

Sustainable Urban Transport



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Sustainable Urban Transport

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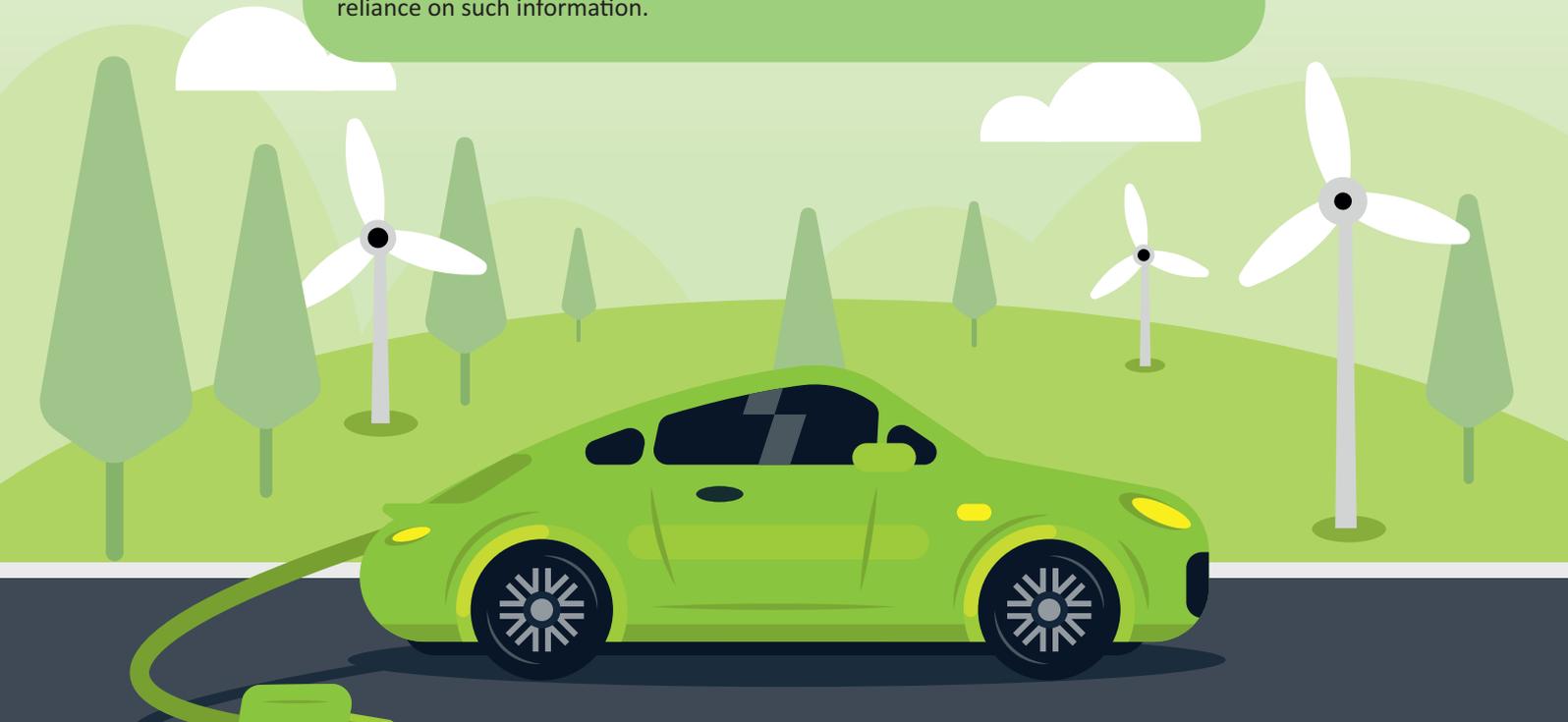
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Preface

The ever increasing population demand as resulted into an advanced industrialization and urbanization. This has led to a negative impact on the environment and has escalated the ecological footprint and carbon footprint. Urbanization results in an irreversible resource use, here sustainability plays an important role. Sustainable development has been defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. However, sustainable urban development implies a process by which sustainability can be attained, emphasizing improvement, progress and positive change, incorporating both environmental and social dimensions.

Urban Transportation plays an important role in the urban municipal services. It defines the complexity of transferring people and cargo within the territory and between the immediate suburban zones through different modes of transportation. Greenhouse gas emissions are increasing in a faster rate from the transportation sector. This has a huge impact on the environment in terms of the pollution it causes and the resources it uses. Sustainable transport is the need of the hour as it has a positive contribution to the environmental, social and economic sustainability it serves to the communities.

Sustainable urban transport is a proactive approach when it comes to mitigating climate change and reducing the dependence on the non-renewable resources. Sustainable transport is not an option now but a necessity so as to reduce the air pollution and to increase the quality of life for the city residents.

This book presents the challenges in urban transport, policies and measures adopted globally to tackle traffic congestions, and environmental pollutions caused due to transportation. It also presents sustainable mobility measures and few case studies of the world.



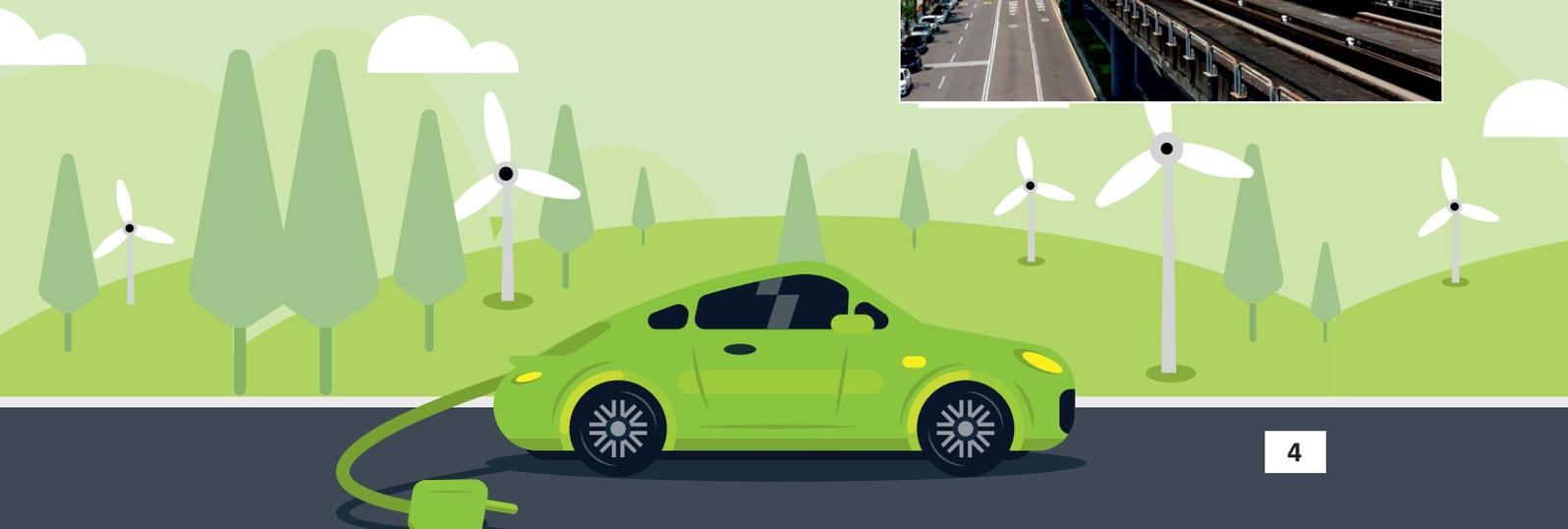
INTRODUCTION TO TRANSPORTATION

Historically, urban commuting has tended to be restricted to walking, making urban mobility rather inefficient and time-consuming. With an increasing share of the global population living in cities, urban transport has evolved to support passenger mobility in large urban centres. Urban transportation is highly complex due to the modes involved, the multitude of origins and destinations, and the volume and variety of traffic. Demand for urban travel is on the rise in both developed and developing countries. Overall population growth and rising urbanization have led to rapid growth in large cities, which are crippled by the surge in demand for travel.

The advancement of technology in transportation has raised issues of air and noise pollution and its impact on environment. The environmental effects of transportation not only end at air pollution but extend to global warming, habitat destruction, loss of species etc. Urban transport poses great challenges in many of the rapidly growing metropolitan and other urban areas of developing countries where lack of adequate planning and public transport services causes economic losses. These losses are due to high consumption of fuels, congestion and air pollution, through sulphur dioxide (SO_x), oxides of nitrogen (NO_x), volatile organic compounds (VOCs) and particulates, with the associated impact on public health. According to projections of UNHabitat, by 2050, two-thirds of humanity will live in towns and cities. Hence cities in developing countries urgently need affordable high-quality public urban transport systems.

Urban planners face the challenge of balancing an appropriate separation and mix of residential, industrial, commercial and recreation zones so that jobs, markets and residences are not separated by long distances. The bicycle is by far the most affordable mode of transport for the urban poor. Adequate provision of safe cycle routes and parking facilities can enhance sustainability in urban transport systems. Similarly, policies to support walking as a prime mode of transport through the provision and maintenance of walkways can also be effective in urban areas. Many European cities and towns have successfully restricted motor vehicle use in commercial centres by introducing pedestrian-only shopping zones.

Subway and light-rail systems form the basis for rapid, cost-effective and environmentally benign urban passenger transport. Located mostly in the industrialised countries, 116 cities operate their own metro systems, which are used by an estimated 155 million passengers each day. In addition, there are about 400 light-rail systems worldwide, while over 200 new systems are planned. However, the construction of subways in existing cities poses major challenges and is often very costly, and thus not easily affordable for developing countries, even though tunnel construction technologies are now very advanced.



A growing number of developing countries have embarked on, or are considering, the introduction of bus rapid transit (BRT) systems, which are characterised by mostly larger buses that run on segregated lanes parallel to the local traffic. In comparison with light-rail transit or subway systems, BRT systems are much less costly whilst still achieving comparable high transport efficiency. Enhanced BRT systems offer climate-controlled buses with platform-level entry, pre- or post-fare payment and global positioning systems to inform customers of expected waiting times and transfer connections. Modern BRT systems can move up to 45,000 passengers per hour along a single route direction compared to less than 10,000 passengers for mixed traffic on the same corridor. Although the costs of individual buses and BRT systems are moderate, many such systems are urgently needed to enable developing countries to tackle growing urban transport problems. For many developing countries, BRT systems would be affordable only with significant international technical and financial support.

Area licensing, road pricing and parking charge schemes, such as those applied in Singapore, London and Paris, have proven effective in terms of reduction of urban vehicular traffic. Some cities, in particular those where air pollution poses a major threat to human health, have implemented temporary restrictions on the use of cars, for example by day of week, number plate or minimum occupancy. Public information and public health campaigns advocating car-free days or temporary road closures for biking, walking or street markets have also become increasingly popular. In a growing number of cities, new urban planning and innovative business concepts, including car-free housing, 10 car sharing and short-term car rentals and 'dial a ride' services, as well as company bicycles and urban bicycle rental schemes, are offering new low-carbon transport options. In many European capitals and most of the larger cities, bicycles are now easily available for rent at major train or subway stations.

The Freight traffic in urban areas is increasing with the growing population and its everlasting demands. Though the Freight traffic contributes to a total of 10% to the entire traffic, an estimated 40% of pollution caused in urban areas is due to the urban freight transport. Hence, a sustainable transport system in freight traffic will improve its efficiency in operations through facilities like consolidation centers or freight villages, use of web based technology and Intelligent Transport Systems.

Transport solutions should inculcate a holistic perspective with minimal impairment to the environment. Growth must be permitted without endangering the health of the ecosystem. The urban transport system should be developed keeping in mind its sustainability. It also requires the provision of a diverse, integrated and balance public transportation services. It also requires the provision of a public transit system that provides good connections with the major activity areas and by ensuring efficient use if scarce resources. This could only be achieved by endorsing fuel efficient green vehicles, carpooling etc. People using less personalized vehicles and opting for sustainable public transport will lower the level of traffic congestion and demand for new road ways.



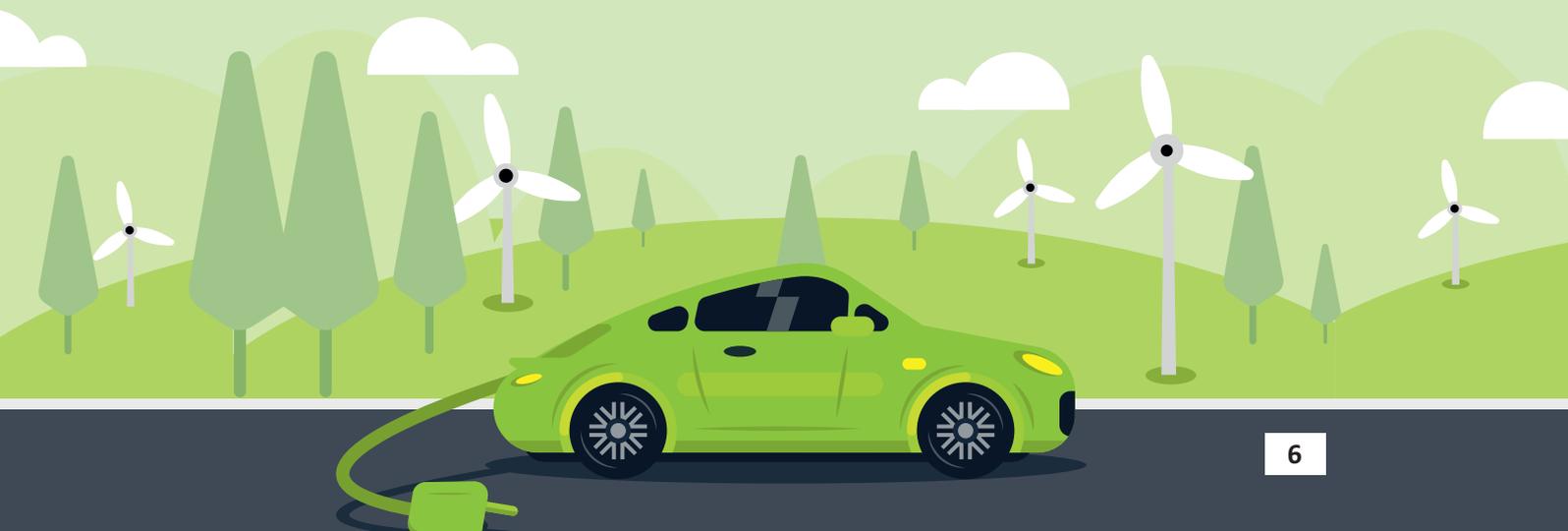
SUSTAINABLE URBAN TRANSPORTATION: CHALLENGES

The world's population continues to grow; the past 50 years in particular have seen a rapid increase in rates of urbanization across the world. According to projection of the UN World Urbanization Prospects (2018), it is estimated that 68 per cent of the world's population will live in urban areas. Owing to both demographic shifts and overall population growth, it means that around 2.5 billion people could be added to urban areas by the middle of the century, predicts the UN Department of Economic and Social Affairs (DESA). According to the report these swelling populations will place extra demands on both resources and services in urban areas. So many countries will face challenges in meeting the needs of their growing urban populations, including for housing, transportation, energy systems and other infrastructure.

Since 1971, the global transport energy use rose steadily at 2.0-2.5 per cent per annum, closely reflecting global economic growth. Road transport used the most energy and experienced the highest growth in absolute terms. The current transport systems, largely dependent on fossil fuels, bring along with them serious environmental, social and economic costs in terms of heavy congestion, air pollution, GHG emissions, accidents, etc.

Urban transport poses great challenges in many of the rapidly growing metropolitan and other urban areas of developing countries where lack of adequate planning and public transport services causes economic losses. These losses are due to high consumption of fuels, congestion and air pollution through sulphur dioxide (SO_x), oxides of nitrogen (NO_x), volatile organic compounds (VOCs) and particulates, with the associated impact on public health and environment.

The transport system enables the economy to grow, if not well-managed, it can also retard growth and the efficient delivery of essential social services. The lack of comprehensive planning of transport systems, without due consideration to social, economic, environmental and cultural elements of the city, can result in physical breaks in the fabric of communities and reinforce social exclusion. The impact on quality of life and the environment cannot be underestimated. Properly designed transportation systems should meet mobility and people requirements and also provide safety and eco-friendly vehicles.



Issues

1. Rapid Urbanisation

Rapid urbanisation and sprawling cities are placing great pressure on the existing transport systems in terms of meeting the mobility needs of people as well as goods. Economic efficiency of cities and well-being of urban inhabitants are directly influenced by mobility or the lack of it. The increasing rate of urbanization and city size already put the urban transport system under great stress. The urban population across the world has increased significantly from 1 billion in 1960 to more than 4 billion people in 2017 as projected by UN World Urbanisation Prospects 2018. The urban population in India as per 2011 census has increased significantly from 286 million in 2001 to 377 million in 2011. The “World Urbanization Prospects 2018” puts India's urban population at 460.78 million in 2018 and at 34 percent of its total population. These changes exacerbate the demand for transport – a demand that many cities have not been able to meet. If the effects of rapid urbanization, growing population and urban development are not considered carefully, this can lead to numerous environmental, economic and social drawbacks.

2. Urban air pollution

The transport sector is responsible for around a quarter of global CO₂ emissions from fossil fuel combustion; a share which is growing. CO₂ emissions in developed countries have been stabilised in most sectors, with the exception of emissions from transportation. Exposure to air pollutants i.e. increasing concentrations of NO_x and Particulate Matter (PM) leads to serious health problems. Electric vehicles and cleaner fuels can reduce local air pollution, benefitting human health and the urban environment.

3. Unrestrained motorization

Motorization has been increasing with the growing population. Car use absorbs massive public investments for road infrastructure building and maintenance, it creates traffic jams that hinder the mobility of the bus, develops air pollution, makes noise, leads to accidents, creates obstacles to lower income pedestrians and leads to using spaces for parking vehicles. Restriction on use of personal automobile would encourage usage of public transport.

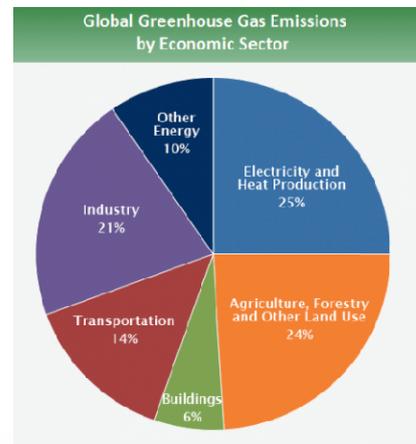
4. Road Safety

As per WHO's Global health estimates (2018) and the Global status report on road safety (2018), about 1.3 million people die on the world's roads and 20 - 50 million are injured every year. Road traffic crashes are a major cause of death among all age groups and the leading cause of death for children and young adults aged 5–29 years. A range of issues such as the frequency or severity of road collisions and casualties, levels of active travel (walking and cycling) and the quality of the street environment can be solved using environmental zones. Technologies improving safety (e.g. braking distance) also offer benefits in the form of fewer road casualties.



5. Energy Security & Greenhouse Gas (GHG) Emissions Source:

Urban transport represents one of the fastest growing sources of greenhouse gas emissions that contribute to global climate change (UNCRD, 2009). Transport sector contributes 14% of 2010 global greenhouse gas emissions. (Shown in figure) Greenhouse gas emissions from this sector primarily involve fossil fuels burned for road, rail, air, and marine transportation. Almost all (95%) of the world's transportation energy comes from petroleum-based fuels, largely gasoline and diesel. Of the 23% of global CO₂ emissions from the transport sector, road transport accounts for 73%, followed by international shipping and international aviation. According to United Nations Framework Convention on Climate Change (UNFCCC 2011) it is the sector where emissions have increased the most (by 14 per cent from 1990 to 2008) and, in a business-as-usual scenario, are expected to grow by 25.8 per cent by 2020 compared to 1990 levels.

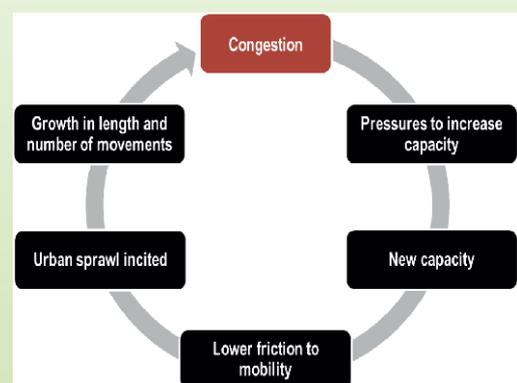


Source: (IPCC 2014)

Cities should understand that action upon climate change must be done collectively and seeking global goals of mitigation, while acting locally. The co-benefits of such an approach would also be significant and must be always understood as part of a package of urban transport improvements. Without aggressive and sustained mitigation policies being implemented, transport emissions could increase at a faster rate than emissions from the other energy end-use sectors and reach around 12 Gt CO₂eq/yr by 2050. (IPCC 2014)

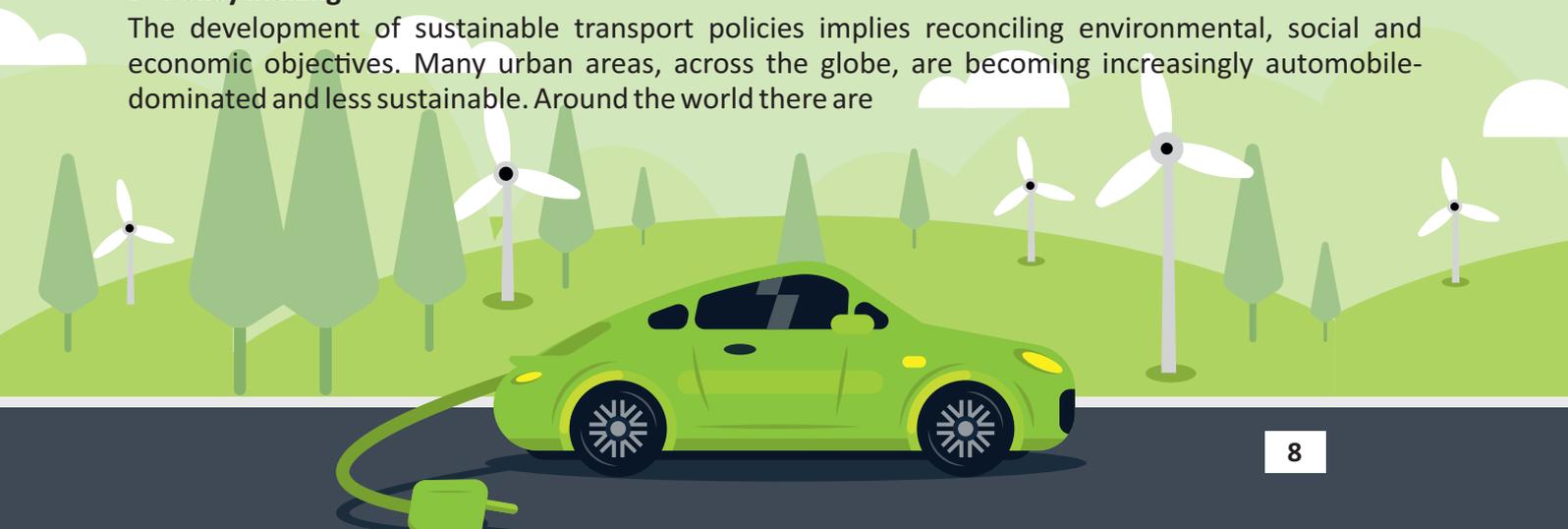
6. Traffic Congestion and parking

Congestion occurs when the volume of traffic reaches maximum infrastructure capacity. It is linked with the motorization and the diffusion of the automobile. It in turn increases the demand for transport infrastructures. Vehicles spend the majority of the time in parking. It not only demands parking space but also creates carbon footprint problems. Cities need to move towards new patterns of transportation based on sustainable principles. Cities should improve mass transit services, increasing the number of users and quality of services.



7. Policy making

The development of sustainable transport policies implies reconciling environmental, social and economic objectives. Many urban areas, across the globe, are becoming increasingly automobile-dominated and less sustainable. Around the world there are



very few examples can be found where the responsibilities for urban transport governance are coordinated effectively. In many cities, a combination of weak administrative arrangements, limited planning capacity, and a lack of coordination between land use and transport policy-making prevails, which together inhibits the development of more innovative, integrated, and sustainable policies. There is often no shortage of transport plans for cities in countries across the world. However, the lack of funding as well as political will often severely limits their implementation. Another key challenge to the effective implementation of urban transport policies and plans is the political influence of transport operators involved in providing public and private services. The involvement of the private sector in local transport financing is increasing in many countries, and sometimes actively encouraged to fill funding gaps. It also demands institutional cooperation and the willingness and the ability of institutions to coordinate the work of professionals within and across public and private organizations, in order to work efficiently toward the common goal of transport sustainability (Pojani and Stead 2017).

In India, for example, public-private partnerships (PPPs) have recently been introduced for the construction, operation, and maintenance of urban infrastructure projects. However, rather than easing the financial burden of cities, PPPs have often led to legal and financial disputes to the detriment of transport operations and management (Rathi 2017).

In India the Motor Vehicles Act, passed in the year 1988 by the Indian Parliament, regulates almost all aspects of road transport vehicles. It has provisions for traffic regulations, vehicle insurance, registration of motor vehicles, controlling permits and penalties. The Act came into force from 1 July 1989. To make roads safer, the Government of India in consultation with state transport ministers came up with this Motor Vehicles (Amendment) Bill to make changes to the Motor Vehicles Act, 1988. The Motor Vehicles (Amendment) Act, 2019, was implemented from September, 1 2019. The New Motor Vehicle Act provides for a National Road Safety Board, to be created by the central government through a notification. The Board will advise the state and central governments on all facets of traffic management and road safety, including standards of motor vehicles, licensing and registration of vehicles, promotion of new vehicle technology and standards for road safety.



Source:

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- 2 Dorina Pujani and Domonic Stead (2017): Policy design for sustainable urban transport in the global south. Policy Design and Practice, Volume 1, Issue 2, 90-102p.
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- 4 <http://www.urbantransport.kar.gov.in/National%20Urban%20TransportPolicy.pdf>
- 5 <https://www.orfonline.org/research/policymaking-towards-green-mobility-in-india/>
- 6 Shanghai Manual – A Guide for Sustainable Urban Development in the 21st Century
- 7 GIZ_SUTP_Challenges-of-urban-transport-in-developing-countries_EN.pdf
- 8 https://iihs.co.in/knowledge-gateway/wp-content/uploads/2015/07/RF-Working-Paper-Transport_edited_09062015_Final_reduced-size.pdf
- 9 <https://www.who.int/news-room/facts-in-pictures/detail/road-safety>
- 10 https://transportgeography.org/?page_id=4621
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- 12 <https://www.un.org/development/desa/en/news/population/2018-world-urbanization>
- 13 <https://ourworldindata.org/urbanization#number-of-people-living-in-urban-areas>
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SUSTAINABLE TRANSPORT POLICIES IN INDIA

According to Ministry of Housing and Urban Affairs (MoHUA), Government of India, India's urban population is currently around 31.6% of its total population. There has been an increase of 3.35 percentage points in the proportion of urban population in the country during 2001-2011. It is projected by Ministry of Urban Development (Now MoHUA), Government of India in National Urban Transport Policy (2013) that India's urban population would grow to about 473 million in 2021 and 820 million by 2051, as against only 285 million in 2001. Hence, cities must not only meet the mobility needs of the current population but also provide for the needs of those yet to join the urban population.

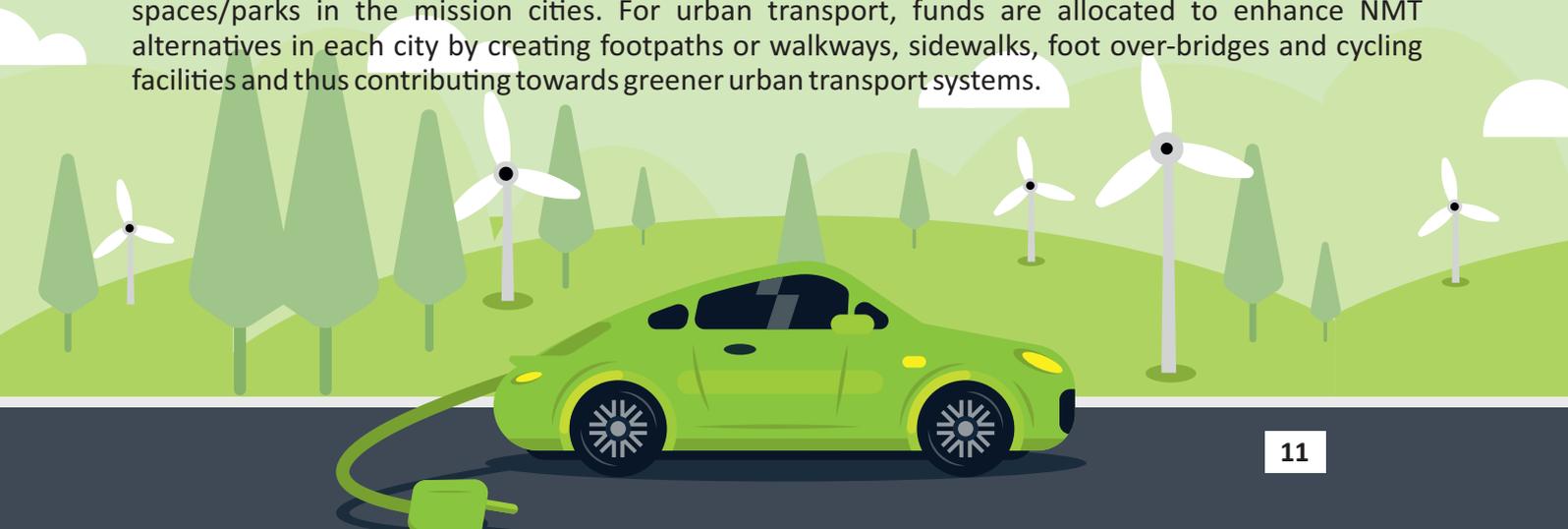
1. National Urban Transport Policy (NUTP)

It was launched in 2006 and revised in 2014, paved the way for large-scale reforms in India's urban transportation sector. It aims at providing better mobility and sustainability by focusing on people mobility and not vehicle mobility. The policy envisages an urban mobility framework that is contextual, and is suited to the geographical, social and economic needs of cities and citizens.

NUTP serves as the base document for several other projects and programmes, such as the Smart Cities Mission's transport initiatives and the National Electric Mobility Policy. Along with the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), the 2006 NUTP envisioned and launched several schemes on sustainable transportation, such as the bus rapid transit system (BRTS), light rail projects under the mass rapid transport schemes and the upgradation of city bus systems in big towns and smaller cities. In 2014, the NUTP was amended to consider the country's new transportation needs, defining a vision for creating city-specific mobility solutions along a low carbon path. It included factors like integrated land use and transport planning, the creation of comprehensive mobility plans and public transport and non-motorized transportation (NMT) plans and provided guidelines to create multimodal sustainable urban transport systems. The key objectives of the NUTP are to allocate road space to move people rather than vehicles; to incorporate urban transport at the urban planning stage; to promote seamless, user-friendly and reliable public transport and to develop walking and cycling as safe modes of urban transportation.

2. Atal Mission for Rejuvenation and Urban Transformation

Announced in 2015, the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) is a revised version of the JNNURM policy for smaller cities across India. A vehicle for urban transformation in 500 mission cities across the country, AMRUT focuses on specific aspects of urban service delivery and the betterment of water supply, sewerage, storm water drainage and urban transport and creating green spaces/parks in the mission cities. For urban transport, funds are allocated to enhance NMT alternatives in each city by creating footpaths or walkways, sidewalks, foot over-bridges and cycling facilities and thus contributing towards greener urban transport systems.



3. Smart Cities Mission

One of the focus areas of the Smart Cities Mission, launched in 2015 by the MoHUA, is improving transport and connectivity and providing an impetus to walkable communities. It aims to reduce congestion, air pollution and resource depletion, stresses on the principle of 'streets for people', makes design changes and provides amenities within walking or cycling distance for most of the population. It aims to promote transit-oriented development, public transport and last-mile para-transport connectivity, technological upgradations in urban transport with the introduction of citywide command and control centres using Intelligent Traffic Monitoring Systems (ITMS).

The key NMT projects were public bicycle sharing schemes, electric bus and electric rickshaw fleets, IT-enabled fleet tracking for e-mobility options, and EV charging and parking bays. Smart city projects have considerably diversified the transportation options available in India. Yet, compared to intermediate public transport like rickshaws and taxis, non-motorised options are far less preferable. The MoHUA, through the Smart Cities Mission, has announced a 'CYCLE4CHANGE' challenge, which intends to create extensive cycle networks in Indian cities through various interventions, such as pop-up bike lanes, non-motorised zones in cities and community-led cycle rental schemes. Through this challenge, the Ministry aims to promote cycling as a safe (and green) solution to the recovery for cities, businesses and communities post lockdown.



4. National Transit-Oriented Development Policy

The Ministry of Housing and Urban Affairs, Government of India in 2017 has formulated National Transit Oriented Development (TOD) Policy to address the challenges of urbanisation. The policy framework aims to promote living close to mass urban transit corridors like the Metros, monorail and bus rapid transit (BRT) corridors. It integrates land use and transport planning and aims to develop planned sustainable urban growth centers, having walkable and livable communes with high density mixed land-use.



This policy contributes to creating a green mobility framework for Indian cities. It stresses on sustainable aspects of mobility, such as encouraging high-density, mixed-use spaces and compact developments with mandatory inclusive housing. It focuses on aspects of transport like traffic calming and universal accessibility with the creation of vibrant public spaces, and encourages the monetization of these developments through various mechanisms like Value Capture Financing, thus ensuring NMT strategies will have enough funds to be adopted.

5. Policy on Electric vehicles (Evs)

Since 2011, national government has been making efforts to introduce a transition from conventional vehicles to electric vehicles. Ministry of Heavy Industries (MoHI) launched National Electric Mobility Mission Plan (NEMMP) in 2013. Later in 2015, Department of Heavy Industry (DHI) introduced FAME I (Faster Adoption and Manufacturing of Hybrid & Electric Vehicles) scheme, followed by FAME II (in 2019). At national level, initiatives and policies related to e-rickshaws developed cover various aspects including safety standard adherence mandate for manufacturers, financial support through loans or subsidy, details of licensing and other supporting reforms.



After national level efforts in EV sector, various state governments are also developing a regulatory framework for e-rickshaws at state level. State governments are also working on formulating EV and charging infrastructure policies. Policy and reforms at state level are applicable at city level, supporting the operation of e-rickshaws at local level.

a. National Electric Mobility Mission Plan (NEMMP), 2020

The 2020 National Electric Mobility Mission Plan (NEMMP) is intended to provide the future roadmap, establish common set of priorities, broad principals and framework for promoting the adoption of the full range of electric mobility solution for country, which can enhance national fuel security, provide affordable and environmentally friendly transportation and enable the automotive industry to achieve global manufacturing leadership.

It encourages the adoption of electric and hybrid vehicles in the country through government-industry collaborations, to allow India to emerge as a leader in EV manufacturing by 2020. The NEMMP includes detailed forecasting and situational analysis, projecting India's potential to emerge as a global EV market leader by 2020. It has a set target of 5-6 million



Some of these have been utilised and incorporated into various schemes, such as the adoption of e-auto-rickshaws in Bhubaneswar, Surat, Visakhapatnam, Indore, Pune Coimbatore etc. under the Smart City Mission.



b. Faster Adoption of Electric/Hybrid Vehicles (FAME)

Fame India is a part of the National Electric Mobility Mission Plan (NEMMP 2020). It was announced on 8 April 2015 by the Government of India to be implemented in phases and introduced by Ministry of Heavy Industries and Public Enterprises. It was launched with the objective to support hybrid/electric vehicles market development and manufacturing eco-system in the country. The main objective of the scheme is to encourage the use of electric vehicles by providing subsidies. FAME India Scheme emphasis on e-vehicles and promote e-mobility.

6. Sustainable Urban Transport Project

The Sustainable Urban Transport Project (SUTP) was launched in 2010 by United Nations Development Programme in partnership with the Ministry of Urban Development (now known as Ministry of Housing and Urban Affairs), Government of India and was funded by Global Environment Facility. It aimed to strengthen capacities of government agencies national/state urban transport departments, municipal corporations and transport experts engaged in urban transport planning and regulations to reduce urban transport emissions causing environmental damage. The objective was to promote environmentally sustainable urban transport in India and to improve the usage of environment-friendly transport modes through demonstration projects in selected cities.



The MoHUA aimed to push the NUTP principles through capacity building in urban and sustainable transport, and create regulations to protect Indian cities from pollution and emissions and through city-level projects.

The SUTP created demo projects in ten cities across India and developed guidelines and model documents for various aspects of sustainable transport, such as bike-sharing, city bus operations, transit-oriented development and NMT. The SUTP closed in December 2018.

Projects executed in the ten demo cities included those focusing on BRTS and NMT, as well as capacity building initiatives to create awareness about NMT principles among city governments and officials from implementation agencies and parastatals. Cities like Hubli-Dharwad, Indore and Pimpri Chinchwad began BRTS, BRTS lite and NMT projects based on the SUTP. Since the project ended, there has been little understanding of its impact on India's green mobility space. But the training modules and guidelines developed as part of the SUTP will be of great value for future sustainable mobility projects in the country.

7. Green Urban Mobility Initiative

To boost green and sustainable alternatives under the Smart Cities Mission, the Ministry of Housing and Urban Affairs has launched the Green Urban Mobility Initiative (GUMI) in 2017. The thrust of the initiative is on two components:

- **Sustainable urban mobility:** This provides impetus to solutions like public transport and NMT, and increases the adoption of technological solutions for transport integration, using BRTS, walking and cycling tracks.
- **Sustainable vehicles and fuels:** This advances the adoption of EVs, and clean and renewable alternatives to fossil fuels for public transport projects. It aims to create over 1000 kilometres of BRT networks and redevelop 550 buses, 20,000 para-transit services and 6,000 buses on alternative fuel/electric systems.

Both components of the initiative aim to bring about public transport interventions and will involve local government through a Green Mobility challenge on the lines of the Smart Cities Challenge. The initiative targets different zones in India amongst the 103 smart cities so far.

The GUMI was expanded to include the following components:

- Establishment and operationalisation of Unified Metropolitan Transport Authorities
- Adoption and implementation of transit-oriented development
- Adoption and implementation of travel demand management measures
- Adoption and implementation of policy for urban street vendors
- Establishment of an urban transportation fund
- Adoption of an anti-encroachment policy to reclaim the right of way
- Preparation of comprehensive mobility plans and their integration with the city master plan



India's existing green mobility policies

Policies/ Programmes	Key Features	Green Impact
National Urban Transport Policy	<ul style="list-style-type: none"> • Focus on moving people, not vehicles • To provide seamless connectivity to metro regions • Guidelines to create multimodal and sustainable urban transport systems 	<ul style="list-style-type: none"> • Huge strides in providing efficient bus transport, in major cities • Create comprehensive mobility plans • More focus on bus, light rail and intermediate public transport connections, still the walking and cycling last-mile connectivity options were neglected.
National Urban Transport Policy	<ul style="list-style-type: none"> • Revised version of JNNURM for 500 smaller cities • Focuses on various aspects of urban service delivery, and has specific fund allotted to create and enhance NMT 	<ul style="list-style-type: none"> • Most of the states (and cities) have utilised AMRUT funds for other urban renewal aspects, NMTs have seen only 2 percent of total AMRUT outlays. • Poor validation and follow up on the part of the national mission as to how each city is spending its intended funding.
Smart Cities Mission	<ul style="list-style-type: none"> • Providing impetus to walkable communities is one of the focus areas. • Promote transit-oriented development, public transport and last-mile para-transport connectivity. • Further technological upgradations in urban transport through Intelligent Traffic Monitoring Systems. 	<ul style="list-style-type: none"> • Has furthered the green mobility cause through programmes and challenges aimed at cities. • Since the COVID-19 outbreak, has brought out programmes like cycles4change and complete streets, that aim to enhance walkability and bike infrastructure and adoption in Indian cities • Scope for standardisation of the programmes and to ensuring that their outcomes continue to impact even after the programmes/ challenges themselves are over.
National Transit Oriented Development Policy	<ul style="list-style-type: none"> • Comprehensive approach to creating sustainable mobility options in cities • Covers various aspects of transport policy and practice, including finance and urban planning 	<ul style="list-style-type: none"> • To be implemented successfully across cities, changes must be made in the urban planning mandates. • This is the most comprehensive policy to be adopted into a green mobility framework in the future.

Source: Amruta Ponkshe, "Policymaking Towards Green Mobility in India," ORF Occasional Paper No. 277, October 2020, Observer Research Foundation.

Source:

- 1 <http://mohua.gov.in/cms/urban-growth.php>
- 2 <https://www.itdp.in/10-ways-you-can-make-india-a-cycling-nation/>
- 3 <http://mohua.gov.in/cms/amrut.php>
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SUSTAINABLE URBAN MOBILITY MEASURES

Sustainable transport is a major concern in connection with urban development worldwide. It emphasizes the importance of social and environmental dimensions of transport. Transport solutions should inculcate a holistic perspective with minimal impairment to the environment. Growth must be permitted without endangering the health of the ecosystem. The urban transport system should be developed keeping in mind its sustainability. It requires the provision of a diverse, integrated and balanced public transportation services. It also requires the provision of a public transit system that provides good connections with the major activity areas and by ensuring efficient use of scarce resources. This could only be achieved by endorsing fuel efficient green vehicles, carpooling etc. People using less personalized vehicles and opting for sustainable public transport will lower the level of traffic congestion and demand for new road ways. This chapter dictates few measures that could bring sustainability in the transport system globally.

1. Electric Vehicles and Fuel Cell Vehicles

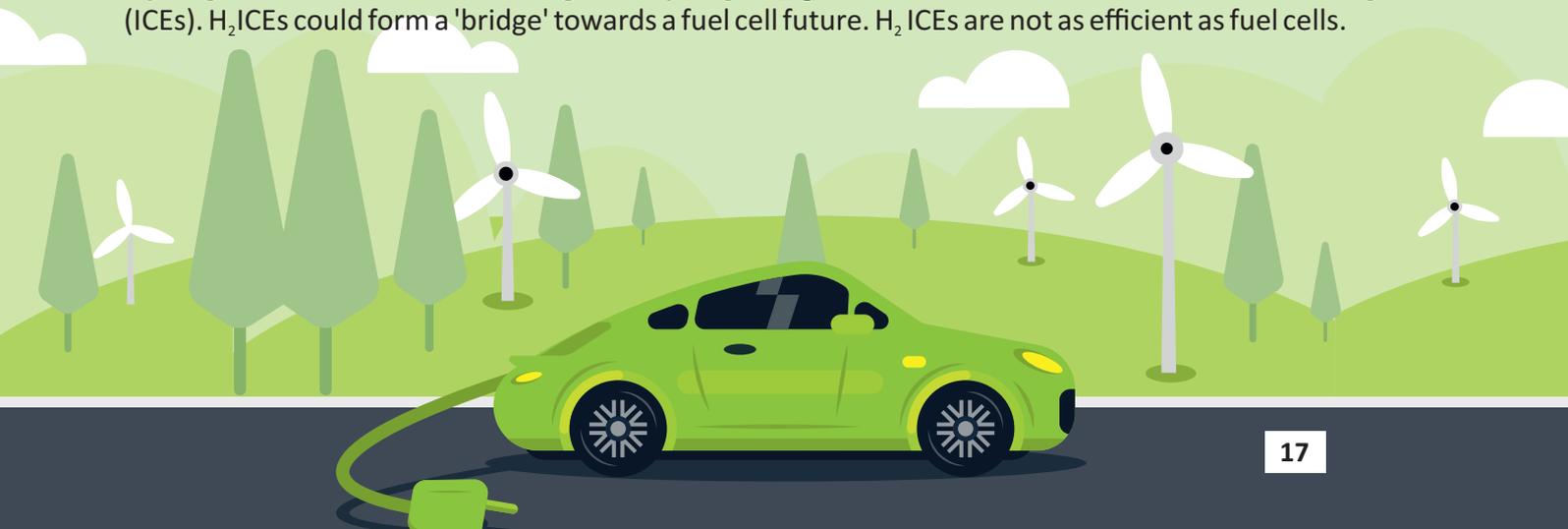
E-Vehicles do not emit climate-damaging greenhouse gases or health-harming nitrogen oxide and is very easy to operate. These vehicles seem to have more advantages over cars that run on petrol or diesel. There are two basic types of EVs: all-electric vehicles (AEVs) and plug-in hybrid electric vehicles (PHEVs). AEVs include Battery Electric Vehicles (BEVs) and Fuel Cell Electric Vehicles (FCEVs). The number of EV's on the streets has increased across the globe.

- PHEV (plug-in hybrid electric vehicles): It can either run on electricity or Petrol/Diesel. To recharge the vehicle, it can be plugged in to an electrical outlet.
- BEV (Battery Electric Vehicle): It relies exclusively on the electricity from the power grid.
- FCEV (Fuel Cell Electric Vehicle): Powered by fuel cell which generates energy from a chemical reaction between on-board stored hydrogen and oxygen.

Electric vehicles offer a huge range of benefits, especially when compared to conventional internal combustion engine (ICE) vehicles. Some of the benefits include: Lower operating costs, Higher efficiency, Lower maintenance costs, Greenhouse gas emission reduction, Air quality improvements, Reduction of traffic noise, Employment benefits through the use of domestically produced electricity, Feels like any other car to drive, Less vibration while driving.

Fuel Cell Vehicles: Fuel cells run on hydrogen (H_2) and produce electricity. Major research programmes are underway to commercialise fuel cells. The only emission from a fuel cell is water. Fuel cell stacks can provide any desired voltage. There are several options for storing H_2 onboard vehicles. A liquid fuel containing H_2 would be easier to distribute but would require additional reformers onboard vehicles. Refueling with pure H_2 would be the environmentally preferable option. Fuel cells powered by renewably produced H_2 promise CO_2 -free energy. These are currently at demonstration stage.

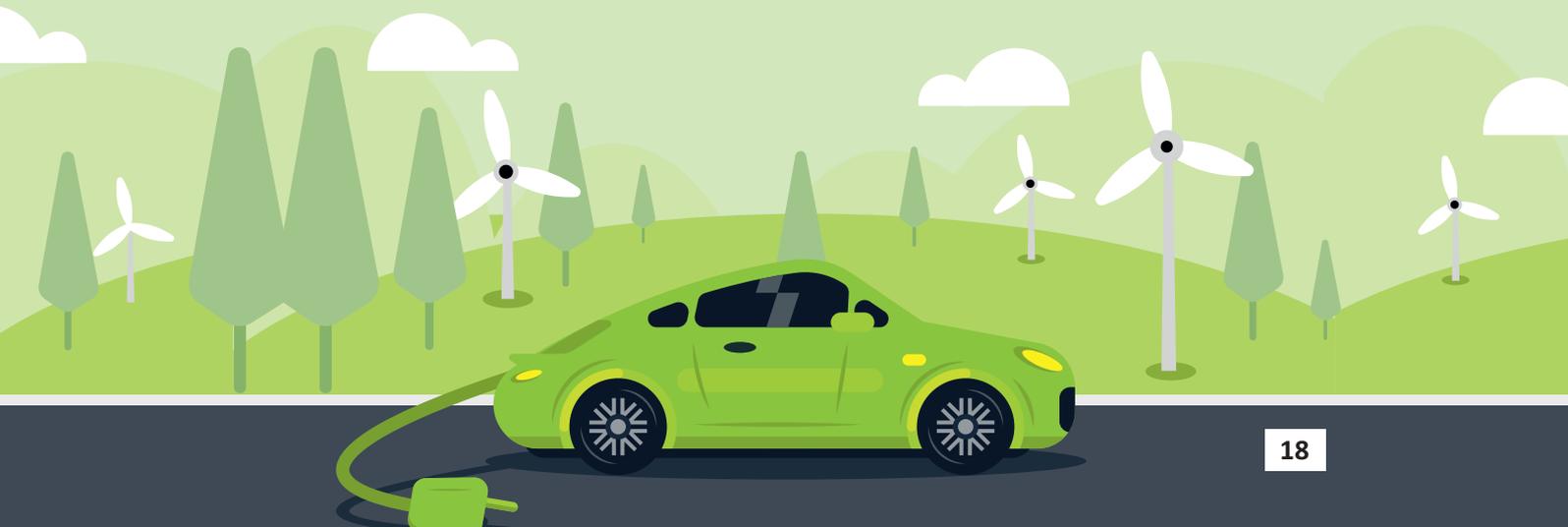
Hydrogen Internal Combustion Engines: Hydrogen (H_2) can be used to fuel internal combustion engines (ICEs). H_2 ICEs could form a 'bridge' towards a fuel cell future. H_2 ICEs are not as efficient as fuel cells.



2. Cleaner Vehicles

Clean-fuel vehicles are motor vehicles designed to be propelled by one of these fuels: biodiesel, hydrogen, electricity (e.g. plug-in technology including hybrid and all battery), ethanol, liquefied natural gas (LNG), liquefied petroleum gas (e.g. LPG or propane), and natural gas (e.g. compressed natural gas or CNG).

- a) **LPG:** It is a mixture of propane and butane. LPG vehicles are similar to petrol vehicles but have different fuel systems. LPG tanks are usually cylinder or 'donut' shaped. Most petrol vehicles can be converted to LPG but not diesels. A good LPG vehicle usually has a small emissions advantage over its petrol equivalent.
- b) **Natural Gas:** Natural gas is predominantly methane and is extracted from vast underground chambers. Natural gas vehicles (NGVs) are similar to petrol vehicles but with different fuel delivery mechanisms. Fuel is stored on board as compressed natural gas (CNG) or liquefied natural gas (LNG). Dedicated NGVs are optimized to run on natural gas (NG), leading to lower emissions. There are nearly 4 million NGVs in use worldwide.
- c) **Biofuels:** Biofuels can be produced from organic matter, or biomass, such as corn or sugar, vegetable oils or waste feedstock. The use of biofuels have grown over the past decade, driven largely by the introduction of new energy policies in Europe, the USA and Brazil that call for more renewable, lower-carbon fuels for transport. Today biofuels represent around 3% of road transport fuels in use around the world. It can help energy security, reduce greenhouse gas emissions, and offer new markets for agriculture.
- d) **Types of Biofuels:** Today, most biofuels are produced from agricultural crops and are called conventional biofuels. New technologies and processes that produce fuels from waste, inedible crops or forestry products are being developed and these fuels are known as advanced or second-generation biofuels. Advanced biofuels are likely to become the primary form of biofuels in the future as they can improve their sustainability. The main biofuels are biodiesel and bioethanol.
 - **Biodiesel** is made from vegetable oils, fats or greases or from recycled cooking oils (palm oil, sunflower, soybean, rapeseed and castor oil). It is blended with diesel, generally at low levels (up to 7%). Biodiesel from oil seeds costs about twice as much as fossil diesel. Use of 100% biodiesel would reduce "lifecycle" CO₂ emissions by 40-50%, Use of 5% blend reduces CO₂ emissions by around 2- 2.5%. Biodiesel can reduce other tailpipe emissions.
 - **HVO or Hydrotreated Vegetable Oil** differs from biodiesel in the way it is produced and in the quality of the final product. HVO is produced through the hydroprocessing of oils and fats. It can typically be blended with diesel without a blending limit. HVO is also commonly referred to renewable diesel.
 - **Bioethanol** is mainly produced from sugar beet or wheat. Technologies for producing bioethanol from sugar beet and wheat are commercially available Bioethanol can also be made from cellulosic materials, but the technologies are



not yet commercially available Bioethanol can be used as a 5% blend with petrol. A 5% blend can be used in normal engines with no modifications. Bioethanol costs 2-3 times as much as petrol. It reduces “life-cycle” Co₂ emissions by 50-60%. It can reduce other tailpipe emissions.

- e) **Biogas** is predominantly methane and is produced from decomposition of waste materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. Biogas must be upgraded for vehicle use. Using biogas can bring major reductions in greenhouse gas emissions. Till date only a few thousand vehicles worldwide run on biogas.

3. Urban Freight Transport

National and international freight transport in urban areas faces a challenge in terms of both logistical performance and environmental impact. Goods, waste and service trips in urban areas have negative traffic and environmental impacts and take place in space shared with many other actors, including public transport operators, private car users, taxis, cyclists and pedestrians.

4. Access Restrictions

Certain zones or areas in the urban cities are identified as low emission zones or clean air zones. Here, variety of urban vehicle access is regulated. For example, in some areas diesel vehicles are banned for their high SO_x - NO_x index, certain zones have complete restrictions to vehicular entry whereas in some time slots are allotted for entry and exit. Some cities completely ban entry of heavy vehicles during day time while other congested zones allow only pedestrians or cyclists. These access restrictions have proved to be successful in reducing the jamming, noise pollution, air pollution and thus improving the public health and environment in overall.

5. Road Space Reallocation

It involves shifting road space currently devoted to automobile traffic or parking to serve other modes, such as sidewalks, bike lanes, High Occupancy Vehicle (HOV) and bus lanes, or rail lines. Road Space Reallocation is particularly appropriate on congested roadways. A vehicle's road space requirements increase with its size and speed. Many congested urban arterials have on-street parking lanes. In such situations, Road Space Re-allocation involves trade-offs between convenient automobile parking and improved mobility by alternative modes. Re-allocating this road space to transit, HOV or cycling lanes, or increased sidewalk space can help achieve equity and efficiency objectives by improving mobility options for non-drivers and encouraging travelers to shift from automobile to more space-efficient modes such as transit, ridesharing, cycling and walking, particularly since automobile parking can be provided off-street or on nearby streets.



6. Environmental Zones

An environmental zone is an area in which the only vehicles permitted to be driven are those that meet certain emission standards and which are identified as such by a special colour-coded sticker. Vehicles that do not meet these standards are not permitted inside the zone.

7. Congestion Charging

Congestion Charging is a system of surcharging drivers of operating vehicles at highly congested times and locations to reduce travel times, improve air quality and decrease greenhouse gas emissions.

8. Parking Policy

Parking spaces can take up a lot of open spaces and thus create a habitat or biodiversity loss. And it can also emit green house gases and pollutants while parking. Parking restrictions, parking permits, paid parking, parking subsidy etc helps in development of environment friendly and efficient parking.

9. E-ticketing

E-ticketing is more environment friendly than the traditional paper ticketing method. It emits less carbon, easy to carry, has wider reach in e-commerce and advertisement.

10. Using new models of vehicles and Inclusive urban design

With the advancement in technology, more environment friendly and sustainable automobiles are produced. All the urban transport policies and strategies should be designed keeping in mind the sustainability factor, and should be inclusive considering the habitat fragmentation, noise pollution and air pollution.

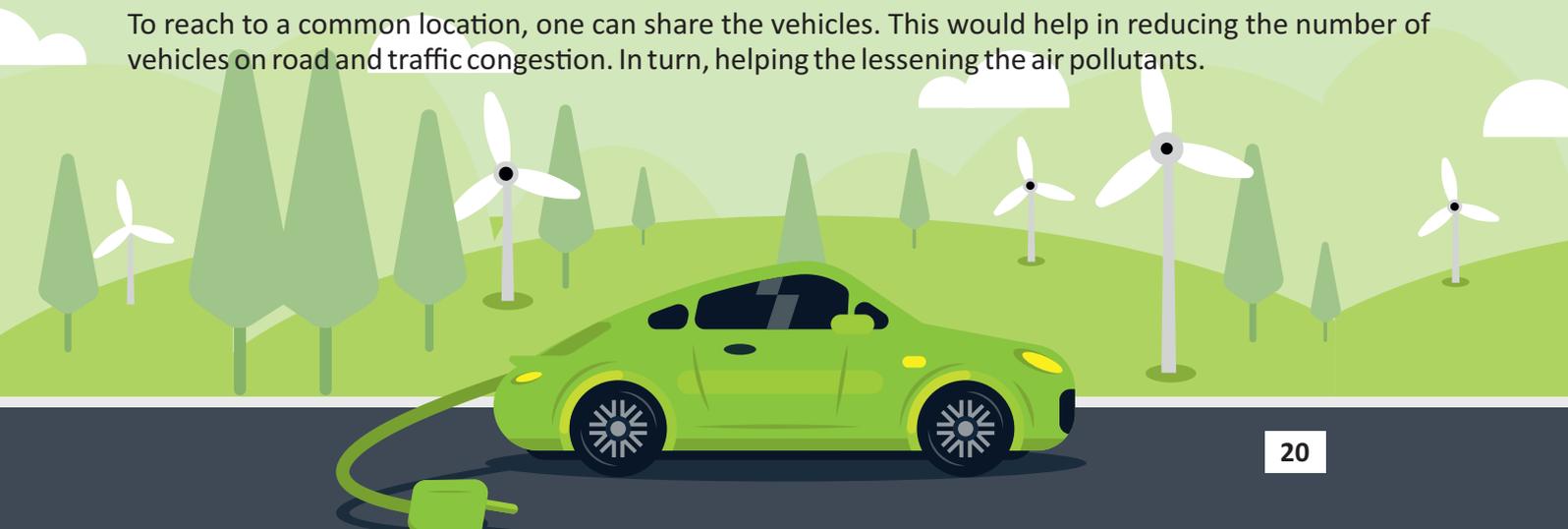


11. Walking/Cycling

Lanes for pedestrians and cyclists. It would promote a healthier life and environment

12. Bike Sharing / Carpooling

To reach to a common location, one can share the vehicles. This would help in reducing the number of vehicles on road and traffic congestion. In turn, helping the lessening the air pollutants.



13. Metro

Metro is a low carbon and sustainable urban transport solution. Metro system offers comfortable, punctual and eco-friendly services.

The adoption of the United Nations 2030 Development Agenda with the 17 Sustainable Development Goals (SDG's) in 2015 has provided a new momentum to address the sustainability of transport systems and urban areas across the world. The New Urban Agenda that was adopted at the Habitat III summit in 2016 also emphasized the urgent need to tackle transport as part of wider urban development challenges (United Nations 2016). In October 2016, the United Nations Secretary Generals' High-Level Advisory Group (HLAG) on Sustainable Transportation submitted its report 'Mobilizing Sustainable Transport for Development' calling for sustainable urban mobility plans that support intermodal and interconnected transport, and comprehensive monitoring and evaluation methodologies for sustainable transport by national and local governments (UN-HLAG 2016). In India, the Government of India's Smart Cities Mission, the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), and the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) are working to address the challenge of improving urban spaces for sustainable transport. Comprehensive Mobility Plan (CMP) is envisaged for a long - range transportation package designed to improve the city and its region, environment, land city and its region, environment, land -use, and economic use, and economic development. The CMP will follow the National Urban Transport Policy (NUTP), which emphasizes the importance of pedestrian facilities, non-motorized transport measures, and public transport systems, including buses and sustainable mass rapid transit systems.

Source:

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- 2 <https://sti-india-uttoolkit.adb.org/mod1/se1/004.html>
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CASE STUDIES

1. China

Buses are the significant mode of public transport around the world. According to a study, 1,000 electric buses can displace 500 barrels of diesel demand each day. Additionally, as per a new report by Bloomberg New Energy Finance, China electric-bus revolution may reduce oil demand in future, with 6.4 million barrels a day displaced by electric vehicles by 2040. China is the largest manufacturer and consumer of e-buses in the world. The Chinese government has initiated numerous policies to promote electric vehicles, with an aim to minimize exhaust emissions. For instance, in China, the Ministry of Transport (MOT) provides subsidies and tax benefits to electric automobile manufacturers for the development of low-emission bus fleet. Shenzhen a Chinese city, which is home to 12 million people, has 16,000 Electric Buses and 22,000 Electric Taxis. According to Bloomberg New Energy Finance, at the end of 2017 there were 3 million city buses in operation worldwide; of these 385,000 belong to the category of electric bus.



2. Europe

The new rules adopted by the European Union in February 2019 require that a quarter of new buses purchased by public authorities be “clean” by 2025. Ratio which will rise to one third from 2030. At the same time, 40 cities (including Paris, Berlin, London, Copenhagen, Barcelona, Rome and Rotterdam) have signed the C40 Declaration for fossil-free streets, in order to achieve zero-emission bus fleets by 2025. Growth over the past year has been staggering, increasing the electric bus fleets from 1,289 buses (2018) to 2,561 buses (2019), equivalent to a doubling of the fleet and more than 2% of the total bus fleet (source: European Alternative Fuels Observatory (EAFO) In 2019, 12% of city bus orders were for electric to reach 40% by 2025. The city of Paris tested (with IES Synergy) its first power line (line 341) in 2017, and with its 2025 Climate Plan, aims to have 100% “carbon-free” public transport by 2025 with the replacement of its 4,700 buses. Today, this fleet of 4,700 buses is broken down as follows: 3,527 thermal buses, 950 hybrid buses, 83 ebuses and 140 bioNGV buses. The objective being, by 2025 to have a fleet with 2/3 electric buses and 1/3 biogas buses.



3. United States

In US, There are about 650 e-buses on U.S. roads today, but that's more than double the 300 that the clean energy research group BloombergNEF counted last year. And under current pledges by states, cities and urban transit agencies, at least a third of the nation's nearly 70,000 public transit buses will be all-electric by 2045, according to a report from the U.S. Public Interest Research Group (U.S. PIRG). American cities are acquiring fleets of electric buses. California has adopted a new rule, i.e the Innovative Clean Transit Rule which would be followed by other states. From 2023, 25% of new buses purchased must be "zero emission". California's goal is to convert its 12,000 city buses to 100% electric by 2040. Goal boosted with the arrival of the 2028 Olympic and Paralympic Games in Los Angeles.



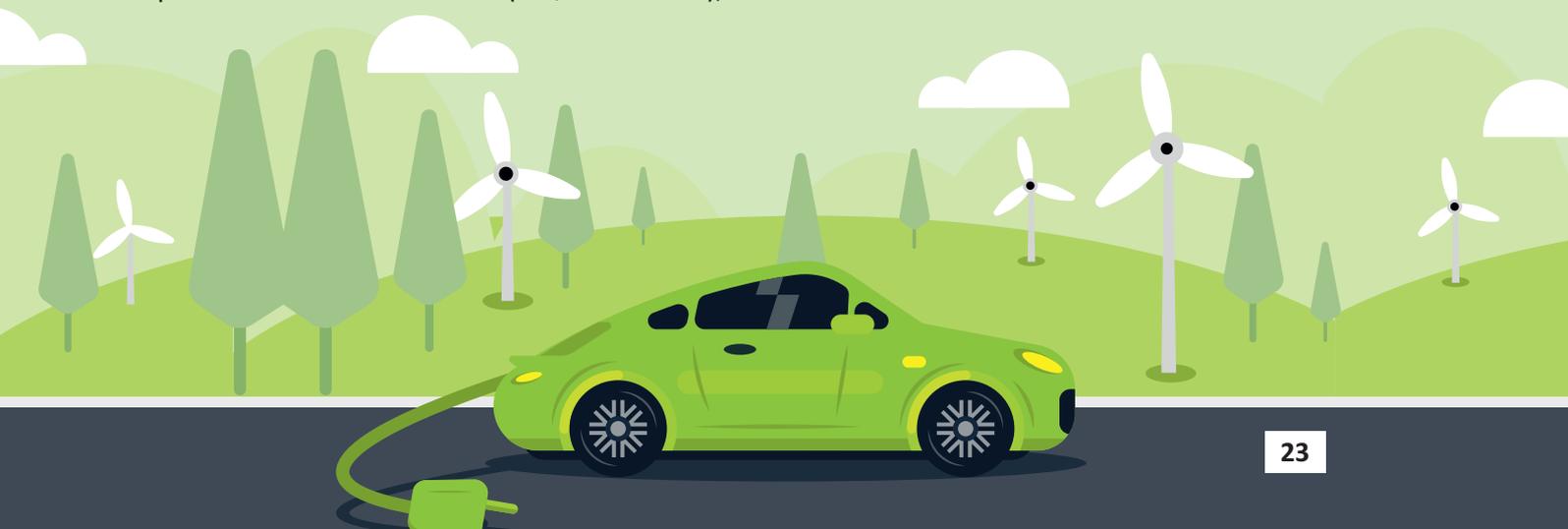
4. India

With an aim to promote eco-friendly vehicles, the government had launched the FAME India scheme (Faster Adoption and Manufacturing of (Strong) Hybrid and Electric Vehicles in India) in 2015 which has gained momentum and an increased interest from global investors.



The second phase of FAME India Scheme focuses on supporting electrification of public and shared transportation and aims to support through subsidies electric vehicles, including buses, passenger cars and two-wheelers. Phase-II of FAME India Scheme is being implemented from April 1, 2019 for three years. This phase focuses on supporting electrification of public & shared transportation and aims to support, through subsidies, 7090 e-Buses, 5 lakh e-3 Wheelers, 55000 e-4 Wheeler Passenger Cars and 10 lakh e-2 Wheelers

The central government has allocated 35.45 billion Indian rupees (Rs) (US\$486 million) in incentives to support the adoption of 7,090 e-buses-amounting to a subsidy of Rs 5 million (US\$69,000) per bus. To date, 5,595 e-buses have been sanctioned to 64 cities and STUs. As per an RMI (Rocky Mountain Institute, an independent, non-partisan, non-profit organization of experts across disciplines working to accelerate the clean energy transition and improve lives.) analysis, over their lifetimes, they will run 3 billion kilometers without tailpipe emissions, produce oil import savings of 5.5 million barrels of oil equivalent worth Rs 36 billion (US\$493 million), and avoid 1.2 million tons of carbon dioxide emissions.



5. United Kingdom

As widely known, London is the leader of the transition to electric buses in the UK. 36 electric bus vehicles were delivered in November 2018 by BYD and ADL. According to the plans, by 2037 all buses in London (about 8,000) will be zero-emission. A multimillion pound scheme known as zero-emission-buses regional area (ZEBRA) scheme has been launched by UK's Transport Secretary Grant Shapps to enable local transport authorities to roll out Zero emission buses. The funding will deliver up to 500 zero-emission buses, supporting the government's wider commitment to introduce 4,000 zero-emission buses. The funding comes from the wider £3 billion fund announced by the government to improve bus



6. Japan

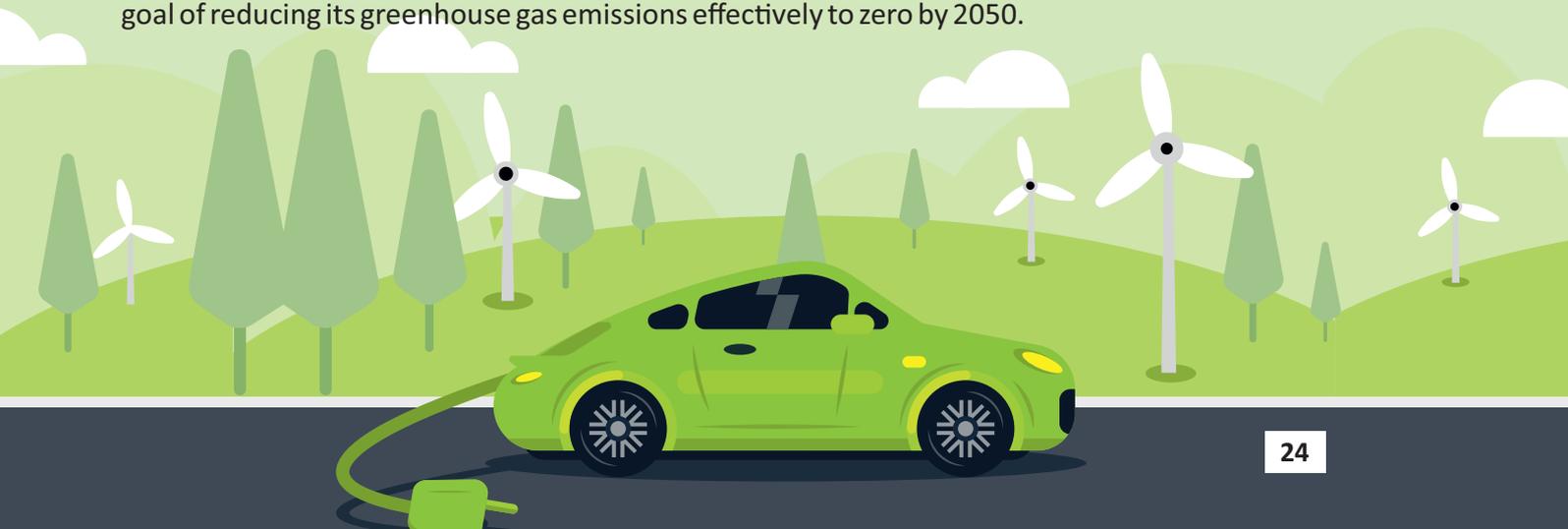
Japan was one of the early nations to commit to carbon reductions for climate policy; electrification of vehicles has been one of its strategies. Japan's economy ministry is targeting "100% electrification" over approximately 15 years, a move that would gradually bump gasoline-engine cars out of the new car market.



All new vehicles sold in Japan by the mid-2030s will be hybrid or electric as the government begins to unveil concrete steps for reaching its goal of becoming carbon neutral by 2050. A new vehicle market consisting of only hybrid and electric automobiles would be a significant shift, given they only make up about 29% of Japan's 5.2 million new motor vehicle registrations, according to Japan's Automobile Manufacturers Association.

The Japanese government took action by subsidizing equipment and installation expenses for charging stations to support local governments, highway operators, and other stakeholders in further developing the domestic e-mobility infrastructure.

The government plans to double the value of subsidies aimed at promoting electric vehicles, on condition that such vehicles are charged with renewable energy, including solar power. The maximum amount of subsidies given per vehicle will be raised to ¥800,000 from the current ¥400,000. The move reflects the government's resolve to further promote electric vehicles, which do not emit carbon dioxide and Japan's goal of reducing its greenhouse gas emissions effectively to zero by 2050.



7. Germany

As part of both the new 2030 Climate Plan and the 2020 economic stimulus package, the German government has pledged funds and development rights to different areas of its transport system to reach the updated electrification goals.

Ongoing and new initiatives include:

Batteries and infrastructure: As part of the new €130 billion package, €2.5 billion will be spent on battery cell production and the expansion of the charging infrastructure, with Germany aiming to have 1 million charging stations by 2030.



Electrify petrol stations: The German government has announced plans that will require all gas stations to also offer EV charging in the future. This will mean that fuel stations will now function simultaneously as EV charging stations, helping to increase electric mobility.

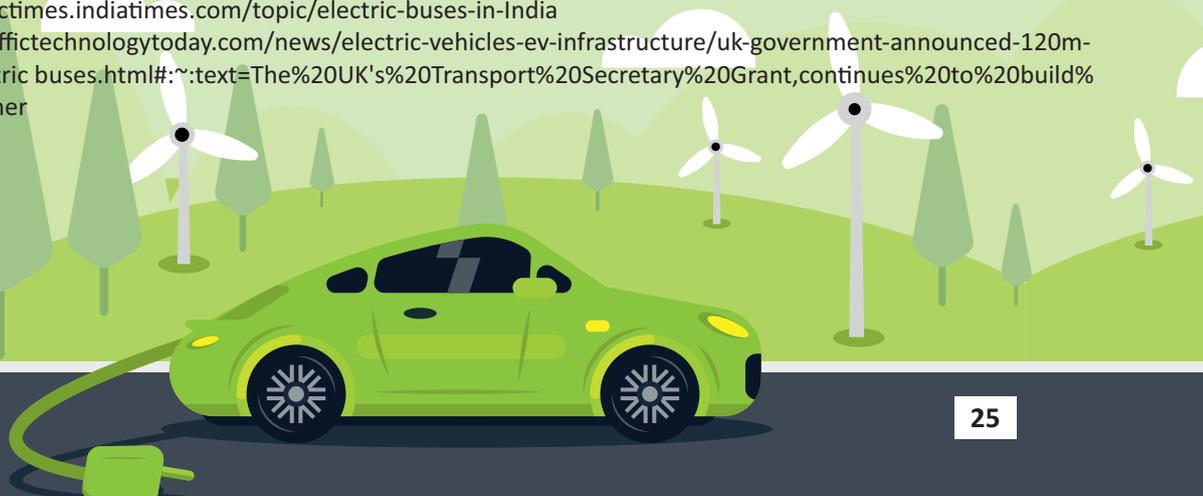
Subsidies for manufacturers: as part of a bonus program for 2020 and 2021, to invest in “new technologies, processes, and plants”.

Fleet exchange programs: as part of the post-COVID-19 economic stimulus package, these are designed to ensure that small and medium-sized enterprises (SMEs) and social services don't cut back on the renewal of their fleets during the financial uncertainty of the corona and post-corona economy. The first program is Sozial & Mobil, which will promote electric mobility in urban traffic and support non-profit organizations with an allocated fund of €200 million in 2020 and 2021. The second program is designed for tradespeople and SMEs that use EVs of up to 7.5 tonnes.

Bus and truck funds: for a limited period until the end of 2021, funding for electric buses, trucks and their charging infrastructure will be increased. Private and municipal operators will receive €1.2 billion to switch to alternative drive systems, as an incentive to make urban transport switch to electric.

Source:

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Consumer Education and Research Centre

Consumer Education and Research Centre (CERC), set up in 1978, is a non-political, non-profit and non-government organisation dedicated to the education and empowerment of consumers as well as promotion and protection of consumer interests through effective uses of education, research, the media and law. CERC has three major roles-to make consumer aware of their rights, to help them protect themselves and to make providers of goods & services accountable. Its activities include, besides comparative testing of products, complaints handling, legal advice and litigation, consumer education and awareness programmes, library and information service, publication, advocacy, investor and environment protection.

CERC-ENVIS Resource Partner

Ministry of Environment, Forest & Climate Change, Government of India has recognized Consumer Education and Research Centre (CERC) as ENVIS (Environmental Information System) centre in 2005. The focus is to provide environmental information to decision makers, policy planners, scientists and engineers, research workers, etc. across the country. ENVIS was conceived as a distributed information network with the subject-specific centres to carry out the mandates and to provide the relevant and timely information to all concerned.

Subject assigned to the CERC-ENVIS Centre is 'Environment Literacy – Eco-Labeling & Eco-friendly products'. The centre launched the website <http://cercenvis.nic.in/index.html> on NIC (National Informatics Centre) platform with the theme of 'Environment Literacy – Eco-Labeling & Eco-friendly products'. The website furnishes the information on national and international scenario on this subject.

It publishes theme based quarterly newsletter named 'Green Insights'. It also circulates bi-monthly e-bulletin 'Green Alert'. Since social media is very popular among youth and to sensitise them towards eco products, ENVIS Resource Partner has a page on Facebook, official account on Twitter and YouTube.



Consumer Education & Research Centre

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