



This report draws from the State-Level Capacity Building Workshop on Net-Zero Cities and Urban Climate Actions, held under the *Inclusive Net Zero Transport in Cities of Gujarat* project, jointly organized by UNEP Copenhagen Climate Centre, Ahmedabad University, IIT Delhi, and GUDM – Government of Gujarat. The workshop brought together government officers from multiple Urban Local Bodies (ULBs) across Gujarat, along with sector experts and community representatives, to strengthen municipal capacity for climate governance. It introduced the project's comprehensive approach, including the ERASI (enhance–retain–avoid–shift–improve) framework, GHG inventory tools, and strategies for land-use and transport emissions mitigation. Participants engaged in reviewing preliminary findings from primary and secondary data collection, providing valuable feedback to refine the project's strategy and advance inclusive, low-carbon mobility pathways aligned with the Viksit Gujarat 2047 vision and India's 2070 Net-Zero target.



Capacity Building Workshop on Net Zero Cities and Urban climate action

Report 2025

ACKNOWLEDGEMENTS

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Climate Action and Net-Zero in Cities
Agenda for Workshop – August 5 – 6, 2025
Venue: GIDM, Gandhinagar
DAY 1

Speaker	Presentation	Time
Registration and Tea: 9:45 - 10:15		
Inaugural Session: 10:15 - 11:30 <i>Session Moderator: Dr. Darshini Mahadevia</i>		
Shri I.P. Gautam (IAS) Director General, GUDI	Welcome Note: Capacity Building in 2025- The Year of Urban Development	10:15-10:30
Lighting the Lamp & Honouring Dignitaries	Project Team & GUDI Team	10:30 – 10:45
Prof. Raghavan Rangarajan (Dean, School of Arts & Sciences, Ahmedabad University)	Welcome note from Ahmedabad University, & University's Vision	10:45 - 11:00
Prof. Darshini Mahadevia (Project Lead Net Zero Transport)	Inaugural Address: Need for Climate Action in Cities & its Alignment with Viksit Gujarat 2047	11:00 – 11:15
Dr. Talat Munshi (Senior Advisor at UNEP Copenhagen Climate Centre)	UNEP's Commitment to a Net-Zero Future & Introduction of the "Net Zero Transport" Project	11:15 – 11:30
Tea Break: 11:30 – 11:45		
Session 1 - Net Zero Conceptualization for Urban Practitioners: 11:45 - 13:30 <i>Session Moderator: Dr. Geetam Tiwari</i>		
Dr. Subash Dhar	Net-Zero Gujarat: Key Results	11:45 – 12:15
Saumya Lathia (Chief Minister's Fellow, Urban Development Department) (Project Coordinator, Net Zero Transport, Ahmedabad University)	Gujarat's Climate Ambitions: Aligning state priorities with urban climate action	12:15 - 12:25

Prof. Geetam Tiwari (Professor, Emeritus, Transportation Research and Injury Prevention Centre, Indian Institute of Technology Delhi)	Net-Zero Transport Conceptualization (Need & Approach) – Components of Net Zero Transport	12:25 – 13:00
Prof. Deepty Jain (Project Coordinator, Net zero transport, IIT Delhi)	Climate Change: Sectoral Perspective- Net zero Transport in Indian Cities (Indicators). Introduction of Exercise	13:00 – 13:30
	Open Discussion	
Lunch Break: 13:30 - 14:30		
Session 2- Hands-On Learning Exercises: 14:30 – 16:00 (Two parallel Exercises with 4-5 groups each		
Hands-On Session A: Carbon Footprint Baseline for Transport CO2 Emissions (Groups of 4) – Key Emission Sources in Urban Areas Introduction (20 min) – Approaches Top Down and Bottom Up – Data Requirements for Baseline Assessment – How to estimate base year emissions – Projections methods and baselines – Exercise: Baseline Emissions Inventory (Basic)	Subash Dhar, UNEP Team <i>Saumya Lathia & Jayesh Solanki</i>	14:30 – 16:00
Hands-On Session B: Assessing Applicability of Indicators for Net-Zero at City level (Groups of 4) – Assessing Data availability – Alternate Data Sources – Exploring Applicability and Measurability of Proposed Indicators	IIT Team <i>Dr. Deepti Jain and Nandini Sharma</i>	14:30 – 16:00
Tea and Snacks 16:00 – 16.15		
‘Learnings’ Discussion Session – Presentation by the teams	Prof. Mahadevia & Prof. Tiwari	16:15 – 16:45

DAY 2

Speaker	Presentation	Time
Session 1 - Net-Zero Transport for Urban India: 10:00 - 11:30 <i>Session Moderator: Dr. Darshini Mahadevia</i>		
Strategies from UNEP Model: Net-Zero Cities	UNEP Team	10:00 – 11:30
Presentation: Strategies for compact development, green spaces, and sustainable urban design <i>Hands-On Exercise: ‘Most-viable’ Net-Zero Strategies for Your City</i>	UNEP Team <i>Saumya Lathia</i>	
Tea Break: 11:30 – 11:45		
Session 2 - Sustainable Transportation Solutions: 11:45 – 13:15 <i>Session Moderator: Dr. Talat Munshi</i>		
Strategies from IIT Model: Net-Zero Transport Strategies	IIT Team	11:45 – 13:15
Presentation: Potential Net-Zero Strategies from Case study of Rajkot <i>Hands-On Exercise: Exploring Scenarios and its Effectiveness for Net-Zero Transport for Four Cities of Gujarat</i> – Understanding travel data to assess effectiveness of alternate scenarios. – Defining strategies for achieving best-fit scenario. – Acceptability of alternate strategies and scenarios for Net-Zero transport – Scenario-based assessment using worksheet	IIT Delhi Team	
Discussion Session		
Lunch Break: 13:15 - 14:00		
Session 3- Net-Zero Land-use & Transport: 14:00 - 15:30		
Hands-On Session: Land-use & Transport Emission Model – Excel Based Model	Dr. Munshi and Dr. Jain	14:00 – 15:00
Group Presentations	Workshop Participants	15:00 – 16:00
Tea and Snacks: 16.00 – 16:15		
Closing Ceremony & Certificate Distribution	Remya Mohan (IAS) Commissioner of Municipalities Administration Project Team, GUDI Team & Dignitaries	16:15 – 17:00

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Net Zero Cities and Urban Climate Action

The project ‘Inclusive Net-Zero Transport in Cities of Gujarat’ emphasizes an inclusive approach for achieving net zero emissions within the transport sector. The project is a collaborative effort between Ahmedabad University, Indian Institute of Technology (IIT), Delhi, and UNEP Climate Centre Copenhagen (UNEP CCC). The project is funded and supported by UNEP CCC. The project objectives include developing a detailed approach and methodology, studying the existing transport scenario, and proposing a scenario-based net zero plan for the case city of Rajkot.

The transport sector is a major contributor (10%) of greenhouse gas (GHG) emissions, with road transport alone accounting for 70% of total urban transport emissions. A sustainable and net-zero transport scenario in Indian cities requires a paradigm of **enhance-retain-avoid-shift-improve-eliminate framework**; that is, **enhance** mobility of those not experiencing one now, **retain** current low trip lengths, **avoid** motorized trips for all, **shift** to public transport and non-motorized transport, and **improve** technology of motorized vehicles. Additionally, net-zero transport needs to interface with Sustainable Development Goals (SDGs) as highlighted in various Intergovernmental Panel on Climate Change (IPCC) reports. The 1.5°C Report and Assessment Report Six of the Working Group III indicates that climate change mitigation efforts must aim to achieve the SDGs. Hence, the former must be assessed for their synergies and conflicts with the latter.

The project approach and methodology aim to achieve net-zero urban transport in Indian cities, in the context of mobility-poverty, through a low-carbon transportation system that improves access for underserved populations. The project outlines three scenarios for 2030, 2040, and 2050: Business as Usual (BAU), a Technology Scenario for Net-Zero Emissions, and an Inclusive Net-Zero Emissions Scenario. The 2050 scenario is expected to link with the ‘Viksit Gujarat 2047’ vision, whereas India’s commitment is to achieve net-zero by 2070. Effective implementation of this plan, require definition of net-zero and net-zero transport within the Indian context, developing pathways for inclusive transport solutions, and creating indicators to track progress.

Project Partners:

- School of Arts and Sciences, Ahmedabad University
- Transportation Research and Injury Prevention (TRIP) Centre, IIT Delhi
- UNEP Climate Centre Copenhagen

Prof. Darshini Mahadevia (Project Lead), Prof. Geetam Tiwari (IIT Delhi), Prof. Deepty Jain (Project Coordinator, IIT Delhi) and Ms. Saumya Lathia¹ form the core project team placed at

¹ Ms. Saumya Lathia is currently employed as a Chief Minister’s Fellow with the Urban Development Department, Government of Gujarat. She continues to engage with the project in an Honorary capacity.

Ahmedabad University and IIT Delhi, India. UNEP Copenhagen Climate Centre supports and funds the project. The project is grounded in the city of Rajkot in Gujarat, and is conducted in coordination with Rajkot Municipal Corporation officials.

Day 1

Inaugural Session

The inaugural session was anchored by Prof. Darshini Mahadevia, School of Arts and Sciences, Ahmedabad University. She welcomed the dignitaries of the session with a bouquet of flower. The dignitaries on the stage included Shri I. P. Gautam (IAS), Director General of Gujarat Urban Development Institute (GUDI), Prof. Geetam Tiwari, Transportation Research and Injury Prevention (TRIP) Centre, Indian Institute of Technology, Delhi (IITD), Dr. Subash Dhar, United National Environment Programme (UNEP), Copenhagen Climate Centre, Dr. Talat Munshi (project coordinator), from UNEP, Copenhagen Climate Centre, and Prof. Raghavan Rangarajan, Dean, School of Arts and Sciences, Ahmedabad University.

This capacity building workshop was jointly organised by the Urban Development and Housing Department, Government of Gujarat, Gujarat Urban Development Institute, Ahmedabad University, IIT Delhi, and UNEP Copenhagen Climate Centre.

Shri I P Gautam gave his inaugural speech welcomed the participants from the nine newly declared Municipal Corporations of Gujarat, namely, Navsari, Vapi, Anand, Nadiad, Mehsana, Surendranagar, Morbi, Porbandar, Bhavnagar, and Gandhidham. Besides, these, representatives from Rajkot Municipal Corporation, Surat Municipal Corporation, and Vadodara Municipal Corporation were also present. Deputy Municipal Commissioner of Rajkot, Deputy Municipal Commissioner Navsari, and Assistant Municipal Commissioner from Surat participated in this workshop for two full days.

Shri I P Gautam, presented profound ideas related to urban transport. He said that urban transport is not a technical issue but a social project. He suggested that while in the last two decades cities have focused on expanding the public transport network and invested heavily in the systems, its use has been limited partly because of last leg connectivity issues. There is therefore a need to expand public bus system, which can also act as a feeder system to metro or BRTS system. He highlighted that this workshop has come in the year, which has been declared as an Urban Year. That is, 2025 has been declared as an ‘Urban Year’ by the Government of Gujarat. 2005 was also declared as ‘Urban Year’ by the Government of Gujarat.

He also said that it is not 20 years since the National Urban Transport Policy (NUTP), 2006. But, recommendations in this policy are still valid and have to be implemented. After the formulation of the NUTP, 2006, revised in 2014, the auto rickshaws were converted to CNG. Now after 20 years, the auto rickshaws need to be converted to Electric Vehicles (EVs).



He raised an important governance issue, of getting onboard all the stakeholders in the net-zero transport project. He said that when the project of converting autos to CNG, there was resistance from the auto-rickshaw mafia. They were convinced and brought on board for this successful transition. At one go, 5,000 auto rickshaws were converted to CNG in the early period. Now, all auto rickshaws are CNGs. He said that now, we need to once again think of a governance system to bring on board all stakeholders and the people to the project of net-zero transport.

Lastly, and importantly, he flagged the importance of forging partnerships in this net-zero endeavour. The partnership should be of the academic institutions, the government, and people. This workshop is a step in that direction.

The second speaker in the inaugural session was Prof. Raghavan Rangrajan, Dean of the School of Arts and Sciences, Ahmedabad University. He introduced the University, stating that this is a research university with an emphasis on interdisciplinary, and problem-solving approach to academic learning. That is, the real world is brought into the class room. He further stated that two main areas of focus of Ahmedabad University are Climate Change and Urbanisation. Thus, this workshop is very important part of Ahmedabad University's education and research. This focus has led to Ahmedabad University setting up, firstly a Global Centre on Energy and Environment, followed by a Climate Institute. The Global Centre was started under the leadership of Prof. P R Shukla, who was the co-chair of the Working Group III for the Assessment Report 6 of the Intergovernmental Panel on Climate Change (IPCC). Prof. Raghavan said that now, for the globe, and also for India, there is no Plan B on Climate Change and hence we have to act now.

Prof. Darshini Mahadevia introduced the importance of urban areas for climate change actions. She presented some data related to this point. More than half the population in India will be living in the urban areas in India (See Chart 1). Chart 2 shows that largest urban population in India will be living in the cities less than 300,000 and then in cities between 300,000 to 500,000. Hence, the small and medium sized cities will require to transform to net-zero situation. Hence, this workshop, which has brought these cities together is very important starting point.



Chart 1: Urbanisation Trend in India

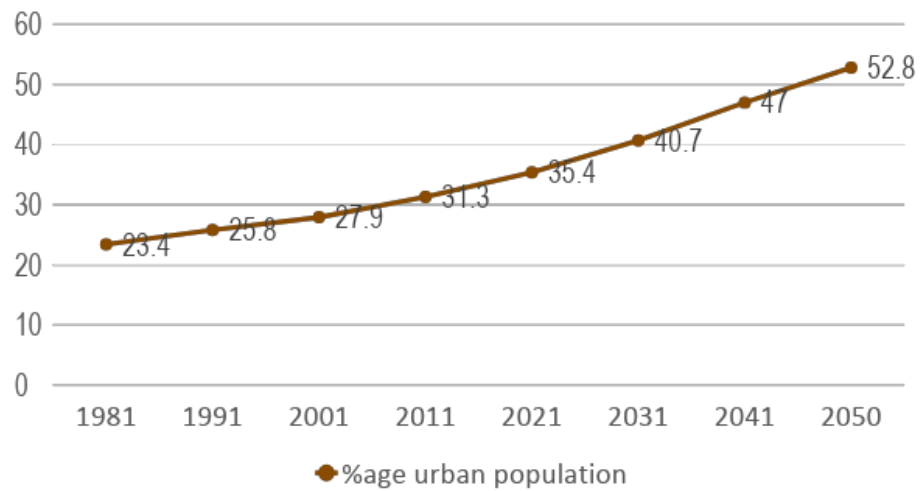
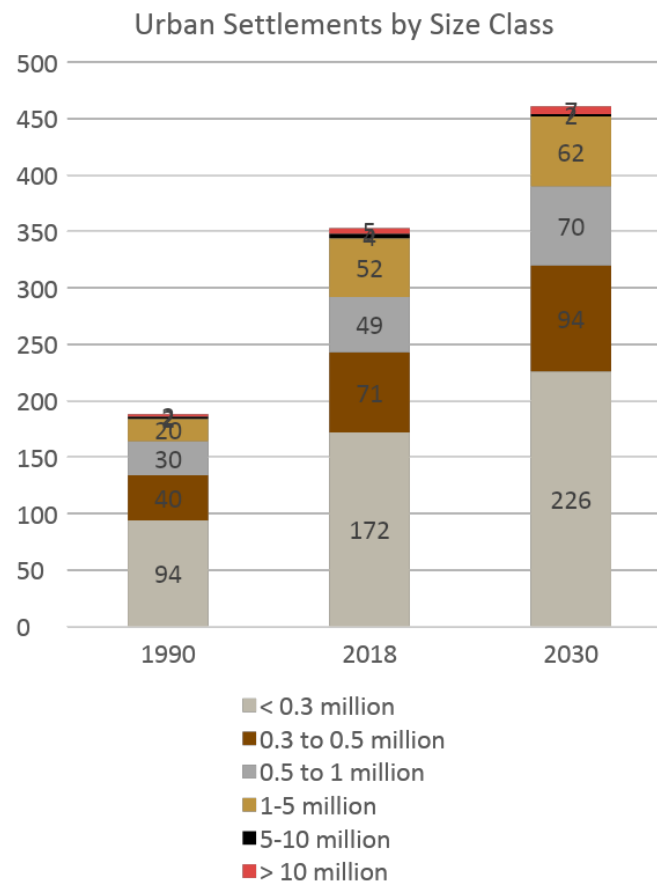
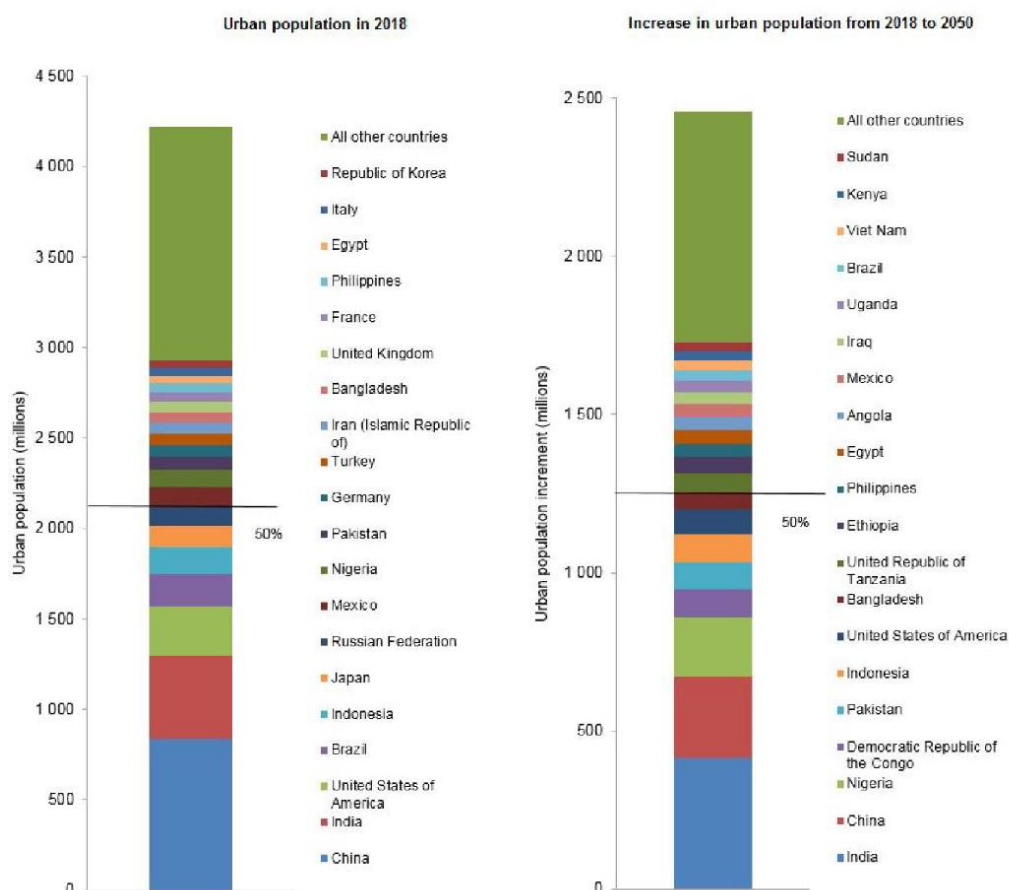


Chart 2: Urbanisation Pattern in India



The third important point Prof. Mahadevia raised was that by 2050, India will house the largest number of urban residents in the world. In 2018, India stood second in total number of urban residents. Hence, cities in India will be an important contributor to achieving the national and global ambition of net-zero.

Chart 3: Size of Urban Population for Select Countries



Prof. Mahadevia flagged the following issues for achieving net-zero ambition:

1. Cities can achieve net-zero or near net-zero through deep decarbonization and systemic changes
2. Urban deep decarbonisation entails implementing three broad strategies concurrently: (i) reducing urban energy consumption across all sectors, including through compact and efficient

Development &
Planning Department
Government of Gujarat



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urban forms and supporting infrastructure; (ii) electrification and switching to net zero emissions resources; and (iii) enhancing carbon uptake and stocks

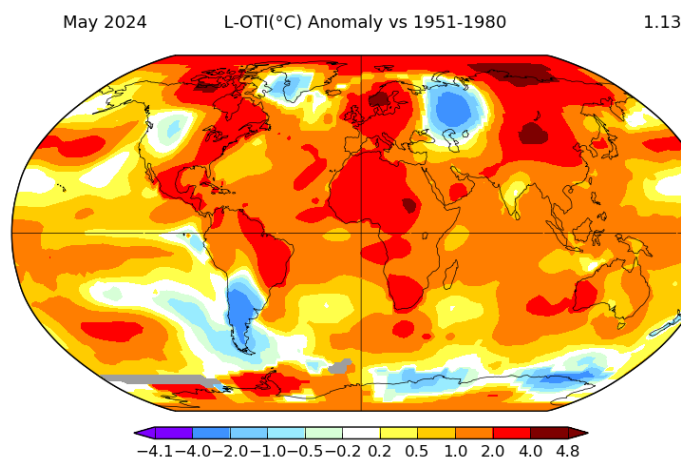
3. Integrated spatial planning to achieve compact and resource-efficient urban growth through co-location of higher residential and job densities, mixed land use, and transit-oriented development could reduce GHG emissions between 23-26% by 2050 compared to the business-as-usual scenario

4. Urban green and blue infrastructure can mitigate climate change through carbon sequestration, avoided emissions, and reduced energy use while offering multiple co-benefits

5. With over 880 million people living in informal settlements, there are opportunities to harness and enable informal practices and institutions in cities related to housing, waste, energy, water, and sanitation to reduce resource use and mitigate climate change.

The inaugural session ended with a brief presentation by Dr. Talat Munshi of UNEP Copenhagen Climate Centre on the UNEP's commitment to Net-Zero. He introduced the whole Net Zero project of UNEP. He said that this project in Gujarat has other components, (i) Net-Zero Gujarat, which is has been conducted in partnership with Ahmedabad University and led by Dr. Subash Dhar, (ii) Net-Zero Transport, about which this workshop will be discussing, (iii) Nature-based solutions in partnership with CEPT University, and (iv) Loss and Damages with ICLEI. He then showed data that although the temperature rise in India has not been as high as in the Europe, a few degrees increase in situations of high temperatures in India is fatal. It is getting hotter in India and in Gujarat (see Figure 1).

Figure 1: Global Temperature Increase





Dr. Munshi also raised the issue that globally the transport mitigation focuses on the Avoid-Shift-Improve (ASI) paradigm, in this project, we have added a component of Enhance, i.e. Enhance, Avoid, Shift and Improve approaches. Enhance is to address the issue of development in our cities. He then briefly introduced the Tool named 'City Transparency Tool', which has components related to Data Preparation and Population analysis, Trip Generation and Mode Choice data generation, Emissions Analysis, and Scenario Comparison. He also introduced the idea of Co-benefits, that is, with the reduction in GHG emissions and local pollution due to Net-Zero transport, there will be co-benefits in the area of local environment, health, well-being and economic growth. He said that the City Transparency Tool will also help in assessing the co-benefits of Net Zero Transport. Lastly, this tool helps in city level policy making.

Session 2

This session was chaired by Prof. Geetam Tiwari. Firstly, Prof. Tiwari listed the potential of different modes to be green and low-carbon transport modes in a hierarchical manner. The modes that have zero emissions are walking and cycling. Then, road-based public transport, followed by rail-based public transport, is low-carbon, followed by Electric two-wheelers and Electric four-wheelers. She then introduced Kaya Identity in transportation, stating that the GHG emissions from transport are determined by (i) system infrastructure and modal choice, (ii) fuel carbon intensity, (iii) Energy intensity of vehicles, and (iv) activity (that is, trip-rates and trip-lengths). She said that the Net Zero Urban Mobility Concept is one in which “a system that encourages low carbon modes of transport, providing safe mobility and accessibility for all, reduces the carbon intensity of the motorised modes and integrates nature-based solutions and circular economy concept to offset waste generation and emissions.”

Prof. Tiwari, using 2011 Population Census data, showed that in Indian Cities, 49% did not use motorized transport, 20% used motorized two-wheelers, and only 5% used motorized four-wheelers. She said that nearly 20% of urban male workers and 33% of urban female workers did not travel for work. Among those who travelled, 70% did not travel more than 5 kms. This means that currently India's urban transport situation is sustainable and the transport planning endeavour is to retain this. She then simulated the situations concerning travel distance and preferred modes, showing that rail-based public transport, that is, metro, works well if the trip distance is more than 15 kms, whereas walking works best if the travel distance is less than 2 kms and cycling if the travel distance is less than 10 kms. These choices will save time and most people choose a mode based on travel time and then convenience. She also said that the smaller the cities, higher the potential for low-carbon modes as the travelling distances are shorter. She argued this with data from different small cities in India.

Capacity Building Workshop

Net Zero Cities and Urban Climate Action

A Collaborative effort focusing on an inclusive approach for achieving Net-Zero emissions in the transport sector.

- Building foundational understanding of climate change
- Practical tools for calculating carbon footprint
- City specific strategies for Net-Zero transportation and Landuse
- Inter-city collaboration and peer learning

Strategies based on:

- | | | |
|---|---|---|
| ■ ENHANCE
Mobility for underserved population | ■ RETAIN
Current low trip lengths and sustainable travel patterns | ■ AVOID
Unnecessary motorized trips for all users |
| ■ SHIFT
To public transport and non-motorized transport modes | ■ IMPROVE
Technology of motorized vehicles (EV, clean fuel) | ■ ELIMINATE
Sequester additional CO2 emissions |



Research engagements in allied domains

5-6 AUGUST 2025

VENUE:

Gujarat Institute of Disaster Management (GIDM)



GIDM

 GUJARAT INSTITUTE OF DISASTER MANAGEMENT

BUILDING RESILIENCE

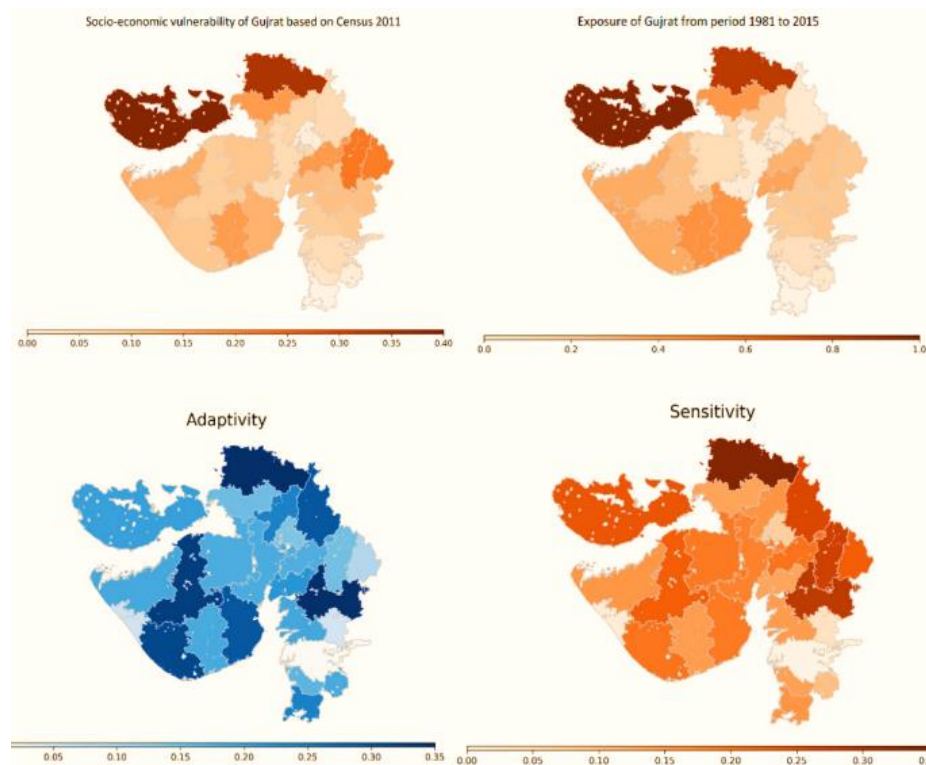
Ms. Saumya Lathia, Chief Minister Fellow, Urban Development Department, presented ideas on Mainstreaming Climate Action into Urban Planning & Policy Frameworks for Gujarat. She presented some broad statistics on urbanisation and climate change in the world followed by observed impacts of climate change in Indian cities, which are:

- 200% increase in extreme weather events (EWEs) since 2005
- Heatwaves to increase 75-fold; 10 of the world's 15 "warmest" cities
- Extreme rainfall to increase by 70% and droughts by 30%
- Over 80% (close to 388 million) of the Indian population is vulnerable to either flood, drought, or cyclone
- Acutely vulnerable population residing in low-elevation coastal zones likely to triple by 2060 (216 million)
- Extreme Weather Events (EWEs) cause economic loss of 9-10 million annually, making India the most "economically harmed" country by EWE worldwide
- 21 major Indian cities heading towards Zero Groundwater
- The cost of poor planning is estimated between 1.2% - 6.3% of GDP by 2050

She presented basic facts about urban Gujarat:

- Higher urbanization level than national average since 20th century
- Has the fastest growing cities since 2001; decadal growth rate of 35%
- 73% urban population resides in Class-I cities (cities with population more than 100,000)
- 53% urban population in 4 cities: Ahmedabad, Surat, Rajkot & Vadodara
- Despite having the longest coastline, Gujarat's urbanization is clustered in-land

Figure 2: Climate Change Vulnerability in Gujarat



She presented data on Gujarat's climate change vulnerability. These are:

- Gujarat is semi-arid; with 5 sub-climate types
- 54% of the cultivated land dependent on rain and more than 60% of the total land area lying in drought-prone zones
- 19 of the 26 districts in Gujarat could become climate change hotspots by 2050
- 52% of Gujarat's land area was degraded/ under desertification
- Area under dense and moderately dense forest cover has declined by 11% since 2005
- 60% of the total area is drought-prone
- 4 cities housing 54% population 'highly-prone' urban flooding

Gujarat's efforts in addressing climate change were highlighted:

- First state in Asia to have a dedicated Climate Change department
- Implemented 110 policies across 27 departments since 2005
- Ranks 1st in Solar Rooftop Installation; hosts 25% of national capacity
- Ranks 1st in Composite Water Management Award by NITI Aayog 2017-19

- Ranks 3rd in total installed renewable power in the nation
- Several Awards under Swatchh Survekshan in 2025
- Applauded for its “high performance” in NITI Aayog’s “SDG India Index & Dashboard for 2020-21
- One of the first states to develop a State Action Plan on Climate Change (2014)
- Pioneer in Cool Roofs Strategy and ECBC implementation
- Modhera Sun Temple - now a solar village
- Gujarat pledged 100 GW RE capacity by 2030 (out of India’s 500 GW)
- Gujarat aimed to have Solar Rooftop Scheme adoption of 1 crore houses; its innovative policy landscape has already encouraged 1.3 crore registrations
- Gujarat’s ambitious RE goals will enable 17 lakh jobs and reduce emissions by 72%
- Gujarat has identified 12 industrial cities to adopt RE and 50 ports to adopt Hydro-pump mechanisms for increased RE capacity and generation
- 8 high-speed corridors are also identified to install innovative RE
- Viksit Gujarat pledges: NET-ZERO by 2047

Dr. Deepty Jain, IIT Delhi, in her presentation on indicators in Session 3, explained the relevance of indicators in decision-making, programme monitoring, and evaluation. She said that the indicators guide the decision-making process, assist in evaluating existing and desirable situations, and assess alternatives. They also help in communicating decisions, policies, and programs. Finally, the indicators must be context-specific. She then illustrated the use of indicators. For example, if the approach to transport planning is ‘Retain’, then the strategies would involve putting in place active mobility infrastructure, whose indicator would be the percentage of roads with 1.5 m wide footpaths. If the approach is ‘Avoid’, then the strategy would be mixed land use, and its indicator would be the percentage of areas with mixed land use.

Dr. Jain presented the indicators developed so far into the following components:

- i) Infrastructure,
- ii) Social, which included indicators related to affordability, mobility, safety, and security
- iii) Environment, which includes environmental impacts and energy
- iv) Economic,
- v) Technology, and
- vi) Response, which included indicators on economic responses.

Google Sheets presentation slide showing transport data tables.

Percentage of trips by distance		Scenario - shift from modes by distance		Average trip length (km)
Modal share	< 5 km	> 5 km	% < 5 km to NMT	% > 5 km to bus
10%	88%	12%	0%	3.4
35%	65%	35%	0%	5
11%	48%	52%	0%	4.31
3%	51%	49%	0%	7.8
2%	30%	70%	0%	11.87

Vehicle efficiency (km/ltr)		
Gasoline	Diesel	CNG
52.6		
19.5	27.3	31.70
3.61	3.7	0.64
10	17	18.50

Percentage of fleet			
	Gasoline	Diesel	CNG
MTW	100%		
IPT	1%	33%	66%
Bus	0%	100%	0%
Car	28%	18%	40%

Define Scenarios
Baseline

Gujarat Institute of
 Urban
 & Regional Planning
 or, Architecture & Planning
 Building
 Properties
 City
 Urban
 Strategies
 5-6
 VENUE
 Gujarat Institute

This presentation was then followed by a ‘hands-on exercise’ with the participants on their selection of indicators. A hard copy of the selected indicators was circulated among the participants so that they could provide their input. The participants were asked to review the indicators based on three criteria: firstly, essential indicators (Yes/No); secondly, whether there are available data sources (Yes/No) and listing what those are; and lastly, what should be the time period for data update frequency.

Chart 4 provides an overview of the responses for the first criterion for all the indicators. The chart shows the responses to which indicators are considered essential by the participants. The indicators under the social component have most responses as essential, for example, average waiting time for PT services, modal share, etc. This reflects that these indicators are most essential in achieving the net-zero emission targets, according to the participants. The following component is infrastructure, which has received the most responses. The indicators under the response component registered less number of responses, for instance, the indicator- other charges levied as applicable at the city level, disaggregated by modes received only 7 cumulative responses.

Chart 4: Response Rate for Indicators



The participants mentioned various sources of data for the indicators. Figure 3 lists the major data sources as suggested by the participants. For the third criterion of data update frequency, there were variations in the responses of the participants. The most common response was yearly data upgradation for the majority of the indicators. But there were some variations. For instance, in the infrastructure component, indicators such as- percentage of roads with footpaths $\geq 2\text{m}$, the participants have suggested 7, 30, 60, 90, and 365 days. Similarly, for the indicator- average number of interchanges per public transport trip, the responses are daily, 7, 30, and 90 days. On the other hand, for indicators under the technology component, such as- alternate fueling stations, almost all the participants have suggested a yearly basis. Therefore, the participants have taken into account the components along with the indicators while suggesting the time period for data update frequency. Some of the participants have commented that regular data updates are required for the indicators.

Figure 3: Data Sources for Measuring Indicators

Technology	RTO, Fueling stations, Town planning, Surveys, MOH
Infrastructure	Municipal corporation, Road Department, Town planning, Public Transport authorities, Surveys- QR codes for public, MVO, GIS data, traffic police department
Environment	RTO, Electricity department- area-wise, Energy Efficiency Cell, Urban Local Body (ULB), Forest department, Environment and energy department, Pollution Control Board
Social	Saarthi app, Public transport authorities, Municipal corporation, Survey- ULB, reports of institutions like CEPT
Economy	Surveys, Census data, Transport department, RTO, Tax department.
Response	Ticketing, MVO, Transport department, RTO, Ministry of Energy, Traffic police, State govt authorities, Municipal corporations

Day 2

In the first session, Dr. Subash Dhar presented the results from the Net-Zero Gujarat project, which is also being implemented in partnership with Ahmedabad University. However, before presenting the findings, he explained various terminologies used in climate change related research. He explained the terms mitigation and adaptation, net zero, and various measures of energy, which are used in the literature. He first laid out the question of setting the boundary for the modeling exercise. The boundary has to be set with regard to geography (which is very important for city level modeling exercises), temporality (that is the period of projection of data and scenario building), sectoral boundary (which sector is being dealt with), assumption about energy sources, and emission gases (which gases are being modeled for). In case of Gujarat, all economic activities undertaken within the boundary of Gujarat have been considered. Similarly, for the Rajkot model, the boundary of the city projected for 2050 has been taken. All emission gases can be modeled but these then have to be converted to carbon equivalent. However, for local air pollution assessment, other gases such as NO_x, methane, etc. should also be considered.

Dr. Dhar introduced the top-down approach for estimation of GHG emissions and listed parameters that are included in the model. He then introduced the bottom-up approach for estimation of emissions. This is Avoid Shift Improve Fuel Framework (ASIF)

$$A * S_i * I_i * F_{i,j} = Total\ GHG$$

Where:

A is total Transport Activity (in PKM)

S is share of PKM by mode (i)

I is fuel efficiency by mode (i) (lit/km)

F is emissions per unit of fuel by mode and type of fuel (i,j) (kgCO₂/GJ)

i is mode

j is type of fuel



In transport modeling he explained that there are two inputs for calculation, activity data and emission factors for each of the fuel used.

He undertook a brief exercise of calculating overall emissions from economic activity.

Dr. Dhar also presented the results of their Net-Zero Gujarat model. Chart 4 gives the GHG emissions for Gujarat disaggregated by sectors. He then presented the assumptions used for the transport sector projections for Gujarat, which is presented in Chart 5. Since, the entire transport is expected to shift towards Electricity, Hydrogen, or Biofuels, with majority share contributed by Electricity, it was important to see the electricity production projections for the Net Zero Scenario, which are given in Chart 6.

Chart 4: GHG Emissions for Gujarat

SECTOR	2018	2019	2020	2021	2022
Agriculture	1.13	1.22	1.27	1.32	1.32
Captive Electricity Generation	17.18	18.46	19.54	17.11	17.96
Commercial	0.40	0.35	0.38	0.40	0.42
Industry	101.06	97.87	95.91	104.43	114.53
Residential	3.47	3.38	3.40	3.53	3.70
Transport	24.06	25.82	23.93	26.22	29.91
Utility Electricity Generation	91.42	94.92	90.67	68.86	63.73
Grand Total	238.74	242.02	235.10	221.68	231.59

Chart 5: Sectoral assumptions in LEAP – Transport

Assumptions	Reference scenario	NZ scenario
Transport		
Phase out of oil products in the transport sector	No	Phase out by 2050 in cars, by 2070 in buses, by 2070 in three wheelers.
Share of bio fuel and bio CNG	No	Bio-CNG reach 13% in cars, 30% in buses, 10% in three wheelers in 2070
Electrification of road transport	No	Share of electric vehicles reaches 100% in 2035-2045 (cars, three-wheelers, buses) in line with targets set in GFEI

Chart 6 shows that:

- Electricity generation increases by 9.5 times in the Reference scenario and by 18.8 times in the Net Zero SS Scenario by 2070 compared to 2020.
- In the Reference scenario, the share of coal for power generation decreases slightly from 63% in 2020 to 49% in 2070, with coal remaining a major energy source of energy generation.
- In the Net Zero SS Scenario, coal's share gradually reduces and reaches 23% in 2070.
- Renewable power generation (solar and wind) increases from 15% in 2020 to 33% in 2070 in the Reference Scenario, and to 66% in the Net Zero SS Scenario.

Chart 6: Electricity Generation

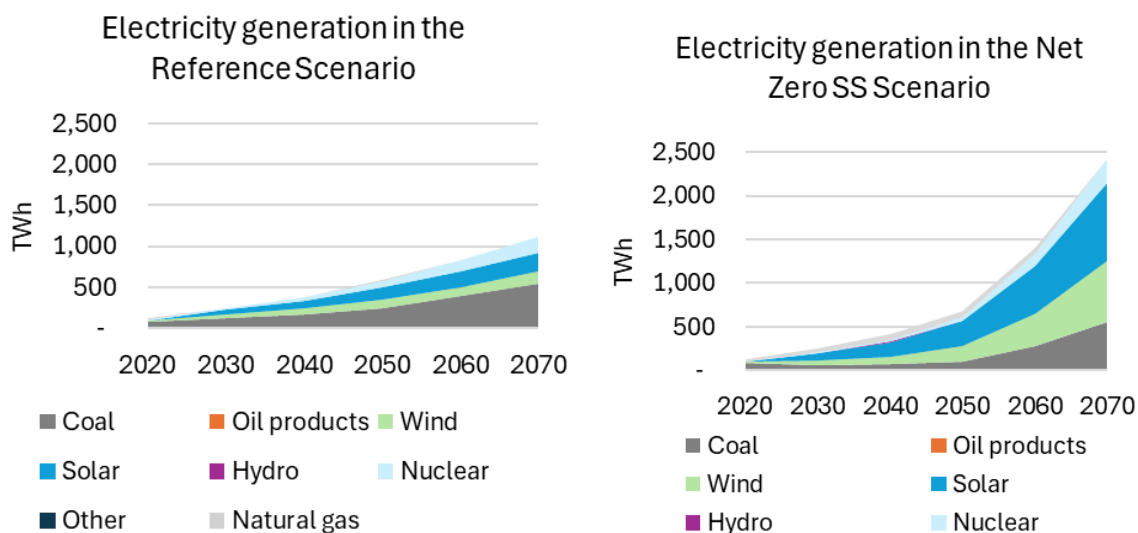
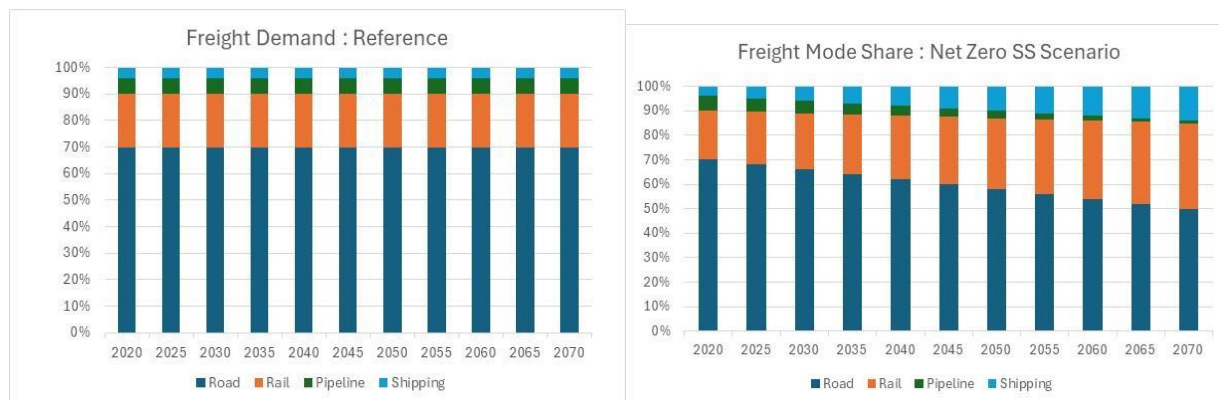


Chart 7: Transport Modeling Results



The Transport Sector Modeling results are seen in Chart 7, which shows that:

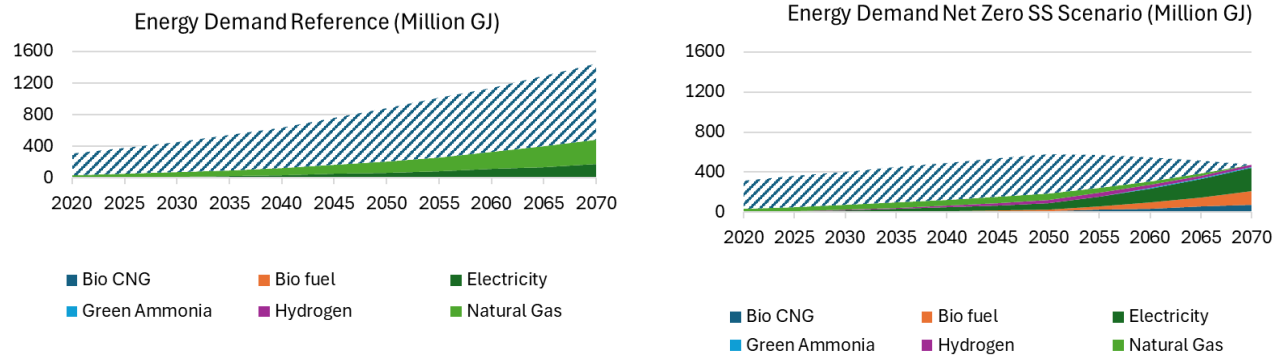
- Transport sector energy demand in 2020 was 312.6 million GJ (16.5% of final demand)
- Reference scenario:
 - Overall passenger demand increases by 3.1 times between 2020 and 2070
 - Overall freight demand increases by 9.8 times between 2020 and 2070
- SS (Net Zero) Scenario
 - Overall passenger demand increases by 2.1 times between 2020 and 2070
 - Overall freight demand increases by 8.5 times between 2020 and 2070

Energy Demand for the Transport Sector and its sources are given in Chart 8, which shows that:

- **Reference Scenario**
 - Overall demand for energy increases by **4.6 times from 313 million GJ in 2020 to 1445 million GJ in 2070.**
 - The share **of oil reduces to 66.6% by 2070**, whereas the share of **CNG increases to 21.5%**, and the share of **electricity increases to 11.9%.**
- **SS (Net Zero) Scenario**
 - Stronger energy efficiency improvements, **a stronger shift towards EVs** and a greater role of **alternative fuels (bio CNG, biofuels, green ammonia, and green hydrogen).**
 - Overall demand for energy increases slowly and, in fact, declines from 2050 onwards, **and in 2070 is 475 million GJ or only 1.3 times of 2020.**
 - Energy mix is **completely fossil-free**, with **electricity taking 50%** of the final energy demand, followed by **biofuels and bio-CNG. Green ammonia and green hydrogen.**



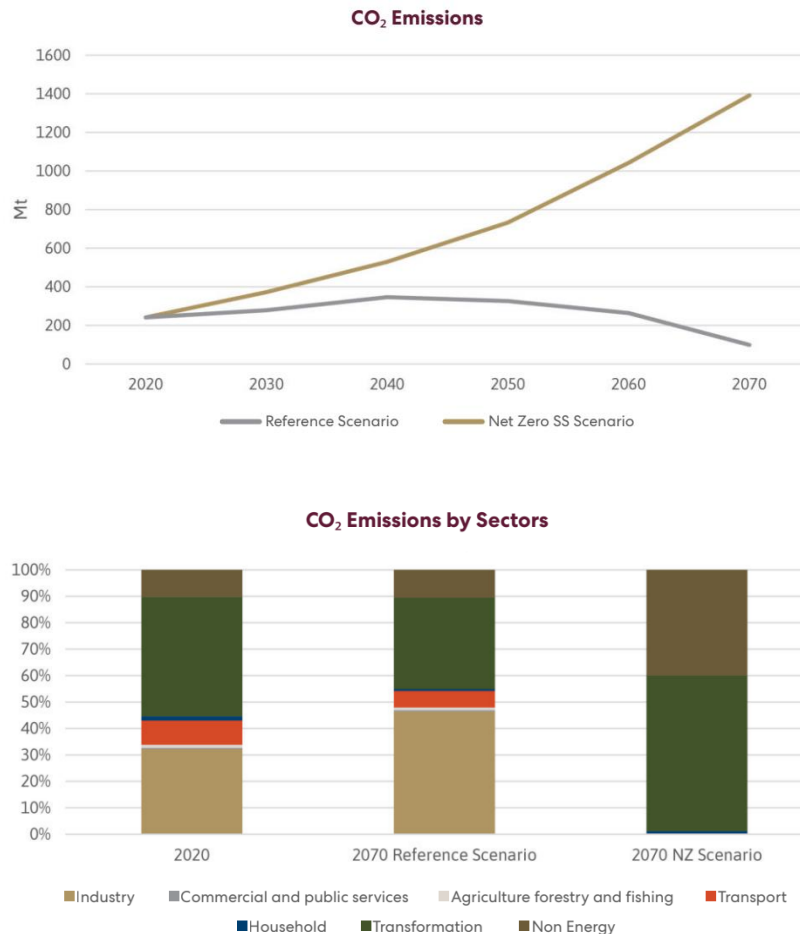
Chart 8: Energy Demand and Sources for Transport Sector



Finally, Dr. Dhar presented the final CO₂ emissions in Gujarat, which is presented in Chart 9. This chart shows that:

- In the reference scenario, CO₂ emissions to rise from 241 Mt in 2020 to 1391 Mt by 2070, with a CAGR of 3.6%.
- In the Net Zero SS Scenario, CO₂ emissions peak in 2040, then gradually decline to 98 Mt in 2070.
 - Different sectors reach their peak emissions at different times: the industry sector peaks in 2050, electricity generation in 2040, and IPPU in 2070
 - By 2070, all sectors except IPPU achieve nearly zero emissions.
 - Other options such as CCUS and carbon sequestration will be further explored to reach net zero.

Chart 9: Total CO₂ Emissions in Gujarat.



After Dr. Dhar's presentation, Dr. Deepty Jain presented the emission model developed by IIT Delhi and carried out an exercise with the participants on various scenarios related to the Net-Zero transport framework adopted by this research project.

This was followed by a presentation by Dr. Deepty Jain in which she showed the transport model for Rajkot and illustrated how the emissions changed with different assumptions. She carried out an exercise with the participants to put some numbers on the different assumptions of the model and assess the emission numbers that came out of the model. This was a participatory exercise, wherein the participants could immediately assess the impact of their decisions related to mode choice promoted, infrastructure provided, and regulatory measures put in place.

In the post-lunch session, Dr. Talat Munshi presented his City Transparency Tool for Transport (CTTT), showed how to navigate the tool, and showed some preliminary results. He also shared the CTTT tool with the participants and told them to work on it in the workshop. Some participants worked on this tool using their smart phones and some using their laptops. GUDI had instructed

all the participants to come with their lap tops so that they could work on the exercises in this workshop.

He explained that the City Transparency Tool for Transport is structured around a set of urban and transport-specific indicators that form the basis for scenario development and analysis. These indicators include demographic characteristics (population projections, age distribution, workforce participation), land use metrics (residential, commercial, industrial, and mixed-use densities), spatial features (green spaces, parks, street trees, green corridors), infrastructure capacity (road networks, public transport coverage, multimodal connectivity), and environmental data (emission inventories of CO₂, PM_{2.5}, NO_x, and sequestration potential of green infrastructure). Health-related variables, such as air pollution exposure and the benefits of active mobility, are also integrated to assess public health outcomes.

The model is organized into modular components that run iterative simulations of urban development and transport scenarios. Policy parameters such as mode share targets, infrastructure investments, land use intensification, and green space expansion can be introduced, and the model processes these inputs using spatial and attribute data layers to reflect city-specific conditions. Scenario development is supported through an interactive interface where stakeholders can upload datasets and run customized or predefined simulations.

The outputs generated cover a broad range of domains. These include economic metrics (benefit–cost ratios, net present values, and investment appraisals), mobility indicators (mode share distributions, infrastructure utilization, accessibility measures), environmental metrics (emission profiles, sequestration-adjusted net emissions), space efficiency measures (passenger-kilometers per square meter, utilization ratios), health impacts (pollution exposure costs, active mobility benefits), productivity effects (accessibility-driven gains and agglomeration benefits), and climate compatibility metrics (comparisons of emission reductions and resilience outcomes under different scenarios).

Together, these outputs provide a structured, evidence-based foundation for transport planning. They enable transparent comparisons of policy alternatives and help align strategies with the objectives of environmental sustainability, economic efficiency, and social equity. Results are presented through dashboards, spatial visualizations, and reports that can be directly applied in planning and policy contexts.

The last session of the workshop was Certificate Distribution. Ms. Remya Mohan (IAS), Commissioner of Municipalities Administration, MD GUDI

There were 39 participants in the workshop, see Annexure A, who received the Certificate of Participation from Ms. Remya Ms. Remya Mohan (IAS), Commissioner of Municipalities Administration, MD GUDI.



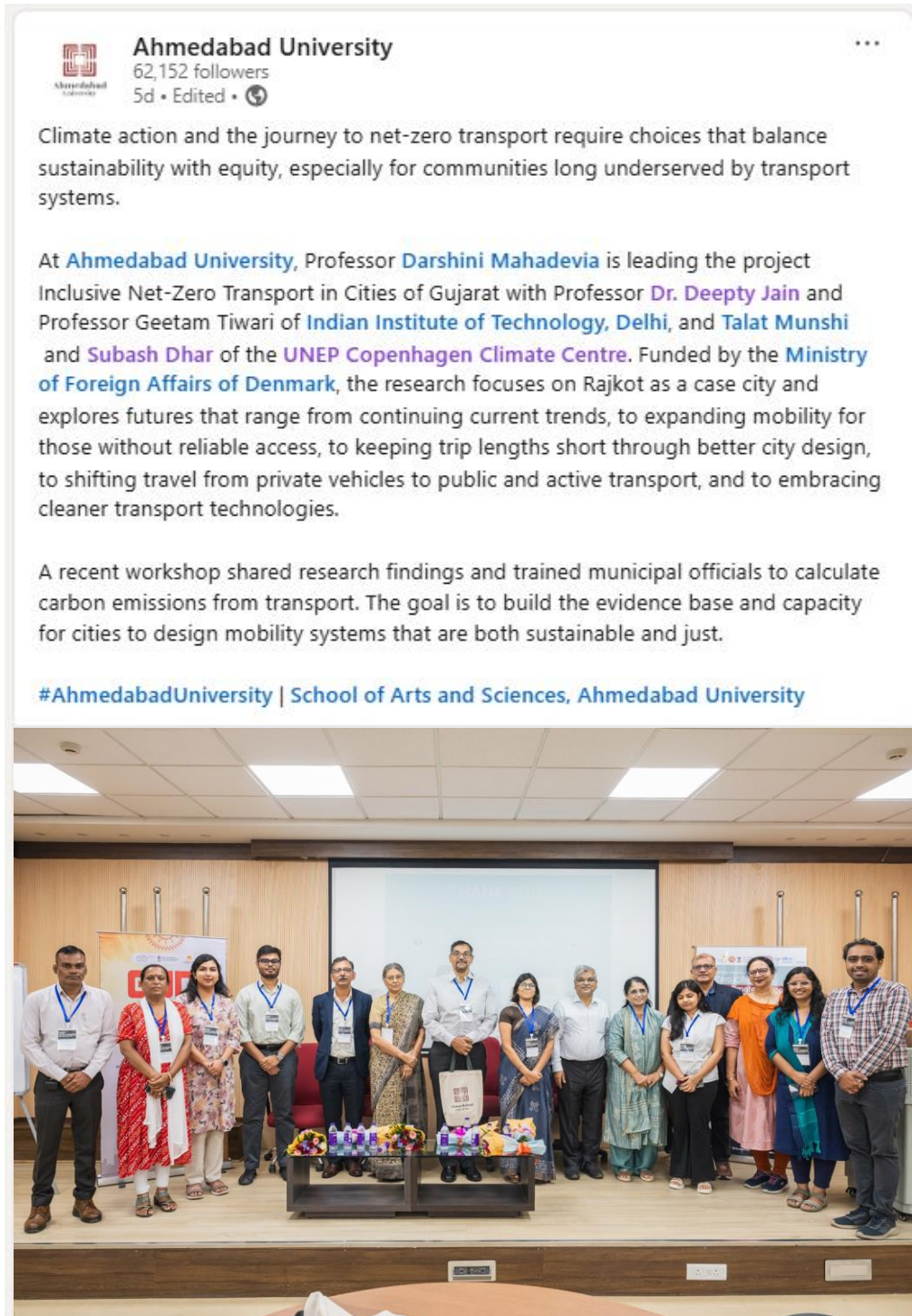
Annexure A

List of participants with their affiliations

Sr No.	Name of Corporation	Name of Participants	Designation
1	Gandhinagar	Prakash Patel	Asst. MC
2	Gandhinagar	Payal Shah	Environmental Manager
3	Gandhinagar	Vishvassinh Parmar	DEE- Mechanical
4	Mahesana Municipal Corporation	Patel Hareshkumar Bhagavanbhai	Transport Manager and Fire Officer
5	Mahesana Municipal Corporation	Patel Udaykumar Maheshbhai	City Manager IT
6	Surat Municipal Corporation	Mansingbhai N. Chaudhari	Executive Engineer
7	Surat Municipal Corporation	Pravinkumar R. Prasad	General Manager
8	Surat Municipal Corporation	Rakeshbhai B. Parmar	Junior Engineer (Civil)
9	Junagadh Municipal Corporation	Hajabhai K. Chudasama	SWM Project Officer
10	Vadodara Municipal Corporation	Shree Ashivn Pathak	Deputy Municipal Commissioner
11	Vadodara Municipal Corporation	Chintan A. Chaudhari	DEE- Mechanical
12	Vadodara Municipal Corporation	Kashyap Shah	Environment Engineer
13	Karamsad Anand Municipal Corporation	Pinalbhai Sanghani	Municipal Engineer
14	Jamnagar Municipal Corporation	Manoj D. Rathod	Deputy Executive Engineer
15	Jamnagar Municipal Corporation	Ramesh G. Solanki	Deputy Executive Engineer
16	Gandhinagar Municipal Corporation	Rajkumar Prafulkumar Darji	Civil Engineer DE
17	Gandhinagar Municipal Corporation	Jay Sunilbhai Solanki	DE - Mechanical
18	Gandhinagar Municipal Corporation	Nirbhay Gadhvi	City Manager SWM
19	Morbi Municipal Corporation	Nitesh Dabhi	DE Transport
20	Morbi Municipal Corporation	Anurag Santoki	SWM Manager
21	Bhavnagar Municipal Corporation	Kamlesh B. Chauhan	Additional Assistant Engineer (Civil)
22	Navsari Municipal Corporation	Kiranbhai Ashokbhai Patel	Assistant Engineer

23	Navsari Municipal Corporation	Umeshkumar Amitkumar Maru	SI
24	Navsari Municipal Corporation	Shivani Dipakkumar Limbachiya	Planning Assistant
25	Navsari Municipal Corporation	Niralben Manjibhai Padhariya	GIG Expert
26	Surendranagar Municipal Corporation	Hareshkumar J. Golani	Malaria Inspector
27	Surendranagar Municipal Corporation	Saileshkumar I. Parmar	Municipal Engineer
28	Surendranagar Municipal Corporation	Akash L. Khatariya	SSI
29	Surendranagar Municipal Corporation	Chavda Bhargav	Ward Engineer
30	Bhavnagar Municipal Corporation	Gautamkumar M. Baraiya	Chief Sanitary Inspector
31	Nadiad Municipal Corporation	Harsh Shah	Additional Assistant Engineer
32	Nadiad Municipal Corporation	Akash Joshi	Additional Assistant Engineer
33	Rajkot Municipal Corporation	Manish Gurweni, IAS	Deputy Municipal Commissioner
34	Rajkot Municipal Corporation	Paresh Ahia	City Engineer
35	Rajkot Municipal Corporation	Prateesh Solanki	Environment Engineer
36	Vadodara Municipal Corporation	Jatan Badheka	Execu: w/w
37	Surendranagar Municipal Corporation	Mukesh Kumar Ola	Civil Engineer
38	GUDM	Jay Talati	DY. Manager
39	GUDM	Yogeshwari Gujar	MES. GUDM

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https://www.linkedin.com/posts/ahmedabaduniversity_capacity-building-workshop-net-zero-cities-activity-7361617024545902593-Yool?utm_source=share&utm_medium=member_desktop&rcm=ACoAADJ4eM0BM8EnLsHuoApAunVbZCjHTG0yl2Y