Provide Low-Carbon Solutions for the Rural (Non-Urban) Populations

For

Low Carbon & Sustainable Mobility in India
(Decarbonisation of Indian Transport Sector)

Lead

FICCI

Knowledge Partners

IPPMG

WWF

SHAKTI SUSTAINABLE ENERGY FOUNDATION



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PREFACE

To move down the path of reduced emissions from the Indian transport sector and provide direction to low carbon and sustainable mobility for India, FICCI embarked on the initiative for Developing an **India Roadmap** for Low Carbon and Sustainable Mobility with thrust on decarbonisation of the Indian transport sector. FICCI is supported in this initiative by knowledge partners, WWF-India, Paris Process on Mobility and Climate (PPMC) and Shakti Sustainable Energy Foundation (SSEF). The India Roadmap has eight distinct components outlined below.

1. Urban transformation for healthier, inclusive lifestyles and efficient, resilient, prosperous cities
2. Low-carbon energy supply strategy
3. Improve intermodal and mode-wise system efficiencies
4. Optimise supply chains to manage freight transport emissions
5. Avoid vehicle kilometres for commuting, shopping and accessing services
6. Provide low-carbon solutions for the rural (non-urban) populations
7. Accelerate action on adaptation in the transport sector
8. Large scale deployment of economic instruments and leveraging finance

Each of these components is covered in detail under individual reports, available separately as Theme Reports. The India Roadmap provides summaries of each component and actionable recommendations for short-term (2020-22), medium-term (2022-30) and long-term (2030-50). For detailed narrative of each component, the reader may refer to the individual theme reports of the respective component. For getting an overview of all components, the India Roadmap provides the complete context for low carbon and sustainable mobility for India.

This report covers the sixth component on "Provide Low-Carbon Solutions for the Rural (Non-Urban) Populations".

The work on the India Roadmap has been guided by the FICCI Core Group on Sustainable Mobility consisting of eight working groups, each of which has worked on the eight components. The components are based on the Global Macro-Roadmap developed by PPMC. This methodological approach developed by PPMC is at the heart of the India Roadmap, with components of the India Roadmap being customised to Indian context and circumstances.

INTRODUCTION

As per the statistics of the 2011 Census of India, the rural population in India stands at 833 million, constituting almost 68% of the total population, while the rural economy and constituted 46% of the national income. As India develops rapidly, rural India continues to lag behind, grappling with issues such as declining agricultural incomes, lack of health and education facilities as well as an overall improvement in the quality of life. Despite the rise of urbanisation, more than half of India's population is projected to be rural until 2050. Mobility access comes as a ray of hope in this scenario. With mobility access, rural areas have the potential to prosper and this will also impact urban areas due to the decreasing pressure of rural-urban migration. Rural mobility can also drive the all-important transition in the composition of output and occupation from agriculture to more productive non-farm. This change can ultimately impact the economic fabric of the country and bring about transformation in the rural and total economy.

This report aims to provide insights on the need for rural mobility and access to rural areas to be in line with a number of Sustainable Development Goals (SDGs), discuss the challenges to be addressed on providing sustainable mobility solutions for rural populations in India. It gives thrust to suggesting ways to build and strengthen rural infrastructure, creating local employment through building sustainable business solutions (such as low-cost biofuel distilleries and battery recycling units) while also deliberating upon the policy, regulations and incentives required. Avenues for funding in rural areas in India have also been considered.

CHAPTER 1

HEART OF THE PROBLEM

Inside every problem lies an opportunity.

1. Rural Mobility

As per the Centre for Monitoring Indian Economy (CMIE) survey 2019, there has been an increase of 8.4 million low skilled jobs in agriculture, mainly in poultry, animal husbandry and crop cultivation. On the other hand, there has been a fall in jobs in the IT (information technology), manufacturing and financial sector (Annexure 1). There are slated to be more opportunities in the development and promotion of advanced biofuels , horticulture and animal husbandry for women, which will lead to their empowerment. Hence for rural India, flexible, quick, efficient and predictable mobility will serve as a strong enabler for economic development and social transformation.

So, it is important to know rural mobility and how it is defined. As per the National Sample Survey Organisation (NSSO), a rural area is defined as:

- An area with a population density of up to 400 per square kilometre
- Villages with clear surveyed boundaries but no municipal board
- A minimum of 75% of male working population involved in agriculture and allied activities

Rural mobility entails movement of people and goods across rural areas, as well as between rural area and the nearby town/s or urban area. The mobility should be provided for all people, affordable and equitable, supporting economic development and human well-being, and should have the qualities of reliability, resource-efficiency, sustainability, and resilience.

Rural mobility can also be a vehicle for women who miss out on many opportunities due to the lack of mobility.

As per the Census of 2011, 55% of rural women do not travel at all-while 30% moved on foot, 7% by bus, and less than 5% by other means of transport (Annexure 2).

Thus, providing access to rural areas will also be in line with 13 out of the 17 Sustainable Development Goals (SDGs), specifically SDGs 1 to 13, as follows:

SDG 1: No Poverty: Rural mobility will provide economic opportunities to people for moving out of poverty by giving access to the markets.

SDG 2: Zero Hunger: Mobility access will increase food security.

SDG 3: **Good Health and Well-being:** Better opportunities for livelihood improvement will also improve the nutritional status of rural people including women and children. There will be faster access to health facilities. This will facilitate aid workers, NGOs (non-governmental organisations), and Governments' reach to erstwhile difficult to reach areas.

SDG 4: **Quality Education:** Access to educational institutes and student enrolment will increase with a decrease in commuting time for both students and teachers.

SDG 5: **Gender Equality:** Mobility will save time for women who need cooking fuel, water, and need to go on market trips. Women will also be able to cover further distances safely for job and education.

SDG 6: **Clean Water & Sanitation:** Mobility solutions for rural areas will reduce the efforts in fetching clean water. The material and labour for sanitation efforts will reach many more areas with mobility.

SDG7: **Affordable and Clean Energy:** Shifting to cleaner fuels like biofuels/bio-CNG (compressed natural gas) and drop-in fuels, and electric-based mobility will reduce the demand for conventional fuels. The aggregated demand will make clean energy more affordable.

SDG 8: **Decent Work and Economic Growth:** Better job opportunities can be created in the rural areas by setting up food processing units, farm waste utilisation for production of biofuel/energy, etc. The development and operation of mobility services will itself provide employment. The prosperity in rural India will reflect in the overall economic growth.

SDG 9: **Industry, Innovation and Infrastructure:** Opportunity for local production, a better supply chain for rural produce, development of low impact infrastructure.

SDG 10: **Reduced Inequalities:** Affordable mobility brings opportunities for more people, thus bringing equality.

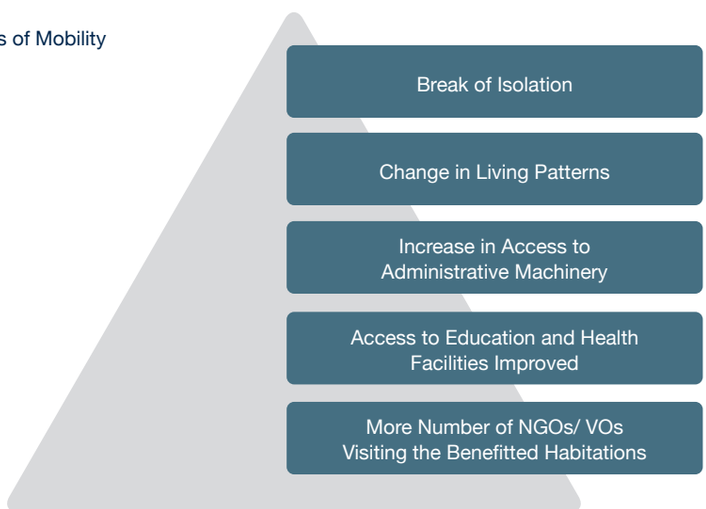
SDG 11: **Sustainable Cities and Communities:** The quality of life for communities in rural areas will improve, with reduced pressure on cities.

SDG 12: **Responsible Consumption and Production:** Sustainable low carbon transport for rural areas will replace their potential shift to conventional transport solutions.

SDG13: **Climate Action:** Sustainable mobility will result in reduced emissions, methane mitigation, and climate change resilient infrastructure development.

With mobility access, rural areas will prosper and this will also impact urban areas due to the decreasing pressure of rural-urban migration. The transition in the composition of output and occupation from agriculture to more productive non-farm sectors is considered as an important source of economic growth and transformation in the rural and total economy. Rural mobility access will also serve this transformation.

Figure 1
Other Favourable Outcomes of Mobility



Source: PMGSY Progress Document

2. Scenario Today

Transport demand by multiple modes: The first challenge of providing sustainable mobility for rural areas is the lack of demand data.

Due to the large geographical spread of these areas, demand data is not readily available, and one has to rely on secondary data and guesswork for demand determination.

To understand this better, it is important to deep dive into the rural scenario. In rural India, majority of the population comprises farmers. The distance from their homes to the fields is about two to three kilometres, which is covered by walking. Their transport demand is for intra-village trips, inter-village trips to nearby villages and long trips to nearby cities/transport hubs. Bicycles and cattle-drawn carts have been the primary mode of transport for inter-village transport, which are being replaced with motorised vehicles like motorcycles, improvised vehicles (Jugad), cars (Jeeps) and tractor trolley, as the income of the overall village or some inhabitants rise, as well as an increased ease of availability of fuels. Mofussil[1] buses are also being used for a short-term travel in and around the villages. The transport is highly unorganised with relatively prosperous inhabitants sharing their vehicles to provide mobility services to other inhabitants.

A vicious circle of insufficient transport, users, and services impedes development. The goods transport demand was originally for grains, vegetables, crops, hay, cattle feed and other essential commodities. With time, building materials and farm machinery are also increasing the goods travel demand. Patterns of transport demand and supply are often linked to population density and income levels in three broad categories.

- The first is low transport density in low-income areas,[2] with few motorised vehicles or intermediate means of transport.
- The second category has higher transport density in low-to-medium income areas, and is associated with medium-to-high population density, irrigated agriculture, cash crops, efficient marketing systems, and non-agricultural employment.
- The third category has low-to-medium transport density in high-income rural areas.

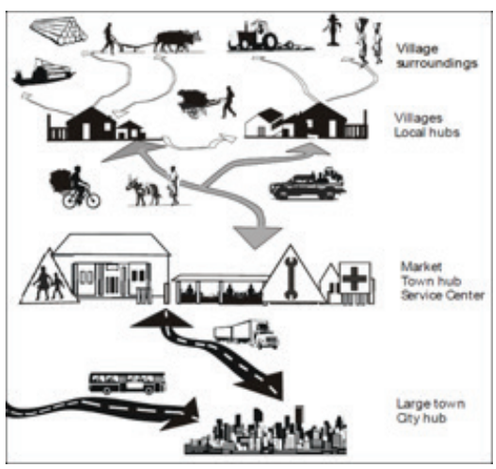
ALONG THE ROAD



Contrary to the common perception about the predominance of agriculture in the rural economy, about two-third of rural income is now generated in non-agricultural activities. Similarly, it's amazing to find that more than half of the value-added in the manufacturing sector in India is contributed by rural areas. However, the impressive growth of the non-agricultural sector in rural India has not brought significant employment gains or reduction in disparity in worker productivity. This underlines the need for a new approach to direct the transition of the rural economy.

Source: Ramesh Chand, S.K. Srivastava and Jaspal Singh (2017). "Changing Structure of Rural Economy of India: Implications for Employment and Growth", Discussion Paper, November. New Delhi: NITI Aayog, https://niti.gov.in/writereaddata/files/document_publication/Rural_Economy_DP_final.pdf

Figure 2
Rural Transport System



Source: Starkey, Paul, Simon Ellis, John Hine and Anna Ternell (2002). "Improving Rural Mobility: Options for Developing Motorized and Nonmotorized Transport in Rural Areas", World Bank Technical Paper. August. https://doi.org/10.1596/0-8213-5185-0

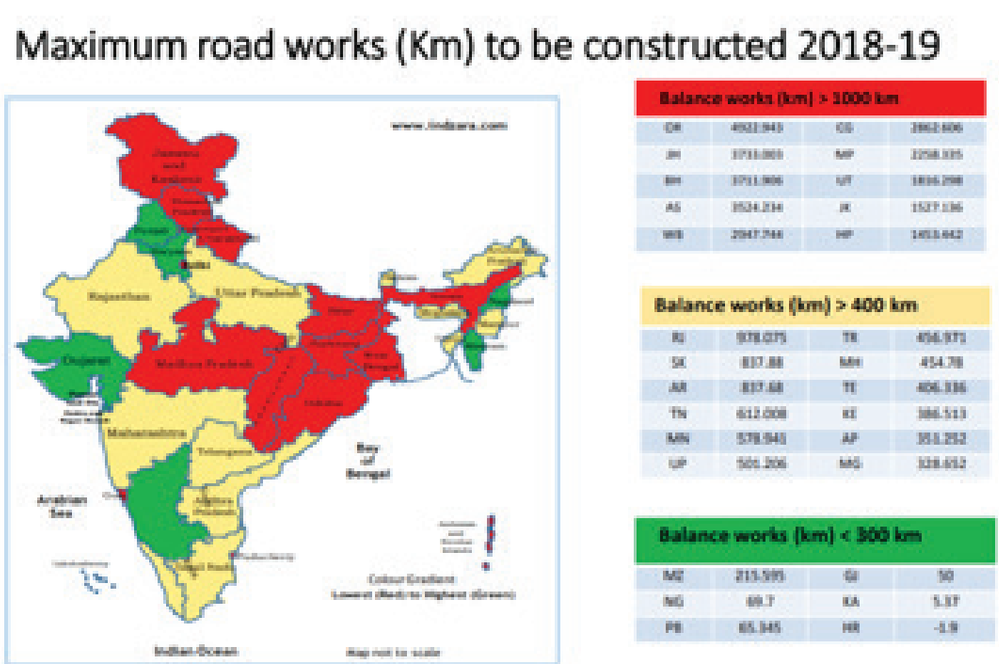
[1] Derived from the urdu word mofassil, which is used to refer to a region lying outside an urban centre.
[2] Starkey, Paul, Simon Ellis, John Hine and Anna Ternell (2002). "Improving Rural Mobility: Options for Developing Motorized and Nonmotorized Transport in Rural Areas", World Bank Technical Paper. August. https://doi.org/10.1596/0-8213-5185-0

Figure 3
Biomethane Bus Launched by TATA Motors



- **Transport networks available:** Transport networks vary from village to village and geographically. Additionally, there are various issues with present modes of transport—for people, goods, such as availability, affordability, safety, lack of opportunity.
- **Pollution by modes:** Furthermore, emissions contributed by rural transport can be estimated once the present demand is deduced.

Figure 5
PMGSY Progress Document January 2019



ALONG *THE ROAD*



It is often felt that unplanned rural to urban migration, particularly in search of better economic opportunities, is putting severe pressure on urban amenities and forcing a large number of low wage migrants from rural areas to live in unhygienic and deprived conditions. Thus, to check unplanned migration from rural to urban areas and to improve the socio-economic conditions of the vast majority of the population in the country, there is a need to make the rural economy stronger and create employment opportunities in rural economic activities. The improvement in economic conditions of rural households is also essential for reducing the disparity in the per capita rural and urban income, which has remained persistently high.

Source: Ramesh Chand, S.K. Srivastava and Jaspal Singh (2017). "Changing Structure of Rural Economy of India: Implications for Employment and Growth", Discussion writereaddata/files/document_publication/Rural_Economy_DP_final.pdf

3. Business-as-Usual (BAU) Scenario by 2030/2050

In rural mobility, the BAU scenario projection throws up some interesting possibilities. For instance, what will the transport demand by multiple modes be like? What can be the percentage of rural roads with power lines running alongside?

It is also worth considering the minimum road width of rural roads – in plains and hilly areas as per manuals. It is important to evaluate the geographical cover of roads (all-weather) by 2022 and the percentage of rural population covered in this. There is a need to assess & project travel demands, and validate it with Research road & rail coverage. Infrastructure for goods & people also needs to be defined based on these transport networks available. Allied issues like waste management are also critical.

4. Implication for Rural India

There are many factors that will determine the impact of rural mobility on India. Here's a quick glance:

- Health
- Economic development
- Alternate livelihood
- Quality of life & overall well-being
- Relation with urban development
- GDP (gross domestic product) impact for India
- Development of advance biofuels/biohydrogen, drop in fuels
- Enhancing farm production for catalysing growth in food processing
- Last-mile connectivity

CHAPTER 2

IN RESPONSE

As long as a problem inspires a response, there is hope.

1. Summary of Schemes: A slew of policies has been released to enable a better response to rural mobility:

Pradhan Mantri Gram Sadak Yojana (PMGSY): The Government launched PMGSY on 25 December 2000 to provide all-weather access to unconnected habitations. A 100% Centrally Sponsored Scheme, 50% of the Cess on High Speed Diesel (HSD) is earmarked for this programme, and PMGSY has been able to provide connectivity to 1,45,047 habitations (90.41% against 1,78,184 eligible habitations).

National Rurban Mission (NRuM): The objective of NRuM is to stimulate local economic development, enhance basic services, and create well planned Rurban clusters.

Sustainable Alternative Towards Affordable Transportation (SATAT): Launched in October 2018 by Ministry of Petroleum & Natural Gas, SATAT aims at providing Sustainable Alternative Towards Affordable Transportation. Under this programme, potential entrepreneurs would set up Compressed Bio-Gas (CBG) production plants and make CBG available in the market for use in automotive fuels. This significant move has the potential to boost the availability of more affordable transport fuels, better use of agricultural residue, cattle dung and municipal solid waste, as well as to provide an additional revenue source to farmers. It is planned to roll out 5,000 CBG plants across India in a phased manner, with 250 plants by the year 2020, 1,000 plants by 2022 and 5,000 plants by 2025. These plants are expected to produce 15 million tonnes of CBG per annum, which is about 40% of current CNG consumption of 44 million tonnes per annum in the country.

2. Synergies with Existing Policies and Plans

a. Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) for providing wage employment.

b. National Rural Livelihoods Mission (NRLM) for self-employment and skill development: Capacity building, Green Jobs, NSDC.

c. Pradhan Mantri Gram Sadak Yojana (PMGSY) for construction of quality roads.

d. Shyama Prasad Mukherjee RURBAN Mission for bridging the rural-urban divide, stimulating local economic development, spreading development in the region, and attracting investment in rural areas.

e. National Biofuel Policy for promotion of the use of biofuels.

f. Doubling Farmers' Income: Agriculture as a value-led enterprise has identified seven major sources of growth, viz., improvement in crop productivity; improvement in livestock productivity; resource use efficiency or savings in the cost of production; increase in the cropping intensity; diversification towards high-value crops; improvement in real prices received by farmers; and shift from farm to non-farm occupations. Enterprises may be promoted for the biomass supply chain.

g. Jal Shakti Abhiyan: Announced by Ministry of Jal Shakti on 1 July 2019, the scheme aims at promoting sustainable farming for water conservation and water security. Advance biofuel may be promoted for micro-irrigation purposes.

h. Increased domestic production of oil and gas: Hon'ble Prime Minister has urged all stakeholders to increase the domestic production of oil and gas to reduce import dependence from 77% to 67% by the year 2022. He had used a certain percentage oil import dependence in the fiscal year 2013-14 (ending 31 March, 2014) as a reference. The Government focusing on biofuels such as first- and second-generation ethanol, biodiesel and bio-CNG as a part of efforts for "import reduction, environmental benefits and increased income to farmers".

i. Pradhan Mantri JI-VAN Yojana: This scheme was launched with the objective of making the 2G ethanol production viable while providing alternate income to farmers by utilising the crop residues. It envisages setting up of 12 Commercial scale Second Generation (2G) Bioethanol projects and 10 demonstration scale 2G Bioethanol projects, based on non-food biomass feedstocks and other renewable feedstocks which will be provided viability gap funding.

j. KUSUM Scheme: Pumpsets are captured in this scheme. Chargers also need to be captured in line to create more stations.

k. Strengthening of Kisan Seva Kendra (KSK) by Oil Marketing Companies (OMCs) as a low-cost retail outlet in rural/agricultural market in order to deliver co-products of Bio-CNG/Advance biofuels at the doorsteps of farmers.

CHAPTER 3

CHALLENGES ALONG THE WAY

Inside every problem lies an opportunity.

The road ahead for rural mobility is almost symbolic of rural roads in reality: rough, uncharted. However, it is also how any path to change is paved, fraught with challenges that must be surmounted. These challenges include a lack of cash flow, a low willingness to pay due to low wages. Additionally, consumer behaviour patterns veer towards choosing inconvenience due to low purchase power.

Lack of access to data means commuter profiling is difficult. Furthermore, demand is not concentrated due to non-availability of transport solutions.
The state of infrastructure (read quality of power supply biomass collection, aggregation, storage and processing in an organised manner) is also challenging. Non-well-researched and validated governance measures can result in local enterprises performing at lesser levels of sustainability, productivity and efficiency.

CHAPTER 4

ROUTES TO CHANGE

The beginning of change is the beginning of the future.

4.1 Methodology

Even as the problem of rural mobility seeks a host of solutions, these solutions always need to come with available and modifiable products. Any other solution is sure to bring in a lot of high-cost imports and additional capital investments.

So it is imperative to work on the solutions that will have cost parity with the solutions slated for 2023-2025, and not solutions that target parity today.

Here is a detailed look at these solutions:

- Sustainability management at a local level: Each mandal and zilla should be made sustainable at its level, although they can be tied up with a bigger city. The focus should be on the promotion of Block/ District level entrepreneurs.
- Panchayati Raj Institutions (PRIs) have to be involved in the roadmap: These institutions constitute the core of decentralised planning and development, and implementation of plans and schemes in rural areas.
- Low carbon solutions and sustainability should not be forced as a mandate: This will result in burdening of the rural population. Mandates perhaps could be on the bigger cities that could ideally hold responsibilities to the respective rural areas in the state.

4.2 Development Needs and Changes Proposed

- Deriving from these core methods, several changes are proposed. To begin with, there is a great need for mobilisation of funds, along with multiple decarbonised options of transport fuels (biofuels, electric vehicles, etc.). The changes can be further categorised as follows:

Infrastructural Changes:

1. **Local generation like Microgrids:** With India moving towards 100% household-electrification as well as 175 GW renewables, proper business model with rooftop solar supplying electricity to charging stations or battery swapping stations will need to be evaluated, and the number of vehicles charged per day to assess the return on investment will also need to be considered. Setting up of bio-CNG with Solar PV (photovoltaics) charging stations for firm charging infrastructure can also be explored.

2. **Strengthening existing grids:** Availability of spare capacity and upgradation of distribution infrastructure will need to be assessed to evaluate the possibility of catering to additional load through existing electrical infrastructure. The government claims that all rural roads will be "all-weather roads" by the end of 2019. In line with this, if e-mobility services are to be built along these roads, then the electrical network will need to be developed for charging stations.

3. **Setting up low-cost biofuel distilleries** run by local enterprises such as production units for advance biofuel/Bio-CNG4.

4. **Setting up/strengthening and increasing the number of low-cost retail outlets:** This will need to be done in rural and agricultural markets with a special focus on KSK to deliver co-products of Bio-CNG/Advance Biofuels at the doorsteps of farmers.

5. **Promoting Polymer Electrolyte Membrane (PEM) Fuel Cells Based on Hydrogen:** This could be extracted from biomethane/biomethanol. As hydrogen storage would require a safe and controlled environment, Biomethane and Biomethanol generated locally can be used to make PEM cells as a source for export income.

CROSSROADS OF CHANGE



TRANSFORMING THE TRANSPORT SECTOR IN THE INDIAN SUNDARBANS



Access to clean, safe, reliable and affordable modes of transportation for last mile connectivity has always been a challenge. This becomes even more challenging in the Sundarbans landscape in India, which is a cluster of low-lying islands in the Bay of Bengal. Sundarbans is home to a very rich floral and faunal diversity, and also a climatically vulnerable region inhabited by over 4.5 million people mostly dependent on highly polluting, unsafe and illegal modes of transport. Recognising the need towards promoting renewable energy-based transport for a cleaner and sustainable future, WWF-India has set up a pilot project on electric mobility for local transport. As part of the project, two electric vehicle solar charging stations have been installed in one of the remotest islands of Sundarbans and four government-approved models of electric vehicles have been introduced to ply on the same. Moreover, rural institutions have been formed to own, manage and operate the charging stations, as well as the electric vehicles. Working in tandem with various government agencies, grassroots level organisations and other stakeholders, the project has set a precedent of successfully carrying out the first of its kind institutional registration of standard and government-approved models of electric vehicles in the Sundarbans. The scale-up potential presents an opportunity of improving livelihoods and promoting environment conservation.

Battery Swapping Facilities: In rural areas, the majority of public transport consists of three-wheelers. As the three-wheelers increased, the number of trips for each three-wheeler will need to be reduced. Therefore, the battery capacity of an electric three-wheeler will need to be enough to last long for a day without getting discharged (considering a fixed trip from point A to point B). This suggests that electric three-wheelers will be mainly charged at night at their respective homes (as is the practice).

Thus, battery swapping will be more viable than charging stations as three-wheelers can take up the charged battery and start their trip, and at the end of the day, can plug it in the battery swapping centre.

If the battery gets discharged during the day, even then it can be swapped with a charged battery.

In areas where three-wheelers carry out long trips, charging stations need to be installed but to have a higher return on investment, the charging station deployment should consider the usage by electric two-wheelers and four-wheelers like Tata Magic, which are used for public transport.

- With regards to Mapping & Profiling of Demand for e-mobility and Bio-CNG/Bio-fuels vehicles within a Block and District level, the important routes need to be mapped on the basis of traffic and landmark locations like the town hall, hospital, main marketplace, etc. Once defined, electrical infrastructure will need to be established at these routes for implementing charging stations.
  With regards to Mapping & Profiling of Demand for e-mobility and Bio-CNG/Bio-fuels vehicles within a Block and District level, the important routes need to be mapped on the basis of traffic and landmark locations like the town hall, hospital, main marketplace, etc. Once defined, electrical infrastructure will need to be established at these routes for implementing charging stations.

- Having a Network of Infrastructure: Doing it not just in a captive form will make a difference.

- New Government policies for setting up of retail outlets by non-oil companies to encourage the availability of alternative fuels like Bio-CNG

- Lowest TCO (total cost of ownership) per passenger

- For unorthodox and small vehicles, robust hand driven vehicle like a wheelbarrow can be designed for transporting goods and materials.

- Establish recycling units in low-cost real estate spaces: This will bring in employment as well as lower the costs for recycling.

- Local employment benefit: Develop skill and increase local employment through maintenance and running of charging/fuelling stations.

- Skilling for capacity building on the development of District/Block level entrepreneur: This will go the distance for collection, aggregation, storage and transportation of biomass.

- Subvention of regulation will also play a key role.

ALONG *THE ROAD*



Rural transport services must be actively promoted to turn the vicious circle of insufficient transport services and inability to pay for them, into a virtuous circle of better transport services that stimulate economic activity and social improvement. This will in turn lead to easier access and more efficient transport services. Governments and NGOs should promote new means of transport in many low-density, lowincome areas, and efforts should consider the needs of disadvantaged groups.

Source: Starkey, Paul, Simon Ellis, John Hine and Anna Ternell (2002). "Improving Rural Mobility: Options for Developing Motorized and Nonmotorized Transport in Rural Areas", World Bank Technical Paper no. WTP 525. Washington, D.C.: The World Bank. http://documents.worldbank.org/curated/en/819101468780344782/Improving-rural-mobility-options-for-developing-motorized-and-nonmotorized-transport-in-rural-areas

Table 1
Access Problems and Means to Address Them

Transport Task	Elements of Accessibility				
	Mobility				Siting and Quality of Facilities
	Rural Transport Infrastructure		Means of Transport		
	Rural Roads	Footpaths & Tracks	IMT	Motorised Transport Service	
Water and Firewood Collection		*	*		**
Crop Production	*	*	**	*	*
Crop Marketing	**		*	**	*
Access to Economic and Social Services	*	*	*	*	**
Non-agriculture Income Generation	*		**	*	

* most important means of addressing an access problem
** complementary means of addressing an access problem

Source: Barwell, Ian (1996). "Transport and the Village: Findings from African Village-level Travel and Transport Surveys and Related Studies", World Bank discussion paper no. WDP 344. Africa region series. Washington, D.C.: The World Bank. http://documents.worldbank.org/curated/en/846361468764127131/Transport-and-the-village-findings-from-African-village-level-travel-and-transport-surveys-and-related-studies

CHAPTER 5

DESTINATION LOW CARBON SOLUTIONS

Optimisation is the way of the future.

ACTIONABLE RECOMMENDATIONS

5.1 Low Carbon Transport Solutions

A significant growing rural population will demand quick solutions. And the key to effective rural transport solutions and all additions in the sector will have to be one - low carbon transport.

Only specific low carbon transport solutions will help in meeting the country's commitments to international goals while developing sustainably.

Furthermore, the use of farm waste for the production of Bio-CNG/CBG in transport will facilitate waste management and reduction in GHG (greenhouse gas) emissions.

Here is a framework for achieving low carbon transport for rural areas.

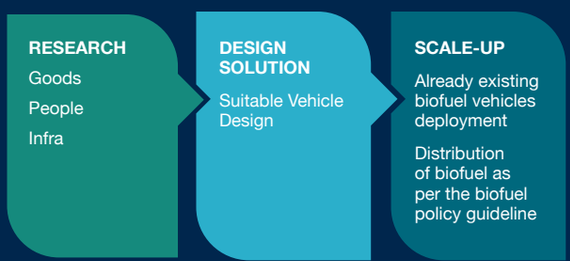
Decarbonising Fossil Fuel: The focus needs to be on developing/evolving passenger and goods vehicles powered by biofuels blending (such as biodiesel, bioethanol and bio-CNG/Drop-in fuels. The four key elements of the biofuels roadmap are:



Production: Biofuel generation will need to be addressed by the National Policy for Biofuels. The potential for CBG (compressed bio-gas) production from various sources in India is estimated at 62 million tonnes per annum. CBG plants are proposed to be set up mainly through independent entrepreneurs. 5,000 CBG plants are planned to be rolled out across India in a phased manner, with 250 plants by the year 2020, 1,000 plants by 2022 and 5,000 plants by 2025. These plants are expected to produce 15 million tonnes of CBG per annum, which is about 40% of current CNG consumption of 44 million tonnes per annum in the country.

Retailing: Channels and mechanisms of biofuels/ bio-CNG dispensing are also mostly covered in the National Policy for Biofuels. A local production model for biofuels/bio-CNG, especially in rural areas, where abundant farm waste and other bio-resources are available, will not only reduce the hassles of unavailability of biofuel but will also empower rural areas to be fuel sufficient and independent. The produced CBG can be transported through cascades of cylinders to the fuel station networks of OMCs (oil marketing companies) for marketing as a green transport fuel alternative. Kisan Seva Kendra (KSK) can be strengthened to participate in the retailing network. Biofuels/bio-CNG generated locally may be used for local consumption and surplus could be a source of revenue for the Block/District level entrepreneur. Biofuel filling should be made for both captive and local filling stations that employ the rural population.

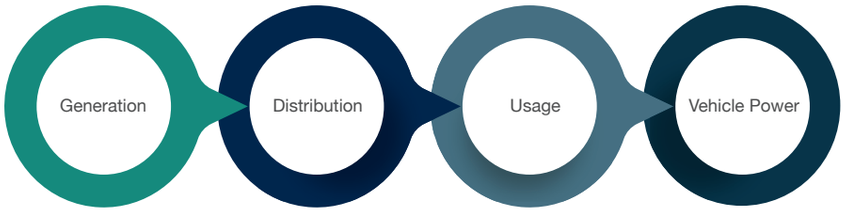
Sustainable Mobility/Energy: Vehicle manufacturers need to manufacture vehicles that cater to the rural mobility demands and will be captured through research and the pilots as proposed. Compliance, design modification will be of prime importance.



The roadmap to change will need to start with research into the demand data for movement of goods and people, and then, moving on to understanding the infrastructure requirement. The analysis of this demand will reflect the proportion that can be served by low carbon transport fuels such as biofuels and biodiesel.

Thereafter, suitable vehicular modifications will need to be made, followed by deployment and scaling-up of the number of vehicles in this segment. Successful pilots of using compressed biogas for transportation will need to be scale-up so as to produce such vehicles in large numbers that can meet the rural mobility demand. Production facilities could be set up in local areas to ensure availability and to create local employment opportunities.

Electric Mobility (vehicles such as e-Buses, e-Ricks, e-Bikes, and the likes): The four key elements of the EV (electric vehicle) roadmap are:

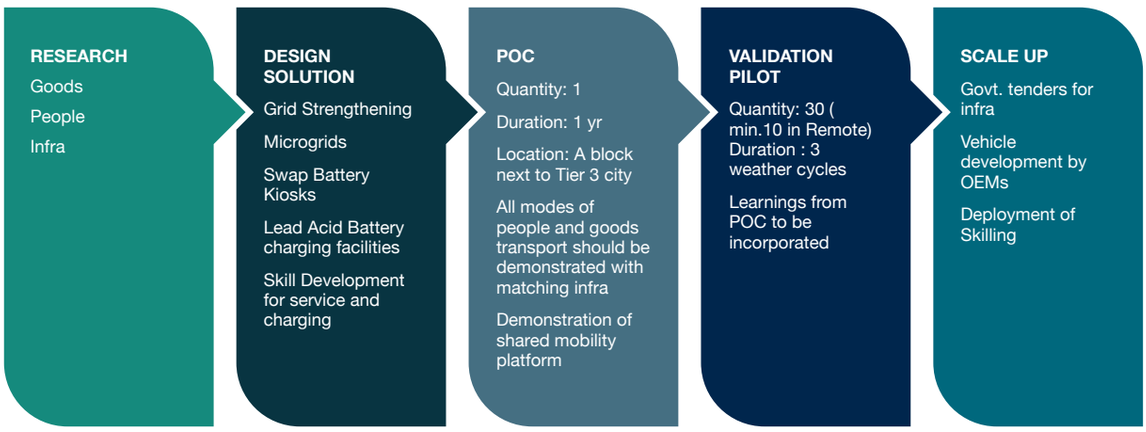


Generation: This factor is important because it assesses the annual quantity of vehicles to be produced to meet the mobility demand. After estimating travel demand, the grid capacity required to support EV charging needs will have to be assessed.

Distribution: This part of the roadmap focusses on the channels and mechanisms of distribution. It proposes the local generation model for power through micro-grids and enables EV adoption in places where the current grid does not reach or support.

Usage: This further addresses the modes of charging. Usage of power will need to be done with effective means, such as captive charging stations that cover a certain geography or battery swapping kiosks.

Vehicle: Vehicle manufacturers will need to manufacture vehicles that cater to rural mobility demands captured through research and the POC (proof of concept) and scale-up pilots as proposed below. Compliance, design modification will be of prime importance in this roadmap.



Introducing electric mobility in rural areas will need to be a stepwise process.

- The roadmap recommends to begin with a research into the data for projecting travel demand for goods and individuals.

- Analyses will need to be made for determining the proportion of that demand that can be served with electric mobility solutions.

- Required actions like strengthening the grid need to be performed along with the development of solutions to basic problems of electric mobility, however, in a rural context.

- The POC, and thereafter the pilot at a relatively larger scale, will be needed to demonstrate the confidence and feasibility of the solutions.

- The final step will be scaling-up by government tenders for infrastructure and industry developing dedicated EV options for rural customers. This will be accompanied by more investment in human capital in the form of skill development for the new ecosystem.

Increased Share of Non-Motorised Transport (NMT) and Shared Mobility: NMT modes are feasible for shorter distances, facilitate decongestion, and the relatively smaller size of facilities at lower cost gives them a higher penetrative value in built environments. In addition, low consumption of energy and resources make them viable options for sustainable transportation. Therefore, sustainable and improved NMT options such as bicycles, peddled rickshaws, cattle driven carts with better and efficient designs need to be developed.

Infrastructure Requirement:

Power: Electrification of core rural areas is not enough. Grid strengthening in rural areas for load from electric mobility pick-up will be required. Factors that will play a crucial role in charging systems are distributed generation from micro-grid to power the charging stations and low-cost charging stations. Battery swap options can be more successful where the large cost of battery ownership can be borne by energy service companies that can capitalise on aggregated demand.

Biofuel refining: Measures for increasing predictability of availability by better storage and supply chain. Decentralised refining at the cluster level to minimise cost. Biomass supply chain collection, aggregation, storage and processing needs to be developed.

Markets: The markets should be planned close enough to rural communities so that low-cost intermediate means of transport can be used. Rural people can sell directly in the markets with reduced need for traders and wholesalers. These markets can thereafter benefit from the use of more efficient logistics and freight services. The concentrated demand from these markets will bring the cost of these services down. Setting-up/strengthening of retailing outlets to deliver co-products of Bio-CNG/Advance Biofuels at the doorsteps of farmers will be other crucial steps.

Experimental Vehicles Used in Logistics



Table 2
Biodiesel Demand

Year	Diesel demand (Ml)	Biodiesel demand (Ml) 5% Blending	Biodiesel demand (Ml) 10% Blending	Biodiesel demand (Ml) 20% Blending
2010-11	60.1	3	6	12
2015-16	81.6	4.1	8.2	16.3
2020-21	110.8	5.5	11.1	22.2
2025-26	151.2	7.6	15.1	30.2
2030-31	206.4	10.3	20.6	41.3

Source: CVC Infra

Mobile communication: The increased coordination due to mobile communication will result in optimal usage of transport services as well as infrastructure. The increased predictability by using communication infrastructure will get better prices and control for the agricultural producers. The development of IT infra will also accelerate the low carbon solution, such as shared mobility by aggregating the demand and optimising the resource allocation. This will also help the penetration of digital payments and cashless transaction for rides.

Infrastructure to facilitate mobility: While the demand for mobility will need to be captured, there needs to be sufficient focus and planning for bus stops, enclosed pick up and drop off points, traffic signals, pavements along roads, safe interjection points and markings, sanitation facilities and ATM facilities.

Central Motor Vehicles Rules, 1989 will be the overarching rule, which the OEMs will need to comply with. Scale as compared to cities will be smaller and this will need to be borne in mind by the OEMs to incorporate efficient low-cost design at the component level itself.

5.2 New Policy Recommendations

Due to the wide diversity in usage patterns, geographies and cultures in rural areas, most means of transport will spread via small-scale private initiative, which can be supported by the government with conducive policies. In addition to increasing the efficacy and reach of ongoing initiatives like SATAT and JI-VAN, new policies are required. These new policies should aim to concentrate demand in rural areas. For remote areas, operational incentives to make low demand transport services viable for small entrepreneurs should be at the core of policymaking.

- **Regulations**: Rural transport will need to be brought under the State government planning that would finally need to arrive at regulations such as a certain fixed percentage of fleet mandated to be alternate fuel/BOV vehicle for state-owned transport.

- **A proper procedure for registration of electric three-wheelers** will need to be defined as it provides the majority of public transport. This will help them avail benefits of various financial schemes and other benefits in terms of incentives and subsidies.

- **Standards**: Post the Pilot Phase, the size of the vehicle, micro-grids and appropriate infrastructure will need to be standardised for realising the scale of economy.

- **Incentives**: Viability Gap Funding will need to be addressed by the Governments both at State and Central level to invite public and private players to invest in rural mobility and logistics. Tax exemptions/ incentives for Bio-CNG/CBG-based vehicles may need to be provided.

5.3 Capacity Building

1.The rural mobility wave cannot be implemented unless everyone is sensitised to it, and the capacity is enhanced enough to embrace the change:

a. **Formation of local, formal, or informal networks:** Specialised networks will need to be formed to bring together people who would not otherwise be linked, and involve them in planning, implementation, monitoring, and evaluation. Setting-up/strengthening of retailing outlets to deliver co-products of Bio-CNG/Advance Biofuels at the doorsteps of farmers

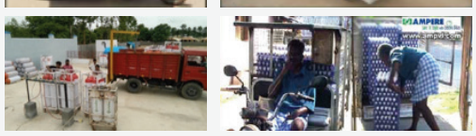
b. **Block/District level Entrepreneurs:** Skilling for capacity building on the development of block/district-level level entrepreneurs for collection, aggregation, storage & transportation of biomass will be imperative.

c. **Manufacturing and maintenance skills need to be provided as well.**

Employment generation: Affordable and low carbon transport options will enhance employment generation as well.

CROSSROADS OF CHANGE





Ampere Vehicles Pvt. Limited in Coimbatore has improvised the battery-powered vehicles according to the local needs of the business. These vehicles serve a wide range of applications, such as serving as a mobile food cart, waste collection vehicles, load carriers, etc. The range of applications makes the technology more scalable. Each modular plant of Bio-CNG of 3 million kg/annum capacity will create a livelihood for 200 people and enhance the income of 200 farmer households. Far more livelihoods will be created to catalyse growth in households through poultry and animal husbandry.

5.4 Funding Routes

Financial institutions and rural banks not providing any financial schemes for EV and deployment of charging stations in rural areas will need to introduce incentives like low interest on EV loans, single-window clearance, rebates on interest etc., to promote more usage of EV in rural areas. Agricultural loan providing institutions for rural people will also need to include the component of EV for tractors to promote environment-friendly solutions for farming. The assessment for it can be done in the four aspects of:

- Availability (availability of physical and electrical infrastructure),
- Affordability (affordable for consumers and the EV owners),
- Reliability (reliable supply of electricity, EV reliability in terms of availability of charging stations and their trip making capability), and
- Sustainability (long term benefits).

Easy and low-interest loans should be made available by financial institutions for setting-up the production unit and creating the necessary Bio-CNG/Biofuels dispensing infrastructure. Working capital should be made available to the entrepreneurs for collection, aggregation, storage and transportation of biomass. Loan credit can dramatically speed up the adoption of means of transport, but access to credit is generally poor in rural areas. Operating subsidies are a common solution in high-income countries and may be appropriate for some areas in developing countries.[3]

Rural mobility can provide an opportunity for better living conditions— health, education—increased options for livelihood activities, increased efficiency in agriculture, last-mile connectivity. It's time the change is ushered.

[3]Starkey, Paul, Simon Ellis, John Hine and Anna Ternell (2002). "Improving Rural Mobility: Options for Developing Motorized and Nonmotorized Transport in Rural Areas", World Bank Technical Paper. August. https://doi.org/10.1596/0-8213-5185

2020-2022

Short-term

- Research into data for projecting travel demand for goods and people
- Proper planning of rural transport by State Govt.
- Proper procedure for registration of e-3-wheeler-rickshaws
- Awareness campaigns for Low Carbon mobility

2022-2030

Medium-term

- Improve efficacy of SATAT scheme
- Strengthening existing grids
- Improve efficacy of JI-VAN scheme
- Develop appropriate infrastructure for EVSE
- Introduce incentives like low interest on EV loans to promote rural usage of EV

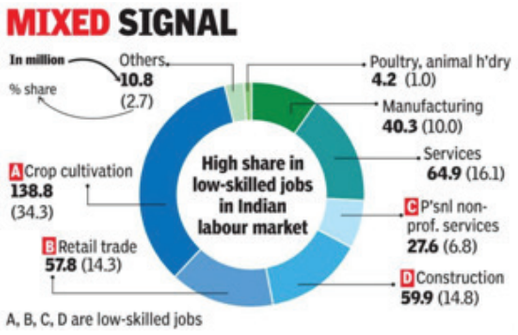
2030-2050

Long-term

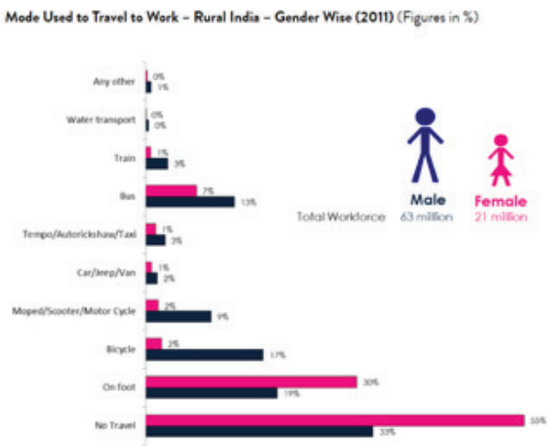
Implementation of all advanced biofuels as envisaged under the National Biofuel Policy 2018

Annexures

Annexure 1



Annexure 2
Modes Used to Travel in India: Rural India—Gender Wise (2011)



Source: "CMIE Jobs Data: Indian Business News", Times of India, 30 October 2019.

Annexure 3
Statistics Related to Road Transport

Statement 5.12: Statistics related to Road Transport
विवरण 5.12 : सड़क परिवहन से संबंधित सांख्यिकी

	Unit यूनिट	2000-01	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17(P)	
1. Length of roads										**1. सड़कों की लंबाई**
Total	Thousand Km हजार कि.मी.	3373.5	4690.3	4865.4	5231.9	5402.5	5472.1	5603.3	5898	कुल *
Surfaced		1601.7	2524.7	2698.6	3171	3220.5	3341	3501.9	3730	पक्की सड़क
2. Length of national Highways										**2. राष्ट्रीय राजमार्गों की लंबाई**
Total	Thousand Km हजार कि.मी.	57.7	70.9	76.8	79.1	91.3	98.0	101.0	114.1	कुल *
Surfaced		57.7	70.9	76.8	79.1	91.3	98.0	101.0	114.1	पक्की सड़क
3. Length of State Highways										**3. राज्य राजमार्गों की लंबाई**
Total	Thousand Km हजार कि.मी.	132.1	163.9	164.4	169.2	170.8	167.1	176.2	175	कुल *
Surfaced		129.9	161.9	163.0	167.2	169.0	165.3	170.2	169	पक्की सड़क
4. No. of Registered vehicles										**4. पंजीकृत वाहनों की संख्या**
All vehicles	Thousand हजार	54991.0	141866.0	159491.0	176044 (R)	190704	210023	230031	253311	सभी वाहन
Goods vehicles		2948.0	7064.0	7658.0	8307 (R)	8698	9344	10516	12256.33	माल वाहन
Buses*		634.0	1604.0	1677.0	1814.0 (R)	1887	1971	1757	1864.21	बसें*
5. Revenue realised from Road Transport										**5. सड़क परिवहन से प्राप्त राजस्व**
Central	(Crore) (करोड़)	23861.0	75453.2	75572.5	90931.2 (R)	89084.1	109941	199659.7	280132.1	केंद्रीय
States		12901.7	45992.4	55161.5	50602.7 (R)	56749.8	61230.7	70003.3	79962.2	राज्य
6. Freight and Passenger Movement by Road Transport										**6. सड़क परिवहन द्वारा माल एवं यात्री संचलन**
Freight	Billion Tonnes Km बिलियन टन कि.मी.	494.0	1287.3	1407.8	1515.4	1650.8	1824.3	2026.1	2232	माल
Pessenger	Billion Passengers Km बिलियन यात्री कि.मी.	2076	8409	9478	10461	11730	13403	15415	17550	यात्री

Source: Ministry of Road Transport & Highways
1. Basic Road Statistics of India 2016-17
स्रोत : सड़क परिवहन एवं राजमार्ग मंत्रालय
2. Road Transport Year Book 2016-17
R: Revised
P: Provisional/अनंतिम
*: Included omni buses.

Source: Envistats 2019, Ministry of Statistics and Programme Implementation

Annexure 4
Status of Registered Motor Vehicles
Year-wise State-wise Registered Motor Vehicles

Statement 5.13 : Status of registered motor vehicles
विवरण 5.13 : पंजीकृत मोटर वाहनों की स्थिति
(a) : Year-wise State-wise Registered motor vehicles
(क) : पंजीकृत मोटर वाहनों की वर्षवार और राज्यवार स्थिति

(in numbers/संख्या)

Sl. No.	States/UT	Transport परिवहन					Non- Transport गैर परिवहन					राज्य/संघ राज्य क्षेत्र
		2013	2014	2015	2016	2017(P)	2013	2014	2015	2016	2017(P)	
1	Andhra Pradesh	1301472	922583	1013986	1115430	1270390	11386231	6079560	6868276	7612128	8355980	आंध्र प्रदेश
2	Arunachal Pradesh	...	...	...	38894	27340	...	...	...	225859	152529	अरुणाचल प्रदेश
3	Assam	202784	377127	409050	433619	364670	1674738	1839880	2100687	2383771	2663995	असम
4	Bihar	336941	388302	440632	499561	568793	3280286	3775094	4336964	4982768	5677154	बिहार
5	Chhattisgarh	206189	267570	293803	321679	293837	3231053	3603787	4020124	4488773	4948195	छत्तीसगढ़
6	Delhi	14317	15233	15775	10746	11603	79129	87477	95881	94576	104576	दिल्ली
7	Goa	317963	334434	354665	614092	600807	7467320	7958323	8496055	9090649	9659645	गोवा
8	Gujarat	106035	111120	115807	120396	125433	832337	898242	967861	1037845	1113211	गुजरात
9	Haryana	1586748	1685570	1805276	1925382	2031685	14185705	15406029	16915291	18435914	20004854	हरियाणा
10	Himachal Pradesh	630231	687498	751638	822115	909952	5969363	6551250	7175912	7810841	8460405	हिमाचल प्रदेश
11	Jammu & Kashmir	180127	190032	198069	202641	210892	695934	784238	879335	972869	1144920	जम्मू एवं कश्मीर
12	Jharkhand	171561	185306	199443	213247	254935	849225	947771	1044828	1152305	1255910	झारखंड
13	Karnataka	930461	196292	219856	351862	551774	2486316	1522468	1845750	2125156	2833573	कर्नाटक
14	Kerala	1180736	1289580	1404626	1542349	1684690	10882950	12045526	13380335	14749416	16186672	केरल
15	Madhya Pradesh	1751514	1845241	1912392	1467557	1531125	6106308	6929800	7735928	8704256	9771900	मध्य प्रदेश
16	Maharashtra	520521	569970	640175	605641	602536	8239518	9151655	10500952	10535400	12596336	महाराष्ट्र
17	Manipur	2091627	2241906	2339973	2467932	2659848	19396525	21151870	23222202	25401934	27557263	मणिपुर
18	Meghalaya	37895	42011	48658	41192	47144	258032	352533	258485	264847	293067	मेघालय
19	Mizoram	66453	82398	85992	361085	367649	153568	165867	181112	197384	215458	मिजोरम
20	Nagaland	25476	28694	30546	37689	29038	95860	108537	120940	133602	157988	नागालैंड
21	Odisha	138309	134680	141271	168189	185084	157566	167357	176189	195370	207809	ओडिशा
22	Punjab	437391	481243	525889	574564	613671	3778149	4220563	4692706	5258793	5943972	पंजाब
23	Rajasthan	317191	317191	317191	1436023	1466790	5945748	5945748	5945748	7628453	8376097	राजस्थान
24	Sikkim	26298	27111	27855	26141	27421	673316	723787	774726	837172	902911	सिक्किम

विवरण 5.13 : पंजीकृत मोटर वाहनों की स्थिति
(a) : Year-wise State-wise Registered motor vehicles
(क) : पंजीकृत मोटर वाहनों की वर्षवार और राज्यवार स्थिति

(in numbers/संख्या)

Sl. No.	States/UT	Transport परिवहन					Non- Transport गैर परिवहन					राज्य/संघ राज्य क्षेत्र
		2013	2014	2015	2016	2017(P)	2013	2014	2015	2016	2017(P)	
25	Tamil Nadu	816107	833014	952581	1032204	1116525	9255838	10300406	11426348	12599882	13784037	तमिलनाडु
26	Telangana	14415	16409	17465	18729	20082	21862	23199	25745	30276	34024	तेलंगाना
27	Tripura	1679608	1757430	1827887	1906590	1997034	17552453	19106232	20690782	22296758	24111932	त्रिपुरा
28	Uttar Pradesh	50188	45581	50198	55969	69000	194734	210589	231936	263513	313687	उत्तर प्रदेश
29	Uttarakhand	629389	690011	751001	831046	864206	5747088	6383098	7093715	7878143	8980215	उत्तराखंड
30	West Bengal	103708	114653	122473	152553	152227	1356428	1525275	1704564	1735667	1985106	पश्चिम बंगाल
31	Andaman And Nicobar Island	725149	825816	914353	1000467	1129492	16323035	18288876	20721178	22935899	25135754	अंडमान एवं निकोबार द्वीपसमूह
32	Chandigarh	672493	720148	761919	655972	712328	5438241	6024856	6641322	5832417	6733245	चंडीगढ़
33	Dadra & Nagar Haveli	8073	8301	8572	8945	9210	77369	85390	93729	102184	112349	दादरा एवं नगर हवेली
34	Daman & Diu	35525	17913	19159	19765	21758	1070824	612812	657317	817172	861031	दमन एवं दीव
35	Lakshadweep	9457	7421	7809	7670	7886	82088	87904	92570	97857	103428	लक्षद्वीप
36	Puducherry	1620	2078	2375	2183	2476	9485	10946	11856	13825	15611	पुदुचेरी
	Total	**17323972**	**17459867**	**18728360**	**21090119**	**22538931**	**164954622**	**173076945**	**191127349**	**208923674**	**230754839**	**कुल**

Source : Road Transport year book, Transport Research Wing, Ministry of Road Transport & Highways
स्रोत : सड़क परिवहन आंकिकी, परिवहन अनुसंधान प्रकोष्ठ, सड़क परिवहन एवं राजमार्ग मंत्रालय

P: Provisional/अनंतिम

...: Not reported.

Source: Envistats 2019, Ministry of Statistics and Programme Implementation

State-wise Category-wiseRegistered
Motor Vehicles

Statement 5.13 : Status of registered motor vehicles
विवरण 5.13 : पंजीकृत मोटर वाहनों की स्थिति
(b) State-wise Category-wise Registered motor vehicles
(ख) राज्यवार और श्रेणीवार पंजीकृत मोटर वाहन
(31 मार्च, 2017 तक की स्थिति के अनुसार)

(In numbers संख्या)

Sl. No. क्र. सं.	States/UT	Transport (P) परिवहन						राज्य/संघ राज्य क्षेत्र
		Multi-axled/Articulated Vehicles/Trucks & Lorries बहु-धुरीय/ट्रेलर वाहन/ट्रक एवं लॉरी	Light Motor Vehicles (Goods) हल्के मोटर वाहन (माल)	Buses बस	Taxies टैक्सी	Light Motor Vehicles (Passengers) हल्के मोटर वाहन(यात्री)	Total Transport कुल परिवहन	
1	Andhra Pradesh	306300	188543	41187	79683	444295	1270390 *	आंध्र प्रदेश
2	Arunachal Pradesh	6012	7142	5192	860	8134	27340	अरुणाचल प्रदेश^^
3	Assam	140535	131545	21749	60209	10632	364670	असम
4	Bihar	107756	59232	33751	96344	271710	568793	बिहार
5	Chhattisgarh	127446	92859	15484	17830	40218	293837	छत्तीसगढ़
6	Goa	44047	18316	11888	19698	4411	125433 #	गोवा
7	Gujarat	396061	676915	74855	125461	758393	2031685	गुजरात
8	Haryana	390321	196239	57696	80555	183110	909952 #	हरियाणा **
9	Himachal Pradesh	76211	85071	9633	35190	4787	210892	हिमाचल प्रदेश
10	Jammu & Kashmir	57174	80328	29079	59185	28779	254935	जम्मू एवं कश्मीर
11	Jharkhand	92738	200194	10398	38054	89497	551774	झारखंड
12	Karnataka	306290	400358	93690	292320	447895	1684690 *	कर्नाटक
13	Kerala	194293	384988	117720	119002	632426	1531125 *	केरल
14	Madhya Pradesh	168626	177294	53468	72285	130863	602536	मध्य प्रदेश
15	Maharashtra	496439	974527	141289	306984	740609	2659848	महाराष्ट्र
16	Manipur	15759	3483	2583	4496	20823	47144	मणिपुर
17	Meghalaya	301698	13431	5517	24428	22575	367649	मेघालय
18	Mizoram	3787	9355	1268	9266	5333	29038	मिजोरम
19	Nagaland	130211	22733	5926	7222	18992	185084	नागालैंड
20	Odisha	171044	178922	27621	97837	138247	613671	ओडिशा
21	Punjab	255684	1045782	45378	8926	111020	1466790	पंजाब^^

Statement 5.13 : Status of registered motor vehicles
विवरण 5.13 : पंजीकृत मोटर वाहनों की स्थिति
(b) State-wise Category-wise Registered motor vehicles
(ख) राज्यवार और श्रेणीवार पंजीकृत मोटर वाहन
(31 मार्च, 2017 तक की स्थिति के अनुसार)

(In numbers संख्या)

Sl. No. क्र. सं.	States/UT	Non-Transport (P) गैर परिवहन								Grand Total (Transport +Non- Tpt.) कुल योग (परिवहन + गैर परिवहन)	राज्य/संघ राज्य क्षेत्र
		Two Wheelers दुपहिया वाहन	Cars कार	Jeeps जीप	Omni Buses ओम्नी बसें	Tractors ट्रैक्टर	Trailers ट्रेलर	Others अन्य	Total Non-Tpt. कुल गैर परिवहन		
1	Andhra Pradesh	7500509	545714	10878	25285	148602	106709	18283	8355980	9626370	आंध्र प्रदेश
2	Arunachal Pradesh	87552	57552	2898	29	954	407	3137	152529	179869	अरुणाचल प्रदेश^^
3	Assam	1974790	620197	0	0	47322	21686	0	2663995	3028665	असम
4	Bihar	4631584	300082	133889	0	387894	196106	27599	5677154	6245947	बिहार
5	Chhattisgarh	4241769	282061	22023	54441	205740	121847	20314	4948195	5242032	छत्तीसगढ़
6	Goa	853421	251034	^	0	3888	##	4868	1113211	1238644	गोवा
7	Gujarat	16144357	2527537	185894	0	687825	379173	80068	20004854	22036539	गुजरात
8	Haryana	5937102	1851788	0	2433	653926	191	14965	8460405	9370357	हरियाणा **
9	Himachal Pradesh	678918	318244	22411	1999	6197	109	117042	1144920	1355812	हिमाचल प्रदेश
10	Jammu & Kashmir	745165	421391	15224	35966	22896	878	14390	1255910	1510845	जम्मू एवं कश्मीर
11	Jharkhand	2264951	352510	64614	34	80816	64659	5989	2833573	3385347	झारखंड
12	Karnataka	12955113	2110493	46319	130890	498977	335745	109135	16186672	17871362	कर्नाटक
13	Kerala	7194235	2385995	0	0	13150	0	178520	9771900	11303025	केरल
14	Madhya Pradesh	10479538	869777	^	135650	1073487	##	37884	12596336	13198872	मध्य प्रदेश
15	Maharashtra	22132190	3715744	535487	18753	655756	397077	102256	27557263	30217111	महाराष्ट्र
16	Manipur	233075	52120	4118	0	1190	16	2548	293067	340211	मणिपुर
17	Meghalaya	106072	81083	19967	73	884	2877	4502	215458	583107	मेघालय
18	Mizoram	112621	26869	6929	0	285	0	11284	157988	187026	मिजोरम
19	Nagaland	86835	74563	34390	498	2868	1068	7587	207809	410178 &	नागालैंड
20	Odisha	5225666	350226	48669	3668	143874	124584	47285	5943972	6557643	ओडिशा
21	Punjab	7480829	0	0	0	0	0	895268	8376097	9842887	पंजाब^^

Statement 5.13 : Status of registered motor vehicles
विवरण 5.13 : पंजीकृत मोटर वाहनों की स्थिति
(b) State-wise Category-wise Registered motor vehicles
(ख) राज्यवार और श्रेणीवार पंजीकृत मोटर वाहन
(31 मार्च, 2017 तक की स्थिति के अनुसार)

(In numbers संख्या)

Sl. No. क्र. सं.	States/UT	Transport (P) परिवहन						राज्य/संघ राज्य क्षेत्र
		Multi-axled/Articulated Vehicles/Trucks & Lorries बहु-धुरीय/ट्रेलर वाहन/ट्रक एवं लॉरी	Light Motor Vehicles (Goods) हल्के मोटर वाहन (माल)	Buses बस	Taxies टैक्सी	Light Motor Vehicles (Passengers) हल्के मोटर वाहन(यात्री)	Total Transport कुल परिवहन	
22	Rajasthan	561158	109020	108681	143075	194591	1116525	राजस्थान
23	Sikkim	3847	1585	363	14282	0	20082	सिक्किम
24	Tamil Nadu	569017	428544	187073	404282	408118	1997034	तमिलनाडु
25	Telangana	121117	222215	51580	122520	345904	864206	तेलंगाना
26	Tripura	13938	17191	2953	13665	21253	69000	त्रिपुरा
27	Uttar Pradesh	265167	359769	75309	117208	312037	1129492 #	उत्तर प्रदेश
28	Uttarakhand	19485	45068	12031	44082	31352	152227 #	उत्तराखंड
29	West Bengal	0	443966	46964	136813	84555	712328 #	पश्चिम बंगाल
	TOTAL STATES (1)	**5342161**	**6574615**	**1290326**	**2551762**	**5510559**	**21858170**	**कुल राज्य (1)**
	UTs							**संघ राज्य क्षेत्र**
1	Andaman And Nicobar Islands	2829	0	1088	489	4804	9210	अंडमान एवं निकोबार द्वीपसमूह
2	Chandigarh	2017	9379	2932	1735	5695	21758	चंडीगढ़
3	Dadra & Nagar Haveli	5945	4477	594	20	567	11603	दादरा एवं नगर हवेली
4	Daman & Diu	4538	1968	0	77	1303	7886	दमन एवं दीव
5	Delhi	3158	289707	41682	137773	128087	600407	दिल्ली
6	Lakshadweep	0	1330	0	379	767	2476	लक्षद्वीप
7	Puducherry	2294	11919	3834	2571	6803	27421	पुदुचेरी
	TOTAL UTs (2)	**20781**	**318780**	**50130**	**143044**	**148026**	**680761**	**कुल संघ राज्य क्षेत्र (2)**
	GRAND TOTAL (1+2)	**5362942**	**6893395**	**1340456**	**2694806**	**5658585**	**22538931**	**कुल योग (1+2)**

Source: Offices of State Transport Commissioners/UT Administrations/स्रोत: राज्य परिवहन आयुक्तों / संघ शासित प्रदेशों के कार्यालयों।
*: includes other vehicles not covered in item numbers I to VII of 'Transport Vehicles'.

Statement 5.13 : Status of registered motor vehicles
विवरण 5.13 : पंजीकृत मोटर वाहनों की स्थिति
(b) State-wise Category-wise Registered motor vehicles
(ख) राज्यवार और श्रेणीवार पंजीकृत मोटर वाहन
(31 मार्च, 2017 तक की स्थिति के अनुसार)

(In numbers संख्या)

Sl. No. क्र. सं.	States/UT	Non-Transport (P) गैर परिवहन								Grand Total (Transport +Non- Tpt.) कुल योग (परिवहन + गैर परिवहन)	राज्य/संघ राज्य क्षेत्र
		Two Wheelers दुपहिया वाहन	Cars कार	Jeeps जीप	Omni Buses ओम्नी बसें	Tractors ट्रैक्टर	Trailers ट्रेलर	Others अन्य	Total Non-Tpt. कुल गैर परिवहन		
22	Rajasthan	11250427	988391	435366	0	1029721	80042	90	13784037	14900562	राजस्थान
23	Sikkim	5062	18662	9928	0	0	217	155	34024	54106	सिक्किम
24	Tamil Nadu	21093750	2315769	60662	20354	250631	80082	290684	24111932	26108966	तमिलनाडु
25	Telangana	7137408	1081630	15957	52743	209099	89792	393586	8980215	9844421	तेलंगाना
26	Tripura	260767	41623	5618	14	562	812	4291	313687	382687	त्रिपुरा
27	Uttar Pradesh	21127282	2027972	566225	36711	1338243	16251	23070	25135754	26265246	उत्तर प्रदेश
28	Uttarakhand	1541985	385446	0	0	50670	2616	4389	1985106	2137333	उत्तराखंड
29	West Bengal	5595357	961369	0	0	136112	0	40407	6733245	7445573	पश्चिम बंगाल
	TOTAL STATES (1)	**179078330**	**25015842**	**2247466**	**519541**	**7651569**	**2022944**	**2459596**	**218995288**	**240870743**	**कुल राज्य (1)**
	UTs										**संघ राज्य क्षेत्र**
1	Andaman And Nicobar Islands	86402	0	25108		^	839	0	112349	121559	अंडमान एवं निकोबार द्वीपसमूह
2	Chandigarh	366541	469672	24543	0	275	0	0	861031	882789	चंडीगढ़
3	Dadra & Nagar Haveli	77811	24768	314	5	275	5	1398	104576	116179	दादरा एवं नगर हवेली
4	Daman & Diu	71585	30336	610	51	429	224	193	103428	111314	दमन एवं दीव
5	Delhi	6595993	3061817	^	4	211	0	1620	9659645	10260052	दिल्ली
6	Lakshadweep	14708	155	36	39	171	0	502	15611	18087	लक्षद्वीप
7	Puducherry	799907	91080	1349	4116	2455	745	3259	902911	930332	पुदुचेरी
	TOTAL UTs (2)	**8012947**	**3677828**	**51960**	**4215**	**3816**	**1813**	**6972**	**11759551**	**12440312**	**कुल संघ राज्य क्षेत्र (2)**
	GRAND TOTAL(1+2)	**187091277**	**28693670**	**2299426**	**523756**	**7655385**	**2024757**	**2466568**	**230754839**	**253311055**	**कुल योग (1+2)**

Source: Offices of State Transport Commissioners/UT Administrations/स्रोत: राज्य परिवहन आयुक्तों / संघ शासित प्रदेशों के कार्यालयों।
&: Includes 16805 Government Vehicles(for which category-wise break-up is not available.) - : Not reported.
^ : Included in cars. # : Includes Motor Cycles on hire ## : Included in tractors P: Provisional/अनंतिम

Source: Envistats 2019, Ministry of Statistics and Programme Implementation

Annexure 5
Registered Motor Vehicles in Million Plus Cities of India

Statement 5.14: Registered motor vehicles in million plus cities of India
विवरण 5.14 : भारत के एक मिलियन से अधिक आबादी वाले शहरों में पंजीकृत मोटर वाहन

(in number/ संख्या)

Sl. No. क्र. सं.	Name of City	2015			2016			2017 (P)			शहर का नाम
		Transport परिवहन	Non-Transport गैर परिवहन	Total कुल	Transport परिवहन	Non-Transport गैर परिवहन	Total कुल	Transport परिवहन	Non-Transport गैर परिवहन	Total कुल	
1	Agra	32,904	8,72,119	9,05,023	32835	889866	922701	35916	925705	961621	आगरा
2	Ahmedabad	3,42,431	30,77,397	34,19,828	361112	3294736	3655848	379370	3525582	3904952	अहमदाबाद
3	Allahabad	48,781	8,48,254	8,97,035	52175	1007604	1059779	57918	965077	1022995	इलाहाबाद
4	Allappuzha	-	-	-	28034	169769	197803	27042	183200	210242	आलाप्पुझा
5	Aurangabad	44,725	3,81,521	4,26,246	43418	711255	754673	47383	668098	515481	औरंगाबाद
6	Bengaluru	5337364#	50,25,994	55,59,730	597521	5515356	6112877	667949	6165158	6833107	बेंगलुरु
7	Bhopal	73,807	10,06,670	10,80,477	63965	996645	1060610	66411	1189373	1255784	भोपाल
8	Chandigarh	88,203	6,57,317	7,45,520	19765	817172	836937	20511	861031	881542	चंडीगढ़
9	Chennai	4,67,290	44,67,122	49,34,412	470866	4467122	4937988	494303	4804580	5298883	चेन्नई
10	Coimbatore	83,236	18,18,041	19,01,277	85869	1818041	1903910	92154	1966460	2058614	कोयम्बटूर
11	Delhi	3546654	84,96,055	88,50,720	354665	8496055	8850720	600407	9659645	10260052	दिल्ली
12	Dhanbad*	58,723	5,04,703	5,63,426	62760	541439	604199	66456	584602	651058	धनबाद*
13	Durg Bhilai	41,080	7,27,842	7,68,922	44219	772527	816746	40770	774454	815224	दुर्ग भिलाई
14	Ghaziabad	44,230	7,07,373	7,51,603	45685	794046	839731	53369	864231	917600	गाजियाबाद
15	Greater Mumbai	2,66,932	23,04,272	25,71,204	293926	2525726	2819652	321050	2731851	3052901	ग्रेटर मुंबई
16	Gwalior	39707*	5,77,974	6,17,681	37613	596611	634224	37613	596611	634224	ग्वालियर
17	Hyderabad	204890*	21,63,928	23,68,818	204890	2163928	2368818	225413	2489097	2714510	हैदराबाद
18	Indore	1,63,003	15,49,699	17,12,702	131121	1679622	1810743	140099	1794489	1934588	इंदौर
19	Jabalpur	50,628	5,87,591	6,38,219	44815	618027	662842	44815	618027	662842	जबलपुर
20	Jaipur	1,70,440	20,78,800	22,49,240	193468	2230125	2423593	208904	2374202	2583106	जयपुर
21	Jamshedpur*	45,091	4,26,960	4,72,051	2392	56259	58651	19431	246302	265733	जमशेदपुर*
22	Jodhpur	97,749	8,18,423	9,16,172	104574	872620	977194	110513	941301	1051814	जोधपुर
23	Kannur	30,387	1,58,110	1,88,497	32113	181225	213338	31404	200753	232157	कन्नूर
24	Kanpur	40,793	14,20,737	14,61,530	43494	1498669	1542163	46244	1586438	1632682	कानपुर

Statement 5.14: Registered motor vehicles in million plus cities of India
विवरण 5.14 : भारत के एक मिलियन से अधिक आबादी वाले शहरों में पंजीकृत मोटर वाहन

(in number/ संख्या)

Sl. No. क्र. सं.	Name of City	2015			2016			2017 (P)			शहर का नाम
		Transport परिवहन	Non-Transport गैर परिवहन	Total कुल	Transport परिवहन	Non-Transport गैर परिवहन	Total कुल	Transport परिवहन	Non-Transport गैर परिवहन	Total कुल	
25	Kochi	84,641	5,21,048	6,05,689	51819	449528	501347	51819	449528	501347	कोचि
26	Kolkata*	1,91,541	12,10,097	14,01,638	98680	642199	740879	103175	696987	800162	कोलकाता*
27	Kollam	38,606	2,35,400	2,74,006	39346	264944	304290	39346	264944	304290	कोल्लम
28	Kota	41,691	6,12,350	6,54,041	43875	666800	710675	45883	717807	763690	कोटा
29	Kozhikoda	50,121	3,62,183	4,12,304	51030	394332	445362	51030	394332	445362	कोझीकोड
30	Lucknow	47,878	16,61,784	17,09,662	53330	1764765	1818095	54122	1924223	1978345	लखनऊ
31	Madurai	71,460	8,83,433	9,54,893	73108	883433	956541	75194	962045	1037239	मदुरै
32	Malappuram	63,111	2,13,654	2,76,765	64259	239524	303783	64293	259563	323856	मलप्पुरम्
33	Meerut	25,534	4,99,701	5,25,235	27165	539540	566705	27638	595921	623559	मेरठ
34	Nagpur	55,087	12,20,488	12,75,575	72559	1402658	1475217	79568	1447209	1526777	नागपुर
35	Nashik	44,949	5,77,257	6,22,206	46573	630491	677064	37022	670896	707918	नासिक
36	Palakkad	-	-	-	34628	217849	252477	33925	233289	267214	पालाक्कड
37	Patna	1,09,009	9,09,789	10,18,798	123547	1012528	1136075	135801	1122105	1257906	पटना
38	Pune	1,28,658	22,08,427	23,37,085	137668	2380965	2518633	164560	2552762	2717322	पुणे
39	Raipur	1,07,580	10,04,165	11,11,745	115427	1097805	1213228	111521	1212361	1323882	रायपुर
40	Rajkot	69,358	9,10,065	9,79,423	124334	1679364	1803698	128439	1797866	1926305	राजकोट
41	Ranchi	75,704	4,71,332	5,47,036	112847	499928	612775	89980	670069	760049	रांची
42	Srinagar	50,215	1,85,399	2,35,614	54067	218801	272868	55115	236300	291415	श्रीनगर
43	Surat	1,88,474	22,70,637	24,59,111	197967	2467627	2665594	207283	2679669	2886950	सूरत
44	Thiruvananthapur	64,635	5,07,321	5,71,956	69783	545899	615682	88743	724169	812912	तिरुवनंतपुरम
45	Thrissur	51,727	3,03,764	3,55,491	55722	334385	390107	55722	334385	390107	त्रिशूर
46	Tirchy	52,897	7,10,499	7,63,396	53840	710499	764339	56876	774525	831401	तिरुचिरापल्ली
47	Vadodara	86,248	9,55,570	10,41,818	167962	1727188	1895150	176130	1845558	2021688	वडोदरा
48	Varanasi	61,394	7,07,575	7,68,769	64088	713042	777130	69157	837676	906833	वाराणसी
49	Vijayawada	75,675	5,34,646	6,10,321	83442	579576	663018	83442	579576	663018	विजयवाड़ा
50	Visakhapatnam	65,494	6,65,378	7,30,872	71010	711580	782590	71010	711580	782590	विशाखापट्टनम
	Total	**52,24,918**	**6,10,18,864**	**6,62,43,782**	**54,39,371**	**6,54,89,191**	**70928562**	**5992237**	**71211613**	**77203849**	**कुल**

Source: Transport Research Wing, Ministry of Road Transport & Highways/सोत : परिवहन अनुसंधान प्रकोष्ठ, सड़क परिवहन एवं राजमार्ग मंत्रालय
Includes other vehicles which are not covered in 'Transport Vehicles' P: Provisional/अनंतिम * Includes motor cycles on hire

Source: Envistats 2019, Ministry of Statistics and Programme Implementation

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The FICCI Environment and Climate Change Secretariat steered the entire initiative of the India Roadmap, convening meetings of the Core Group, working groups, stakeholder consultations, and experts' consultation, providing information and background research of government programmes and schemes, gathering feedback of stakeholders and collation and compilation of the reports and roadmap. FICCI also reached out to various government departments during the course of the project, and organised a kick-off event with Shri Nitin Jairam Gadkari, Minister for Road Transport and Highways, Government of India, meetings with Shri C K Mishra, Secretary, Ministry of Environment, Forest and Climate Change, Government of India, and Mr Anil Srivastava, Mission Director, National Mission for Transformative Mobility, Niti Aayog. We thank them for their blessings and feedback. FICCI helped in the finalisation of the theme reports under the guidance of the working group Leads and Members, with complete coordination for six of the eight working groups (Working Groups 2, 3, 4, 5, 7 and 8). The individual meetings of the working groups as well as joint meetings and workshops of all working groups was also coordinated and organised by FICCI.

The formation of working groups was preceded by a brainstorming session of experts in May 2018, thereafter the working groups after being formed met numerous times in the 20 months that followed. A joint workshop of the working groups took place in May 2019 to assess the development of the theme reports and Roadmap halfway through the project. Thereafter, extensive deliberations of the working groups were held alongside stakeholder consultations until the culmination of the final eight theme reports and the India Roadmap. The 8 Leads of the working groups met numerous times through the project period. The joint meetings of the working groups and frequent meetings of the Leads ensured there was no silo in the deliberations or formulation of the eight components of the Roadmap. We are thankful to all of them for devoting their time and energy in this manner.

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We are grateful for the candid feedback and inputs of participants of the three stakeholder consultations – in Navi Mumbai organised by FICCI and BOCI at Prawaas 2019 on July 26, 2019, in Bengaluru organised by WWF-India on September 26, 2019, in Delhi organised by FICCI on October 22, 2019 – and the experts' consultation organised by FICCI and Shakti Sustainable Energy Foundation on March 6, 2020.

We acknowledge the inputs, feedback and experience sharing by international stakeholders who participated in the events organised by FICCI on the development of the India Roadmap at the Movin'On – World Summit on Sustainable Mobility in Montreal, Canada in 2018 and 2019 and the side events organised by FICCI in UNFCCC COP-24 in Katowice, Poland in December 2018 and UNFCCC COP-25 in Madrid, Spain in December 2019.

We thank Mr Mahesh Babu, CEO, Mahindra Electric for his guidance as Co-Chair during the first year of the project. We also acknowledge the hard work by ex-FICCI colleagues Krishna Chandran and Mallika Bose who were part of this initiative from the start.

WORKING GROUPS

Working Group on "Provide Low-Carbon Solutions for the Rural (Non-Urban) Populations"



Working Group Lead:
Mr Karthick A, Head, EV & eMobility Solutions, Ashok Leyland

Members:

1. Ola Mobility Institute (OMI)
   Shilpi Samantray

2. CVC India Infrastructure Pvt Ltd
   Niranjan Khatri

3. India Smart Grid Forum
   Reji Kumar Pillai
   S. Kundu

4. Ashok Leyland
   Sriram Tirunantalwan

5. RMI's India program
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ACRONYMS

BOV: battery operated vehicle
CBG: compressed biogGas
CMIE: Centre for Monitoring Indian Economy
CNG: compressed natural gas
EV: electric vehicle
GDP: gross domestic product
GHG: greenhouse gas
GW: giga watt
IMT: intermediate means of transport
IT: information technology
KSK: Kisan Seva Kendra
MGNREGA: Mahatma Gandhi National Rural Employment Guarantee Act
NGO: non-governmental organization
NMT: non-motorised transport
NRLM: National Rural Livelihoods Mission
NRuM: National Rurban Mission
NSSO: National Sample Survey Organization
OMCs: Oil Marketing Companies
PEM: Polymer Electrolyte Membrane
PMGSY: Pradhan Mantri Gram Sadak Yojana
POC: proof of concept
SDGs: Sustainable Development Goals
SATAT: Sustainable Alternative Towards Affordable Transportation
TCO: total cost of ownership

SOURCES / REFERENCES

Derived from the urdu word mofassil, which is used to refers to a region lying outside an urban centre.

Starkey, Paul, Simon Ellis, John Hine and Anna Ternell (2002). “Improving Rural Mobility: Options for Developing Motorized and Nonmotorized Transport in Rural Areas”, World Bank Technical Paper. August. https://doi.org/10.1596/0-8213-5185-0

ABOUT PARTNERS

FICCI

Established in 1927, FICCI is the largest and oldest apex business organisation in India. Its history is closely interwoven with India's struggle for independence, its industrialisation, and its emergence as one of the most rapidly growing global economies.

A non-government, not-for-profit organisation, FICCI is the voice of India's business and industry. From influencing policy to encouraging debate, engaging with policy makers and civil society, FICCI articulates the views and concerns of industry. It serves its members from the Indian Private and public corporate sectors and multinational companies, drawing its strength from diverse regional chambers of commerce and industry across states, reaching out to over 2,50,000 companies.

FICCI provides a platform for networking and consensus building within and across sectors and is the first port of call for Indian industry, policy makers and the international business community.

PPMC

The PPMC is an open and inclusive platform that actively invites all organisations and initiatives that support effective action on transport and climate change to join in the process. The PPMC is created to strengthen the voice of the sustainable transport community in the UNFCCC process, especially with a view to the upcoming Conference of Parties (COP21) in December 2015 in Paris. COP21 is expected to result in a new global agreement on climate change, which will shape climate policy in the years to come at a global, regional and national level. By bringing together different actors and stakeholders in the sustainable transport community it will be possible for the transport sector to have its voice heard and speak with one voice on the important contribution that sustainable mobility can make to the mitigation of, and adaptation to climate change.

The PPMC contributes to realising a Global Agreement on Climate Change that empowers transport sector to take action on climate change. The realisation of this objective requires an active engagement of the PPMC before, during and after COP21. It will be equally important to advocate for an agreement that incentivises the transport sector as well as work with the transport and climate community on the implementation of a new global agreement on climate change at the global, regional, national and local levels.

WWF-India

WWF-India is one of the leading conservation organizations in the country. It is a science-based organization that addresses issues such as the conservation of species and its habitats, climate change, water, and environmental education, among many others. Over the years, its perspective has broadened to reflect a more holistic understanding of the various conservation issues facing the country and seeks to proactively encourage environmental conservation by working with different stakeholders- Governments, NGOs, schools and colleges, corporates, students and other individuals.

Shakti Sustainable Energy Foundation

Shakti Sustainable Energy Foundation (Shakti) seeks to facilitate India's transition to a sustainable energy future by aiding the design and implementation of policies in the following areas: clean power, energy efficiency, sustainable urban transport, climate change mitigation and clean energy finance.

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