Promoting Low Carbon Transport in India
Project Booklet

UNEP

UNEP DTU PARTNERSHIP

Low Carbon Transport in India

Foreword

Promoting Low Carbon Transport in India was a major transport initiative of the United Nations Environment Programme (UNEP). For the last five years, the project has developed a network of expertise in transport planning, safety, social inclusivity, air pollution, and climate change. This crosscutting approach is used to assure that the benefits of low carbon transport solutions are informed by social and gender realities in India. However, in order to turn these sustainable ideas into reality, policy decisions need to be coordinated between stakeholders, the national government, and cities.

This is where the project has focused its energies: on providing the analysis and the know-how necessary to create an effective policy environment for low carbon transport on both a national and a city level. The project has, in a coordinated and systematic manner, integrated the climate agenda and its co-benefits into its promotion of sustainable transport development in India. In parallel, India has advanced on its low carbon development pathway. India's Intended Nationally Determined Contributions (INDCs) spell out the specific role of the transport sector in reducing its emission intensity. The project has conducted detailed analysis and action plans on how to achieve India's INDC targets.

UNEP looks forward to future cooperation with our partners, and to building upon the outputs, outcomes, and strategic partnerships of the Promoting Low Carbon Transport in India project.

Ligia Noronha,
Director, Division of Technology, Industry and Economics (DTIE)

Acknowledgements

The United Nations Environment Programme (UNEP) would like to thank the following institutions and individuals for their invaluable contributions to the Promoting Low Carbon Transport in India project:

- International Climate Initiative (IKI), the German Federal Ministry for the Environment, Nature Conservation, Building, and Nuclear Safety (BMUB)
- UNEP-DTU Partnership
- Indian Institute of Management Ahmedabad
- Indian Institute of Technology Delhi
- CEPT University
- Ministry of Urban Development, Government of India
- Institute of Urban Transport,
- Ministry of Environment, Forest and Climate Change, Government of India
- The cities of Rajkot, Udaipur, and Vishakhapatnam
- Urban Mass Transit Company (UMTC)
- iTrans
- The Project's Steering Committee Members

Finally, UNEP would like to thank everyone who has contributed to the project and its achievements.

About the Project

The project's framework strategically linked the transport aspect of India's National Action Plan on Climate Change (NAPCC) with urban transport renewal and the development of smart cities. **The project aimed to achieve two overall goals: creating an enabling environment for coordinating policies to achieve a sustainable transport system, and building cities' capacity to improve mobility while lowering CO_2 emissions.**

Launched in 2010 by UNEP, the project was implemented by the UNEP-DTU Partnership and key partners in India: the Indian Institute of Ahmedabad (IIMA), the Indian Institute of Technology Delhi (IITD), and CEPT University. The project was funded by the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation, Building, and Nuclear Safety (BMUB), and developed in consultation with the India's Ministry of Environment, Forest and Climate Change (MoEFCC) and Ministry of Urban Development (MoUD).

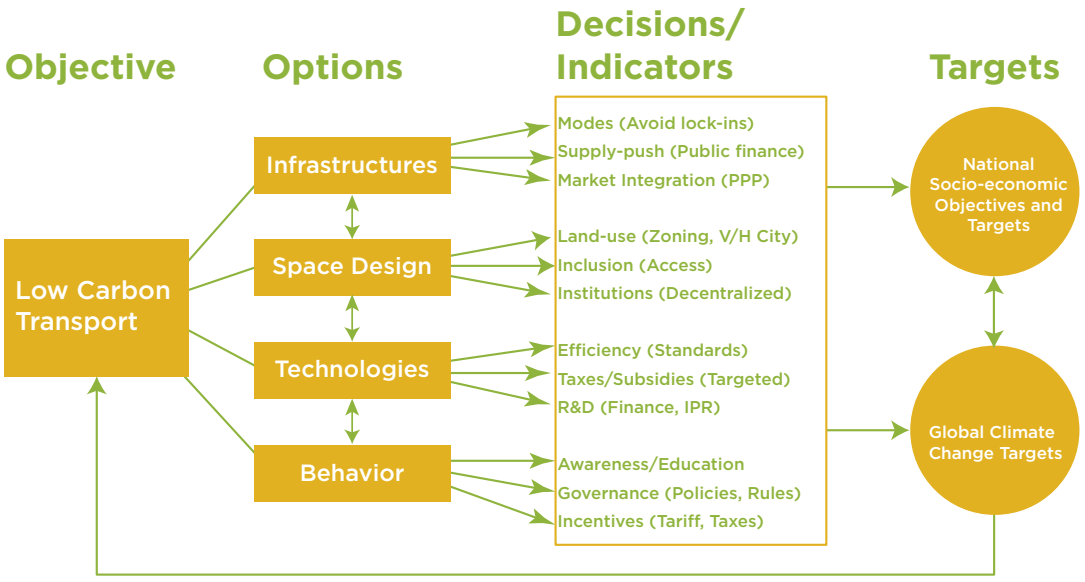
Overall Context

As of 2012, India's transport sector was responsible for 14 percent of the country's energy-related CO_2 emissions, as well as the resulting impacts on air quality, public health, road safety, and sustainable urban development. In recent years, increased vehicle use has led to an increase in congestion, accidents, and local air pollution. If this trend continues, the situation will deteriorate even further.

India has endorsed the long-term target of limiting the global temperature increase to under 2°C, and has also made a voluntary pledge to reduce its emissions intensity by 20 to 25 percent of 2005 levels by 2020. By aligning development and climate goals, India can make its transport growth more sustainable. The NAPCC outlines a combination of measures that can reduce transport CO_2 emissions, including increased public transit, expanded biofuel use, enhanced vehicle energy efficiency, and other initiatives, organized in eight National Missions. The mission that is most relevant to future low carbon cities is the National Mission on Sustainable Habitat.

The figure below illustrates a framework for achieving low carbon transport while fulfilling both national development objectives and global climate change targets.

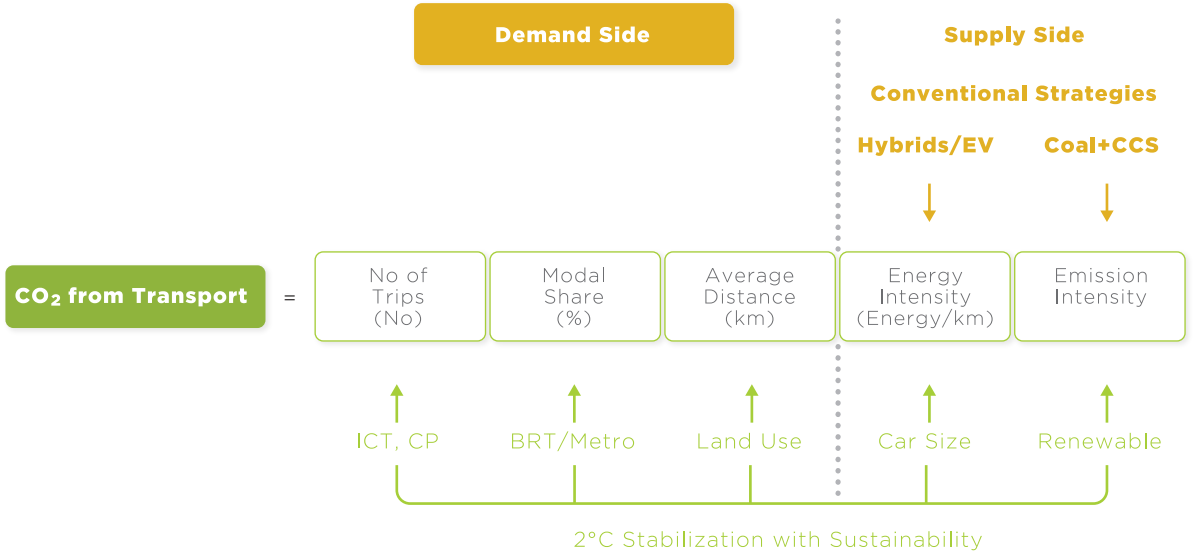
Framework for Sustainable Low Carbon Transport



Project Approach

The project focused on mapping out a low carbon transport pathway for India by analysing both the supply and demand for transportation, as illustrated below.

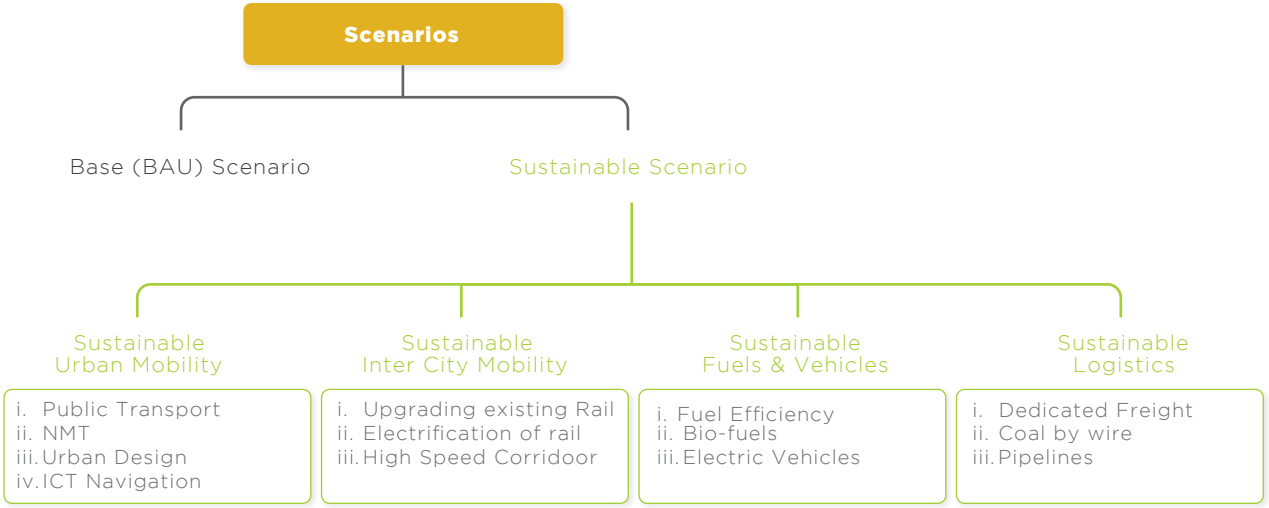
Emission Identity



Legend: EV - Electric Vehicle; CCS – Carbon Capture and Storage; ICT – Information and Communication Technology; CP – City Planning; BRT – Bus Rapid Transit

By modelling the business-as-usual scenarios for current and future demand against a low carbon scenario for 2050, the project was able to develop strategies for reducing emissions in the transport sector. The low carbon scenario looks at what kind of policy, infrastructure, investment, legal, and other actions would be required in the transport sector to achieve the global climate change target of 2°C stabilization for atmospheric CO_2 concentration by 2050.

Scenario Storylines



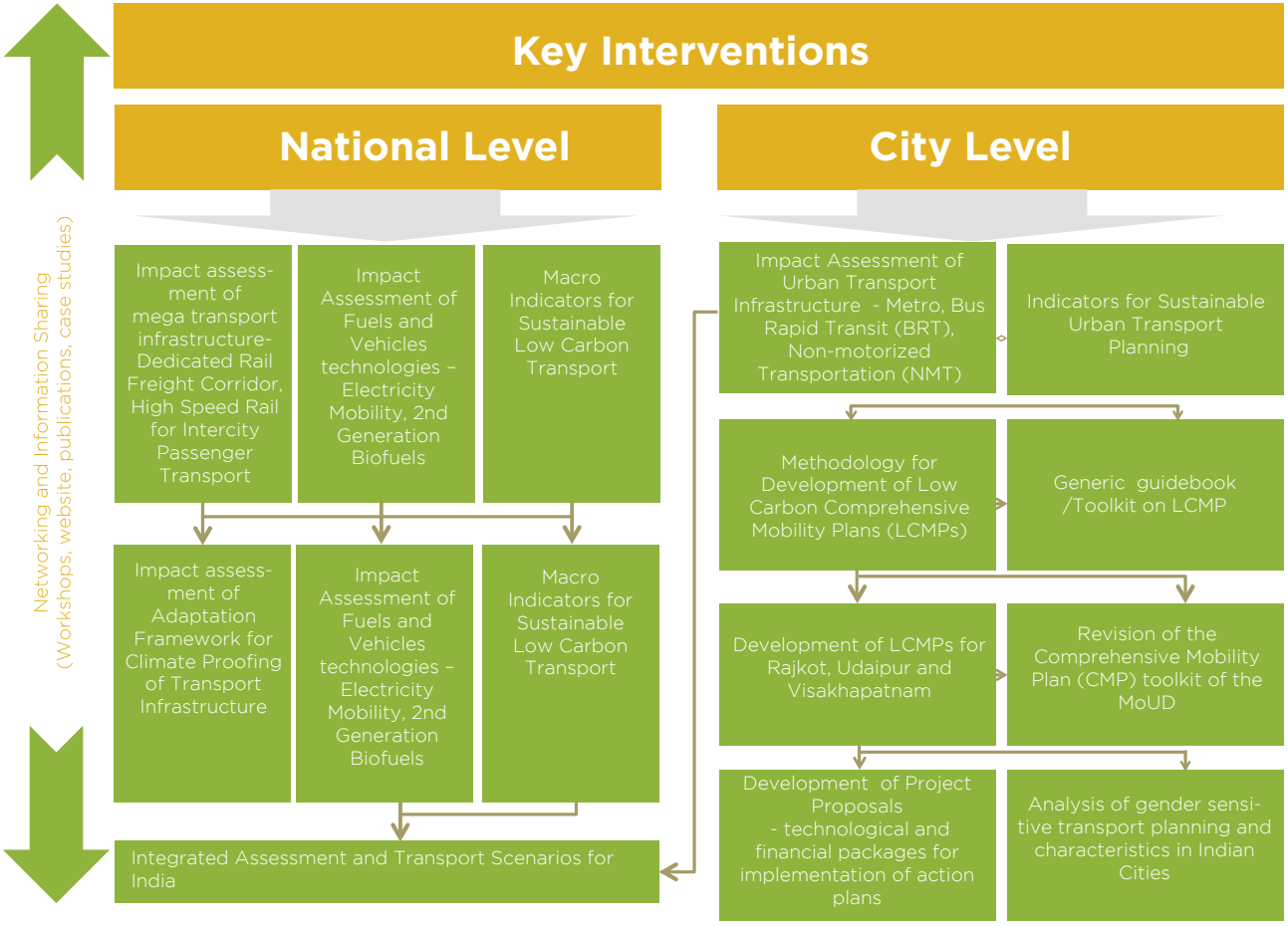
Activities, Achievements and Outputs

At the national level, the project conducted a model-based assessment for analysing India's low carbon transport options. The results of the modelling assessment were incorporated into an integrated assessment of India's transport sector, and were then used to outline an action plan that would help India achieve its climate change goals.

At the city level, the project assisted three Indian cities in preparing Low Carbon Comprehensive Mobility Plans (LCMPs). The process included analyzing business-as-usual trends in mobility demand and their implications, while using indicators for accessibility, inclusiveness, environment, and CO_2 emissions. Using a sustainability approach, alternative scenarios were then generated to identify strategies that help achieve climate and development goals.

The lessons learned from LCMP implementation have been used to revise the MoUD's Comprehensive Mobility Plan (CMP) toolkit [1] , which is the default transport planning guide for all Indian cities. Cities are required to use the CMP if they want to access MoUD funds for implementing sustainable urban transport projects. The toolkit represents an evolution from conventional transport planning methods towards low carbon mobility, and will be applied to all Indian cities.

[1] http://moud.gov.in/sites/upload_files/moud/files/pdf/CMP%20Report%20Revised.pdf


Key Interventions
National Level
City Level
Networking and Information Sharing
(Workshops, website, publications, case studies)
Impact assess-ment of mega transport infrastructure-Dedicated Rail Freight Corridor, High Speed Rail for Intercity Passenger Transport
Impact Assessment of Fuels and Vehicles technologies – Electricity Mobility, 2nd Generation Biofuels
Macro Indicators for Sustainable Low Carbon Transport
Impact assess-ment of Adaptation Framework for Climate Proofing of Transport Infrastructure
Impact Assessment of Fuels and Vehicles technologies – Electricity Mobility, 2nd Generation Biofuels
Macro Indicators for Sustainable Low Carbon Transport
Integrated Assessment and Transport Scenarios for India
Impact Assessment of Urban Transport Infrastructure - Metro, Bus Rapid Transit (BRT), Non-motorized Transportation (NMT)
Indicators for Sustainable Urban Transport Planning
Methodology for Development of Low Carbon Comprehensive Mobility Plans (LCMPs)
Generic guidebook /Toolkit on LCMP
Development of LCMPs for Rajkot, Udaipur and Visakhapatnam
Revision of the Comprehensive Mobility Plan (CMP) toolkit of the MoUD
Development of Project Proposals - technological and financial packages for implementation of action plans
Analysis of gender sensi-tive transport planning and characteristics in Indian Cities

National Level

- The project conducted in-depth analysis of India's transport sector, developing both business-as-usual and future scenarios. To do this, the project developed specific macro indicators and methodologies that made it possible to create roadmaps for low carbon transport.

- Various roadmaps were created for transport planning, including a roadmap for a sustainable low carbon transport system in India, encompassing technology needs, research and development, technology transfer, finance, and pathways for international cooperation. Two other roadmaps cover electric mobility and second-generation biofuels.

- The institutional capacity and skills of partner institutions was enhanced through hands-on training on sustainable transport.

- Three case studies were conducted on climate-proofing transport infrastructure, rail freight corridors, and the potentials of high-speed rail. A policy study was also done on the potential for improved fuel economy in both light- and heavy-duty vehicles.

- The project developed an integrated assessment of India's transport that harmonizes low carbon transport with development benefits. A targeted assessment was also conducted on alternative fuels and technologies, specifically, the potential benefits of second generation biofuels and electric mobility.

City Level

- Low carbon mobility indicators were developed to measure both inclusiveness and sustainability at the city level.
- The project developed a methodology for creating LCMPs for cities, and piloted the LCMP process in in three Indian cities (Udaipur, Rajkot and Vishakhapatnam). Project proposals were also developed for the ideas formulated in the cities' respective LCMPs.
- Training workshops on LCMP methodology were held for city managers and consultants.

The project revised MoUD's default toolkit for preparing CMPs for cities. The toolkit revision focused on incorporating climate change, inclusiveness, and sustainable development in transport planning. The revision brings the CMP closer to the city's master development plans.

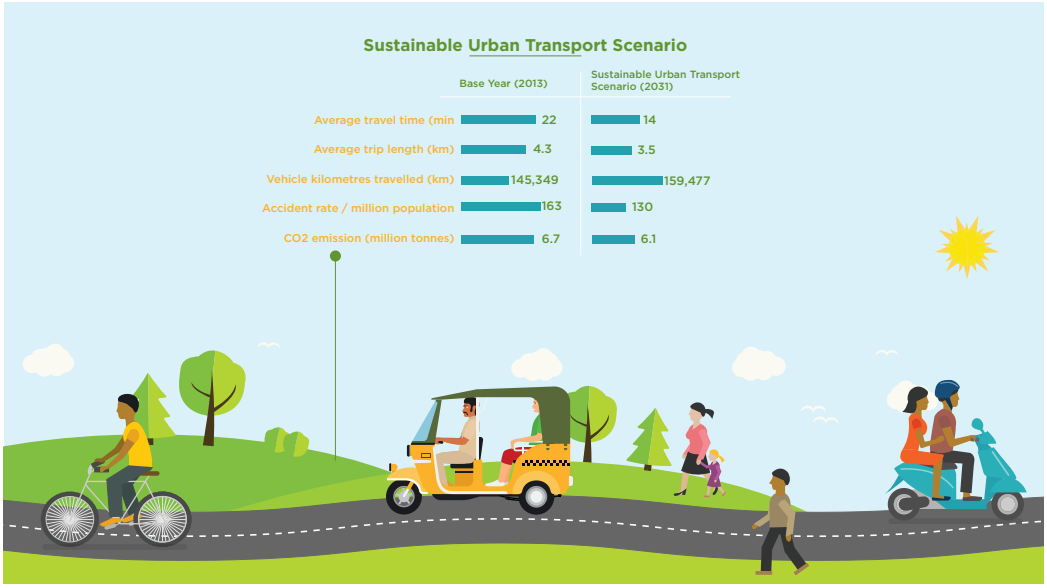
Knowledge Development and Information Sharing

- The project created an online information sharing network to facilitate stakeholder cooperation and encourage public engagement. Stakeholders were consulted in workshops before finalizing all key reports.
- News about transport infrastructure and ongoing interventions was disseminated; research and results were shared in peer-reviewed journals and international forums.
- All project results and outputs are available on the project website: **www.unep.org/transport/lowcarbon**. A publication catalogue listing all the project's reports, guidebooks, toolkits and other documents can also be found on the site.

Key Findings and Recommendations

LCMP Outcomes at the City Level

Apart from the LCMP methodology, the framework used for achieving a low mobility at the city level involves a four-prong intervention of improving land use planning, improving public transportation, improving non-motorized transportation, and improving fuels and vehicle technology.
The following tables show the key results from the LCMP work in Rajkot and Udaipur.



Low Carbon Urban Transport Scenario Indicators for Rajkot

Mobility and Accessibility

	Base Year (2013)	Sustainable Urban Transport Scenario (2041)
Modal Share of Walk	25%	28%
Modal Share of Cycle	3%	9%
Modal Share of Two Wheeler	48%	20%
Modal Share of IPT	18%	10%
Modal Share of Car	3%	1%
Modal Share of Public Transport	3%	32%

Safety to use NMT (user perspective)

	Base Year (2013)	Sustainable Urban Transport Scenario (2041)
Walk	7.50%	83%
Cycle	7%	80%
Total Motorised Vehicle Kilometers(Thousand Kms)	880,489	1,335,210
LOS of NMT facilities as per MoUD SLBHandbook	4	2

Land Use Mix Intensity

Increase in the % of Intra-Zonal Trips as compared to Base Year (Base year value is 19%)	Base Year (2013)	Sustainable Urban Transport Scenario (2041)
	16%	68%

Accessibility

	Base Year (2013)	Sustainable Urban Transport Scenario (2041)
% of HH within 10 minutes of walking to access PT (IPT for Base Year)	69	83
LOS of PT facilities as per MoUD SLB Handbook	4	2

Outcome of the Integrated Assessment of the Transport Sector

The project's integrated assessment shows that a low carbon transport transition is possible for India. The five key wedges that deliver mitigation benefits in the sustainable low carbon transport scenario are shown in the chart below.

First Wedge: **Electricity cleaning**, including the uptake of electric vehicles and the decarbonisation of electricity in India's power grid.

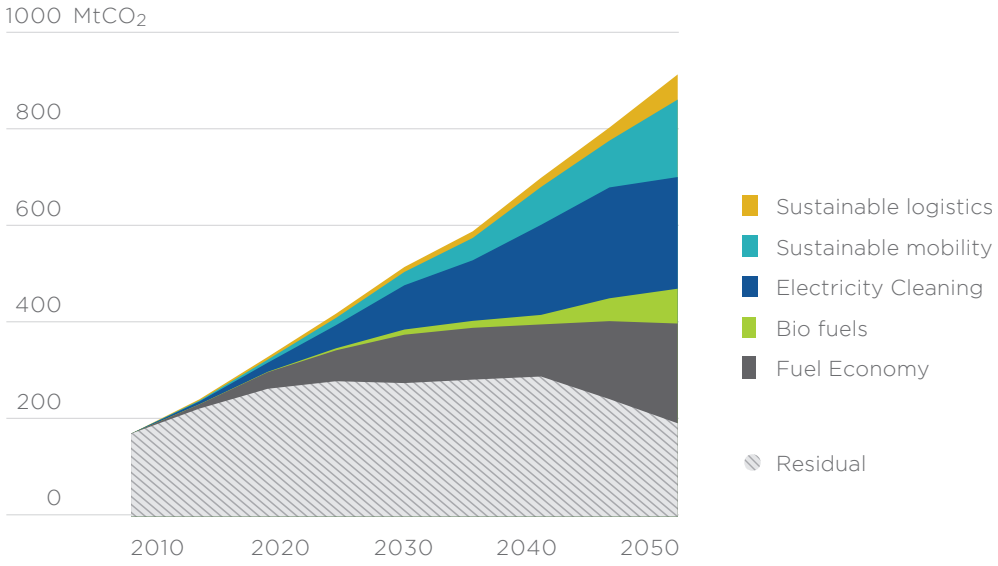
Second Wedge: CO_2 reduction from implementation of stringent **fuel economy** targets consistent with the vision set under the Global Fuel Economy Initiative.

Third Wedge: **Sustainable mobility**, including passenger transport initiatives such as faster implementation of metro and Bus Rapid Transit (BRT) systems, along with improved integration of non-motorised transport modes, the use of feeder buses, and a higher share of rail in intercity transport.

Fourth Wedge: **Biofuel penetration,** facilitated through national policies and enabling mechanisms, as well as carbon price.

Fifth Wedge: Interventions in the **freight transport** sector through the implementation of dedicated freight corridors, demand reduction for coal freight, etc. Significant energy-efficiency impact is already evident in the business-as-usual scenario and further co-benefits can be achieved in the low-carbon scenario from air pollutant reductions.

CO_2 Mitigation wedges from transport



Source : Dhar & Shukla, 2015

Note :
Detailed analyses are available in the report entitled "Transport Scenarios for India: Harmonizing Development and Climate Benefits" [2]

[2] http://www.unep.org/transport/lowcarbon/PDFs/TransportScenarios.pdf

The Project's Contribution to Existing Policies in India

- The integration of environment, safety, and climate change into Indian urban transport planning. These elements were formally integrated into the revised CMP toolkit with the cooperation of the Institute of Urban Transport.

- Improved availability of information regarding sustainability impacts of metro and BRT projects in cities.

- Studies of climate change impacts on large infrastructures (e.g., Konkan Rail) and climate impacts on large infrastructures (e.g., the Delhi- Mumbai Dedicated Freight Corridor).

- Mainstreaming climate change within institutions at the national and sub-national levels through a large number of workshops and trainings.

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- National Institute of Urban Affairs (NIUA)
- United Nations Environment Programme (UNEP)

Low Carbon Transport in India

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