-Activities-to-Phase-Out-ICE-Vehicles-FINALOct-3-2018.pdf



The ZeEUS project (zero emission urban bus system), European Union (2013–2018)

The ZeEUS project aimed at facilitating the uptake of electric buses.

» It set up ten demonstration sites across ten European cities to monitor and improve upon technical, economic and operational performance of electric city buses.

» The project is expected to aid informed decision-making with respect to procurement and introduction of electric buses as it concludes.

» The project was set up at a budget of € 22.5 M (€ 13.5 M funded) with an aim at decarbonizing the transport sector.

» The ZeEUS project brings together a network of 40 partners, including public transit authorities and operators, vehicle manufacturers, energy providers, academic and research centers, engineering firms and associations.

» The ZeEUS project is closely observing the progress of bus system electrification in Europe. As per the annual report of ZeEUS: An overview of electric buses in Europe, 2016, the number of electric buses increased from twelve to thirty-two between August 2015 and August 2016. Twenty one of these buses were BEVs and eleven PHEVs. The report states that during 2015–16, the electric buses helped save 226,921l of diesel and 519 tons of CO_2 emission.

For more details refer to the annual report of ZeEUS: An overview of electric buses in Europe, 2016; www.zeeus.eu/uploads/publications/documents/zeeus-ebus-report-internet.pdf

8.0 Resources

Case studies

» Global EV Outlook 2017: www.webstore.iea.org/global-ev-outlook-2017

» Global EV Outlook 2018: www.webstore.iea.org/global-ev-outlook-2018

» Report on Electric bus revolution of Shenzhen city in China, India Smart Grid Forum (ISGF), 2018: www.indiasmartgrid.org/reports/ISGF%20-%20Visit%20to%20Shenzhen%20Eastern%20Bus%20Company%20Ltd%20on%2016th%20April%202018.pdf

» Electric Vehicles for Smarter Cities: The Future of Energy and Mobility, World Economic Forum and Bain & Company, 2018: www3.weforum.org/docs/WEF_2018_%20Electric_For_Smarter_Cities.pdf

» Competing and Co-existing Business Models for Electric Vehicles: Lessons from International Case Studies, Claire Weiller, Amy Shang, Andy Neely, Yongjiang Shi, International Journal of Automotive Technology and Management, University of Cambridge, 2015: www.innovation-portal.info/wp-content/uploads/2015-January-Business-Models-for-EV.pdf

» The emergence of electromobility: Comparing technological pathways in France, Germany, China and India, Tilman Altenburg,1,* Eike W. Schamp2 and Ankur Chaudhary3, Science and Public policy, 43(4), 2016, 464–475, Oxford, 2015: www.watermark.silverchair.com

» White paper on Emerging Best Practices for Electric Vehicle Charging Infrastructure, 2017: www.theicct.org/sitesdefault/files/publications/EV-charging-best-practices_ICCT-whitepaper_04102017_vF.pdf

» White paper on Power Play: How are governments spurring the electric vehicle industry, ICCT, 2018: www.theicct.org/sites/default/files/publications/EV_Government_White Paper_20180514.pdf

» Report on International evaluation of public policies for electromobility in urban fleets, 2017: www.theicct.org/publications/international-evaluation-public-policies-electromobility-urbanfleets

» Electric Vehicle Grid Integration in the U.S., Europe, and China Challenges and Choices for Electricity and Transportation Policy, ICCT, 2013: www.theicct.org/sites/default/files/publications/EVpolicies_final_July11.pdf

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1. www.elbil.no/english/norwegian-ev-policy/

2. Jones, 2018; www.theguardian.com/money/2018/jul/02/norway-electric-cars-subsidies-fossil-fuel

3. www.wri.org/blog/2018/04/how-did-shenzhen-china-build-world-s-largest-electric-bus-fleet

4. In order to improve urban air quality in London, older vehicles plying within Central London need to pay an extra daily charge, in addition to the Congestion Charge, in case they do not adhere to minimum Euro emission standards. The T-Charge (or the Emissions Surcharge) is applicable in the Congestion Charge zone.


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Authors:
Akshima Ghate
Clay Stranger

Art Director: Vindhya Tripathi
Designer: P. Pallavi Baasri

Editorial Director: Ashpreet Sethi

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CONTACT

For more information, please contact:
RMI: india_contact@rmi.org