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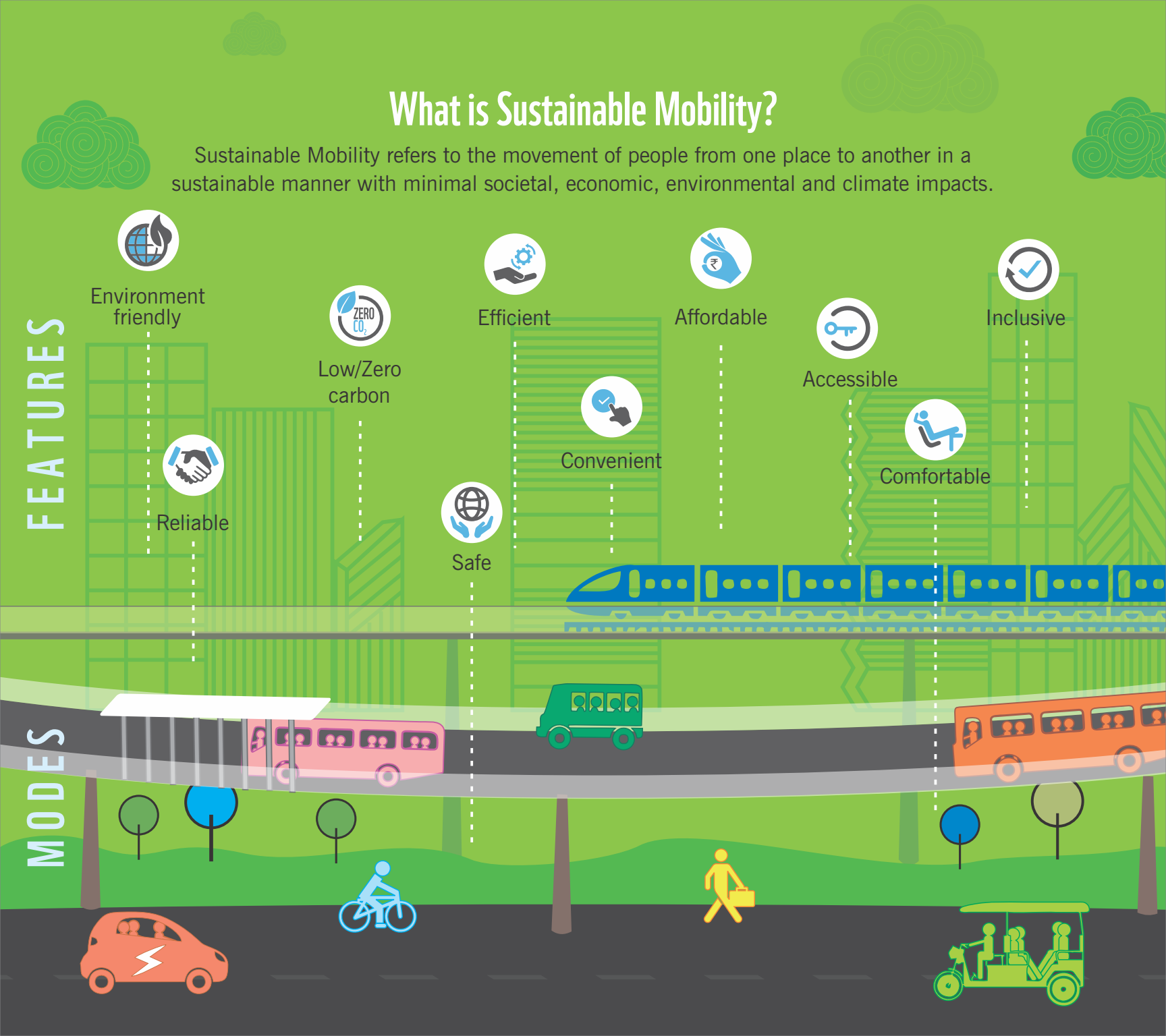
DEMYSTIFYING THE FUTURE OF MOBILITY

What is Sustainable Mobility?

Sustainable Mobility refers to the movement of people from one place to another in a sustainable manner with minimal societal, economic, environmental and climate impacts.



Sustainable Mobility is Vital for

- Enabling inhabitants to commute efficiently and according to their needs.
- Reducing traffic congestion.
- Reducing energy-use and greenhouse gas emissions.
- Improving human health through the reduction of transport related air pollution.
- Reducing the number of deaths and injuries from road accidents.

Conventional Mobility	Sustainable Mobility
Single User	Mass/Shared
Vehicle centric	Multi-modal integration
Polluting	Clean
Inefficient	Fuel Efficient / Electric
Expensive	Affordable
More road space required	Less road space required
Social costs like injuries, health impacts etc	Social benefits such as reduced air pollution leading to better health

Need for India to Adopt Sustainable Mobility Solutions

Transport Sector Accounts for 10% of India's GHG Emissions[1]

14 of World's 15 most Polluted Cities in India[2]

1.1 Million Deaths in India attributed to air pollution as per the 2017 Global Burden of Disease Report[3]

India Ranks 177 out of 180 countries in Environmental Performance Index in 2018[4]

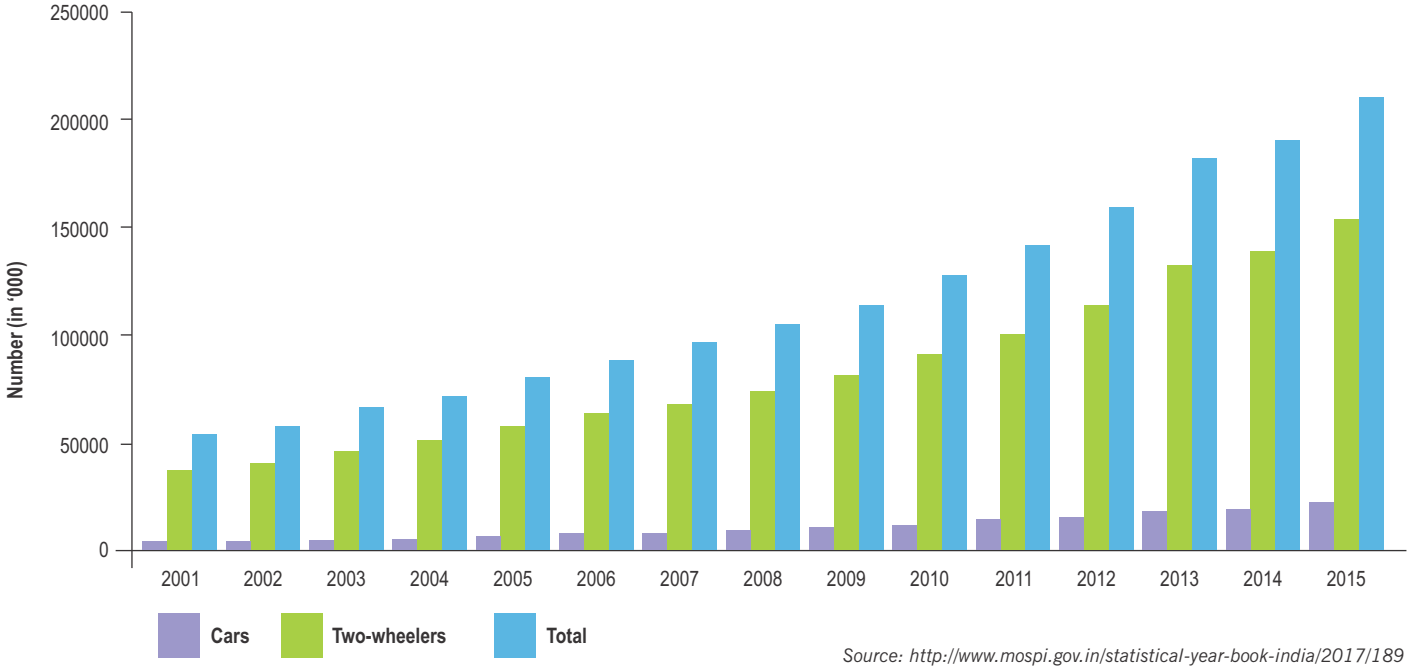
[1] *Ministry of Environment, Forest and Climate Change. (2015). First Biennial Update Report to UNFCCC. New Delhi: MoEFCC, Government of India, pp 59*

[2] *http://www.who.int/phe/health_topics/outdoorair/databases/cities/en/. Retrieved June 1, 2018*

[3] *https://www.theicct.org/india#publications. Retrieved June 1, 2018*

[4] *Yale University; Columbia University. (2018). Environment Performance Index. Retrieved June 1, 2018, from https://epi.envirocenter.yale.edu/: https://epi.envirocenter.yale.edu/downloads/epi2018policymakerssummaryv01.pdf*

Vehicle Registration by Types in India



Source: http://www.mospi.gov.in/statistical-year-book-india/2017/189

Total vehicle sales (including two wheelers) increased from about 96 million in 2007 to over 210 million in 2015, and the total number of vehicles on the road is estimated to cross 300 million by 2020.

Source: Ministry of Statistics and Programme Implementation (MoSPI)

Push for Sustainable Mobility through Global Initiatives

New Urban Agenda

New Urban Agenda lays emphasis on improving road safety, achieving affordable and accessible transport modes for all, by integration of transport and mobility with urban planning.

Sustainable Development Goals

There are in total 17 goals, established by the UN, which would lead the world towards an equitable, innovative and sustainable future. Goal number 11 specifically deals with sustainable cities and communities, and highlights the pressure of rising population in cities. Sustainable mobility is recognized as one of the important aspects in addition to other measures that would help create sustainable cities.

Actions of Government of India Promoting Sustainable Mobility

Policies

- National Urban Transport Policy, 2014
- Transit Oriented Development Policy, 2017
- National Policy on Bio-Fuels, 2018

Missions and Programmes

- Jawaharlal Nehru National Urban Renewal Mission, 2005 - 12
- National Mission on Sustainable Habitat, 2010
- National Electric Mobility Mission Plan (NEMMP) 2020, 2013
- Atal Mission for Rejuvenation & Urban Transformation (AMRUT) Mission, 2015
- Smart Cities Mission, 2015
- Urban Green Mobility Scheme , 2017
- National E-Mobility Programme, 2018
- Vehicle Fuel Efficiency Programmes / Euro norms

Types of Sustainable Modes of Transport

A) Public Transport consists of Mass Rapid Transport system (MRTS), Para-transit, and personalized transport. MRT is a bus-based or rail-based system, which can carry large number of people in one go. In some cities water transport modes like ferries are also used as means of public transport. Para-transit modes include tempos and mini-buses, and personalized transport modes include autos and taxis.

B) Non-Motorized Transport (NMT) consists of walking and cycling. These modes of transport are usually taken up for shorter distances and are slower in speed than the other public transport modes. Cycle rickshaws and E-rickshaws[5] have been clubbed with non-motorized transport fleet owing to their character of slow speed and their utility for shorter distance and last mile connectivity.

C) Electric Vehicles, though in early stage of development, are being seen as a sustainable mobility solution. Government of India is keen to transform the mobility sector by introducing and scaling up of electric vehicles by 2030.

[5] *E-rickshaws with motor power upto 650W are considered NMT, as per Ministry of Road Transport. (http://www.thehindu.com/news/cities/Delhi/ericks-to -stay-branded-as-nonmotorised-vehicles/article6125423.ece)*

Sustainable Mobility : Success Stories

BRT in Ahmedabad, Gujarat

The BRT system has revolutionized the public transport system in the city by providing efficiency, affordability, safety and security. It is branded and known as 'Janmarg'.

Presently the city has an 89 km long BRT corridor which operates 223 buses on 21 routes[6], making it the largest operational BRT system in India. This system has a ridership of approximately 0.13 million passengers per day[7]. The BRT bus routes complement with Ahmedabad Municipal Transport Services (AMTS) buses, bringing the system within reach throughout the city. This system paved the way for transit-oriented development in the city, ensuring higher population density along the routes.

BRT Systems in India

Other BRT Systems

Today 8 cities in India have operational BRT systems, and have plans to expand the existing network, whereas 6 BRT systems are under construction.

Globally, TransJakarta is the longest BRT system with 230 km long BRT stretch and 13 functional routes. It is used by approximately 0.45 million people every day and has more than 1500 buses in operation. Curitiba's Rede Integrada de Transporte was the first BRT system implemented in the world, in 1974. Planners utilized mobility driven and mixed-land use driven growth in establishing sustainable growth model for Curitiba and an example for the world[8].

[6] *http://www.ahmedabadbrts.org/web/About_JanMarg.html. Retrieved June 1, 2018*

[7] *http://www.ahmedabadbrts.org/web/About_JanMarg.html. Retrieved June 1, 2018,*

[8] *National Institute of Urban Affairs. (2016). Transit Oriented Development. New Delhi: NIUA https://tod.niua.org/todfisc/book.php?book=1&section=4*

Metro Rail, Delhi

Delhi Metro started its operations in December 2002. The DMRC has a network length of 296 km, with 214 stations spread across seven operational lines. Delhi metro has about 270 trains[9]. These trains make more than 2,700 trips per day[10] on seven operational corridors. The average daily ridership is estimated to be about 2.7 million[11].

The Delhi Metro project proposes to cover the entire city of Delhi and the adjoining sub-cities (Gurgaon, Noida, Ghaziabad, etc.) with a network of 405 km, in four phases, by 2021. Phase III is being launched in 2018, whereas phase-IV is in the planning stage.

Other Metro Projects

Kolkata was the first city in India to have a metro system, which started operations in October, 1984. Currently, 10 Indian cities have a functional metro system in place and plan to expand their network to cater to larger urban populations. There are 5 cities where metro system is under construction and would become operational between 2018 – 2020. Another 16 metro projects are in the planning phase which would benefit 18 cities and towns by 2025 (as of May 2018).

Globally, New York Subway system is the largest in terms of number of stations – 468 in number. In terms of operational length, Shanghai metro system is the longest, with a 548 kms stretch. In terms of the busiest metro system, Beijing subway system carries roughly 3.5 billion people annually on its 527 km long network. Tokyo metro system along with its two private operated lines carries 3.2 billion people annually[12] and is the second busiest metro network in the world.

Metro Systems in India

[9] *http://www.delhimetrorail.com/about_us.aspx"http://www.delhimetrorail.com/about_us.aspx#Introduction Retrieved June 1, 2018*
[10] *http://www.delhimetrorail.com/press_reldetails.aspx?id=DxsisLpwLn09cIId Retrieved June 1, 2018*
[11] *http://www.delhimetrorail.com/press_reldetails.aspx?id=ZIXC4jMrU00IId Retrieved June 1, 2018*
[12] *https://www.citymetric.com/transport/what-largest-metro-system-world-1361 Retrieved June 1, 2018*

Street Improvement Strategy in Nanded, Maharashtra

In Nanded, about 50 km of the street had been redesigned in 2008 to provide a better level of service to different types of road users[13,14] .

A master plan of the road network proposed for Nanded city includes: rationalisation of motorized vehicle lanes to accommodate all users, separate lanes for NMT, pedestrian precinct around the Sachkhand Gurudwara, as well as, innovative street cross-sections to incorporate tree plantation, hawkers, on-street parking, para-transit stands, bus shelters, public toilets etc.

The project had been taken under the JnNURM scheme through a public-private partnership between IL&FS and the Nanded-Waghala Municipal Corporation.

Street Re-design, Aundh-Baner-Balewadi, Pune

Under the Pune Smart City Plan, it was envisaged to redesign roads in the Aundh-Baner-Balewadi (ABB) region, giving preference to walkability, universal accessibility and cycling. Subsequently, a pilot of 1.5 km had been taken up after extensive citizen engagement including a mock-up of proposed design changes, as per Pune Municipal Corporation. This 1.5 km is part of a larger network of around 27 km which is to be redesigned[15]. The project aims to reduce the use of cars and two-wheelers in the neighbourhood and make a shift to walking and cycling. Pune Municipal Corporation also brought out the Street Design Guildelines[16] in 2016.

Bicycle Sharing Systems

The Bhopal bicycle sharing system involves a fully automated bike sharing system of 500 bicycles with over 50 docking stations across the city, backed by a state-of-the-art IT system. This system connects BRT with key residential and commercial areas of the city. The smart card issued to bikers can be used in BRT and other city buses, thus integrating the system. A single agency named – Bhopal City Link Ltd. oversees the operation and maintenance of the BRTs and cycle sharing systems, thus setting an example of institutional integration[17].

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[13] *ADB;MoUD. (n.d.). Module 5 NMT. Retrieved June 1, 2018, from https://sti-india-uttoolkit.adb.org*

[14] *Tiwari, G., & Jain, D. (2013, August). India Environmental Portal. Retrieved June 1, 2018, from http://www.indiaenvironmentportal.org.in/files/file/NMTInfrastructure_India.pdf.Pg 27*

[15] *The Institute for Transportation and Development Policy. (n.d.). ITDP. Retrieved June 1, 2018, from https://www.itdp.org*

[16] *Smartnet.niua.org, URBAN STREET DESIGN GUIDELINES version I (USDG). Retrieved June 1, 2018, from https://smartnet.niua.org/sites/default/files/resources/urban_street_design_guidelines_in_pune.pdf*

[17] *Smart City Bhopal. (n.d.). Public Bike Sharing Bhopal. Retrieved June 1, 2018, from http://smartcities.gov.in/upload/uploadfiles/files/01-PBS%20Bhopal.pdf*

Pune city launched Cycle Chalao bike sharing system after completion of two years of pilot tests and research. Under the scheme, 25 cycle stations with a fleet of 300 cycles have been put in place. The target population for this scheme is youngsters and low-income groups and the revenue sources include cycle rent and advertisements[18]. The Pune Smart City Development Corporation Limited also launched a cycle sharing scheme in Aundh-Baner-Balewadi areas. The scheme called PEDL has an app named Pedl which helps customers to scan the QR code, pay for the ride and unlock the cycle at the bike station[19].

The adoption of Public Bicycle Sharing (PBS) systems in Bengaluru was announced by the Government of Karnataka in the 2017-18 budget. Subsequently, the Directorate of Urban Land Transport (DULT) became the nodal agency for scaling up PBS in Bengaluru, aiming at about 6000 bicycles in the first phase through different private players[20].

Other Bicycle Sharing Systems

New Delhi, Mumbai, Rajkot, Mysuru, and Ahmedabad also have bicycle sharing schemes.

In 2007 Barcelona city council launched an innovative bicycle borrowing scheme called 'El Bicing'. This bicycle sharing system is only available to residents of Barcelona and is intended as a public transport service for short bicycle journeys of maximum 30 minutes duration.

In early 2013, China had 79 active bike sharing systems, offering about 358,000 bikes. Out of these – Hangzhou, near Shanghai has the largest bike sharing system offering 69,750 bikes.

Apart from China, 48 countries house roughly 330 active bike[21] sharing systems around the world.

Bicycle Sharing System in India

[18] *http://www.cseindia.org/userfiles/Raj%20Janagam.pdf Retrieved June 1, 2018*

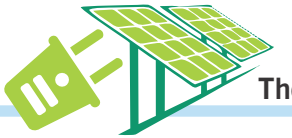
[19] *Pune Smart City Development Corporation Ltd. (2017, Nov 29). PSCDCL to launch "Public Bicycle Sharing System". Retrieved June 1, 2018, from https://punesmartcity.in/pune-smart-city-development-corporation-pscdcl-ready-to-launch-public-bicycle-sharing-system-in-association-with-zoomcars-pedl-and-ofo/*

[20] *Directorate of Urban Land Transport. (n.d.). Public Bicycle Sharing System - Bengaluru. Retrieved August 6, 2018, from urbantransport.kar.gov.in: http://www.urbantransport.kar.gov.in/PBS.html*

[21] *http://www.earth-policy.org/plan_b_updates/2013/update112 Retrieved June 1, 2018*

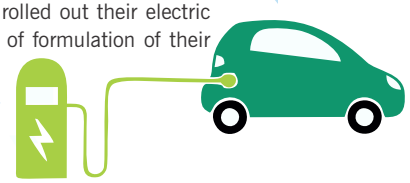
Electric Mobility

Government of India has announced an ambitious target of running more than 30% of vehicles on electricity by 2030. Further, the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME) Scheme was announced in the year 2015. In addition, the National E-mobility programme [22] was also launched to support domestic manufacturing of storage systems and electric vehicles.



The BUZZ around Electric Vehicles (EVs) in India

- Testing of lithium ion batteries developed by Vikram Sarabhai Space Centre for use in 2 and 3 wheelers by Automotive Research Association of India (ARAI).
- In April - June 2017, Chandigarh and Himachal Pradesh pilot-tested electric buses.
- In October 2017, EESL invited bids for 4,000 charging stations in Delhi-NCR after it announced procurement of 10,000 EVs for different ministries.
- In November 2017, the first multi modal EV project in India was inaugurated, along with an Ola Charging station in Nagpur.
- In November 2017, the Brihanmumbai Electric Supply and Transport (BEST) received 4 eco-friendly zero emission buses with a passenger seating capacity of 30.
- Mumbai has also started operating 25 Hybrid (diesel-electric) buses.
- In December 2017, cities of Ahmedabad and Bangalore, and in January 2018, state government of Karnataka announced the purchase of electric buses.
- The Bangalore Metropolitan Transport Corporation selected an operator to run 40 e-buses in the first phase of rolling out 150 e-buses in the city.
- In 2018, the states of Andhra Pradesh, Karnataka, Maharashtra and Telangana have rolled out their electric vehicle policies whereas, Goa, Uttar Pradesh and West Bengal are in different stages of formulation of their respective EV policies.



[22] *Press Information Bureau. (2018, March 7). Shri RK Singh launches National E-Mobility Programme in India. Retrieved June 1, 2018, from http://pib.nic.in/newsite/PrintRelease.aspx?relid=177134*

Sustainable Mobility: Other Initiatives

- **Pedestrian Design Guidelines 2009,** by UTTIPEC under Delhi Development Authority (DDA), aimed to provide design guidance for pedestrian infrastructure, which would ultimately lead to enhanced comfort of pedestrians, increase ridership in buses and metro and, more equity in the provision of comfortable public spaces to all sections of society[23].
- **Policy for Pedestrian Facilities and Safety** in Pune was adopted in 2016, under the Smart City Mission. Keeping the priorities outlined by the Comprehensive Mobility Plan, the city came out with a dedicated policy to provide and improve existing pedestrian infrastructure, thus complementing public transport[24].
- **Transit Oriented Development** in Karkardooma, in East Delhi is being implemented by Delhi Development Authority (DDA). It proposes mixed-use development with a variety of housing types and civic amenities, located next to an interchange station of the metro network and a major bus terminal. This is aimed at encouraging walking and use of mass transit systems (buses and metro)[25]. Similarly, Rajkot plans to link affordable housing with the proposed transit oriented zone around the ring road in the city[26]. This initiative would enhance the appeal of affordable housing projects and promote use of public transport.
- **Multi Modal Hubs** are planned and designed as convergence points of different modes of transport. These hubs offer smooth interchange between inter-city and intra-city modes. For example, Kashmere Gate Inter State Bus Terminal (ISBT) is a multi-modal hub where three metro lines converge. Moreover, a policy on integrated multi-modal logistics and transport is being jointly developed by the ministries of road transport and highways, shipping, aviation and railways. Ten multi modal logistic hubs are being planned where local and interstate freight and passenger transport modes will converge[27].
- **Skywalks** are long foot bridges connecting different locations and building complexes which receive high footfall. These bridges facilitate safe and easy movement of people, without increasing the congestion on roads. In 2009, Mumbai became the first city in India to introduce a 1.3 km long skywalk , connecting suburban regions of Bandra and Kurla. The Santacruz West skywalk with a 2.5 km stretch is the longest in the network. Till date, 28 skywalks have been constructed by Mumbai Metropolitan Region Development Authority[28].
- **Station Area Traffic Improvement Scheme** in Thane has improved the flow of vehicles and pedestrians, thereby reducing the chronic congestion and pollution in the area. The elements of this scheme include pedestrian skywalks, foot-over bridges, and separate parking for autos and taxis.
- **Vayu Vajra-** a dedicated airport bus service operated by Bangalore Metropolitan Transport Corporation has helped in reducing the number of private vehicles taking passengers to and from the airport. Vayu Vajra buses take 251 trips from the city covering 11 routes[29].

[23] *UTTIPEC. (2009, November). Retrieved June 1, 2018, from http://uttipec.nic.in: http://uttipec.nic.in/writereaddata/mainlinkfile/File215.pdf*

[24] *Pune Municipal Corporation. (n.d.). Pedestrian Policy. Retrieved June 1, 2018, from https://pmc.gov.in/sites/default/files/project-glimpses/Pedestrian_Policy.pdf*

[25] *National Institute of Urban Affairs. (2016). Transit Oriented Development . New Delhi: NIUA*

[26] *Rajkot Urban Development Authority. (n.d.). Revised City Development Plan 2031 (Draft). Retrieved June 1, 2018, from http://www.rajkotuda.com/pdf/RUDA-Report-PART-2-14-07-2015-board-sanction-2031.pdf. Pg 23*

[27] *Press Information Bureau. (2017, March 15). Shri Nitin Gadkari says Government to bring in Integrated, Multi-Modal Logistics and Transport Policy. Retrieved June 1, 2018, from http://pib.nic.in/newsite/PrintRelease.aspx?relid=159271*

[28] *MMRDA. (n.d.). Skywalks. Retrieved June 1, 2018, from https://mmrda.maharashtra.gov.in/skywalk*

[29] *BIAL. (n.d.). Airport Shuttle Service: Vayu Vajra. Retrieved August 6, 2018, from bengaluruairport.com: http://www.bengaluruairport.com/transport/buses.jspx?_afrLoop=2506354082516382&_afrWindowMode=0&_adf.ctrl-state=lmoga9c3_4*

Actions by Stakeholders

Individual

- Walk or pedal for short distance travel.
- Opt for public modes of transport.
- Adopt car pooling and reduce carbon footprint.
- Opt for fuel-efficient vehicles.
- Adopt electric vehicles.

Government

- Encourage public transport along with non-motorized modes through policies, incentives, regulations and projects.
- Policy and programme driven push for electric vehicles.
- Create newer avenues for private players to invest in sustainable urban transport.

Corporates and Institutions

- Promote sharing by encouraging employees to opt for cabs and corporate buses.
- Staggered working hours to reduce congestion on roads.
- Adopt EVs for employees' shared transport.
- Promote the use of public transport for commute to work.

Automobile Industry and Technology Service Providers

- Improve the fuel efficiency of existing automobiles.
- Develop apps for car pooling, GPS enabled public information system for buses, as well as websites displaying running status of buses and metro.
- Develop affordable electric vehicles and associated charging infrastructure.

Civil Society

- Raise awareness through campaigns and social events on sustainable transport among different segments of the society.
- Develop knowledge products and document best practices.
- Engage with multiple stakeholders for dialogues, capacity building, networking and partnerships.

Bus Rapid Transit System in Pune

Janmarg-Cycle Lane in Ahmedabad

Sub-urban Train System in Chennai

Electric Buses in Mumbai

Glimpse of Sustainable Mobility Practices in Indian Cities

Transit Oriented Development in Gurugram

Skywalk in Mumbai

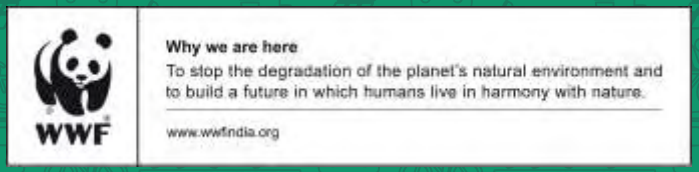
Bicycle Sharing System in Bhopal

Metro System in Delhi

Redesigned Street in Pune

Photo Credits:

Clockwise from left: Rsrikanth05/Wikimedia Commons, Meena Kadri/Flickr, Srini G/Flickr, Rail Analysis India , Suyash Dwivedi/Wikimedia Commons, HT, Sudhir Deshwal /Flickr, Rajesh/Flickr, BL Soni



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