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Ahmedabad Climate Resilient City Action Plan

TOWARDS A NET ZERO FUTURE

Executive Summary

July 2023

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Ahmedabad Climate Resilient City Action Plan - Towards A Net Zero Future

July 2023

Ahmedabad Climate Resilient City Action Plan - Towards A Net Zero Future was led by Ahmedabad Municipal Corporation and developed jointly with the implementing partners of the "Capacity Building for Low Carbon and Climate Resilient City Development -phase II (CapaCITIES II)" Project, supported by the Swiss Agency for Development and Cooperation (SDC). Ahmedabad is one of eight partner cities of the CapaCITIES II project, being implemented by ICLEI-Local Governments for Sustainability, South Asia, the South Pole Group, and econcept AG, with the National Institute of Urban Affairs (NIUA) as a knowledge partner.

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Executive Summary

Climate change is a pressing global challenge resulting predominantly from an increase in anthropogenic greenhouse gas (GHG) emissions. Burning fossil fuels releases GHGs, leading to the greenhouse effect and global warming. The consequences of climate change are evident worldwide, including rising temperatures, more frequent and intense heat waves, unpredictable monsoons, glacier retreats, and sea level rise.

The impacts extend beyond the environment, affecting the economy, food security, and public health. Recognising this urgency, over 2,300 jurisdictions have declared a 'climate emergency.' The Paris Agreement[1], a pivotal global framework, aims to keep global average temperature rise well below 2°C above pre-industrial levels and to pursue efforts to further limit the rise in temperature to 1.5°C above pre-industrial levels. As a signatory to the Paris Agreement, India has committed to ambitious climate action. In its updated Nationally Determined Contribution (NDC)[2], India aims to reduce the emissions intensity of its Gross Domestic Product (GDP) by 45% by 2030, from 2005.

To achieve this, India has announced its increased ambition to target 'Net zero GHG emissions by 2070' and laid out the 'Panchamrit' – the five elixirs to guide this transition. These commitments align with global efforts to combat climate change and create a sustainable future.

Ahmedabad's Vision for a **Net Zero Emissions Future**

The Ahmedabad Municipal Corporation (AMC) envisages a bold transition towards a net zero emissions future, fostering resilience in the face of rising urban heat, flooding, and natural resource challenges, while addressing equity and gender aspects. By integrating blue-green spaces and infrastructure, AMC will create a sustainable city that prioritises the well-being of Ahmedabad's residents and preserves natural ecosystems. With robust climate-resilient and equitable municipal services, AMC aims to ensure safety and enhance quality of life. AMC will act to ensure that citizens breathe clean air.

To drive efforts towards net zero emissions, Ahmedabad's buildings will be built to be greener, energy efficient, and thermally comfortable, and use clean, renewable energy to meet all energy requirements. Embracing a zero-waste and circular approach, AMC will minimise the city's environmental footprint while maximising resource efficiency. AMC's commitment extends to promoting zero-emission mobility, enabling cleaner and greener transportation options for all.

Through collaboration and innovation, AMC aspires to build a resilient community that thrives amidst a changing environment. AMC's vision is to create a city that sets an inspiring example for others, demonstrating the power of sustainable practices and paving the way for a brighter, more climate-conscious and responsive future.

Climate Action at Gujarat State Level

At the state level, Gujarat, India, has taken significant steps towards addressing climate change through its State Action Plan on Climate Change (SAPCC)[3]. The SAPCC provides a comprehensive framework to address climate change and promote sustainability in the state. It focuses on coordinated action to reduce GHG emissions and adapt to climate impacts in the long term.

To ensure climate-responsive development across its six Smart Cities, Gujarat has implemented the 'ClimateSMART Cities Assessment Framework' (CSCAF) launched by the Ministry of Housing and Urban Affairs. The CSCAF includes climate-relevant parameters that enable Indian cities to report on climate action data and evaluate their climate performance. This assessment framework provides a roadmap for cities and urban India to address climate change while planning actions.

By integrating climate resilience measures into city planning and infrastructure, Gujarat actively contributes to India's broader climate goals while ensuring a sustainable and resilient future. Gujarat's focus on renewable energy (RE), energy efficiency, water resource management, and climate-resilient infrastructure aligns with India's NDC and the goals of the Paris Agreement.

Ahmedabad's Climate Journey

Ahmedabad, located in Gujarat, India, is a vibrant city known for its cultural heritage and commercial activities. With over 7.1 million people, Ahmedabad is Gujarat's largest economic hub.

The city experiences a semi-arid climate with hot summers and mild winters and faces climatic risks like heatwaves and occasional flooding. Ahmedabad has proactively addressed climate change, making it a model for other Indian cities. It received a 4-star rating through the CSCAF 2.0[4], reflecting its progress in budget allocation and implementation of climate projects.

The city is promoting RE sources, over 21 MW of wind power and 2 MW of solar power capacity is already installed. It has also replaced the conventional streetlights with energy-efficient LED lights and adopted green building norms. Ahmedabad encourages waste segregation and has set up composting facilities to process organic waste. Municipal solid waste to bio-CNG and waste to energy incineration plants are also in the pipeline; helping Ahmedabad eliminate waste dumping and related methane emissions.

The Ahmedabad Municipal Transport Service (AMTS) and the Bus Rapid Transit System (BRTS) provide public bus services in Ahmedabad; cycling infrastructure is also prioritised by the city. A metro rail system also serves the city. These initiatives have reduced private vehicle usage and improved air quality. The city has also implemented water management measures, including rainwater harvesting and groundwater recharge programs. To provide effective and efficient water supply services, a supervisory control and data acquisition (SCADA) system has also been implemented.

To improve blue-green infrastructure in the city, Ahmedabad has implemented the Riverfront Development Project (Phase I) and plans for Phase II. This project has transformed areas around the Sabarmati River, improving resilience to floods and providing both public recreational spaces and environmental benefits. The city has also implemented the interlinking of lakes and urban forests within the city area. Ahmedabad has already initiated its climate journey by reducing emissions, and building a sustainable future through these efforts, and is now well placed to dial up its climate ambition and aim for a net zero emissions future by 2070, in line with India's NDC targets.

3. Gujarat State Action Plan on Climate Change
4. C-Cube, ClimateSmart cities assessment framework

CapaCITIES II Project

AMC and the Swiss Agency for Development (SDC) have joined forces for the groundbreaking 'CapaCITIES II Project' to foster sustainable and low-carbon city development in India.

The implementing partners, namely, ICLEI - Local Governments for Sustainability, South Asia; South Pole; and econcept, are providing technical assistance to Ahmedabad through this project for preparing the 'Climate Resilient City Action Plan – Towards a Net Zero Future' or CRCAP. This collaborative effort enables city officials to formulate, institutionalise, implement, and continuously update climate resilience strategies and GHG emissions reduction measures.

Additionally, the project is supporting on-ground climate interventions, such as installing renewable energy-powered opportunity EV charging station for electric buses to promote sustainable transport and reducing reliance on fossil fuels.

Ahmedabad's Climate Resilient City Action Plan
Towards a Net Zero Future

Ahmedabad's CRCAP serves as a comprehensive roadmap to address the local impacts of climate change. Aligned with Gujarat's SAPCC and global commitments under the Paris Agreement and Sustainable Development Goals (SDGs), the plan will transform Ahmedabad into a climate-resilient city with net zero emissions by 2070.

The plan focuses on key objectives of reducing GHG emissions, enhancing urban adaptive capacities, planning for climate resilient infrastructure, and promoting circularity and resource efficiency.

To achieve these objectives, a range of strategies have been proposed. These include promoting energy efficiency in buildings, increasing the adoption of RE sources, encouraging sustainable mobility options, implementing effective waste management practices, and providing guidance for developing climate-resilient infrastructure. Local considerations drive Ahmedabad's climate action plan, which aligns with India's net zero commitment.

The plan's successful implementation offers numerous benefits to the city and its residents. Improved air quality, enhanced public health, increased economic opportunities through innovation and clean technologies, strengthened energy and water security, and the creation of green jobs are few of the positive outcomes expected to be achieved. It is estimated that the proposed actions will generate 479,690 green jobs[5] through RE implementation in buildings, electric mobility, and municipal facilities.

Climate Action Plan Methodology

AMC used the 'Net Zero ClimateResilientCITIES' methodology to develop its climate action plan to achieve net zero emissions by 2070. This methodology includes a multi-stakeholder approach that involves assessing climate vulnerabilities, estimating GHG emissions, proposing climate resilient interventions that address adaptation and mitigation, and developing frameworks for financing, implementing, monitoring and reporting climate actions. By incorporating expertise and experience from initiatives led by ICLEI – Local Governments for Sustainability, the plan benefits from a wealth of knowledge and best practices in climate planning and action.

This methodology provided a step-wise approach to address climate change adaptation and mitigation. Its nine steps are organised into three phases: Analyse, Act, and Accelerate. Ahmedabad embarked on a climate-resilient journey through this nine-step process. AMC committed to climate action by forming a City Climate Core Team to lead the charge. A Stakeholder Committee was constituted to seek inputs from and involve the community, including the private sector, in the implementation of the action plan. The city's socio-environmental landscape and key challenges were identified, climate risks and vulnerability assessed, and emissions baselines established. Goals, strategies, and actions that address identified climate vulnerabilities and thematic actions to reduce GHG emissions across sectors, were defined. To guide emissions reduction strategies across three different planning horizons, i.e., 2030, 2050 and 2070, the CRCAP scales the defined goals, strategies, and actions across two emissions reduction scenarios.

5. Future skills and job creation with renewable energy in India – Assessing the co-benefits of decarbonising the power sector Report, October 2019

These are the Progressive Action Scenario and Net Zero Pathway Scenario.

The CRCAP includes detailed, financially viable actions and outlines their implementation framework. A monitoring and reporting framework is also proposed. This will enable regular review of the plan's implementation, mid-course correction, and inclusion of more impactful actions made possible by emerging technologies and changing policy and regulatory regimes.

City Profile & Urban System Gap Analysis

Ahmedabad, founded in 1411 AD, has a rich architectural heritage and has been recognised as India's first World Heritage City by UNESCO[6]. It is located on the eastern bank of the Sabarmati River, which divides the city into eastern and western parts. The city is well connected through various modes of transportation. Sardar Vallabhbhai Patel International Airport and Ahmedabad Junction railway station connect the city to major national and international destinations.

Ahmedabad has a population of approximately 7.18 million people (2021), with a density of 14,935 persons per sq km. Ahmedabad's eastern and central parts have higher population densities than the western. AMC and Ahmedabad Urban Development Authority (AUDA) are the administrative bodies responsible for governance and development of the city and the larger urban agglomeration area, respectively.

Economically, Ahmedabad is a thriving industrial and commercial hub. A major cotton producer, the city is known as the 'Manchester of India' due to its textile industry. Home to various industries, such as chemicals, pharmaceuticals, food processing, and information technology, Ahmedabad attracts investments from national and international companies, contributing significantly to the country's GDP.

Ahmedabad's land use is divided into residential, commercial, industrial, and institutional areas. The city has experienced significant growth in its built-up area, accommodating the increasing demand for urban services and housing.

The AUDA Development Plan emphasises compact and transit-oriented development, aiming to manage growth, regulate density, and organise land use effectively.

Ahmedabad is an educational hub with prestigious institutions like Indian Institute of Management (IIM), National Institute of Design (NID), National Institute of Fashion Technology (NIFT), and Centre for Environmental Planning and Technology (CEPT) University, among others.

Overall, Ahmedabad is a city that blends its rich historical heritage with modern economic activities and infrastructure. Its recognition as a World Heritage City and its industrial and educational prominence makes it an important cultural and economic centre in India.

Rapid urbanisation in Ahmedabad is leading to increased urban service demand, particularly in the public transport, water supply, and sewage management sectors. The city's population grew from 5.58 million in 2011 to 7.18 million in 2021, and is projected to reach 9.2 million by 2030, 13.4 million by 2050, and 15.3 million by 2070. AMC will meet the consequent increase in demand for urban infrastructure and services by continually enhancing the efficiency of existing systems and augmenting infrastructure and service capacity, where needed.

Water Systems

Ahmedabad relies on surface sources such as Narmada Canal, Mahi River, and Sabarmati River, as well as groundwater resources, to meet the existing water demand. However, the city faces water supply disruption during periods of maintenance or breakdowns of the main or branch canals. AMC has proposed to develop a 12,000 ML barrage for water storage, that will fulfil the city's water demand for at least fifteen days and will help tide over any disruptions.

The city is rejuvenating 122 lakes, under the National Plan for Conservation of Aquatic Ecosystems (NPCA), to supplement the existing water source. Groundwater is crucial in meeting 10% of Ahmedabad's water requirement, particularly during emergencies or water shortages from surface sources.

6. UNESCO- Historic city of Ahmedabad

Currently, 275 tube wells are connected to the water distribution stations (WDS), with 214 tube wells actively supplying water. Groundwater levels vary from 1 m to 24 m across the city, with low levels observed near Odhav and Naroda industrial estates due to excessive groundwater usage by industries. However, the western and northern areas, experiencing rapid growth, record groundwater levels ranging from 16 m to 19 m. The increased water demand in developing areas has led to a rise in private tanker water supply businesses, further depleting groundwater resources. Projects like Riverfront Development Phase I and rejuvenation of lakes have helped improve ground water levels. AMC has also initiated 'Catch the Rain' campaign and is providing citizens with 80% of the capital cost for constructing rainwater harvesting or ground water recharge structures. Properties that have such structures are also provided a 10% rebate in property tax, under the GYB scheme (Green, Yellow, Blue Scheme). AMC has proposed to implement water plazas in all 7 zones and percolation wells to improve ground water table.

Water treatment and distribution are vital components of Ahmedabad's water supply system. The city supplies 1,680 MLD (million litres per day) of water, including commercial and industrial supply, through 221 WDS and a network of 5,100 km. The existing water treatment plant capacity of approximately 1,750 MLD is sufficient to meet the current demand. The treated water is distributed through the water distribution network, covering 96% total households and 85% households in notified slum areas. AMC is targeting a 100% water distribution network coverage for equitable and safe water supply.

Installing a Supervisory Control and Data Acquisition (SCADA) system has helped monitor and control water infrastructure efficiently, allowing for timely fault detection and response. AMC has proposed 24X7 water supply with socially acceptable water meter policy to reduce Non Revenue Water (NRW) by 15%; NRW is currently at 25%. The projected 2050 water demand is expected to be more than 1.5 times the existing demand in 2021. The city has proposed various infrastructure projects to address future water supply needs, including constructing new water treatment plants, installing water sensors for real-time monitoring, and implementing water conservation measures. AMC is also exploring the possibility of using treated sewage water for non-potable purposes, thus reducing the burden on freshwater resources.

Sewerage Management

Ahmedabad generates around 1,344 MLD of sewage. The sewerage network covers 95% households and is being expanded to ensure 100% coverage in the near future. Ahmedabad has multiple sewage treatment plants with a combined capacity of 1,218 MLD. Considering the new effluent discharge standards for STPs by National Green Tribunal (NGT) in 2019, AMC is upgrading all old STPs to meet new discharge standards and conserve natural resources. AMC has also proposed new STPs under Gujarat Resilient Cities Program (GRCP), to meet future demand.

AMC has also formulated a wastewater reuse and recycling plan to alleviate the burden on freshwater resources. Treated wastewater from sewage treatment plants can be used for various non-potable purposes such as industrial processes, irrigation, and landscaping. The city aims to implement this in a phased manner. AMC has proposed tertiary treatment plant as well.

To address water supply and sewage management challenges arising from rapid urbanisation and population growth, the city aims to improve water supply infrastructure, enhance water treatment and distribution systems, rejuvenate lakes, manage groundwater resources, upgrade sewage treatment plants, and implement wastewater reuse initiatives. These measures will ensure sustainable water management, address the increasing demand, and secure reliable water supply for the city's growing population.

Solid Waste Management

AMC's Solid Waste Management (SWM) Department plays a pivotal role in effectively managing Ahmedabad's solid waste. The city generates approximately 4,100 metric tonnes (MT) waste daily, with construction and demolition (C&D) waste contributing 1,000 MT. To foster a cleaner and more efficient waste management system, Ahmedabad went bin-free on 2 October 2019, replacing all (1,064) large community bins with 1,046 silver trolleys. These silver trolleys are also being removed by end of 2023 to achieve 'Bin Free City' in real sense.

Waste in Ahmedabad is collected from various sources. Door-step collection accounts for 1,700 MT of waste collected daily from 98% households and 0.46 million commercial units; facilitated by over 1,000 door-to-door waste collection vehicles, including Euro IV standard vehicles.

Narrow streets, chawls, and slum areas are accessed by cycle rickshaws. The city has witnessed a significant increase in waste segregation at source, rising to 76% in 2020 from 13% in 2018.

AMC also ensures the collection and treatment of C&D waste, carcass waste, and biomedical waste from community health centres and government hospitals. Private contractors collect waste from silver trolleys (700 MT) and cradle bins (600 MT), using vehicles provided to them by AMC via a five-year operation and maintenance contract. Collected waste is transferred to Material Recovery Facilities (MRFs) and composting plants for further processing. The city also addresses legacy waste through biomining and reclaiming land by treating accumulated waste. Understanding waste composition is vital for adopting appropriate waste management strategies. Food waste (wet waste) constitutes the highest proportion (41%) of total waste generated. This knowledge informs effective composting and biogas generation. Recyclable waste accounts for 30%, non-recyclable waste 22%, C&D waste 6%, and biomedical waste 1%, of total waste.

AMC is adopting an integrated approach for waste management, addressing the entire value chain, focusing first on raising awareness on '4R' principles of reduce, reuse, recycle and recover subsequently augmenting treatment and processing capacities. Efforts are underway to improve plastic waste management and to implement waste to energy and bio-CNG plants. A massive land reclamation effort is underway; 85 acres of land is being reclaimed by biomining of the Pirana dumpsite.

Through innovation, infrastructure expansion, and community participation, AMC aims to become 'Zero Waste City by 2030' and position Ahmedabad as a model city for effective and sustainable waste management in India.

Transportation

Ahmedabad, a compact city characterised by mixed land use and high density, follows a polycentric model, with various activities dispersed across different zones. Major industrial areas are concentrated in the east, trade centres in the central zone, and institutional regions in the west. As a result, the city witnesses high traffic volumes from the West to the East via Centre in the mornings, and back in the evenings.

The city's road network is well-planned, employing a ring-radial approach. Integrated land use and transport planning have resulted in an average trip length of 6.2 km, average travel time of 18 minutes with average speed of 20.65 kmph. Walking is the preferred mode of transport for 37% of the population, followed by two-wheelers (26%) and public transport (11%). Work-related trips form the chunk of travel in the city, at 47%, followed by education-related trips at 32%. Over the years, Ahmedabad has experienced a significant increase in the number of registered vehicles, reaching 3.9 million in 2021-22 from 2.38 million in 2009-10, a 65% increase over a decade. The majority of registered vehicles are two-wheelers (75%), followed by four-wheelers (18%), three-wheelers (4%), and others (3%). Between 2011 and 2021, Notably, four-wheelers increased more than three-fold and two-wheelers two-fold.

Auto-rickshaws also increased substantially, reaching 0.17 million in 2021 from 40,944 in 2011. To minimise the use of private vehicles, the city has improved the quality of public transport system, which includes AMTS, BRTS, and Metro. First and last mile connectivity is provided through public bicycle sharing schemes and electric rickshaws. AMC is encouraging the use of electric vehicles and has proposed to provide required EV charging infrastructure at 300 locations within city limit.

Freight Management

Freight management is a crucial aspect of transportation in Ahmedabad. The city's strategic location in the centre of five major growth centres and its well-connected road infrastructure make it an economic hub. Various industrial and trading activities in the eastern and central parts of the city result in significant freight movement to and in those areas. Road-side freight vehicle parking, and loading and unloading activities during peak traffic hours cause congestion. AMC has proposed to develop logistic hubs to reduce traffic related issues due to urban freight movement.

Parking

Parking is a pressing concern in Ahmedabad. The city has 74 authorised parking locations, including off-street, on-street, and multi-level facilities, with a capacity of 32,031 vehicles. Parking capacity falling short of the demand leads to parking issues and haphazard parking practices. AMC intends to continue implementing various initiatives and projects to address transportation challenges.

These include road infrastructure improvements, development of traffic junctions, implementation of smart parking systems, introduction of cleaner fuel options for public transport, automated traffic regulation, and establishment of EV charging stations.

Additionally, improving first and last-mile connectivity, promoting non-motorised transport (NMT) options, and enhancing integration between different modes of transportation are key focus areas identified by AMC for improving the overall transportation system in Ahmedabad.

Urban Greening and Biodiversity

Ahmedabad's current tree cover is approximately 48.98 sq.km, accounting for 10% of the city's total area. Over the past five years, AMC has established 128 urban forests covering 1.1 sq.km, using both Miyawaki technology and dense plantation methods. In 2021, AMC planted 1.16 million trees as part of the 'Mission Million Trees Campaign', with a survival rate of approximately 72%. Additionally, AMC has bioremediated legacy waste at the Bopal dumpsite and created an ecological park with over 900 trees over 8,000 sq.m. Current green cover in Ahmedabad is 6.8 sq.m per person, AMC intends to increase per capita green cover to meet WHO's recommendation of 9 sq.m. The city aims to enhance green cover by implementing Miyawaki forests, dense forests, and oxygen parks. Further, development of urban forests is planned on the reclaimed land in Pirana through biomining.

Accessibility to Public Parks and Gardens

Ahmedabad has 277 parks and gardens. AMC, through spatial analysis, has assessed that approximately 16.8% of the population (11,84,993 people) need improved access to public parks as per Development Plan of Ahmedabad Urban Development Authority[7], particularly in Gota, Nikol, Vatva, Narol, Lambha, and Sarkhej wards. To address this gap, the Garden Department of AMC has proposed projects such as the development of 10 urban forests (0.06 sq.km), creation of oxygen corners (mini urban forests) in 150 existing parks and gardens (0.2 sq.km), new gardens at 12 locations, redevelopment of 11 existing parks and gardens, and a tree plantation target of 1.1 million trees for the fiscal year 2023-24.

Disaster Management and Emergency Services

Ahmedabad has experienced various disasters in the past, including earthquakes, floods, cyclones, and heat waves. In response, the Gujarat State Disaster Management Authority (GSDMA) was formed by the state government to support cities and districts in disaster management and mitigation. AMC has established a Disaster Management Cell, overseen by a project officer appointed by the GSDMA under the District Risk Management Program. The cell is responsible for preparing disaster risk management programs and ward-specific plans, including information on past events, emergency strategies, safe places, communication, coordination, rescue efforts, and infrastructure. Ward-level plans have been developed for Bodakdev, Chandlodiya, Ghatlodia, Gota, and Thaltej. Ahmedabad is susceptible to urban floods, extreme heat events, fires, industrial accidents, and building collapses. The city is periodically implementing various activities, training, and mock drills in collaboration with GSDMA. City has prepared a heat action plan to mitigate heat impacts. Ahmedabad has accessible fire stations, with a coverage radius of 5 km to 7 km per station as per Urban Development Plans Formulation and Implementation (URDPFI) Guidelines

Air Quality

Ahmedabad has 24 Ambient Air Quality Monitoring Stations (AAQMS) within the AMC boundary, including 8 Continuous Ambient Air Quality Monitoring Stations (CAAQMS) installed by AMC and two by Central Pollution Control Board (CPCB). In addition, 14 manual AAQMS are monitored by the Gujarat Pollution Control Board (GPCB), and sensor-based air quality monitoring systems are deployed at 50 locations under the Smart City Mission. Air quality in Ahmedabad is periodically monitored under the National Clean Air Program (NCAP). Ahmedabad is listed as a non-attainment city by the CPCB and is part of the NCAP and Clean Air Program under the 15th Finance Commission. A source apportionment study conducted by the Gujarat Energy Management Institute (GEMI) and GPCB identified road dust, the domestic sector, construction activities, and point sources (industries) as major contributors to air pollution emissions.

7. Definition of accessibility: Distance up to 400 m for neighbourhood parks, 800 m for community parks (walking distance), and 3 km for city parks (driving distance)

To improve the city's air quality, AMC has identified hotspot areas and prepared action plans to mitigate the air pollution. AMC has implemented several measures as per hotspot action plan, including end to end pavement of roads to mitigate road dust, and implementation of construction policy to mitigate air pollution from construction activities.

Climate Risk & Vulnerability Assessment

Ahmedabad city's risks and vulnerabilities to climate hazards and air pollution were analysed to guide climate-sensitive urban planning and resilience policies. The assessment is structured in three parts: 1) analysis of climate trends and projection scenario, 2) hazard and risk assessment, and 3) vulnerability assessment, using the 'Net Zero ClimateResilientCITIES' methodology and Shared Learning Dialogues with AMC stakeholders.

Risk assessment guided by historical weather data and future climate projections identified Ahmedabad's vulnerability to extreme heat, urban floods, and air pollution. Risks were assessed via parameters like temperature and rainfall trends, spatial flooding analysis, and air quality data. Vulnerability assessment incorporated data from AMC departments, stakeholder consultations, and spatial analyses of vulnerable areas and urban systems. The analysis also considered impacts on vulnerable demographics and city services. High-risk areas were identified via a map overlay technique integrating complaints, climate risks, and infrastructure gaps.

Climate Trends and Projections

Analysis of temperature and rainfall trends from 1970 to 2020, using data from Indian Meteorological Department (IMD) and Gujarat SAPCC (2021), reveal rise in average and extreme temperatures and rainfall intensity. Climate scenarios for Ahmedabad indicate escalating climate events.

Climate Trend Analysis:

Air Temperature Trend Analysis: Annual average air temperature increased by 0.15˚C per decade (1970-2020), resulting in hot days and nights. The Gujarat SAPCC revealed an increase of 12-18 hot days and 18-24 hot nights (1951-2019) and a decrease of 1-4 cold days and 8-12 cold nights. This could escalate heat wave events, affecting public health and municipal resources.

Rainfall Trend Analysis: Annual rainfall increased by 12 mm per decade (1970-2020), with fewer rainy days. Extreme rainfall events increased, causing urban flooding in certain areas.

Climate Projections and Scenario Statements

Gujarat SAPCC (2021) climate projections (RCP 2.6, RCP 4.5, RCP 8.5 scenarios) indicate increasing temperatures and precipitation for near and midterm periods (up to 2070).

Climate Scenario Statements: Projected climate scenarios for Ahmedabad (RCP 2.6, RCP 4.5, RCP 8.5 scenarios) anticipate a temperature increase of 1-3°C, hot days and nights, and 20-60mm in rainfall by 2070. The frequency of extreme heat and rainfall events is also expected to rise.

Risk and Vulnerability Assessment

Ahmedabad runs a high risk of extreme heat events and urban flooding. The city is prone to flash floods from the Sabarmati River and Dharoi Dam. Climate projections indicate increased temperature, heat waves, and extreme rainfall events. Ahmedabad's air pollution is not within the National Ambient Air Quality Standards (NAAQS), posing a significant risk to city residents. Climate risk assessment discussions were held among key stakeholders.

Extreme Heat Risk: The assessment involved analysing indicators like air temperature trends and future scenarios, land surface temperature (LST), heat index analysis, and heat wave trends. Air temperature trends were studied using IMD data. LST was assessed using satellite imagery. Heat index and heat wave trends were analysed using AMC data.

Land Surface Temperature Analysis: The LST varies depending on land use, infrastructure, and human activities. It varies between 29°C to 47°C during day and 26°C to 29°C during night, indicating potential hotspots.

Heat Index Analysis: The 'feels-like' temperature of the city is a combination of air temperature and humidity. It was plotted, indicating potential risk areas with a 'feels-like' temperature of more than 43°C. The analysis revealed an increasing trend year on year.

Heat Wave Events and Trend: Ahmedabad has seen increased heat wave events with significant health impacts. AMC has taken measures to manage these events. A correlation exists between heat wave events and heatstroke-related morbidity and mortality

Urban Areas Vulnerable to Extreme Heat Risk: The city's most vulnerable areas are those with high LST and 'feels-like' temperature. Such areas include wards like Amraiwadi, Bapunagar, Viratnagar, and industrial areas. Extreme heat may impact water and energy demand. As per Gujarat SAPCC, the number of heat wave events has increased by 4 events from 1951 to 2019 and is expected to increase by 5-30 events by 2070. The actual increase depends on the efforts towards curbing GHG emissions. This increase in heat wave events may have severe public health implications.

Population Groups Vulnerable to Extreme Heat: Elderly, children, women, differently abled, uneducated, and poor people are most vulnerable to extreme heat conditions. The people especially living in slums have poor living conditions, and limited access to cooling options and healthcare. In Ahmedabad, 5.1 million people (2.4 million females, 2.7 million males) are vulnerable, constituting a significant 72.1% of the total population. This vulnerability is aggravated by the presence of 0.4 million children and 0.3 million elders within this group, emphasising the need for targeted support and resources for these age demographics.

Urban Flood Risk: Rise in extreme rainfall events and insufficient stormwater drainage leads to urban flooding. Vulnerable populations, such as the urban poor, are the most impacted due to poor living conditions and limited resources. The flood risk is assessed by analysing rainfall trends, spatial analysis of waterlogged areas, and ward-level analysis of water-borne diseases, revealing areas most affected by flooding. Issues such as heavy siltation in stormwater drains and improper waste and sewage disposal exacerbate flooding, impacting health, mobility, and economic productivity.

Some of the areas severely affected by waterlogging include Naranpura, India Colony, Indrapuri, Khokhra, Thakkarbapa Nagar, Isanpur, Bodakdev, Paldi, Maninagar, Vasna, S P Stadium, Saraspur, and Vatva. The city is experiencing a rise in urban flooding hazards due to intense rainfall occurrences. Residents within a 250 m radius of 166 waterlogged areas or flood points face elevated risks and are susceptible to severe health hazards.

Approximately, 4.3% of the city's total area is affected by urban flooding or waterlogging, impacting around 9.5% of the city's population.

Population Groups Vulnerable to Urban Flooding: Children, elderly, women, and those with special needs are most impacted by urban flooding. Limited access to health facilities, emergency services, and urban services during floods mainly affect these groups. They also suffer from a lack of inclusive infrastructure and access to information. Urban poor living in compromised housing conditions and with limited access to health centres are susceptible to disease outbreaks. Approximately 9.5% of the city's population i.e., 0.7 million (0.3 million females, 0.4 million males) is vulnerable to urban flooding. Vulnerable areas encompass about 4.3% of the city's overall area.

Air Pollution: Air pollution risk is assessed by examining trends of primary air pollutants, spatial analysis of pollution in the city, and incidence of acute respiratory illness (ARI). The most concerning pollutants are PM10 and PM2.5, with the latter posing a significant health risk. Areas with high PM10 concentration include Raikhad, Maninagar, Narol, Vatva GIDC, Sola, and Naroda, while regions with high PM2.5 concentration include Pirana, Raikhad, Bopal, S P Stadium, Vatva GIDC, and Airport. The increase in air pollution can severely impact health, especially for those with co-morbid conditions.

Ahmedabad recorded 2,037 air-borne disease cases (852 ARI and 1,185 tuberculosis) during 2021-22.

Urban Areas Vulnerable to Air Pollution: Areas most impacted by high PM10 and PM2.5 concentrations and also record an increased number of air-borne disease cases include Jamalpur, Danilimda, Maninagar, Baherampura, Lambha, and Vatva GIDC. In total, 27.3% of the city area is at high risk due to critical PM10 concentration, affecting 20.3% of the total city population, while 42.9% of the city area is at risk due to high PM2.5 concentration, affecting 43.2% of the entire city population.

Climate Risk and Urban System Fragility: Urban system fragility is assessed considering service levels, infrastructure, and climate risks of heat and flooding. Extreme conditions can impact water supply, waste management, transport, healthcare, and emergency services. Risks linked to system fragility are evaluated based on their likelihood and impact.

Urban Infrastructure Services Vulnerability: Technical analysis and stakeholder consultations identified systems vulnerable to climate change. The vulnerability assessment covers affected areas, actors, and their adaptive capacities.

Water Supply Vulnerability: Extreme heat and flooding threaten the water supply, impacting 12 wards. 0.2 million slum dwellers (23% of total slum population) and about 14 thousand vendors (22% of total vendors) are vulnerable. 9 wards (Danilimda, Amraiwadi, Navrangpura, Paldi, Maninagar, Naroda, S P Stadium, Saraspur, Vatva) are extremely vulnerable.

Wastewater Management System: Urban flooding risk threatens the sewage system, affecting 11 wards. Approximately 10.9% of all sewage pumping stations (SPS) are affected by urban flooding. 0.3 million slum dwellers (30.7% of total slum population) and about 16 thousand vendors (25.6% of total vendors) are vulnerable. 11 wards (Naranpura, Amraiwadi, Thakkarbapa Nagar, Navarangpura, Paldi, New Vadaj, Maninagar, Vasna, Naroda, S P Stadium, Saraspur) are vulnerable.

Solid Waste: Solid waste exacerbates urban flooding issues in 14 wards. Multiple areas of concern have been identified within the city. Two MRFs (Khadia and Shayona) are at risk due to climate hazards, impacting 30 workers daily.

The Pirana dumpsite exposes around 650 workers to risk due to unhygienic conditions. 0.3 million slum dwellers (34.2% of total slum population) and about 18 thousand vendors (28.9% of total vendors) are vulnerable. Among the 14 vulnerable wards, Paldi and Naranpura are particularly prone to solid waste cleaning issues and urban flooding.

Transport: Ahmedabad's transport systems, particularly public transport, face risks from extreme heat and urban flooding. A considerable number of public transport stations and traffic junctions face extreme heat risks. 117 BRTS stations (58.5% of total) and 2,820 Ahmedabad Municipal Transport Service (AMTS) stations (56.8% of total) are situated in vulnerable areas. 37 major traffic junctions with heavy traffic (56.1% of total) are located in high-risk zones. An estimated 40 thousand to 50 thousand elderly individuals rely on the AMTS for transportation.

Urban flooding significantly impacts the transport sector.

Several public transport stations are currently at risk. 56 BRTS stations (28% of total) and 432 AMTS stations (8.7% of total) are vulnerable. 20 major traffic junctions with heavy traffic (28.8% of total) are at risk. 7 wards (Naranpura, Paldi, Maninagar, Naroda, S P Stadium, Saraspur, New Vadaj) are particularly vulnerable.

Emergency Services: Climate events can hamper accessibility to emergency services, like fire and health services. Vulnerabilities extend to healthcare accessibility, with specific populations requiring significant travel for government facilities. Numerous vital facilities in the city are at risk due to urban flooding. This includes 31.3% of all hospitals (651 hospitals) and 25% of all fire stations (5 fire stations in Bodakdev, Dudheshwar, Maninagar, Naroda, and Gomtipur). Additionally, 10 wards (Amraiwadi, Gomtipur, Isanpur, Maninagar, Naroda, New Vadaj, Paldi, Saraspur, Vasna, and Vatva) are identified as vulnerable. Immediate attention and support are required for these facilities and wards.

Actor Analysis and Adaptive Capacity: The adaptive capacities of vulnerable groups and supporting actors are assessed, helping identify key improvement areas. The assessment of adaptive capacities to climate and air pollution risks among various actors in Ahmedabad presents a diverse landscape of readiness.

Government institutions like AMC, Traffic Police Department, City Police Department, Regional Transport Office, and government healthcare facilities, exhibit high adaptive capacities, scoring 18 each based on the ability to respond, resource availability, and capacity to access information. The private sector, including private hospitals and contractors managing urban infrastructure services, also exhibits a high adaptive capacity. GPCB and Residents Welfare Associations exhibit medium adaptive capacities. However, community groups like the elderly, children, women, people with special needs, uneducated individuals, slum dwellers, rag pickers, people working at dump sites, street vendors, pedestrians, cyclists, and two-wheeler users exhibit low adaptive capacities, making them highly vulnerable to climate change impacts. Non-governmental organisation and charitable Institutions exhibit high adaptive capacity, offering some hope for vulnerable populations. These results underline the crucial role of government departments and the private sector in Ahmedabad's transition to a 'Net Zero' city.

Baseline GHG Emissions

The GHG emissions inventory reflecting Ahmedabad's baseline emissions has been developed for the five-year period from 2017-18 to 2021-22. The city-scale emissions inventory has been prepared following the Global Protocol for Community Scale GHG Emissions using ICLEI's HEAT+ Tool.

Establishing the baseline status of GHG emissions helps identify key sources of emissions, set emissions reduction targets, and develop appropriate evidence-based strategies and actions in different sectors.

Ahmedabad's Total Energy Consumption[8] in 2021-22

98.5 million GJ

Ahmedabad's Total GHG Emission in 2021-22

15.1 million tCO_2e

Per Capita GHG Emission in 2021-22

2.1 tCO_2e

City-scale: Energy Consumption and GHG Emissions

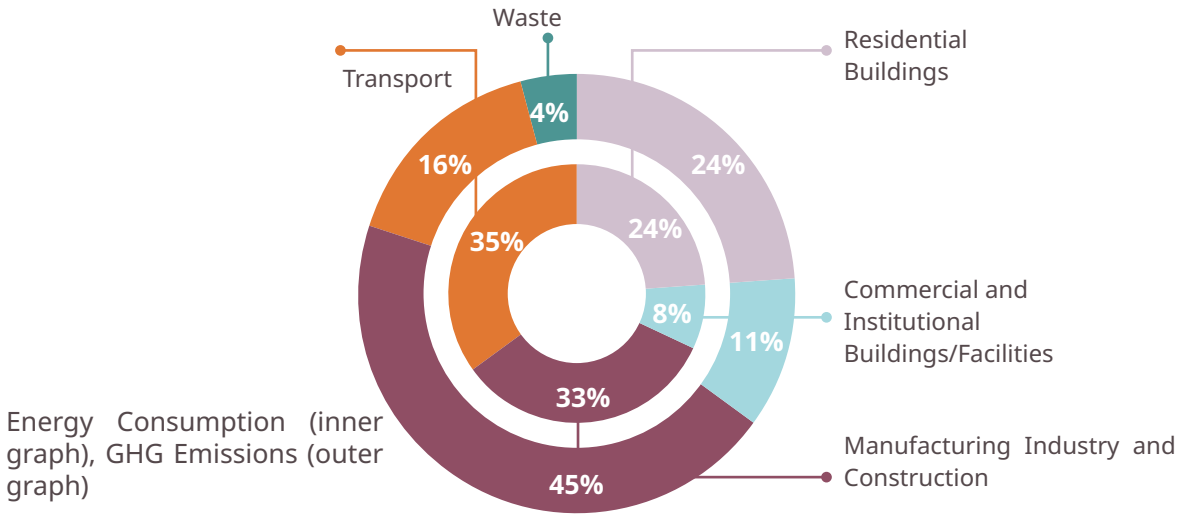

Figure I: Sector wise share of energy consumption and GHG emissions, 2021-22

Highlights

- **Energy intensive sectors:** Transport (35%), Manufacturing Industry and Construction (33%) and Residential Buildings (24%)
- **Sectors with significant GHG emissions:** Manufacturing Industry and Construction (45%), Residential Buildings (24%) and Transport (16%)
- **GHG emissions trend (2017-18 to 2021-22):** 13.4% increase at 2.7% annually[ii]
- **Predominant energy sources:** Electricity (48.6%), Diesel (13.9%), Petrol (13.8%) and Natural Gas (13.6%)
- **Energy sources with significant GHG emissions:** Electricity (76.6%), Diesel (7.1%), and Petrol (6.6%)

8. Includes direct energy use (from combustion of fuels such as kerosene, LPG, petrol, diesel) and indirect energy use (due to consumption of grid electricity
9. All annual growth rates are Average Annual Growth Rates (AAGR)

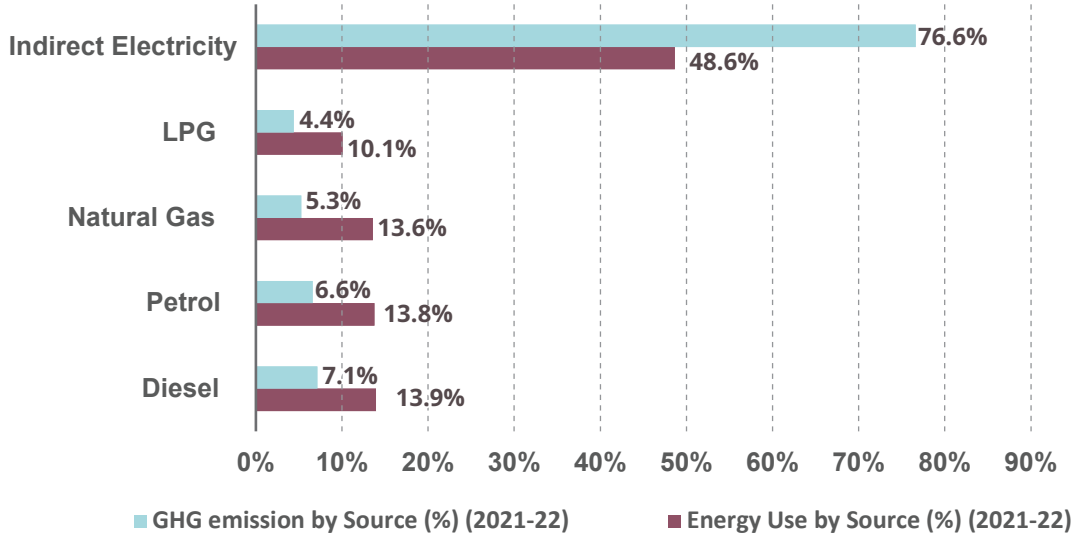

Figure II: Energy consumption and GHG emissions by energy source, 2021-22

Municipal Operations: Energy Consumption and GHG Emissions

Energy consumption and emissions from AMC's operations have been assessed to help take targeted low-carbon action in municipal infrastructure and urban service delivery.

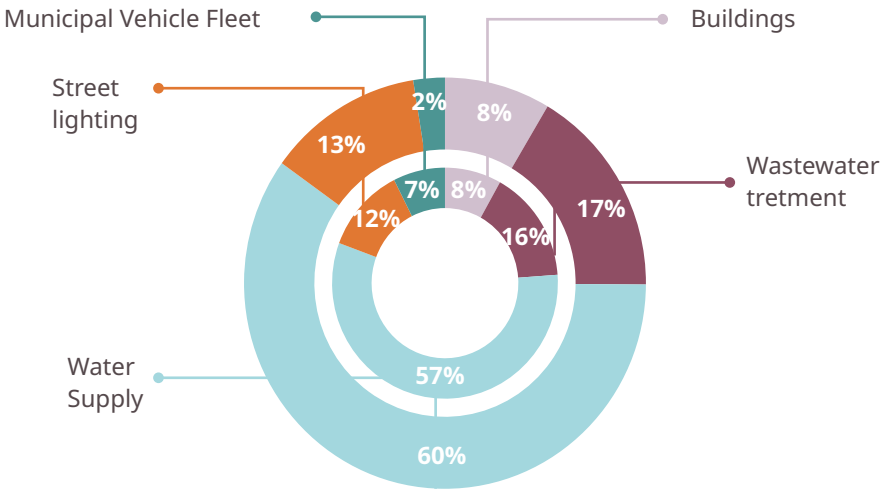

Figure III: Energy consumption and GHG emissions from municipal operations, 2021-22

Highlights

Predominant energy consumers: Water Supply (57%), Wastewater Treatment (16%) and Street Lighting (12%)

Main contributors to GHG emissions: Water Supply (60%), Wastewater Treatment (17%) and Street Lighting (13%)

Trend of GHG emissions (2017-18 to 2021-22): 9.9% increase at 1.99% annually

Scenario Planning for Future GHG Emissions Reductions

Ahmedabad's CRCAP aims to make the city climate-resilient and achieve net zero GHG emissions by 2070. The plan focuses on reducing GHG emissions by promoting energy efficiency, increasing RE use, adopting sustainable waste management practices, and encouraging low-carbon transport options. Scenario Planning is a crucial step in the CRCAP. It involves mapping different trajectories or pathways for future GHG emissions, establishing emissions reduction strategies and targets, and creating a roadmap to achieve net zero goals. The end goal guiding Ahmedabad's GHG emissions reduction strategy is to achieve net zero emissions by 2070, in line with India's national commitment.

The CRCAP identifies two scenarios for GHG emissions reduction: the 'Progressive Action' scenario and the 'Net Zero Pathway' scenario. The Progressive Action scenario represents increased levels of climate action at the city scale compared to status quo. It considers national and state government policies, programs, on-ground scenarios, and local conditions. The Net Zero Pathway scenario is based on India's commitment to achieve net zero emissions by 2070 and builds upon targets set by the national and state governments. Ahmedabad's CRCAP uses the Net Zero GHG Emissions Tool developed by ICLEI South Asia to estimate GHG emissions for each scenario. The tool incorporates local data, population growth projections, economic growth patterns, and sector-specific assumptions. It allows for exploring different scenarios and helps identify specific emissions reduction targets and strategies.

The BAU Projection, or Business-as-Usual Projection, serves as a reference point for assessing the impact of emission reduction scenarios. It represents the level of GHG emissions that would occur unless additional efforts were made beyond the current measures in place. According to the BAU Projection, Ahmedabad's GHG emissions are projected to increase nearly seven-fold by 2070, primarily driven by the Stationary Energy sector.

In the Progressive Action Scenario, the plan considers existing policies, programs, and commitments at the national and state levels, along with local projects and policies in Ahmedabad. The scenario proposes increased activity levels and targets to reflect the current status, local context, resources, and constraints. It considers initiatives such as the National Action Plan for Climate Change, Energy Conservation Building Code, Swachh Bharat Mission, and state policies on RE. The Progressive Action Scenario sets targets for energy efficiency measures based on national initiatives and local progress. It also focuses on the large-scale RE adoption, drawing from state and city-level policies and deployment plans. The plan considers the Gujarat EV Policy and schemes for electric mobility to establish proposed adoption levels in Ahmedabad.

The Net Zero Pathway scenario is based on the commitment of the Government of India to achieve net zero emissions by 2070. It demonstrates the ambitious effort and actions required for the city to transition towards net zero GHG emissions by 2070. The actions in this scenario build on the targets set by the national and state government through various plans, policies, and programs to realise this goal.

By implementing the strategies outlined in the Progressive Action Scenario and moving towards the Net Zero Pathway scenario, Ahmedabad aims to become a climate-resilient city with net zero GHG emissions by 2070.

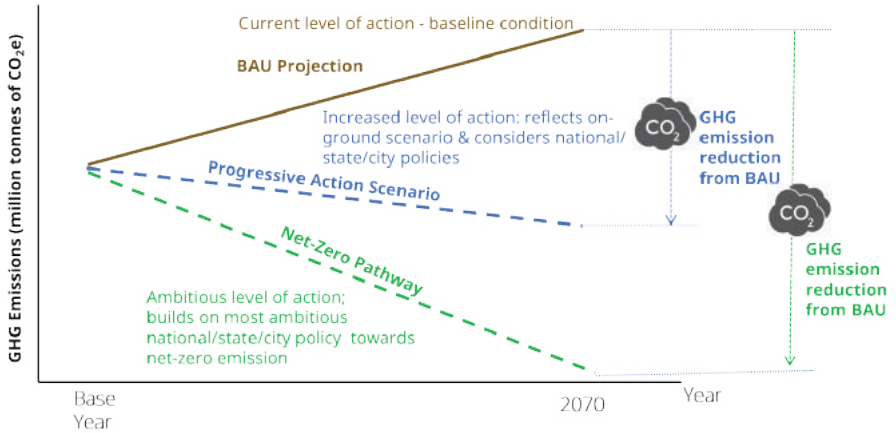

Figure IV: Illustrative depiction of Progressive Action Scenario and Net-Zero Pathway compared to BAU Projection

Ahmedabad's Goals and Strategies for Climate Resilience

Ahmedabad's Vision for a Net-zero Climate Resilient Future: To address the climate emergency by leading a bold transition towards a net-zero emissions future, fostering resilience in the face of rising urban heat, flooding, and natural resource challenges, while considering the principles of equity and gender justice.

Adaptation Goal: Ahmedabad city aims to enhance water, flood and heat resilience for all through policy, infrastructure and nature-based solutions, and by adopting circular economy principles.

GHG Emissions Mitigation Target: Achieving city-scale net-zero GHG emissions by 2070.

Sector	BUILT ENVIRONMENT & ENERGY	TRANSPORT	WATER	WASTEWATER
Goals & Targets	**Resilence Goal:** Transition to a Heat Resilient and Sustainable Energy City **Mitigation Targets:** • 100% of new buildings adopt green building principles by 2050 • 100% energy efficiency appliances in new and existing buildings • Up to 85% of energy demand met by renewable energy	**Resilence Goal:** Adopt Clean, Zero-Emission Mobility **Mitigation Targets:** • 80% motorized trips shift to NMT & public transit • 90% of all vehicles are electric and renewable powered	**Resilence Goal:** Enhance Water Resilience **Mitigation Targets:** • 100% facilities adopt energy efficient and renewable energy • 15% lower non revenue water levels by 2030	**Resilence Goal:** Promote Circular Economy through 100% Wastewater Treatment and Reuse **Mitigation Targets:** • 100% facilities adopt energy efficient and renewable energy • 100% new plants use anaerobic treatment with methane capture
Strategies	• **Strategy 1** Promote green building concepts to mitigate urban heat risk • **Strategy 2** Promote energy efficient and green buildings • **Strategy 3** Transition to clean renewable energy sources to meet energy demand	• **Strategy 1** Enable non-motorized movement of people and promote shift to public transport • **Strategy 2** Accelerate transition to electric mobility powered by renewables • **Strategy 3** Strengthen management of traffic and decongest roads	• **Strategy 1** Reform policy and regulatory frameworks for water resilience • **Strategy 2** Provide efficient, equitable and safe access to water • **Strategy 3** Protect and revitalize urban lakes • **Strategy 4** Ecological restoration of Sabarmati riverfront • **Strategy 5** Efficient water supply networks powered by clean renewable energy	• **Strategy 1** 100% Efficient sewage collection and treatment • **Strategy 2** Achieve 100% sludge and septage management • **Strategy 3** Adopt low carbon technology and improve operational and energy performance of wastewater management systems

The figure below summarises the thematic goals, targets, and strategies identified to help realise Ahmedabad's vision, its overarching adaptation goal, and GHG emissions reduction target.

STORM WATER

Resilence Goal:
Enhance Urban Flood Resilience

- **Strategy 1**
  Adopt green city planning approaches to minimize runoff and urban flooding
- **Strategy 2**
  Improve stormwater management and rehabilitate natural drains

SOLID WASTE

Resilence Goal:
Transition to a Zero Waste City

Mitigation Targets:

- 100% segregated waste collection
- 100% scientific processing, treatment and disposal of waste

- **Strategy 1**
  Minimize solid waste generation and maximize reuse and recycling
- **Strategy 2**
  Ensure 100% source segregation and implement effective primary and secondary waste collection
- **Strategy 3**
  Augment sustainable waste processing and disposal infrastructure

URBAN GREENING & BIODIVERSITY

Resilence Goal:
Enhance Blue-Green Infrastructure for Climate Resilience

Mitigation Targets:

- Increase green cover by 90 sq. km to meet WHO norms (9 sq. m per person) by 2070

- **Strategy 1**
  Increase urban green cover using native plantation
- **Strategy 2**
  Develop micro habitats for local biodiversity management
- **Strategy 3**
  Increase carbon sink through urban greening

AIR QUALITY

Resilence Goal:
Enhance Liveability by Achieving National Clean Air Program Targets (2025)

- **Strategy 1**
  Adopt measures to reduce vehicular air pollution
- **Strategy 2**
  Manage construction activities and debris
- **Strategy 3**
  Reduce air pollution from industrial activities

Moving towards Net Zero GHG Emissions with the Net Zero Pathway

Ahmedabad's mitigation target underscores its ambition to achieve net-zero GHG emissions by 2070 and contribute to India's net zero emissions goal. The climate action planning process considers two emissions reduction scenarios, the 'Progressive Action' scenario and the 'Net Zero Pathway' scenario, to determine the level of GHG emissions reduction possible with different scale of action (as noted in the Scenario Planning section). Implementation of all actions in the Progressive Action scenario are estimated to achieve emissions reduction of 76% from the BAU in 2070. This falls short of meeting the target of 100% reduction towards net zero emissions.

Thus, Ahmedabad will be required to take more ambitious climate action to address the residual emissions of 24% from BAU by 2070. To advance towards net zero emissions, the Net Zero Pathway is recommended for Ahmedabad.

Strategies and actions identified in the Net Zero Pathway are considered feasible with the contribution of various types of policy and financial support from the city, state, and national governments. A significant financial impetus is required to achieve net zero emissions by 2070.

Results and Highlights of GHG Emissions Reduction from Net Zero Pathway for Ahmedabad

The Net Zero Pathway helps to **reduce** Ahmedabad's **GHG emissions by 91%** in 2070 as compared to that in the BAU. This corresponds to a GHG emission **reduction of 90.5 million tonnes of CO_2e** by 2070. The Net Zero Pathway results in the following levels of emission reduction compared to BAU:

- GHG emissions in 2030: 55.7% lower
- GHG emissions in 2050: 79.2% lower
- GHG emissions in 2070: 91.0% lower

Table I: GHG emission reduction by sector for Net Zero Pathway

Sector	GHG Emissions Reduction Compared to Sectoral BAU Emissions		
	2030	2050	2070
Residential Buildings	28%	55%	78%
Commercial and Institutional Buildings and Facilities	26%	57%	81%
Manufacturing Industries and Construction	24%	54%	77%
Transport	13%	22%	26%
Waste[10]	90%	192%	216%

Note: Additionally, carbon sequestration potential of increased green cover contributes to GHG emission reduction of 0.60, 1.24, and 1.52 million tCO_2e respectively over 2030, 2050 and 2050.

10. GHG emission reduction exceeds 100% for Waste sector in 2050 and 2070 since it also accounts for GHG emission reduction from potential electricity generation from waste to energy facilities and anaerobic wastewater treatment with methane recovery. This additional GHG emission reduction corresponds to and reflects the avoided use of grid electricity that would be otherwise needed in the absence of waste to energy in solid waste and methane recovery from domestic wastewater treatment.

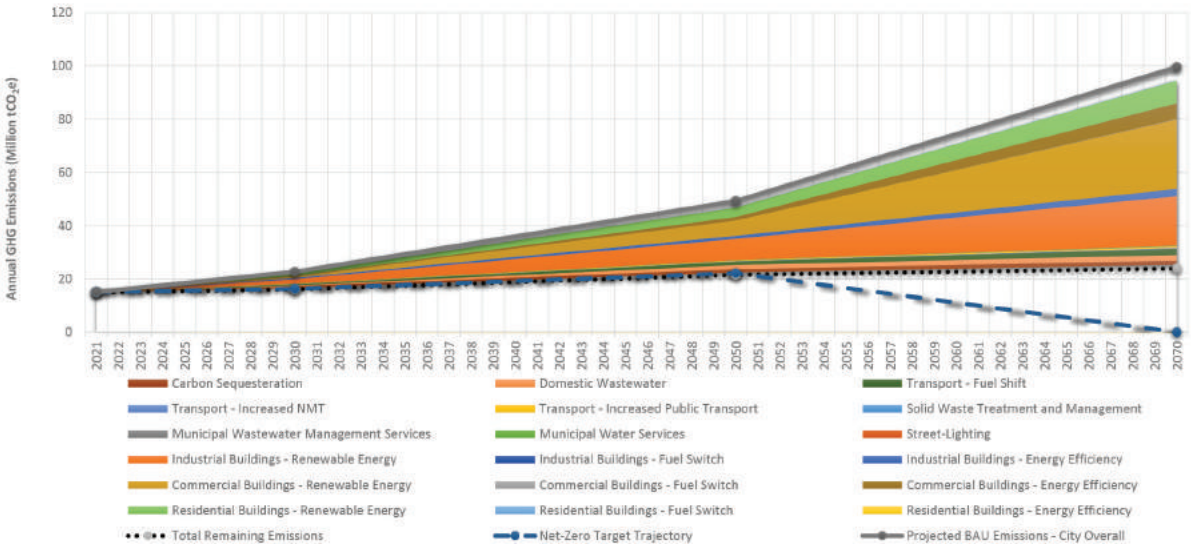

Figure V: GHG emission mitigation trend for Net Zero Pathway, 2021 to 2070

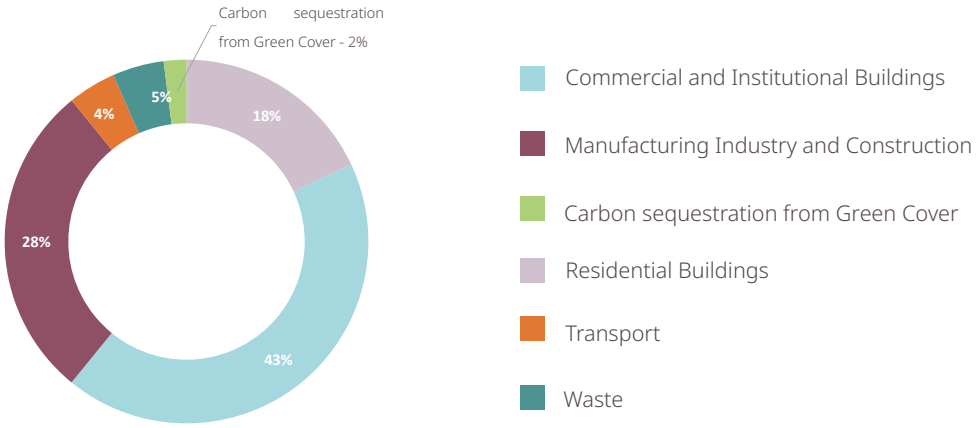

Figure VI: Sector contribution to GHG emissions reduction in Progressive Action Scenario, 2070

Strategies to reduce energy consumption and GHG emissions in Buildings remain pivotal in the Net-zero Pathway, given their predominant share in the city-wide BAU emissions (Table I and Figure VI). The Net-zero Pathway targets that 100% of the appliances in buildings should be energy efficient by 2070. By 2050, every new building that comes up should be green and energy efficient, across different building sub-types and sizes. Renewable energy should meet much as 85% of commercial and industrial energy requirements in 2070. A phased replacement of LPG with electricity and cleaner piped natural gas is also identified. In the transport sector, 90% of all vehicles must be electric and nearly fully powered by renewable generated electricity to meet targets. In Solid Waste, Ahmedabad's goals to become a Zero Waste City by 2030 will lead to significant emissions reduction.

Ambitious deployment and utilization of renewable solar and wind power into municipal utilities such as water supply and wastewater treatment are proposed, based on recommendations in the Sustainable Energy Action Plan, developed through the CapaCITIES II project.

An increase in green cover to the WHO's standard of 9 sq. m per person is targeted, which will deliver numerous benefits: improved biodiversity, better public health, and liveability, reduced urban heat island effect, and carbon sequestration, while also serving as a carbon sink. Ahmedabad's existing tree cover is estimated to sequester about 840,000 tonnes of CO_2 annually. The proposed target will progressively achieve a higher carbon sequestration potential until 2070[11].

11. Climate Centre for Cities

Residual or Remaining GHG Emissions in Net Zero Pathway

Ambitious efforts and targets outlined in the Net Zero Pathway result in the reduction of 91% of BAU emissions by 2070. Reduction of the residual 9% emissions is possible through progressive policies and actions such as decarbonising the grid and incentivising consumption of green power, particularly for powering electric mobility; leveraging advanced technologies based on green hydrogen as an energy source and carbon capture, usage, and storage (CCUS), natural climate solutions and material circularity[12].

Since there is limited line of sight for such technologies and related actions, Ahmedabad city will periodically review and update this Climate Resilient city Action Plan, to ultimately reach 100% reduction of BAU GHG emissions before 2070. Ahmedabad's proactive climate action planning has already made significant operational progress in various sectors. The city is working towards a sustainable and climate-resilient future by adopting sustainable transport, decarbonizing buildings, managing water resources, implementing climate-responsive urban planning, and promoting waste management.

Key Takeaways

1. Strategies and actions identified in Ahmedabad's Net Zero Pathway helps to reduce **90.5 million tCO_2e** GHG emissions by 2070.

2. Ambitious actions proposed for buildings sector in the Net Zero Pathway will reduce GHG emissions by **94% by 2070** from the BAU, while the Transport sector actions will lower emissions by 45% as compared to BAU levels in 2070.

3. The carbon sequestration potential of the targeted increase in Ahmedabad's green cover contributes to GHG emissions reduction of **1.52 million tCO_2e** by 2070.

4. The cost of implementing the CRCAP is in excess of INR 44,06,609 million by 2070 to achieve adaptation goals and mitigation targets. The table below breaks down the cost estimations requirements by sector/ thematic area.

5. 15 adaptation strategies and 53 actions have been proposed across all priority sectors to address vulnerabilities to extreme heat, urban flood, and air pollution in the urban systems and areas at risk. Implementation of these adaptation actions is expected to improve the resilience to climate risks and air pollution. This will benefit the entire city and the community, particularly sections of population most affected by climate change

6. The proposed actions will create an estimated 480,000 green jobs from RE implementation in buildings and municipal infrastructure for water supply and wastewater, and from deployment `of public RE- powered e-bus fleet by 2070.

Table II: GHG emission mitigation trend for Net Zero Pathway, 2021 to 2070

Sector	Estimate Cost of Mitigation Actions[15] (2070) (Million INR)	Estimate Cost of Adaptation Actions[13] (Million INR)	Total
Built Environment and Energy	2,963,087	Not estimated	2,963,087
Transport	649,500	Not estimated	6,49,500
Water	9,925	4,85,538	4,95,462
Wastewater	2,946	46,387	49,333
Storm Water	Not estimated	30,221	30,221
Solid Waste	24,904	113,301	138,205
Urban Green and Biodiversity	Not estimated	80,800	80,800
Air Quality	Not estimated, as sectoral actions may improve air quality as well.		
Total	3,650,362	756,247	44,06,609

12. McKinsey Sustainability

13. Cost estimation is limited to actions where it was possible to provide an estimate. Actual budget requirement will be higher than this estimation

Way **Forward**

AMC has taken significant steps towards climate action by releasing a comprehensive CRCAP to reach net zero emissions by 2070. The plan is a result of collaborative efforts between the AMC, and various agencies and departments of Government of Gujarat. It aims to guide the city's transition towards sustainability and resilience. Throughout the process of creating the CRCAP, areas for improvement were identified, and corresponding solutions were proposed to address them

One crucial aspect highlighted for enhancement is effective governance. Climate action is evolving, and governance systems must adapt to this challenge. The plan suggests improving the authority of the Climate Core Committee and interdepartmental coordination to strengthen the governance framework. A Climate Core team has already been established at the AMC, led by the Mayor and the Municipal Commissioner, composed of departmental heads and engineers. Expanding the scope of this team by allocating dedicated budgetary provisions in the AMC budget can facilitate interdepartmental coordination and collaboration.

To further streamline decision-making processes, a High-Powered Steering Committee comprising stakeholders from parastatals like Uttar Gujarat Vij Company Limited (UGVCL) and government departments can be created. The committee will enable faster decision-making and alignment of priorities across agencies. Inclusivity is also emphasised, suggesting the involvement of academia, industry experts, concerned citizens, and civil society organizations to strengthen collaboration and accelerate climate action in Gujarat.

The Climate Core Team will be responsible for implementing strategies, conducting research, monitoring progress, seeking funding and partnerships, and advocating for the city's interests in climate negotiations, which plays a central role in the CRCAP. This team will undertake various tasks and ensure the integration of climate change considerations into the urban land use policy. Working in collaboration with AUDA, the team will incorporate climate change elements into the city's development plan, allocating areas for green spaces, garbage management, EV charging, and enhancing the adaptation of the vulnerable regions through retention ponds.

In addition to governance improvements, the plan addresses the challenges associated with data collection and management. Robust data systems are crucial for analysing emissions, energy consumption, transportation patterns, and waste management. The plan suggests investing in improved data infrastructure to track progress, identify intervention areas, and evaluate the effectiveness of climate actions. A Climate Data Policy Guideline will be developed to establish data formats, reporting methodologies, and protocols for collection, management, and reporting. Leveraging the Integrated Command and Control Center (ICCC) can aid in data analysis, while satellite imagery and climate vulnerability modelling applications can enhance spatial and granular data. A minimum administrative unit for data capturing across departments will be defined through guidelines.

Monitoring and reporting (MR) mechanisms are vital for effective decision-making, policy development, and tracking progress. The plan emphasizes the need for a well-established institutional framework for MR. The nodal officer of the Climate Core Committee will be responsible for monitoring progress, collecting department reports, and compiling an annual progress report. Key sectoral performance indicators will be tracked, and accountability and transparency will be ensured through regular data assessment and submission to national and international platforms.

The plan suggests short-term hiring of experienced data scientists and organizing training programs, workshops, and knowledge-sharing platforms to build capacity. Collaborative partnerships with universities, research institutions, and multilateral development banks will be fostered to enhance the city's pool of climate experts.

Communication efforts will be amplified to improve public awareness and engagement. These awareness campaigns will be targeted at all the stakeholders to educate them on the impact and actions undertaken by various stakeholders, including administrative, political, technical, academic, and citizens. Budget allocation for public education campaigns and initiatives promoting public participation in decision-making processes will be increased.

Addressing climate change requires substantial financial resources, and the plan acknowledges the importance of climate finance mechanisms. AMC will identify funding opportunities and explore innovative financing models such as the Green Climate Fund, climate bonds, and public-private partnerships.

Engaging with national and international financial institutions and aligning the CRCAP with global frameworks and goals will enhance the city's chances of securing funding and support.

By focusing on improved governance, data collection, and management, monitoring and reporting mechanisms, capacity building, public awareness, and climate finance, Ahmedabad aims to lead the way in addressing climate change. The city can inspire other urban centers to take bold action and join the global effort to mitigate climate change and build a sustainable future through collaboration with governments, academia, industry, and civil society.

Ahmedabad 's CRCAP sets a roadmap for city's transition to a **sustainable** and **resilient** future

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