सत्यमेव जयते
Goverment Of India

LiFE
Lifestyle for Environment

FROM PARIS TO DUBAI

INDIA'S CLIMATE ACTION JOURNEY

RESOLVE TO RESULT

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सत्यमेव जयते

प्रधान मंत्री
Prime Minister

MESSAGE

It is heartening to learn about the publication of a book titled, 'From Paris to Dubai: India's Climate Journey'. This initiative by the Ministry of Environment, Forest & Climate Change is commendable.

In India, faith and nature have had an abiding connection for centuries. As is said, शाश्वतम्, प्रकृति-मानव-सङ्गतम्, meaning the relationship between nature and humanity is eternal.

Our firm belief in following a lifestyle based on sustainable practices becomes clear when the world sees that India's per capita carbon footprint is 60% lower than the global average. It is the manifestation of the same conviction that drives our Mission LiFE - Lifestyle for Environment.

Between the 2015 Paris Agreement and COP28 in the U.A.E, India has made significant strides, demonstrating an unwavering commitment to combat climate change through a multifaceted approach.

Be it through our updated Nationally Determined Contributions (NDCs), meeting our non-fossil installed electric capacity target almost a decade ahead of schedule, manufacturing low-emission products such as Electric Vehicles and energy-efficient appliances, exploring Green Hydrogen to decarbonise India and become a global hub for its production and export, or the committed efforts and resolve to phase out single-use plastic, we have adopted a comprehensive and multi-dimensional approach to combat climate change.

Our commitment to clean energy becomes evident through substantial investments in solar and wind energy projects. Our solar energy installed capacity has grown nearly 20-fold in the last 9 years!

Presently, India stands out as one of the few nations that is effectively separating carbon emissions from its economic growth path.

India is also at the forefront of global collaboration on climate action, climate justice and renewable energy through its proactive approach on initiatives such as the International Solar Alliance and the Coalition for Disaster Resilient Infrastructure.

With the establishment of a Loss and Damage Fund, a significant stride towards climate equity and justice was achieved at COP27 in Sharm El Sheikh, Egypt.

The goal of environmental sustainability can be achieved only through the principle of climate justice to protect the poor and vulnerable from the adverse impact of climate change. For climate action initiatives to be effective, technology transfer and climate finance are needed. This is a collective responsibility that needs to be borne by everyone.

We must always orient our mindset and actions towards preserving our 'One Earth,' protecting the well-being of the global 'One Family,' and advancing towards a sustainable and flourishing 'One Future.'

I am confident that this document, showcasing India's progress from COP21 in Paris to COP28 in the U.A.E, will provide a snapshot of the unprecedented pro-climate actions in less than a decade.

May this book, 'From Paris to Dubai: India's Climate Journey' be widely read.

(Narendra Modi)

New Delhi
अग्रहायण 06, शक संवत् 1945
27th November, 2023

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INTRODUCTION

In the World Economic Outlook report of July 2023, the International Monetary Fund (IMF) projected that India would be the fastest-growing major economy in the world at a 6.1 percent growth rate in 2023. This, at a time when global growth will see a downturn from 3.5 percent in 2022 to 3 percent in 2023 due to many factors, including the long-term impacts of the Covid-19 pandemic. Despite global uncertainties and many domestic challenges, India's economy is a story of resilience.

The country was associated with many development challenges just a few decades ago, but today, India is ranked 5th in the world's Gross Domestic Product (GDP) rankings. Crucial sectors such as agriculture, manufacturing, information technology, and services fuel its economy, and it stands out as a global force that the world wants to collaborate with. When the COVID-19 pandemic posed an unprecedented challenge to the world, India's vaccine programme, Maitri, helped more than 100 nations. In a changing world order, countries see India as a balanced voice of the global south and one that prioritizes universal cooperation. This was apparent in its successful Presidency of the G20, where it brought forward concerns of a larger group of countries hitherto marginalized, and set global roadmaps for collaboration on wide-ranging concerns.

At the core of India's development agenda that has brought about this remarkable change are the efforts to eliminate poverty in all it's forms, ensuring that no individual is left behind. Committed to the ideals of collective efforts towards inclusive development, enshrined in its vision of 'Sabka Saath, Sabka Vikas, Sabka Vishwas, Sabka Prayaas', the country is relentlessly working towards providing food, water, electricity, housing, healthcare, education, and financial inclusion to over 1.4 billion people.

One of the world's biggest challenges today is climate change, and India realizes the importance of cooperation in addressing it. For its part, India has voluntarily committed to an ambitious reduction in emissions intensity, notwithstanding its immense energy needs to meet its Sustainable Development Goals (SGDs). With these commitments in mind, it has integrated its environmental and climate goals into its inclusive development agenda. Environmentally sustainable, low-carbon and climate-resilient initiatives underpin all critical sectors of the Indian economy. India has embraced disruptive technologies and implementation models to fast-track sustainable development, which are paying rich dividends.

This publication throws light on India's climate agenda and progress in its climate action as it powers on, taking 1.4 billion people towards achieving SDGs.

THE CLIMATE JOURNEY

2006

NATIONAL ENVIRONMENT POLICY

To identify key vulnerabilities of India to climate change, assess the need for adaptation to future climate change, and the scope for incorporating these in relevant programmes

2007

EXPERT COMMITTEE ON IMPACTS OF CLIMATE CHANGE

To study the impacts of anthropogenic climate change on India and identify measures to address vulnerability to these impacts

2007

NATIONAL LEVEL COORDINATION COMMITTEE

To coordinate national action for assessment, adaptation and mitigation of climate change

2008

NATIONAL ACTION PLAN ON CLIMATE CHANGE

To identify sectoral and cross-sectoral measures that can simultaneously help achieve India's development and climate change objectives, through focused National Missions

2009

STATE ACTION PLANS ON CLIMATE CHANGE

To ensure the convergence of State level priorities on climate objectives with the National Action Plan on Climate Change

2012-2017

TWELFTH FIVE YEAR PLAN

Climate change recognized explicitly in the Plan document

2014

CLIMATE CHANGE ACTION PROGRAMME

To create and strengthen scientific and analytical capacity for assessment of climate change; to establish an appropriate framework for research, policy, and implementation of climate change related actions

2015

NATIONALLY DETERMINED CONTRIBUTION

India's post-2020 climate actions under the Paris Agreement

2015

NATIONAL ADAPTATION FUND ON CLIMATE CHANGE

To fund adaptation actions that are not otherwise covered under ongoing schemes/programmes

2020

APEX COMMITTEE FOR IMPLEMENTATION OF PARIS AGREEMENT

To oversee the progress in implementation of India's NDC and monitor, review & revisit climate goals; and to regulate carbon markets in India

2020-21

UNION BUDGET

Direction to execute India's NDC in various sectors by concerned Departments / Ministries through the normal budgeting process

2021-22

UNION BUDGET

The ambit of Operation Green Scheme enlarged to include 22 perishable products from the existing 3. Import duty on solar inverters raised from 5% to 20%, and on solar lanterns from 5% to 15% to encourage domestic production

2022

NATIONAL DESIGNATED AUTHORITY FOR THE IMPLEMENTATION OF THE PARIS AGREEMENT

To take decisions in regard to the type of projects that may take part in international carbon market under Article 6 mechanisms

2022

UPDATED NATIONALLY DETERMINED CONTRIBUTION

To enhance India's contribution towards achievement of the strengthening of global response to the threat of climate change, as agreed under the Paris Agreement

2022

LONG TERM LOW EMISSION DEVELOPMENT STRATEGY

Encompasses India's plan for its long-term low-carbon development strategy, laying out the pillars of the country's future growth and development

2023-24

UNION BUDGET

Green Growth – a step in the right direction for enabling climate action in India by introducing Seven Priorities (Saptarishi)

01

INDIA'S CLIMATE AGENDA

Credits: Shutterstock

01

INDIA'S CLIMATE AGENDA

Fundamentally, Indian culture deeply respects and reveres the natural environment. People worship nature in many forms and ancient Indian texts emphasize environmental ethics. Colonialism planted the seeds of ecological degradation in the country, plundering its natural resources. Post-colonialism, the people were left in abject poverty, which worsened matters. Nonetheless, the country's democracy and a strong ethos of environmental conservation have stood it in good stead, and today, India is at the forefront of the climate discourse, leading change and providing examples for the world to follow.

India has been following a three-fold climate agenda of:

01 Advocacy

At every international meeting, the country has a strong presence and vociferously advocates for environmental concerns. Its advocacy is bolstered by its commitment to walking the talk at a national level

02 Alliance

Realizing the importance of collaboration, India has been the prime mover in creating international alliances to address global environmental concerns

03 Action

India has been working steadily to put many strategies and plans into action, to protect natural resources while meeting set SDGs

1.1 ADVOCACY AND COMMITMENTS

At the 1972 United Nations Conference on Human Environment, the then Prime Minister of India was the only foreign head of government out of the 113 nations in attendance. India focused on the links between poverty reduction and environmental conservation and called for a cooperative approach on a global scale to deal with both.

India became a signatory to the Montreal Protocol on substances that deplete the ozone layer in 1992. It played a vital role in the establishment of the Multilateral Fund, the financial mechanism established under the Montreal Protocol, and has actively worked on phasing out of production and consumption of Ozone Depleting Substances, some well ahead of the agreed phase-out schedule.

At the United Nations Framework Convention on Climate Change (UNFCCC) in Rio De Janeiro in 1992, India advocated for including provisions in treaties that better reflected the needs and realities of developing countries. This resulted in the treaties gaining wider acceptance from developing and Least developed nations. Even today, as evidenced by its role in the recent G20 Presidency, India is the voice for many marginalized nation groups and ensures that global agendas factor in their concerns and needs.

As a responsible global player, India ratified the Paris Agreement in 2015 despite a need for more clarity from developed nations on pre-2020 actions and the possibility of this goal requiring mitigation efforts by developing countries like India. India submitted ambitious Nationally Determined Contributions (NDC) and affirmed its commitment to the Agreement. India has shown impressive achievements to what it committed in 2015, as shown in the figure below.

NDC (2015)	Target (2030)	Achievement
Non-fossil fuel based electric installed capacity	40% cumulative	43.8% (August 2023). Target achieved 9 years ahead of committed time
Reduce emissions intensity of GDP	33-35% over 2005 levels	Reduced by 33 per cent between 2005 and 2019
Additional carbon sink	2.5-3.0 billion tons	1.97 billion tons (2021)

India has updated its NDC in August 2022 as follows:

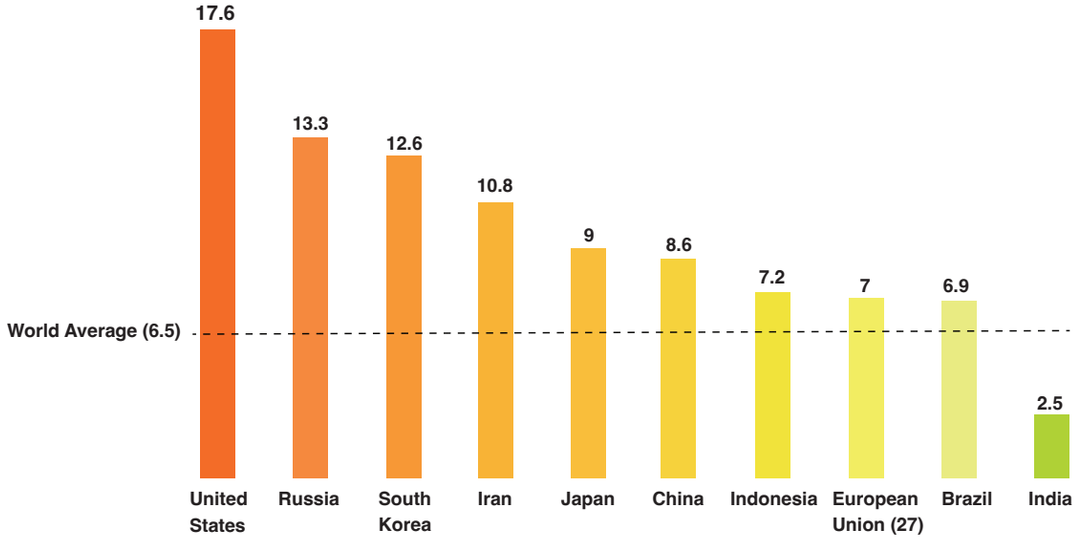
- Meet 50% of India's cumulative electric power installed capacity from non-fossil sources by 2030
- Reduce the emission intensity of GDP by 45% below 2005 levels by 2030
- Put forward and further propagate a healthy and sustainable way of living based on the traditions and values of conservation and moderation, including through a mass movement for LiFE – Lifestyle for Environment as a key to combating climate change.

At Rio and beyond, India has been a pivotal voice that brings equity-based discourse into climate change negotiations. As a part of its overall strategy, India emphasizes the foundational principles of equity and common but differentiated responsibilities and respective capabilities. Equity is essential when national responsibility for climate change mitigation is assigned. A country's historical emissions, its current vulnerability to the impacts of climate change, its development targets to provide basic necessities for all citizens, and current per capita emissions are all factors to consider.

The Summary for Policy Makers (SPM) of the Working Group III contribution to the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) [2022] has noted clearly that the contribution of entire Southern Asia is only about 4% of historical cumulative net anthropogenic emissions between 1850 and 2019, even though the region includes almost 24% of the global population. India's historical contribution to cumulative global GHG emissions is therefore minuscule, despite having a share of ~17% of the world's population. India's per capita annual emissions are about a third of the global average[1].

Per capita emissions for the top 10 total emitters, 2019

(tCO_2e/person)

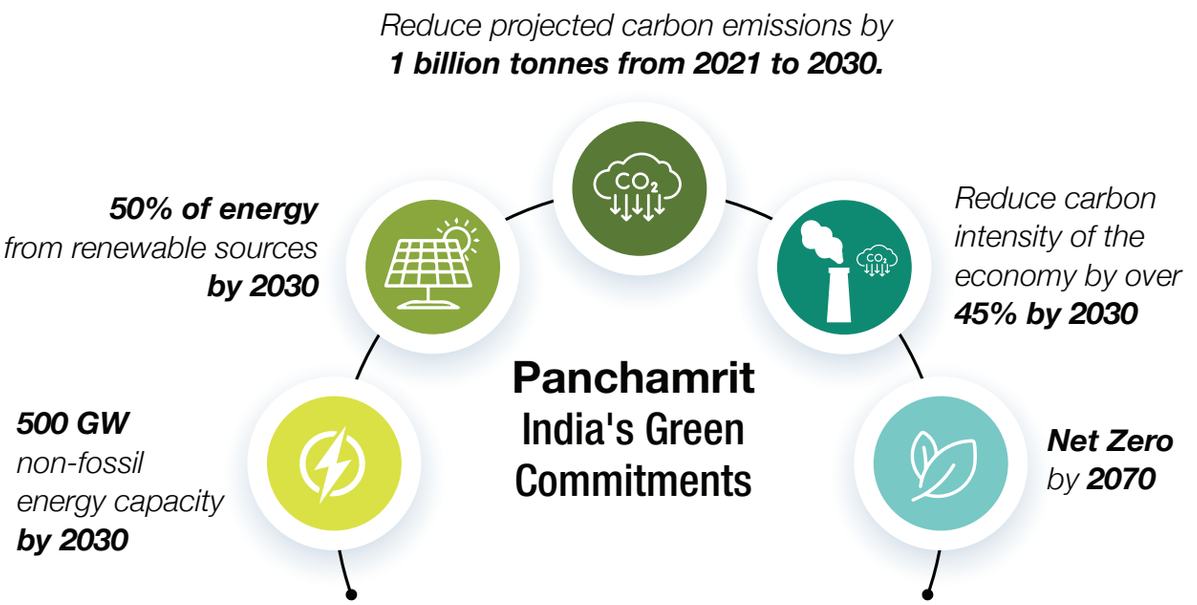


Source: Climate Watch - values include emissions from LUCF sector[2].

The Global Climate Risk Index 2021 classifies India as a vulnerable country to the impacts of climate change. Its development targets and energy needs for the same are immense. Yet, with its strong environmental ethos, India has set very stringent targets for itself, and its NDC are an example for the world to emulate.

At the 26th Conference of Parties (COP 26), India pledged to reduce its GHG emissions to net zero by 2070. The country put forth five elements - Panchamrit - of its climate commitments.

Panchamrit - India's Green Commitments



India has heightened its climate action in the post-pandemic world and is a strong proponent of the need to nudge humanity toward sustainable lifestyles. Encouraging lifestyles where consumption is mindful of the Earth's limited natural resources can be a formidable tool for mitigating global warming and climate change. Against this backdrop, India has proposed Mission LiFE – Lifestyle for Environment, through which traditional knowledge systems are being re-established and simultaneously melded with new technologies to address the well-being of the planet and its inhabitants in a holistical manner.

At COP 27 in 2022, India announced its Long Term – Low Emission Development (LT-LED) strategy, which will facilitate its transition to net zero by 2070. Key features of the strategy are:

- Rational utilisation of national resources with due regard to energy security, and transition from fossil fuels in a just, smooth, sustainable, and all-inclusive manner
- Maximising the use of electric vehicles, achieving ethanol blending of 20% by 2025, and encouraging a substantial modal shift to energy-efficient transport for passenger and freight
- Driving resource-efficient and climate resilient urban development through smart city initiatives
- Improving energy and resource efficiency in the manufacturing sector, and
- Enhancing forest and tree cover as per set goals

1.2 ALLIANCES - INDIA ON THE GLOBAL STAGE

India's global outlook revolves around a phrase from the Maha Upanishad – Vasudhaiva Kutumbakam (the world is one family) – and it believes in striving for the planet's welfare and the common good. Climate change requires humanity to work together, and India has been assuming environmental stewardship on the global stage by bringing together countries and leading climate action. From popularising millets to creating alliances for rapid deployment of solar energy solutions; from successful transboundary wildlife conservation efforts to facilitating mass movements for lifestyle changes, India's pro-planet efforts are significant not just within the country but at a global level as well.

On taking over the Presidency of the G20, India first organized the Voice of the Global South Summit, to understand their priorities and concerns and set the agenda for the Presidency based on those. India helped shape the dialogue on various complex issues covering renewable energy, sustainable development, health, education, women's empowerment, and inclusive growth, among others. With its diverse economy, technological prowess, and commitment to sustainable development, India brings unique perspectives to the table. It can also bring everybody to the same table, as evidenced by the joint declaration of the G20 Presidency having the consensus of all members. It proposed the inclusion of the African Union into the G20, the acceptance of which changed the G20 into G21. India has successfully emerged as a balanced voice of the Global South.

Conceptualized on the sidelines of the 21st Conference of Parties (COP21) to the UNFCCC held in Paris in 2015, the International Solar Alliance (ISA) is a joint effort by India and France to mobilise efforts against climate change by deploying solar energy solutions. At present, 116 countries are signatories to the ISA Framework Agreement, of which 94 countries have submitted the necessary instruments of ratification to become full members of the ISA.

India put forth the idea for the One Sun One World One Grid (OSOWOG) initiative at the First Assembly of ISA in October 2018, and the Green Grids Initiative – OSOWOG was launched at the World Leaders Summit during COP 26 at Glasgow. The initiative aims to connect different regional grids through a common grid that will be used to transfer renewable energy power and, thus, realize the full potential of renewable energy sources, especially solar energy, since 'the sun never sets'.

The Coalition for Disaster Resilient Infrastructure (CDRI) was launched by India at the 2019 UN Climate Action Summit. A multi-stakeholder global partnership of 34 countries, UN agencies, multilateral development banks, the private sector, and academic institutions, it aims to enable a measurable reduction in infrastructure losses from disasters, including extreme climate events. In its formative stage, CDRI will focus on developing resilience in ecological, social, and economic infrastructure, with a concerted emphasis on health, education, transportation, telecommunication, energy, and water.

Leadership Group on Industry Transition (LeadIT) was launched by the Governments of India and Sweden at the UN Climate Action Summit in New York in September 2019. Envisioned as a group of countries, companies, and other actors committed to enhancing climate action, LeadIT supports the implementation of the NDC with a focus on hard-to-abate industrial sectors. It will provide policy and decision support, enable collaboration, and facilitate financing for industry's low-carbon transition. LeadIT intends to provide a platform for sharing technology know-how and sectoral and cross-sectoral learning to commercialize new technologies. 37 LeadIT members have committed to action to achieve the Paris Agreement.

Leaders of India, Singapore, Bangladesh, Italy, USA, Brazil, Argentina, Mauritius, and UAE launched the **Global Biofuel Alliance in September 2023,** on the side lines of the G20 Summit in New Delhi. An initiative by India as the G20 Chair, the alliance seeks to expedite the global uptake of biofuels through facilitating technology advancements, intensifying demand, and shaping robust standard setting and certification. The alliance will also act as a central repository of knowledge and an expert hub.

The launch of an industry-led **Resource Efficiency and Circular Economy Industry Coalition (RECEIC),** facilitated by the Environment and Climate Sustainability Working Group marked a significant milestone under India's G20 Presidency. It is envisaged to be an industry driven self-sustaining initiative, which will facilitate greater corporate collaboration across member countries to accelerate resource efficiency and circular economy transition.

India is party to many major international conventions related to biodiversity and wildlife conservation. Some of these are:

- Convention on International Trade in Endangered Species of wild flora and fauna (CITES)
- International Union for Conservation of Nature (IUCN)
- International Whaling Commission (IWC)
- The United Nations Education Scientific and Cultural Organization – World Heritage Committee (UNESCO – WHC)
- The Convention on Migratory Species (CMS)
- Convention on Biological Diversity (CBD)
- UN Convention to Combat Desertification (UNCCD)
- Cartagena Protocol on Biosafety
- International Network for Bamboo and Rattan (INBAR)

India launched the International Big Cat Alliance (IBCA) in April 2023 to conserve seven big cats: Tiger, Lion, Leopard, Snow Leopard, Cheetah, Jaguar, and Puma. The alliance aims to strengthen global cooperation and conservation efforts across 97 range countries covering the natural habitats of these cats. Conserving big cats and their habitats can secure some of Earth's most important ecosystems, leading to climate change adaptation, water and food security for millions, and improved livelihood and sustenance to forest communities.

Coalitions are the way forward to achieve global environment climate goals, and India is a strong supporter of countries coming together for the greater good.

1.3 INCLUSIVE DEVELOPMENT THROUGH LOW CARBON PATHWAYS

On home turf, India is translating its vision and its commitments into actions with remarkable speed and scale

Between 2015-16 and 2019-21, **135 million** Indians exited multidimensional poverty[3].

Nearly **40 million** houses providing shelter to over **150 million** people were constructed for the poor in the past seven years[4].

100 million people were provided with tap water supply in just four years[5].

India has the world's most extensive school meal programme, where nearly **120 million** children get a hot, nutritious meal in school[6].

The government runs over 1 million schools, providing free education to **140 million** children[7].

The country runs a National Health Insurance scheme that ensures free medical treatment for the poor. The scheme currently covers 248 million people and is being scaled up to cover **550 million** people[8]. We protected our people with 2.2 billion doses of made-in-India COVID vaccines, and that too free of cost.

India led a revolutionary financial inclusion drive, recognized by the Guinness World Records as the world's largest, benefitting more than **460 million** people, 56% of whom are women[9].

800 million people gained access to electricity between 2001 and 2020. 97% of all Indian households now have electricity[10].

The country is working on building Digital India. Today, there are more than **850 million** smart phones and internet users in the country[11].

India has been successfully decoupling its economic growth from GHG emissions, resulting in **reduction of the emission intensity of its GDP by 33 per cent** between 2005 and 2019.

In June 2023, India was announced as the top country with **LEED Zero green building projects**[13].

In July 2020, the Indian Railways set an ambitious target of becoming a **net zero carbon emitter by 2030,** which will make it the largest green railway system globally.

The 'Namami Gange' project to restore and rejuvenate the river Ganga has been declared a **World Restoration Flagship** at the UN Convention on Biological Diversity, and has been hailed as a case study for other countries battling river pollution.

India has made great strides in **protecting its wildlife.** The country has rebuilt forest corridors and protected animal habitats through a landscape approach, to bring back healthy numbers of keystone species like the tiger, elephant, and the Indian rhinoceros.

India is a signatory to the Ramsar Convention, and **75 wetlands in India are deemed** to be of international importance under this Convention.

India retains its 40th rank out of 132 economies in the Global Innovation Index (GII) 2023. India has been on a rising trajectory over the past several years in the GII, from a rank of 81 in 2015 to 40 in 2023[14].

1.4 MISSION LiFE

India has articulated the need for environmentally conscious lifestyles, i.e., "LiFE – Lifestyle for Environment" at a global level and has succeeded in getting the concept included in various International Reports / Communiqués such as:

- IPCC Climate Change 2022 Mitigation of Climate Change Working Group III Report, 2022
- Cover decision of Sharm el-Sheikh Implementation Plan, 2022
- G7 Communiqué adopted in Sapporo, Japan, 2023
- Shanghai Cooperation Organisation Communiqué, 2023
- G20 Leaders' Declaration, 2023

Mission LiFE is working on

1. **Nudging individuals to practice simple yet effective environment-friendly actions in their daily lives (demand)**
2. **Enabling industries and markets to respond swiftly to the changing demand (supply)**
3. ***Influencing government and industrial policy to support both sustainable consumption and production (policy)***

The International Energy Agency (IEA) conducted modelling studies on the benefits of advancing the Lifestyle for Environment (LiFE) initiative through the G20. The initial report points out that worldwide adoption of actions and measures targeted by LiFE - including behavioural changes and sustainable consumer choices - would reduce annual global CO_2 emissions by more than 2 billion tonnes (Gt) in 2030. This is about one-fifth of the emissions reductions needed by 2030 to put the world on a pathway to net-zero emissions[15].

1.5 SABKA SAATH, SABKA VIKAS, SABKA PRAYAAS

India's motto of 'everyone, striving together for universal development' requires all levels of government, corporations, civil society, and individuals to take responsibility and ownership of their actions and decisions.

The government is responsible for setting ambitious targets and putting policies, roadmaps, infrastructure, and financing in place to achieve the same. Collaborations forged with industry and civil society to leverage their expertise (innovation and speed from corporations; community mobilization and ensuring that policies synchronize with people's needs and aspirations from civil society organizations) help fast-track action on the ground. Citizens are the focus, and the design of implementation plans is such that every person takes ownership. This leads to people's movements, which helps achieve scale and reliability of operation.

Multi-pronged top-down and bottom-up approaches involving diverse stakeholders are adopted to achieve set targets while providing equitable and inclusive development. Central, State, and local governments, corporations, academia, civil society, and individuals are working together to achieve the tremendous pace of low carbon and climate-resilient growth we have seen in the country. The following chapters highlight the colossal planning exercise that India has undertaken to ensure systems and policies are in place to implement low carbon and climate resilient pathways without compromising on the country's growth trajectory, as well as a few examples of how India is proving to be a game-changer in different sectors to ensure a better future for the Planet and its residents.

02

OVERARCHING PLANS TO ADDRESS CLIMATE CHANGE

02

OVERARCHING PLANS TO ADDRESS CLIMATE CHANGE

India released its National Action Plan on Climate Change (NAPCC) in June 2008, which outlines its strategy to adapt to climate change and enhance the ecological sustainability of the country's development path. NAPCC provides an overarching framework for all climate actions.

Focused National Missions form the core of the Action Plan, representing multi-pronged, long-term, and integrated strategies for achieving critical goals in the context of climate change. These are:

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Mission on Sustainable Habitat
- National Water Mission
- National Mission for Sustaining the Himalayan Eco-system
- National Mission for a Green India
- National Mission for Sustainable Agriculture
- National Mission on Strategic Knowledge for Climate Change
- National Action Plan for Climate Change & Human Health
- National Mission on Sustainable Transport

With the formulation of the NAPCC, achieving coherence between the strategies and actions at the national and sub-national levels became imperative. Therefore, the Government motivated the State Governments to prepare their State Action Plans on Climate Change (SAPCC) based on the broad objectives of NAPCC. By incorporating climate change considerations into State-level policies and programmes, SAPCCs help India adapt to the impacts of climate change while protecting its local communities and ensuring sustainable development. As of September 2023, thirty-four States /Union Territories (UTs) have prepared, and some have updated their SAPCCs in line with NAPCC and India's NDC, taking into account State-specific issues relating to climate change. These SAPCCs outline sector-specific and cross-sectoral priority actions, including adaptation and climate-resilient infrastructure. Preparing the SAPCCs includes mapping climate vulnerability across all districts, examining future projections, identifying on-ground infrastructure and assessing priorities, and framing actionable strategies. There are very few examples in the world, if any, of such large-scale planning and implementation.

For India to meet set SDG targets by 2030 and achieve net zero by 2070, action is required on several fronts at scale, covering all its States and Union Territories. This comes with its own set of challenges, given India's federal structure. The central government makes climate commitments on the international stage, drafts overarching policy documents, and controls fiscal powers. Constitutional division of powers gives the States control over many natural resources and related activities such as water resources, agriculture, fisheries, etc. Additionally, ecological conservation efforts are landscape-based, cross-sectoral, and not restricted to jurisdictional boundaries. Therefore, implementing climate change adaptation and mitigation measures is a dynamic process, requiring effective coordination within and between all levels of government.

The Prime Minister's Council on Climate Change is in charge of the NAPCC and provides oversight for the Ministries with lead responsibility for each Mission to develop objectives, implementation strategies, timelines, and monitoring and evaluation criteria. The Council is also responsible for periodically reviewing and reporting each Mission's progress.

NATIONAL SOLAR MISSION

Objective - Establish India as a global leader in solar energy by creating the policy conditions for solar technology diffusion across the country as quickly as possible.

NATIONAL MISSION FOR ENHANCED ENERGY EFFICIENCY

Objective - Create market-based mechanisms to enhance the cost effectiveness of improvements in energy efficiency.

NATIONAL WATER MISSION

Objective - Ensure the equal distribution of water across states through integrated water resources development, while minimizing wastage of water.

NATIONAL MISSION FOR SUSTAINABLE AGRICULTURE

Objective - Ensure ecologically sustainable climate resilient agricultural practices and production systems.

NATIONAL MISSION ON STRATEGIC KNOWLEDGE FOR CLIMATE CHANGE

Objective - Ensure focused, high-quality research and technology development towards identifying the challenges and responses to climate change.

NATIONAL MISSION FOR A GREEN INDIA

Objective - Sustainably grow and manage forests and other ecosystems.

NATIONAL MISSION FOR SUSTAINING THE HIMALAYAN ECOSYSTEM

Objective - Address the impacts of climate change on Himalayan glaciers, biodiversity, and wildlife conservation.

NATIONAL MISSION ON SUSTAINABLE HABITAT

Objective - Promote habitat sustainability by improving energy-efficiency in urban planning.

NATIONAL ACTION PLAN ON CLIMATE CHANGE & HUMAN HEALTH

Objective - Strengthen healthcare services to address adverse impacts of climate change on health.

NATIONAL MISSION ON SUSTAINABLE TRANSPORT

Objective - Reduce the environmental impact of transportation.

Sustainable long-term change can come about only when the beneficiaries or people on the ground take pride and ownership in the change. It is a colossal effort to do that, given deep-rooted cultural norms. Despite these and many other challenges, India has done remarkably well in the large-scale implementation of flagship projects, a few of which are elaborated in the following chapters.

2.1 NATIONAL SOLAR MISSION

The National Solar Mission (NSM) aims to establish India as a global leader in solar energy by creating favourable policy conditions for the rapid diffusion of solar technologies across the country.

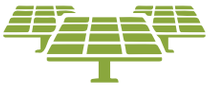
Major schemes under the National Solar Mission are:

Pradhan Mantri Kisan Urja Suraksha Evam Utthan Mahabhiyan (PM KUSUM)

One of the largest initiatives in the world to provide clean energy to more than 3.5 million farmers by solarizing their agriculture pumps.

Roof Top Solar (RTS) Programme

Incentives and subsidies are provided to residential, institutional, social and government sectors to install solar photovoltaic (PV) power systems on their rooftops.



Solar Parks

All States and Union Territories are eligible to get benefits under this scheme to set up large-scale solar power generation projects as a public-private partnership, resulting in large-scale reductions in greenhouse gas emissions.

Green Energy Corridor Project

A series of infrastructure projects that aim to synchronize electricity produced from renewable sources with that from conventional power stations. For large-scale evacuation of renewable energy, the Inter State Transmission System is being implemented in eight renewable energy-rich states of the country.

Greening of islands

This project aims to deploy adequate distributed grid-connected solar PV power to meet the energy requirements of the Andaman and Nicobar Islands and Lakshadweep Islands.

Solar cities

At least one city (the capital or a well-known tourist destination) in each State is being developed as a solar city, where renewable energy, especially solar power, will meet the city's energy needs.

2.2 NATIONAL MISSION FOR ENHANCED ENERGY EFFICIENCY

The National Mission for Enhanced Energy Efficiency (NMEEE) aims to strengthen the market for energy efficiency by creating a conducive regulatory and policy regime. It fosters innovative and sustainable business models in the energy efficiency sector. Implemented in 2011, it consists of four major initiatives:

National Mission for Enhanced Energy Efficiency (NMEEE) Initiatives

PAT
Perform, Achieve and Trade (PAT) – for improving energy efficiency in energy intensive sectors

MTEE
Market Transformation for Energy Efficiency (MTEE) – for accelerating the shift towards more energy efficient appliances

MTEE
Energy Efficiency Financing Platform (EEFP) - for capacity enhancement of stakeholders related to energy efficiency financing

FEEED
Framework for Energy Efficient Economic Development (FEEED) – for development of fiscal instruments to promote energy efficiency

2.3 NATIONAL MISSION ON SUSTAINABLE HABITAT

The National Mission on Sustainable Habitat (NMSH) aims to promote low-carbon urban growth, reduce GHG emissions intensity, build the resilience of cities to climate change impacts, and strengthen their capacity to bounce back better from climate-related extreme events and disaster risks.

The NMSH has identified five thematic areas, namely

Energy and Green Buildings - focuses on reducing energy consumption in India's real estate sector and adoption of green building technologies.

Urban Planning, Green Cover, and Biodiversity - lays emphasis on integrated urban and regional planning approaches to climate-sensitive development. Preservation and rejuvenation of water bodies, green spaces, and eco-sensitive areas are important aspects under this theme.

Mobility and Air Quality - highlights strategies for developing comprehensive, energy-efficient and cost-effective urban mobility plans.

Water Management - prioritizes the augmentation of existing water resources by adopting rain-water harvesting, rejuvenation of water bodies, recycling/ reuse of treated sewage, water conservation, and promoting the circular economy of water by the development of City Water Balance Plans.

Waste Management - focuses on the need for cities to prioritise actions for waste reduction, and promote material recovery, waste-to-energy and waste-to-compost plants.

2.4 NATIONAL WATER MISSION

The National Water Mission's main objective is water conservation, minimizing wastage, and ensuring its more equitable distribution across and within States through integrated water resources development and management.

Creation of a comprehensive water database in the public domain.

Assessment of the impact of climate change on water resources.

Promotion of citizen and state actions for water conservation, augmentation, preservation, and focused attention to vulnerable areas including over-exploited areas.

Increasing water use efficiency by 20%.

Promotion of basin-level integrated water resources management.

2.5 NATIONAL MISSION FOR SUSTAINING THE HIMALAYAN ECO-SYSTEM

The Mission attempts to address important issues concerning Himalayan glaciers and their associated hydrological consequences, biodiversity and wildlife conservation and protection in the region, and traditional knowledge societies and their livelihoods. It seeks to facilitate formulation of appropriate policies and time-bound action programmes to ensure ecological resilience and the continued provision of key ecosystem services in the Himalayas, which impacts a significant proportion of India's population.

An ecosystem's sustainability demands equilibrium between the region's biotic and abiotic resources over time. Recognizing this, the mission works towards building Science and Technology capacities to observe and respond to ecosystem changes sustainably. It strengthens and effectively networks academic and research institutions already engaged in natural resource management activities in the Indian Himalayan region.

Ecosystem management relies heavily on scientific inputs, so the Ministry of Science and Technology is designated the nodal Ministry for this mission. The Ministry coordinates with relevant State and Central government departments to achieve its goals.

The Mission focuses on strengthening personnel and institutions' capacities to build evidence-based policy and governance structures for sustainable development in this ecologically fragile and vital region.

2.6 NATIONAL MISSION FOR A GREEN INDIA

India has committed to creating an additional carbon sink of 2.5 to 3 gigatonnes of carbon dioxide equivalent through additional forest and tree cover by 2030 as an NDC commitment. Green India Mission (GIM) was launched in 2014 to protect, restore, and increase India's forest cover and quality. In the context of climate change adaptation and mitigation, the mission aims to enhance ecosystem services of forests, including carbon sequestration, hydrological services, biodiversity, and other provisioning services such as fodder, small timber and non timber forest products (NTFP).

Specifically, the Mission focuses on enhancing carbon sinks in sustainably managed forests and other ecosystems, adaptation of vulnerable species / ecosystems, and adaptation of forest-dependent communities to the changing climate.

The Mission targets

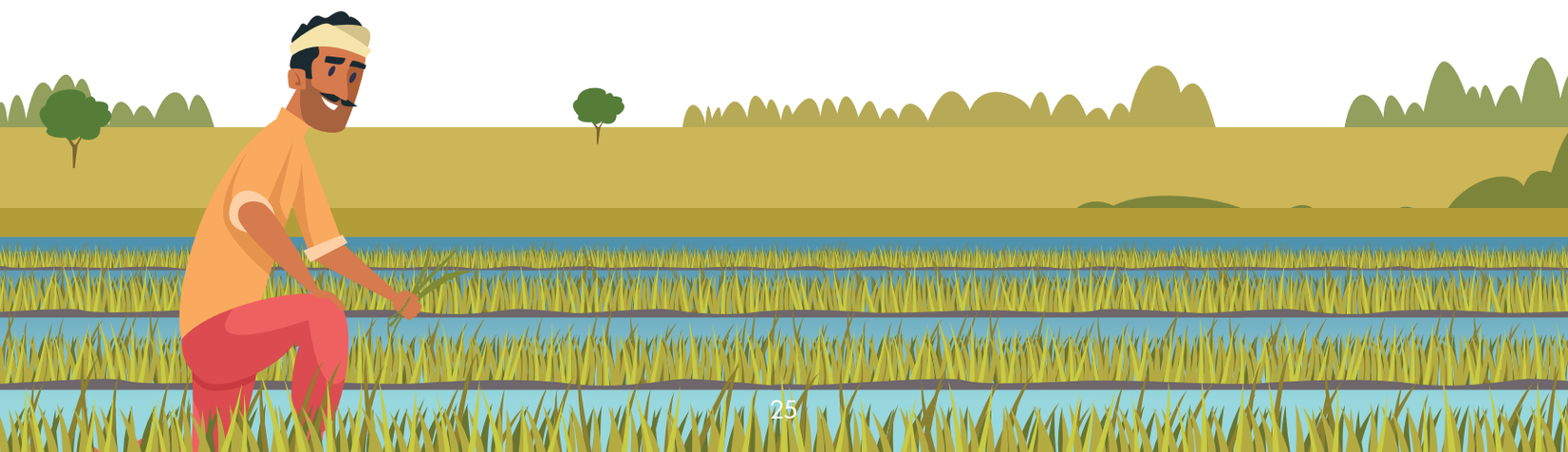
- Improved quality of forest cover, and increased forest and tree cover on forest/non-forest lands.
- **Improved ecosystem services** including biodiversity, hydrological services, and carbon sequestration, as a result of the improved forest cover
- Increased forest-based livelihoods and household income of forest-dependent communities living in and around the forest
- Creation of an additional carbon sink of **2.5 to 3.0 billion tonnes** of CO_2 equivalent by 2030.

The Mission prioritizes restoration / reclamation forestry under the landscape approach, focusing on vulnerable habitats and degraded forest and non-forest areas through existing and regionally applicable eco-restoration models, including, agroforestry, social forestry, and saturation of vulnerable landscapes through tree plantations in identified gaps, in consonance with ongoing afforestation schemes of the Central and State governments. Additionally, it focuses on enhancement of livelihoods and household income of forest- dependent communities living in and around forest areas, through skill development and sustainable cultivation of NTFPs.

2.7 NATIONAL MISSION FOR SUSTAINABLE AGRICULTURE

The National Mission for Sustainable Agriculture (NMSA) aims at making agriculture more productive, sustainable, remunerative, and climate resilient by promoting location-specific integrated /composite farming systems, weather advisories, soil and moisture conservation measures, comprehensive soil health management, efficient water management practices, and mainstreaming rain-fed technologies.

These measures are embedded and mainstreamed into existing / new overarching programmes and schemes of various ministries and departments through a process of restructuring and convergence. The Mission encourages judicious use of common resources through a community-based approach. Emphasis is maintained on progressively shifting to environmentally friendly technologies, adopting energy-efficient equipment, improved agronomic practices, conservation of natural resources, crop diversification, and livelihood diversification through integrated crop-livestock farming systems.



2.8 NATIONAL MISSION ON STRATEGIC KNOWLEDGE FOR CLIMATE CHANGE

The National Mission on Strategic Knowledge for Climate Change (NMSKCC) seeks to build a vibrant and dynamic knowledge system that would inform and support national action for responding effectively to ecologically sustainable development. It promotes research, knowledge generation, and capacity building related to climate science. The Mission provides strategic knowledge to the other Missions under NAPCC to allow for effective responses to climate change challenges without compromising India's growth trajectory.

India's diversity in biogeography and its unique challenges require regional modelling that can provide optimal solutions. Responses to climate change mitigation and adaptation needs also require holistic action based on inputs from varied institutions and organizations.

The formation of **knowledge networks** among institutions engaged in research and development relating to climate science, and data sharing through a suitable policy framework and institutional support

The establishment of global technology watch groups with institutional capacities to research risk minimized technology selection for developmental choices.

The development of national capacity for modelling the regional impact of climate change on different ecological zones within the country, for different seasons, and living standards

The establishment of research networks and encouraging research in the areas of climate change impacts on important socio-economic sectors like agriculture, health, natural ecosystems, bio-diversity, coastal zones, etc.

Providing an improved **understanding and awareness** of key climate processes, and the resultant climate risks and associated consequences.

Building alliances and partnerships through global collaboration in research & technology development on climate change under international and bilateral Science and Technology cooperation arrangements.

Focused research and development (R&D) programmes in climate change science and adaptation are carried out through thirteen Centres of Excellence (CoE), twenty six major R & D programmes, seven National Network Programmes and seven capacity building programmes. Thirteen Climate Change centres / cells have been set up in different states to carry out activities that connect their state action plans with priorities stated by NMSKCC.

The southwest monsoon is the country's lifeline, influencing agricultural yield, economy, water resources, power generation, and the health of ecosystems. India has launched a National Monsoon Mission, which supports focused research to improve models in the short, medium, extended, and seasonal range scales by setting up a framework for generating dynamic forecasts and improving the skill of forecasts. Under the Monsoon Mission, India has developed state-of-the-art weather and climate prediction models, which are now in operation.

2.9 NATIONAL ACTION PLAN FOR CLIMATE CHANGE & HUMAN HEALTH

National Action Plan for Climate Change & Human Health (NAPCCHH) aims to reduce climate-sensitive illnesses through integration with other missions under NAPCC and through programmes run by various ministries. The vision of NAPCCHH is to strengthen the health of Indian citizens against climate-sensitive illnesses, especially among the vulnerable like, children, women, and marginalized populations. With a goal to reduce morbidity, mortality, injuries, and health vulnerability to climate variability and extreme weathers, the objectives of NAPCCHH with some initially identified significant actions are:

- To create awareness among the general population and especially vulnerable communities, healthcare providers, and policymakers regarding the impacts of climate change on human health
- To strengthen the capacity of the healthcare system to reduce illnesses / diseases due to variability in climate
- To strengthen health preparedness and response by performing situational analyses at national / state / district / below district levels
- To develop partnerships and create synchrony / synergy with other Missions and ensure that health is adequately represented in the climate change agenda in the country
- To strengthen research capacity to fill the evidence gap on climate change impact on human health

NAPCCHH is taking a multi-pronged approach to address the health-related aspects of climate change. It seeks coordination with other missions identified under the umbrella of the NAPCC. The targets achieved by other national Missions launched under the NAPCC will also scale down the morbidity and mortality of various illnesses.

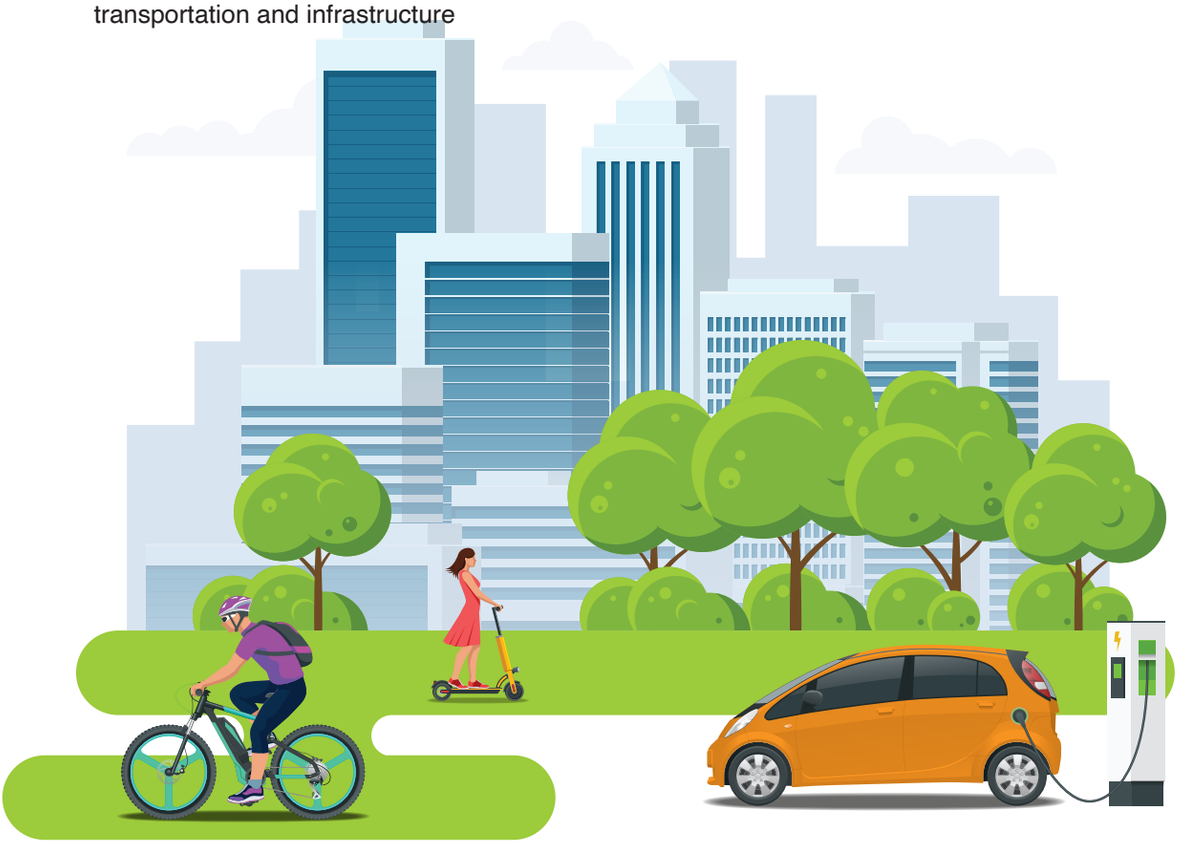
2.10 NATIONAL MISSION ON SUSTAINABLE TRANSPORT

The National Mission on Sustainable Transport (NMST) is being developed to devise efficient and cost-effective strategies across environmental, social, and economic aspects of transportation.

It, therefore, looks at a variety of measures of sustainability, including pollution levels, GHG emissions, energy consumption, infrastructure resilience, efficiency in freight networks, affordability, accessibility, efficiency and convenience of public transportation, urban air quality and its impact on health, etc. These will facilitate the development of sustainable and inclusive transport systems with a climate-sensitive approach.

The Mission aims to :

- **Reduce emissions** from the transport sector and promote transition to alternative and cleaner fuels
- **Promote innovative technologies** for enhancing energy efficiency of vehicular and transport systems
- **Promote fuel efficient** transport modes for passenger, freight, and urban populations
- **Build climate resilient infrastructures** to reduce the compounding risks of climate vulnerabilities
- **Encourage research and development** for future-proof and adaptable technologies in transportation and infrastructure



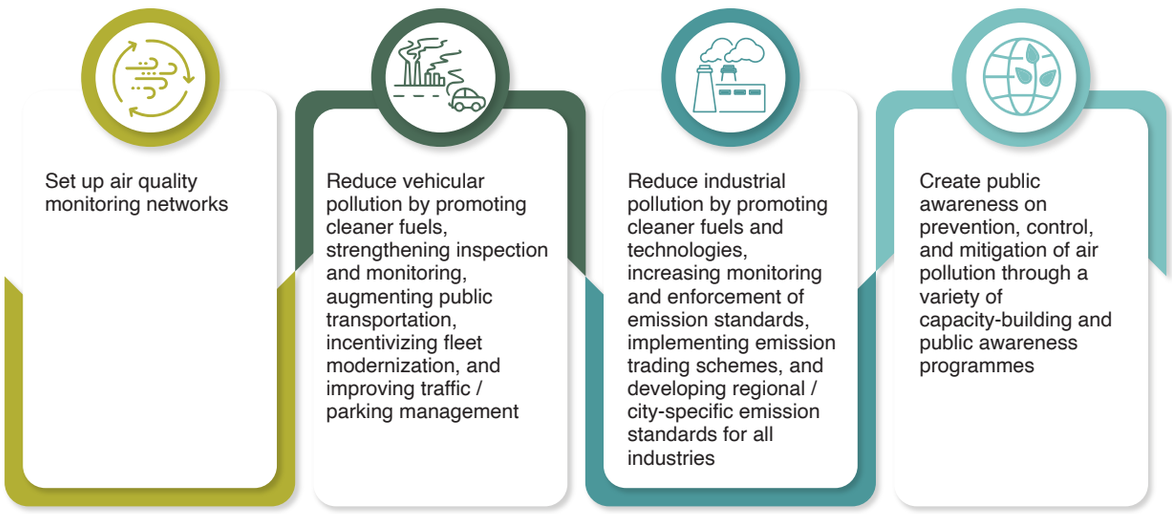
2.11 NATIONAL CLEAN AIR PROGRAMME (NCAP)

In addition to the National Missions that address climate change mitigation and adaptation, India launched the National Clean Air Programme (NCAP) in January 2019 with an aim to improve air quality in 131 cities across 24 States/Union Territories by engaging all stakeholders. The programme envisages achieving reductions up to 40% or achievement of National Ambient Air Quality Standards for Particulate Matter10 (PM 10) concentrations by 2025-26. The specific clean air action plans target city-specific air polluting sources, viz. vehicular emission, road dust, biomass/crop/garbage/MSW burning, construction activities, industrial emission, and other city specific sources.

The NCAP strategy includes the following actions:

- Clean Air Action Plans at National, State, and City levels for source-specific mitigation actions
- Financial incentive structure for targeted cities linked with air quality improvement performance
- Coordinated actions by Central Ministries, State Governments, and their agencies
- Convergence of resources from schemes of Central Government, State Government and Urban Local Bodies
- Building of a mass movement – Jan Andolan.

National Clean Air Programme Objectives



2.12 SECTOR-SPECIFIC ACHIEVEMENTS TOWARDS MEETING SDG AND NDC

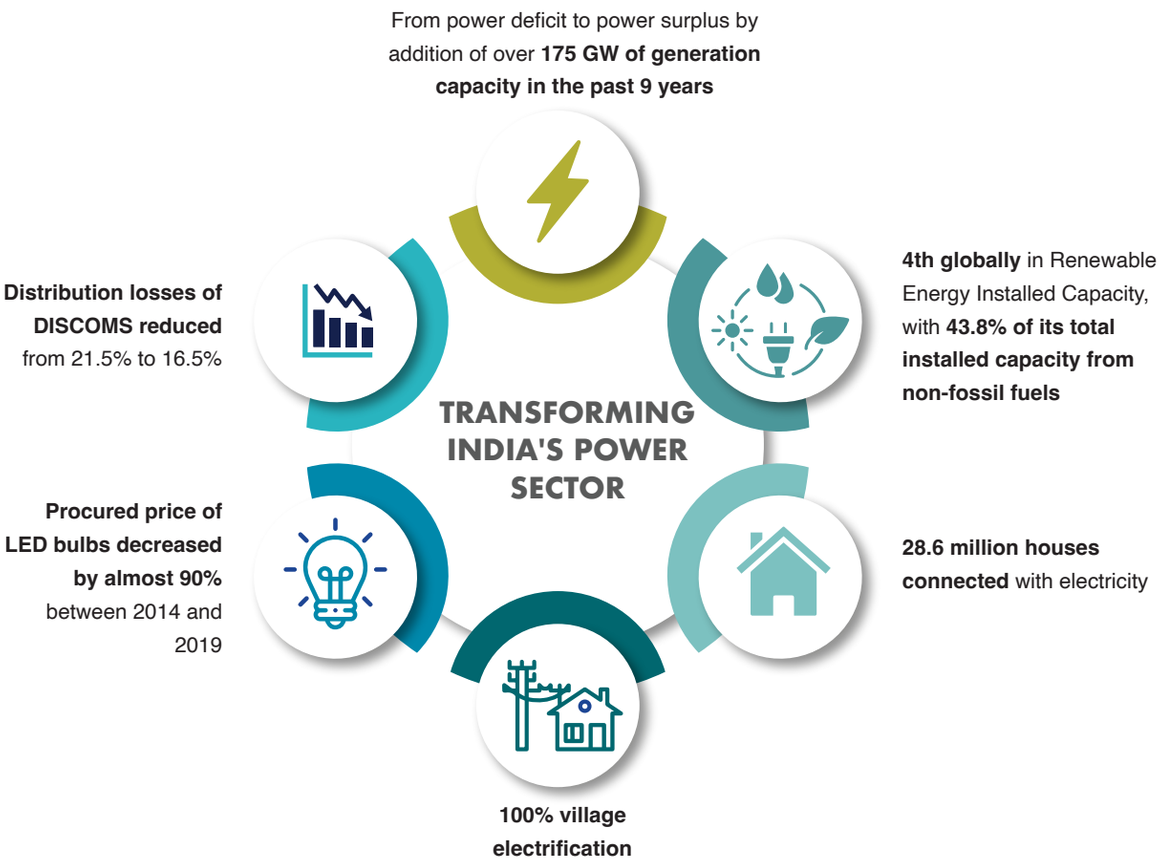
India is undertaking an integrated approach towards meeting its Sustainable Development Goals and updated Nationally Determined Contribution commitments, through its work under each of the above-stated focused National Missions. The following chapters highlight the country's sector-specific achievements towards meeting these goals. These include its work in the areas of clean energy, energy efficiency, the transport sector, built environments, water management, food security, and biodiversity management.

03

INDIA'S CLIMATE ACTIONS – ENERGY

03

INDIA'S CLIMATE ACTIONS – ENERGY



Source: Press Information Bureau[16].

India has a distinctive and daunting task of meeting the SDGs related to providing universal access to affordable and reliable energy services, affordable and safe water, food security, and decent work and economic growth to almost 18% of the world's population, all of which makes enormous demands of its energy sector. The task is even more formidable when put in context with India's global commitments of achieving net zero by 2070, notwithstanding its acute vulnerability to extreme climate events. Global events also require India to become energy-independent.

A challenge faced by no other country in the world, India has made remarkable progress and set an inspiring example for the world. The installed renewable energy capacity in India has increased from 115.94 GW in March 2018 to 172.00 GW in March 2023, i.e., an increase of around 1.48 times. According to the Central Electricity Authority (CEA), electricity generation from renewable energy sources during 2022-23 was about 365.60 billion units[17].

Globally, India has the fourth largest Installed Capacity of renewable energy, as per Renewable Energy Statistics 2023 released by the International Renewable Energy Agency (IRENA), with 43.8% of its total installed electricity capacity coming from non-fossil energy sources. The remarkable growth of renewable energy capacity has cemented India's position as a global leader in renewable energy adoption. At COP 21, as part of its NDC, India committed to achieving 40% of its installed power generation capacity from non-fossil energy sources by 2030. The country achieved this target in November 2021, nine years ahead of the 2030 timeline.

The country has achieved universal electrification, barring only 0.01% of households. India launched the SAUBHAGYA scheme (Pradhan Mantri Sahaj Bijli Har Ghar Yojana) in October 2017 to provide electricity to every household in the country. A challenge of epic proportions, the world's largest household electrification drive brought electricity to over 26 million homes. Another 2 million homes were electrified under successive schemes, and today, only 18,734 houses in left-wing extremist affected areas are yet to get electricity[18].

India's per capita electricity consumption was 1255 kWh in 2021-22, around one-third of the global average of per capita electricity consumption[19]. The Government of India has implemented many schemes involving all stakeholders to increase energy efficiency from both the supply and demand side. The outcomes have been phenomenal - in 2021-22 alone, India saved over 44 million tonnes of oil equivalent of energy, resulting in a reduction in CO_2 emissions of around 280 million tonnes annually[20].

India has set a goal to attain energy independence by 2047, which marks its 100th year of independence. The country is powering ahead towards this end by becoming a major player in green energy generation and through energy efficiency measures, reducing the emissions intensity of its GDP. India's experience will be valuable to other developing nations as they can translate their climate pledges into actions and undertake energy transitions toward a more sustainable energy future.

3.1 CLEAN ENERGY

India's clean energy transition is happening rapidly and through revolutionary models that can be a paradigm for developing countries. Fossil fuels have been the foundation on which economies grew over the past 200 years, creating the problem as we see it now. India, on the other hand, has to look at low carbon alternatives in its pathway to net zero emissions by 2070.

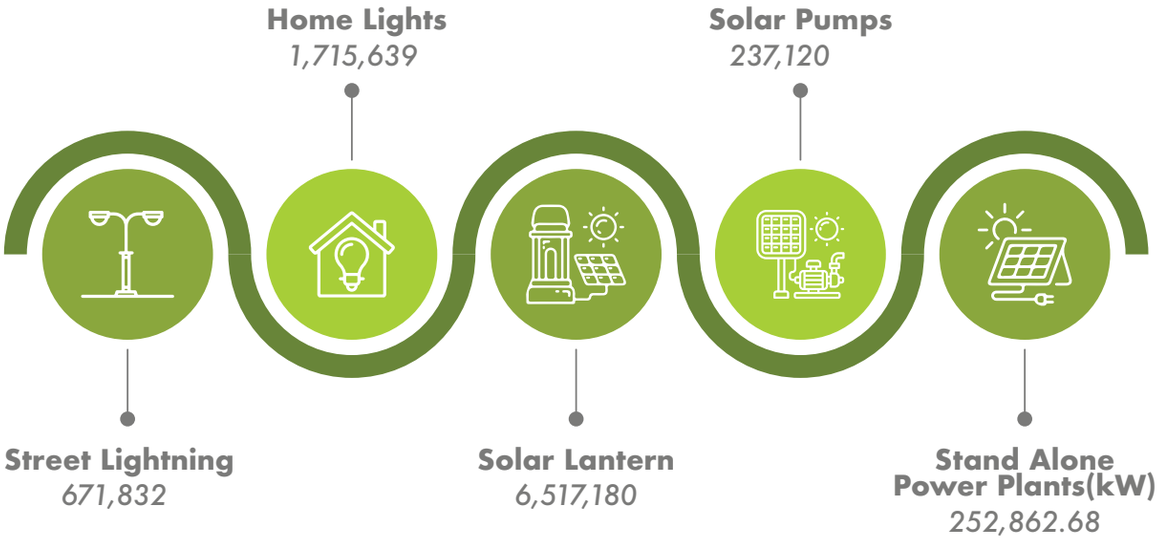
As part of its updated NDC, India has set formidable targets of installing 50% non-fossil fuel based electricity generation capacity by 2030 to meet its growing energy needs. The good news is that this shift to clean energy is well underway, and the share of solar and wind in India's energy mix has grown exponentially. India has over-achieved its commitment made at COP21 in Paris by meeting 40% of its power capacity from non-fossil-fuel sources almost nine years ahead of time. Renewable electricity is growing at a faster rate in India than any other major economy, with new capacity additions on track to double by 2026.

3.1.1 SOLAR ENERGY

As early as 2010, India started its push for solar energy through the National Solar Mission under the NAPCC. The initial target of the Mission was to install 20 GW of solar power by 2022 in 3 phases (2010-13, 2013-17, and 2017-22), which was upscaled in early 2015 to 100 GW. Numerous facilitative programmes and schemes under the Mission have driven grid-connected solar power installed capacity from 2.63GW in March 2014 to over 71 GW in August 2023. Electricity generation through solar power between April and August 2023 has been 48.5 TWh (48463 million units), a record 121% increase over the same period last year[21]. Subsidies and incentives provided under the various programmes have created economies of scale and reduced manufacturing costs, resulting in solar tariffs now being on par with grid power. Low-cost solar energy has also been made accessible to the most marginalized, including women, particularly in challenging demographic terrains and remote rural areas.

De-centralised/Off-Grid Renewable Energy Systems/Devices

(as on 30.09.2022)



Source: National Solar Energy Federation of India[22].

3.1.1.1 Solar Parks and Green Energy Corridors

The government has provided steady policy support to nurture technological development and private enterprise in the solar energy sector. Under its Solar Parks programme, it incentivises States and Union Territories to develop utility-scale solar power plants through a public-private partnership. Simultaneously, it is developing transmission infrastructure and sub-station capacity under the Green Energy Corridor scheme for evacuation of renewable power from such large scale renewable energy projects. It also provides fiscal instruments to facilitate the sale and purchase of renewable energy. India's solar parks are a global success story, and the country is home to the world's largest solar power plants.

Ultra-mega Solar Park

Bhadla Solar Park in Rajasthan is the world's largest solar park, with a total capacity of 2,245MW. Located in a desert area, large open tracts of non-agricultural land are being used to generate energy to power more than 1 million homes and provide jobs to thousands of people. Developed as a public-private partnership, the government has procured land and set up transmission infrastructure, and multiple private parties have invested in the park over phases. Due to low land cost and high capacity utilization factor, this park attracted multiple investors even at very low solar tariffs. The low solar tariffs are making renewable energy increasingly attractive to distribution companies, who can fulfil their renewable purchase obligations under the Electricity Act of 2003 at costs comparable with coal, providing a win-win situation for all stakeholders.

The Pavagada Solar Park in Karnataka, with an operational capacity of 2050MW, is built on 13000 acres of semi-arid drought-prone land where the government has declared drought 54 times in the past 60 years. Land acquisition being the most challenging component of setting up ultra-mega solar parks, this project has experimented an innovative model of leasing the land from the farmers and paying them a steady rental in the ballpark of what they would earn by farming. The farmers' income has been protected from the vagaries of climate change and some of them are being employed at the project site after requisite training, giving them an alternate livelihood. The land acquisition authority, Karnataka Solar Power Development Corporation (KSPDCL), conducted many project-awareness consultations with local residents and a key official from KSPDCL, who is empathetic to the local context, led most of these consultations. This has been a decisive factor in the speed at which this power project was set up[23].

3.1.1.2 Solar water pumps

There is a strong push towards de-dieselising the agriculture sector through solar pumps and decentralised solar power plants under the PM-KUSUM scheme (Pradhan Mantri Kisan Urja Suraksha evam Utthan Mahabhiyan). PM-KUSUM is a demand-driven scheme that has benefitted nearly 246 thousand farmers[24]. It mandates the using of only indigenously manufactured components, including solar modules, solar cells, motor-pump-set, controller, etc., which gives a fillip to the domestic manufacturing industry.

3.1.1.3 National Programme on High Efficiency Solar PV Modules : Production Linked Incentive Scheme

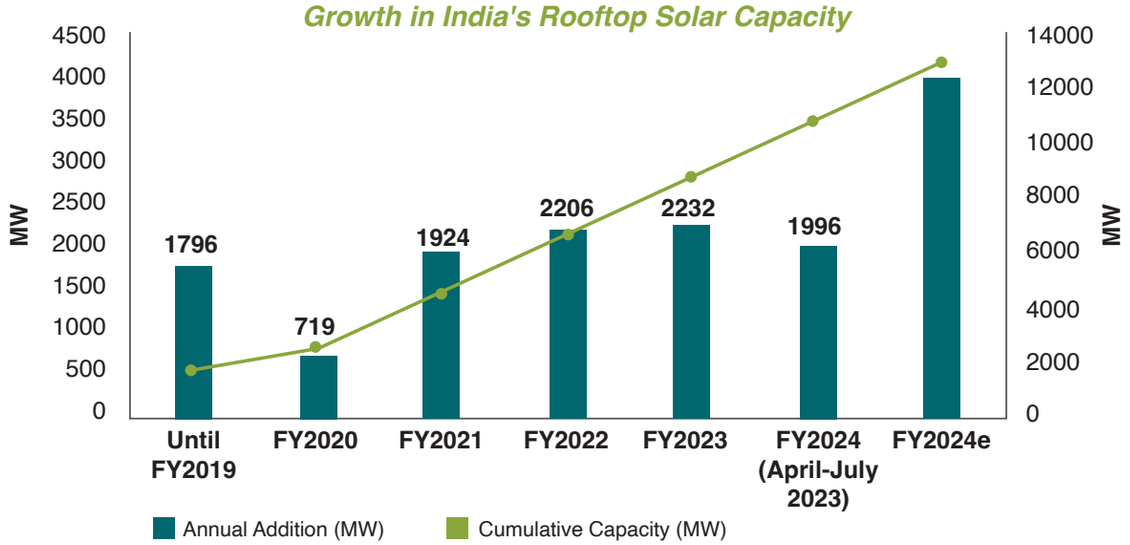
The Government of India is implementing the Production Linked Incentive (PLI) Scheme for the National Programme on High Efficiency Solar PV Modules, with an outlay of USD 2.89 billion (INR 240 billion). The scheme aims to build an ecosystem for manufacturing high efficiency solar PV modules of giga-watt (GW) scale in India and thus reduce import dependence in the area of Renewable Energy.

The objectives of this scheme include the following:

- To expand manufacturing capacity of high efficiency solar PV modules.
- To bring cutting-edge technology to India for manufacturing high efficiency modules. The scheme is technology agnostic in that it allows all technologies. However, technologies which yield better module performance will be incentivised.
- To promote setting up of integrated plants for better quality control and competitiveness.
- To develop an ecosystem for sourcing of local material in solar manufacturing.
- Employment generation and technological self-sufficiency.

3.1.1.4 Rooftop Solar and Solar Cities / Islands

There is a huge impetus to increase solar capacity in urban centres through the rooftop solar and solar city programmes. India's rooftop solar installations are on a healthy growth trajectory, and the falling cost of solar modules will sustain growth in the near-to-medium term. One city in every state is also being developed as a model solar city, with its power requirements met primarily by renewable energy sources. Diu has become India's first solar-powered island, with the sun powering all homes, air-conditioned resorts, hospitals, offices, ice factories, and fish warehouses. Work is in progress to achieve the same in the Andaman and Nicobar Islands and the Lakshadweep Islands.



Source: Institute for Energy Economics and Financial Analysis[25].

Sanchi: India's first solar city

Sanchi, a world heritage centre famous for its Buddhist monuments, has now earned fame as India's first solar city. The city meets its annual electricity requirements with a combination of grid-connected and off-grid solar power, as well as a hybrid solar-wind energy system.

The city's residents are essential stakeholders in this venture and have implemented energy efficiency measures in residential lighting and appliances and adopted solar products under the 'Har Ghar Solar' campaign. Domestic rooftops now feature solar panels with a combined capacity of 63kW. The municipal corporation has transitioned to solar street lights, solar water kiosks and pumps, and energy-efficient devices. E-mobility is being encouraged with solar powered e-charging stations. These efforts are expected to reduce annual GHG emissions to the tune of 14000 metric tonnes, which is equivalent to the emissions reduction brought about by 238000 trees[26].

Modhera – India's First 24×7 Solar-powered Village

Modhera, a village in the state of Gujarat and home to a famous Sun Temple, is India's first solar-powered village. The solarization project includes a ground-mounted 6 MW solar power plant and over 1300 rooftop solar PV systems on government and residential buildings. These are integrated with the country's first ever grid-connected megawatt-hour scale Battery Energy Storage System (BESS), which provides round-the-clock electricity to the residents of the village. The project, completed at a cost of 7.8 million USD (INR 650 million) with 50% funding each by the Union Government and State Government, has provided the villagers with a surplus of renewable energy, which is sold back to the electric grid and is therefore becoming a source of additional income to them[27].

3.1.2 WIND ENERGY

India ranks fourth in the world in wind energy generation capacity, which stood at 44.08 GW in August 2023. From March 2014 to August 2023, the installed capacity of wind power has increased by 109%. Government policies such as the implementation of The Renewable Purchase Obligation (RPO) trajectory until 2029-30 have spurred wind energy projects, and the sector has seen a capacity addition of over 1.1 GW in just the second quarter of 2023, representing a 165% year on year increase[28].

3.1.3 GREEN HYDROGEN

India aims to become a global hub for green hydrogen production and exports. Towards this, the National Green Hydrogen Mission, approved by the Union Cabinet in January 2022, aims to develop a green hydrogen production capacity of at least 5 million metric tonnes (MMT) per annum, with an associated renewable energy capacity addition of about 125 GW by 2030.

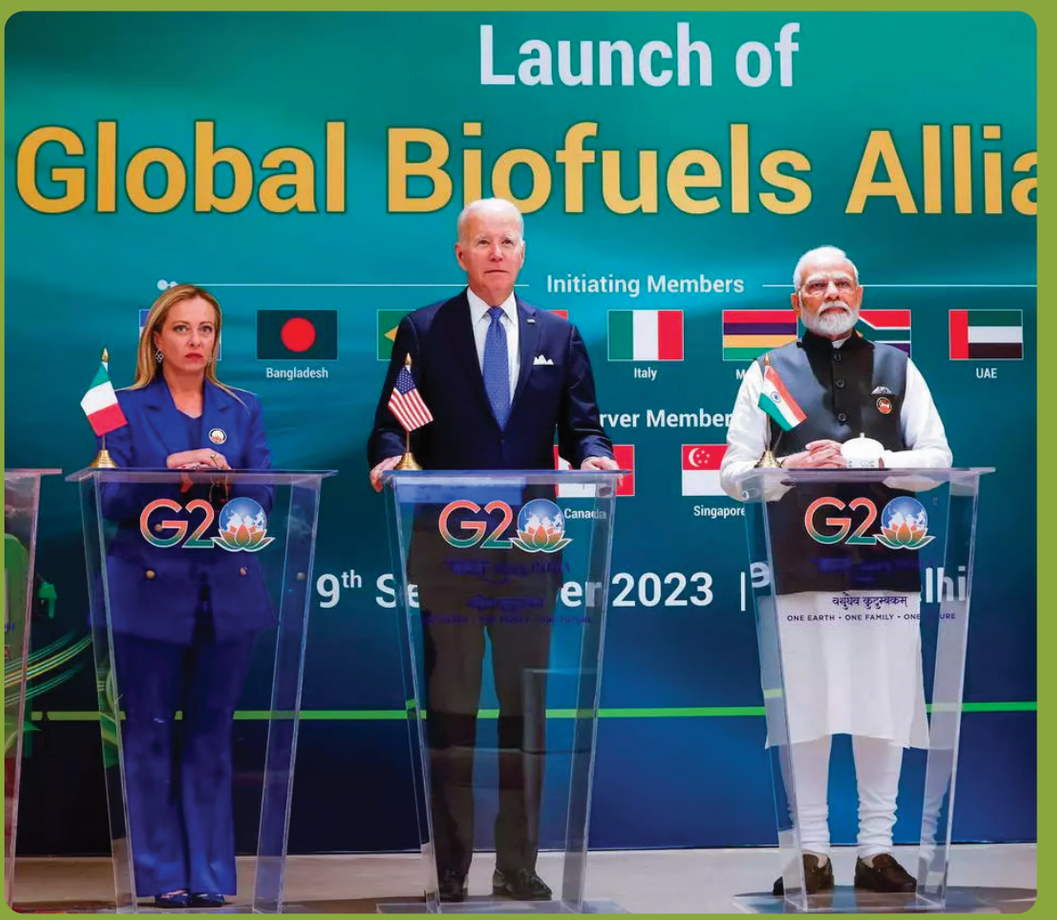
3.1.4 CLEAN COOKING FUEL

The 'Pradhan Mantri Ujjwala Yojana' (PMUY) was launched in May 2016 with the objective of making clean cooking fuel such as Liquefied Petroleum Gas (LPG) available to the rural and deprived households that were otherwise using cooking fuels such as firewood, coal, cow-dung cakes, etc. Under this scheme, women from eligible households were given deposit-free LPG connections along with a free gas stove and first free refill cylinder. By 2022, 90 million households have benefitted from this scheme[29]. The use of improved cooking fuels improves women's health and reduces their drudgery.

3.1.5 BIOFUELS

The government's clean fuel roadmap envisages a strategic role for biofuels, including compressed biogas (CBG), biodiesel, and ethanol, among others. India's biofuel policy is unique in that it focuses on second-generation (2G) feedstock, including cane molasses, cane trash, rice and wheat straw, cotton stalk, empty fruit bunches, cattle dung, municipal solid waste (MSW), etc.

Sustainable Alternative Towards Affordable Transportation (SATAT), launched in October 2018, is a government initiative for boosting CBG as a clean fuel for the transportation sector. Forty-eight plants have been commissioned so far and over 2800 tonnes of CBG have been sold in FY 2023-24. The scheme targets 15 MMT (million metric tonnes) of CBG from 5000 plants[30]. By producing gas from wastes, SATAT offers an efficient solution for the disposal of agricultural wastes and MSW, which otherwise are burnt, causing air pollution. Production of CBG also provides farmers with an additional revenue stream. Organic manure, a by-product of CBG generation, can rejuvenate soil. Additionally, a significant reduction in GHG emissions is achieved by reduced stubble burning.

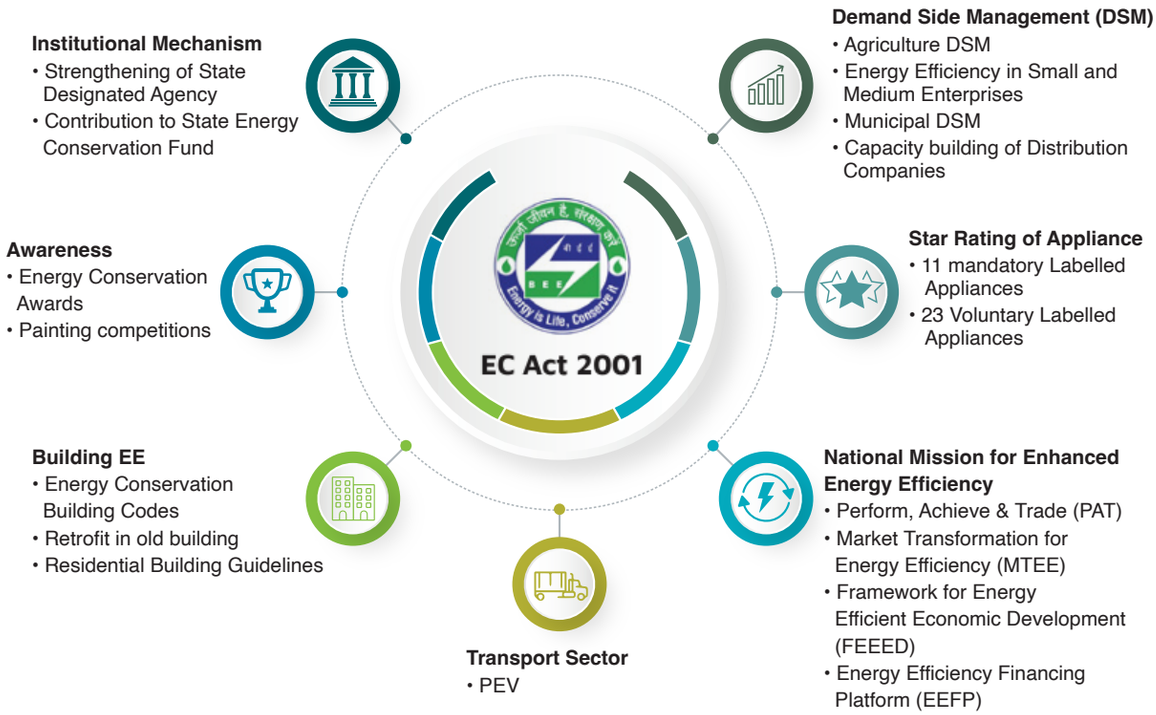


Global Biofuel Alliance

India, Singapore, Bangladesh, Italy, USA, Brazil, Argentina, Mauritius, and UAE launched the Global Biofuel Alliance (GBA) in September 2023 on the sidelines of the G20 Summit in New Delhi. The GBA, an initiative by India as the G20 Chair, intends to expedite the global uptake of biofuels by facilitating technology advancements, intensifying the utilization of sustainable biofuels, and shaping robust standard setting and certification through the participation of a broad spectrum of stakeholders. The alliance will also act as a central repository of knowledge and an expert hub. GBA aims to serve as a catalytic platform, fostering global collaboration for the advancement and widespread adoption of biofuels.

3.2 ENERGY EFFICIENCY

Features of the Energy Conservation Act (2001)



Through the Energy Conservation (EC) Act of 2001 and the establishment of the National Mission for Enhanced Energy Efficiency (NMEEE) of 2010, the Indian government has provided a robust regulatory and policy framework to promote energy efficiency during the last two decades. The Bureau of Energy Efficiency (BEE), a nodal statutory body, and Energy Efficiency Services Limited (EESL), an energy service company (ESCO) set up as a joint venture of 4 public sector undertakings, have been leading the transformation of the energy efficiency market.

In 2021-22 alone, India saved over **44 million tonnes** of oil equivalent of energy, valued at over **USD 19 billion,** and resulting in a reduction in CO_2 emissions of around **280 million tonnes** annually[31]. EESL's deployment of over **368 million LED bulbs** alone has helped India save over **47 billion units** of energy and reduced CO_2 emissions by over **38 million tonnes per year.** It has also reduced peak demand, which has avoided building over **9.5 gigawatts** of new generation capacity[32].

3.2.1 ENERGY EFFICIENCY IN HOMES AND URBAN SPACES

Unnat Jyoti by Affordable LEDs for All (UJALA) was launched in January 2015 to promote energy efficiency at the household level by the use of LED (light emitting diode) lights and energy-efficient fans. The high initial cost of LEDs compared to incandescent lamps (ICLs) or compact fluorescent lamps (CFLs) and lack of awareness about energy savings by using energy-efficient bulbs and fans were a barriers to their adoption. Through the UJALA programme, LED bulbs are provided to households at a very nominal cost, and the balance amount included in electricity bills over a 5-10 year period. This has created economies of scale, bringing down the production cost significantly. Concerted awareness programmes are also conducted across the country. The consequent increased lighting in households and community spaces also contributes to the sense of safety for women and children and may be instrumental in mitigating the threat of gender-based violence.

As of 23 October 2023, 368.6 million LED bulbs have been distributed nationwide under the UJALA program.

Achievements of the UJALA Programme

	Distribution in FY 2021- 22	Cumulative distribution until March 2022 (million)	Annual Energy Saving (million kWh)	Peak Demand Avoided (MW)	Annual GHG emission reduction (kt CO_2)
LED Bulbs	1.05 million	367.9	47780	9567	38700
LED Tubelights	52541	7.2	316	144	259
Energy Efficient Fans	56574	2.3	219	59	180

Source:UJALA dashboard. Endnote 33

The **Street Lighting National Programme (SLNP)** was launched in January 2015 to replace conventional street lights with energy efficient LED bulbs. 13.2 million street lights have been changed so far, resulting in an energy saving of almost 9 billion kWh and avoiding a peak demand of 1.5 gigawatts. GHG emissions reduction from this project is 6.15 million tonnes CO_2[34].

13.2 million streetlights replaced by LED lights across India

Avoided peak demand of **1.5 gigawatt (GW)**

Total energy saving pan-India - almost **9 billion kWh**

Reduction in CO_2 emissions per year **6.15 million tonnes**

India has a robust **standards and labelling programme** that allows consumers to make informed choices on the energy-saving potential, and hence, the cost-saving potential of electrical equipment they purchase. This programme currently covers 34 appliances. The energy saving in FY 2021-22 is a massive 70 billion kWh, resulting in a reduction of 57 million tonnes of CO_2 emissions due to appliances manufactured and interventions carried out between 2018-22[35].

Energy saving in FY 2021-22 is about **70 billion kWh** resulting in a reduction of around **57 million tonnes** of CO_2 emissions

the **Municipality Energy Efficiency Programme (MEEP)** is being implemented in conjunction with Atal Mission for Rejuvenation and Urban Transformation (AMRUT) in 500 cities and towns across the country, to facilitate energy efficiency measures in municipalities on a large scale by deploying more efficient pumps in public waterworks and sewerage systems.

3.2.2 ENERGY EFFICIENCY IN INDUSTRY

Large Industries

Though the industrial sector is the largest energy consumer segment, it didn't have access to capital to fund energy efficiency investments. The Perform, Achieve and Trade (PAT) framework is a market-based mechanism to introduce energy efficiency in energy-intensive industries in a cost effective manner, while meeting set targets of energy consumption reduction.

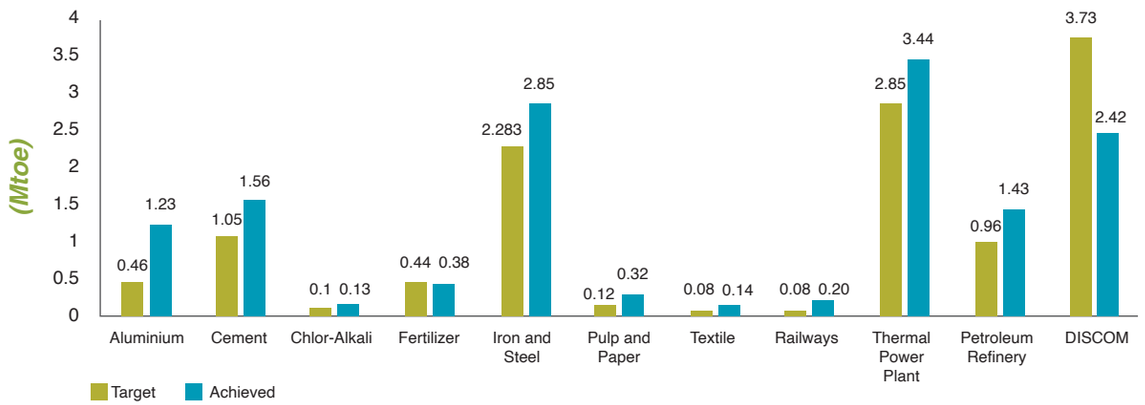
In this mechanism, the government sets targets for each type of industry to reduce their Specific Energy Consumption (SEC), i.e., the energy used per unit of production. Industries can achieve these targets over three years by implementing best practices, changing old technology to new, developing efficient processes, or by any other suitable innovative method. Energy Saving Certificates (ESCerts) are issued to industries that achieve and exceed the target, and those unable to do so have to either pay penalties or buy the ESCerts from industries that have secured them.

PAT cycle – I comprised of 478 industrial units from 8 sectors viz. Aluminium, Cement, Chlor- Alkali, Fertilizer, Iron & Steel, Paper & Pulp, Thermal Power Plant and Textile. Completed in March 2015, the energy savings achieved was 8.67 Mtoe (million tonnes oil equivalent), which was 30% higher than the target of 6.686 Mtoe. This translated into avoiding CO_2 emissions by about 31 million tonnes.

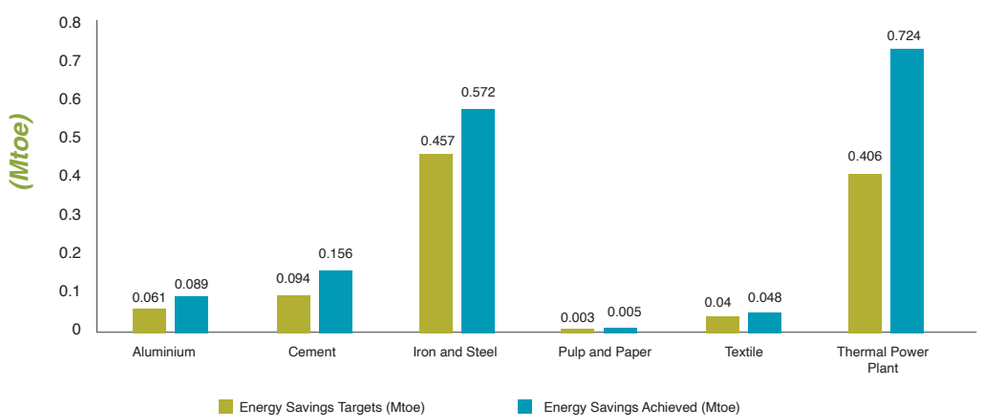
Given the success of PAT Cycle I, fresh PAT cycles are notified every year and we are currently on PAT Cycle VII. Each year, a few more industry segments and designated consumers are added and we now have 13 industrial sectors with 1104 designated consumers.

PAT Cycles II and III have brought forth an energy saving of 15.674 Mtoe and avoided CO_2 emissions of 74 million tonnes. The monitoring and validation of successive PAT cycles is still underway[36].

PAT Cycle II- Energy Savings Target vs Achieved (Mtoe)



PAT Cycle III- Energy Savings Target vs Achieved (Mtoe)



Source: Bureau of Energy Efficiency[37].

Micro, Small and Medium Enterprises (MSME) Sector

Under the National Clean Air Programme, industries are also incentivised to shift to cleaner fuels, which are more energy-efficient and less polluting, on a time-bound basis. Emissions from identified industry sectors are closely monitored, with stringent enforcement of standards.

Micro, Small, and Medium Enterprises form the backbone of the Indian economy, and there are over 63 million MSME units in the country employing more than 100 million people. MSMEs contribute around 8% of India's GDP, and play an important role in strengthening the country's economy. There are many energy intensive industries including forging, foundry, ceramic, refractory, glass, etc. Typically, these industries are located in specific geographical clusters but vary considerably in their production processes and the use of technology. There is, hence, a wide variation in energy performance and GHG emissions. The Bureau of Energy Efficiency has undertaken many programmatic interventions in collaboration with international organizations to improve energy efficiency in different MSME industry clusters. These have brought about an energy saving of 16800 toe (tonnes oil equivalent) and a GHG emissions reduction of 70000 tonnes in 2021-22[38].

3.3 INDIA COOLING ACTION PLAN - A WAY TO SUSTAINABILITY

To have an integrated long-term vision towards cooling encompassing, inter alia, reducing cooling demand, refrigerant transition, enhancing energy efficiency, and advancing technology options, India has developed and launched the India Cooling Action Plan (ICAP) in 2019. The first of its kind in the world, ICAP looks to synergize actions having the potential to provide socio-economic and environmental benefits related to reduced refrigerant use, climate change mitigation, and Sustainable Development Goals with a 20-year time horizon.

Cooling is also linked to human health and productivity. Linkages of cooling with Sustainable Development Goals (SDGs) are well acknowledged. The ICAP has been appreciated internationally as an important policy initiative which has the potential to provide socio-economic and environmental benefits related to reduced refrigerant use, climate change mitigation, and Sustainable Development Goals. The cross-sectoral nature of cooling and its use in development of the economy makes provision for cooling a vital developmental necessity.

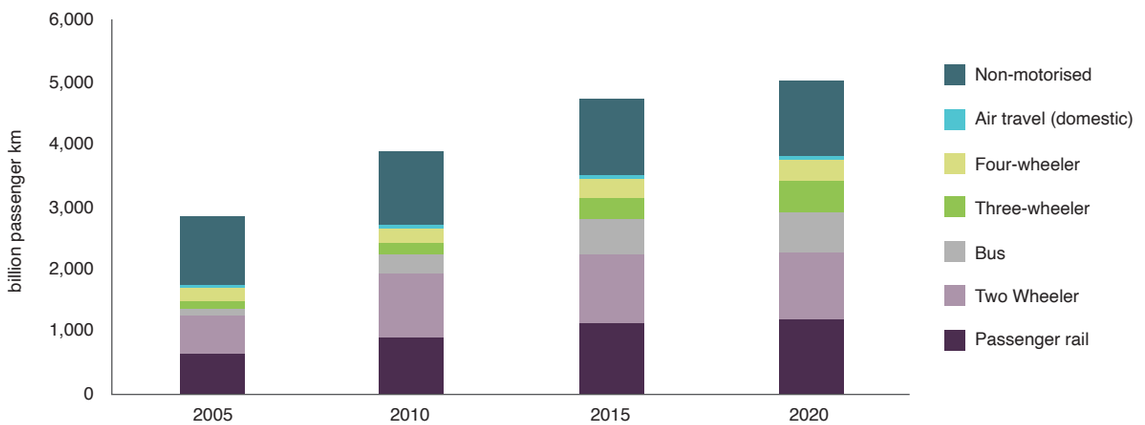
04

INDIA'S CLIMATE ACTIONS – TRANSPORT

04

INDIA'S CLIMATE ACTIONS - TRANSPORT

Modal Mix of Passenger Mobility in India (2005 - 2020)



Source: Council on Energy, Environment and Water[39]

A significant portion of passenger mobility needs in India is met by non-motorised and public modes of transport, as seen in the figure above…, but with a burgeoning middle class, this mobility mix will likely change. In anticipation of this, while staying on course with its net zero commitments by 2070, India is taking dedicated action towards decarbonizing its transport sector and nudging people towards low-carbon mobility choices. It has put in place a range of measures at national, state, and municipal levels to support public transport and shift passenger movement from road and air to rail.

INDIA'S COMMITMENT TO CLEAN MOBILITY

Metros have come up in the big cities, and their reach is being expanded. Low-cost metros are being developed for smaller cities.

Urban renewal plans emphasize green mobility and improved transport efficiency.

India is working towards **100% two-wheeler sales and 30% light-duty vehicle sales to be electric by 2026** and 2030 respectively, and all new car and van sales to be **zero-emission by 2040.**

Work is progressing well on energy storage technologies and networks to allow for greater use of **renewable energy for transport systems.**

The government has initiated a drive for green hydrogen and has brought forward its target of blending **20% ethanol with petrol from 2030 to 2025.**

Stringent emission norms are in place for private vehicles, with a **leapfrogging from BS-IV (Euro IV equivalent) to BS-VI (Euro VI equivalent)** standards in just three years, without an intermediate BS-V.

Fuel efficiency standards are enforced even before vehicles leave the manufacturers' premises. **Fuel efficiency norms for vehicles with less than 9 seats (including driver) and Gross Vehicles Weight (GVW) less than 3.5 tonnes were enforced in two phases – Phase I (1st April 2017) and Phase II (1st April 2022).** For vehicles with GVW greater than 3.5 tonnes, the fuel efficiency standards have been made effective from 1st November 2022.

Through public-private partnerships, **India is setting up an ecosystem for fleet modernization** and a circular economy infrastructure for end-of-life vehicles.

The Indian Railways is well on its way to becoming a **net zero carbon emitter by 2030.**

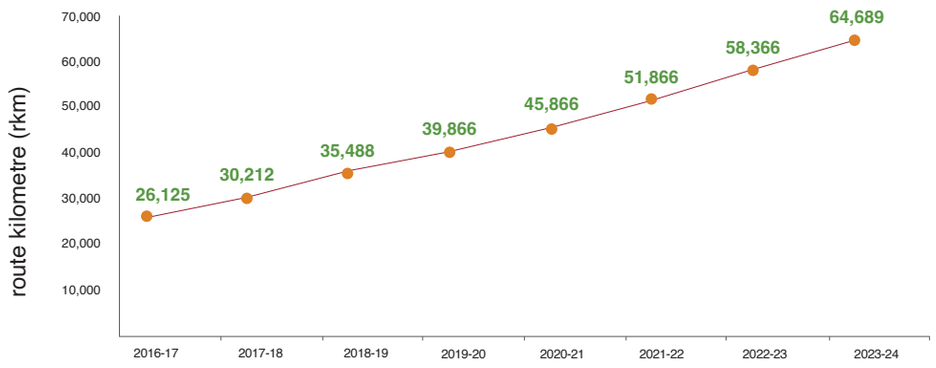
Dedicated rail-freight corridors, multi-modal logistics hubs, and the promotion of **coastal and inland waterway shipping are steps towards low-carbon freight movement.**

4.1 RAILWAYS

Serving over 8 billion passengers and moving over 1.2 billion tonnes of freight annually, the Indian Railways is the fourth largest railway network in the world. In July 2020, the Indian Railways set an ambitious target of becoming a net zero carbon emitter by 2030, which will make it the largest green railway system globally. This amounts to reducing 7.5 million tonnes of CO_2 equivalent each year, approximately the same as two coal power plants[40].

The national transporter is well on its way to 100% electrification of its entire broad gauge network by December 2023, with 90.43% of total broad gauge routes electrified by June 2023[41]. It has already achieved 100% electrification in 14 States / Union Territories, and work is progressing as planned in all other States and Union Territories. The pace of electrification has increased substantially since the 2015 – 3874 route kilometres (rkm) were electrified between 2007 and 2014, and since 2015 over 37200 rkm have been electrified, with over 50% of the broad gauge network being electrified only during the last five years[42].

Pace of Railway electrification



Source: Invest India[43]

The Indian Railways have implemented several energy efficiency measures, including regular energy audits and smart metering across locomotives, coaches, rakes, stations, and administrative buildings. They have entirely switched over to the production of energy-efficient 3-phase electric locomotives with regenerative braking features, which help in saving energy. Their efforts bagged them 14 National Energy Conservation Awards in 2020.

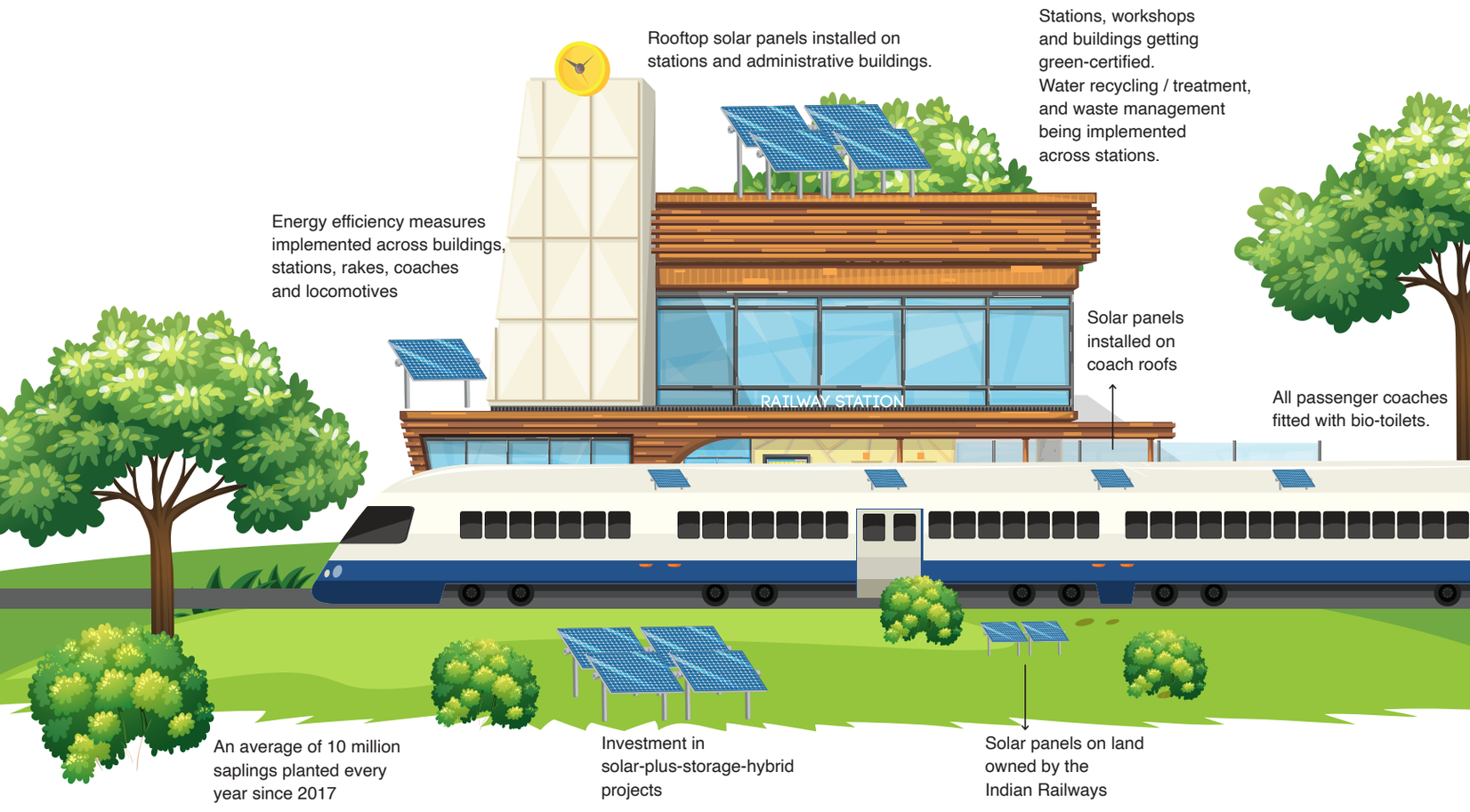
By August 2022, the Indian Railways had 245 megawatt (MW) capacity of renewable energy power, with nearly 3,450 MW capacity in the pipeline[44]. More than 1000 stations have rooftop solar panels.

700 stations are ISO14001 compliant, and 32 stations, 31 railway buildings, and 55 workshops are green-certified. The Railways have installed over 100 water treatment and recycling plants, and more than 250 stations have waste-to-energy/compost/biogas plants/material recovery facilities.

All passenger coaches have been fitted with bio-toilets, in which bacteria digest the waste, and innocuous gases and wastewater are released as by-products. The wastewater is treated before discharge. Along with reducing effluents, a study found that these bio-toilets may prevent emissions of up to 155 tonnes of CO_2 equivalent annually[45].

To offset carbon emissions from its operations, the Indian Railways has been planting an average of 10 million saplings annually since 2017 on vacant railway land.

Towards a Net Zero Indian Railways



The Railways are expanding new rail infrastructure dedicated solely to freight transport through Dedicated Freight Corridors (DFC). By August 2023, 100% of the Eastern DFC and 69.45% of the Western DFC were commissioned. The Western DFC is scheduled to be completed by March 2024[46].

To transition passenger traffic from high-carbon air and road to low-carbon rail, India is investing heavily in expanding its high-speed rail network. It envisages a high-speed rail network expansion of 7,987 km through 2051[47].

Traffic on three indigenously designed and developed semi-high-speed trains - Vande Bharat Express, Tejas Express, and Gatimaan Express – is increasing nationwide. Vande Bharat trains are powered by self-propelled electric multiple units system, making them more energy-efficient than traditional locomotives.

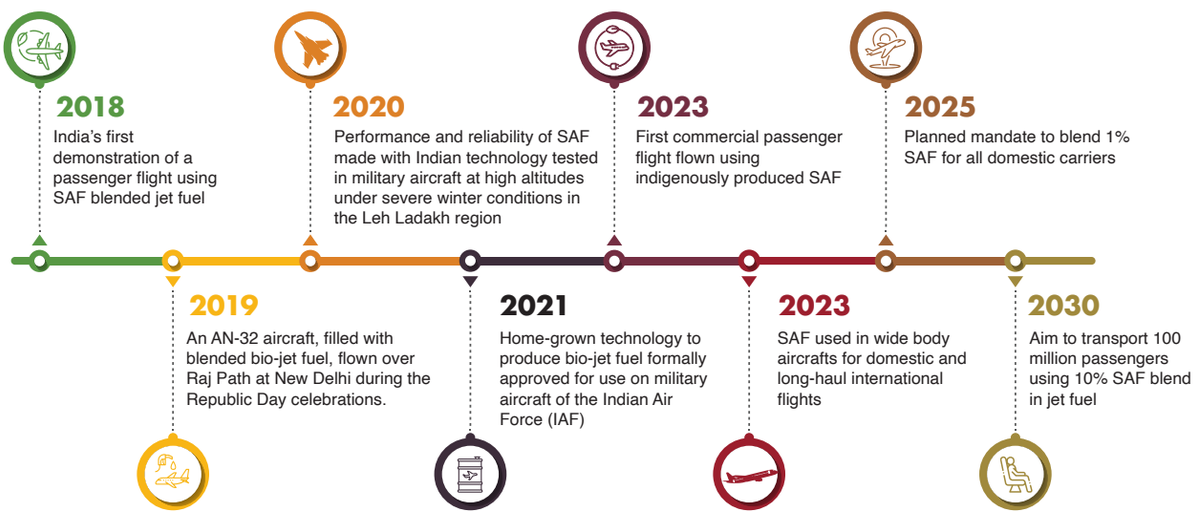
4.2 AVIATION

In a significant development towards decarbonizing the aviation sector, India's first commercial passenger flight using a blend of indigenously produced Sustainable Aviation Fuel (SAF) with conventional jet fuel was successfully flown in May 2023. SAF blended fuel has been used in special demonstration flights since 2018. In 2023, a leading airline of the country operated a domestic and a long-haul international flight using a wide-body aircraft with 17 – 30% SAF blended fuel. Not just commercial aircraft, India's Centre for Military Airworthiness and Certification (CEMILAC) has formally approved the use of SAF across the Indian Air Force's AN-32 transport aircraft fleet as well.

India is championing the use of SAF, and the government plans to mandate the blending of 1% SAF with jet fuel for domestic carriers by 2025. It is working with several stakeholders for the production and deployment of SAFs at scale. The India community of the World Economic Forum's Clean Skies for Tomorrow initiative aims to achieve an ambitious target of 100 million passengers flown on SAF at a 10% blend by 2030[48].

SAF is produced from renewable sources such as agricultural waste, municipal solid waste, hydrogenated vegetable oils, and ethanol, and can potentially reduce greenhouse gas emissions by up to 80% compared to conventional jet fuel. In recent years, SAF production technology has progressed significantly, and India is currently producing SAF using indigenous sugarcane molasses as feedstock.

SAF is currently 200–500% more expensive than fossil jet fuel in India, depending on the pathway and feedstock, but the country has a proven track record in promoting the development of nascent industries such as solar energy and scaling them through innovative measures. It is leveraging this experience in the SAF arena. India has been one of the strongest voices in the world for energy transition and alternative energy sources, such as biofuels. It brought out a National Policy on Biofuels in 2018.

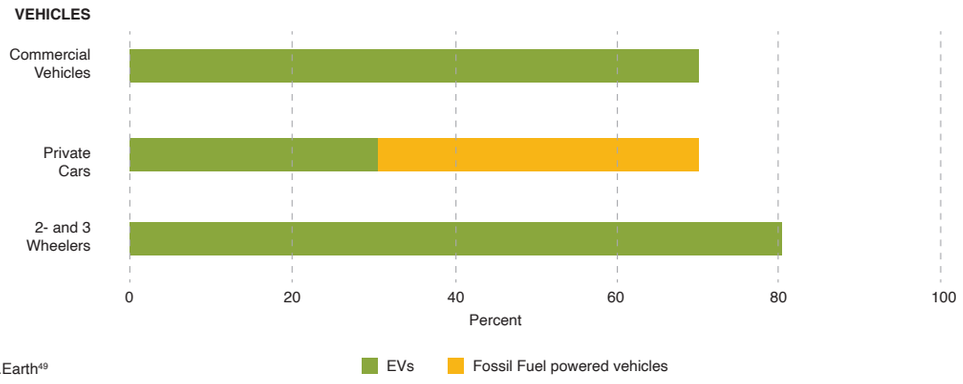


4.3 ROAD TRANSPORT

4.3.1 ELECTRIC VEHICLES (EVs)

The Indian Government has set ambitious targets for achieving the following EV mix in the country's road transport vehicles by 2030. It has also signed up to the global EV30@30 campaign, which calls for electric vehicles to make up at least 30% of new vehicle sales by 2030.

EV to Fossil Fuel Vehicles Mix in India - Target 2030



Source: Bolt.Earth[49]

To achieve this, the government has introduced several policies and incentives to support the growth of the industry. National, state and city-specific e-mobility action plans have been formulated, with an integral component for management of battery scrap. Subsidies for petrol and diesel were removed in the early 2010s, and subsidies were introduced for electric vehicles shortly after that. The Faster Adoption and Manufacturing of Hybrid and EV (FAME) scheme is in its second phase and aims to create battery and EV manufacturing capacity at a global scale. In its first phase between 2015 and 2019, the government allocated USD 63 million (INR 5.3 billion) to incentivize EV / hybrid vehicle manufacturers and buyers. The second phase between 2019 and 2024 has seen substantial increase in funding to USD 1.2 billion (INR 100 billion), with 10% of the funds set aside for improving charging infrastructure, including expansion of renewable energy powered charging infrastructure. Public charging infrastructure has jumped up in the last year from 900 publicly accessible chargers in 2021 to nearly 11000 in 2022[50].

Tourist vehicles that are battery operated or run on ethanol blended fuels are issued an All India Tourist Permit at zero cost. EVs do not require a passenger transport permit and are exempt from registration fees during certificate issuance and renewal. Some states have exempted EVs from road tax. The government is facilitating the conversion of motor vehicles to hybrid EVs, and standards related to safety, range, power, etc., have been defined.

Many states are also coming up with policies that support EV uptake. Delhi, for example, has imposed restrictions on polluting vehicles and exempts EVs from registration fees and road taxes, with an aim of achieving a quarter of new vehicle sales to be EVs by 2024. In December 2022, EVs accounted for 16.8 % of all vehicle sales in Delhi, marking a year-on-year growth of 86%[51].

0.28 million hybrid and electric vehicles were supported under FAME phase 1, which resulted in saving 97 million litres of fuel and an emissions reduction of 242 million kg CO_2[51]. The government's push for increasing electrification of vehicles and using clean energy to power them has significant positive impacts on air quality, reduction in oil imports and carbon emissions, and increase in green jobs. This is a blueprint that many developing economies can emulate.

Electric Vehicle Sales (April 2017 - September 2023)

Category	FY 17-18	FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Grand Total		Jul'23	Aug'23	Sep'23
E-2 Wheelers	2004	28006	26829	44798	252550	727370	354000	1435557		54521	62504	18570
E-3 Wheelers	91970	116031	143051	90898	172543	401882	256401	1272776		53728	56746	15215
E-4 Wheelers	2242	2407	2404	5201	19782	48105	39097	119238		7931	7084	1623
E-Buses	149	745	928	373	1611	1917	1076	6799		136	271	87
Grand Total	96365	147189	173212	141270	446486	1179274	650574	2834370		116316	126605	35495

As per VAHAN Portal on 11th September 2023. Data excludes low speed sales and sales in Telangana and Lakshadweep.

Source: Society of Manufacturers of Electric Vehicles[53]

4.3.2 CLEAN FUELS

The government has notified the use of Hydrogen and Hydrogen - CNG (H-CNG), a blend of Hydrogen and CNG, as automotive fuels. They have established safety requirements and procedures and mass emission standards. Retrofitment of BS-IV vehicles to Hydrogen Internal Combustion Engine (ICE) vehicles has also been notified.

Ethanol blending is also being promoted by notifying safety standards and exempting vehicles using ethanol blended fuels from the requirement of a permit for carrying passengers or goods.

The government is supporting research and pilot implementation in a range of alternate fuel technologies.

4.3.3 GREEN HIGHWAYS

Good road infrastructure has a positive impact on fuel efficiency and reduces carbon emissions. A total of 77,265 km of national highway has been constructed since 2014 and this has the potential to avoid over 32 million tonnes of CO_2 emissions annually according to a study by the Central Road Research Institute and The Energy and Resources Institute[54]. Idling at toll plazas has reduced significantly by the introduction of electronic toll collection.

The Green Highways Policy launched in 2015 allocates 1% of all highway project costs towards highway plantation and maintenance. Indian Space Research Organization's satellites help with stringent monitoring. 35 million saplings have been planted over the past seven years. More than 100 Wildlife Crossings were created in three years across twenty States as a measure for wildlife protection and conservation and to reduce man-animal conflict.

National Highways Authority of India has been institutionalizing eco-friendly construction practices, such as using recycled materials and inert waste from landfills. Direct emissions were almost halved (18.44% to 9.49%) in three years between 2019-20 and 2021-22, due to reduced fuel consumption and energy intensity reduction (in GJ/km) of 37% and 27% were recorded in FY 2020-21 and 2021-22 respectively[55].

4.3.4 VEHICLE EMISSION NORMS

The first stage of vehicular emission norms (Bharat Stage or BS norms) came into force in 1991 and 1992. In the past nine years, India has made rapid strides in tightening emission norms, with Bharat Stage IV norms being mandated in 15 cities in 2010, 33 cities in 2014, and across the country in 2017. In 2020, Bharat Stage VI norms, in line with Euro 6 norms, were mandated across the country after introducing it in Delhi and the National Capital Region in 2018-19. Simultaneously, Corporate Average Fuel Efficiency / Economy (CAFE norms) are applied to auto manufacturers, which require them to meet specified fuel efficiency standards or face penalties. Implementation of the CAFE norms has resulted in the country saving 482 million litres of petrol in 2021-22 only in the M1 segment of vehicles (passenger vehicles comprising not more than eight seats in all) and a CO_2 emissions reduction of 4.41 million tonnes between 2018-22[56].

4.3.5 VOLUNTARY VEHICLE FLEET MODERNIZATION PROGRAMME

Together with stringent vehicular emission norms, India has implemented a blend of incentives and disincentives to introduce a regime of fitter automobiles on Indian roads. The Fleet Modernization Programme creates an ecosystem for phasing out unfit and polluting vehicles, which will result in a reduction of emissions to the tune of 15 – 20%[57]. End-of-life vehicles will be scrapped scientifically with enhanced material recovery, feeding into a circular economy.

The government is setting an example by replacing its older fleet with EVs and introducing EV and clean-fuel public transport buses.

4.3.6 PUBLIC TRANSPORT

India is also witnessing significant progress in efficient and intelligent inter-connected mass transport systems, be it metros, suburban rail, or buses, all of which are tied into the electrification transition process.

Under the National Clean Air Programme, cities aim to achieve set service level benchmarks by augmenting bus services, providing last-mile connectivity to the metro network, formulating a robust-parking policy, and creating adequate parking infrastructure. City mobility plans identify traffic hotspots and provide solutions to address them.

4.3.7 NON-MOTORIZED TRANSPORT

Under the National Clean Air Programme, cities are developing infrastructure for and incentivising the use of non-motorized transport. In keeping with the principles of Mission LiFE, municipal corporations are working with civil society organizations and the public, to facilitate greater use of non-motorized transport for urban mobility. Policies such as the National Urban Transport Policy, Jawaharlal Nehru National Urban Renewal Mission, and the Atal Mission for Rejuvenation and Urban Transformation emphasize the implementation of non-motorized transport infrastructure. Public bike sharing, especially, is becoming increasingly common in many cities.

4.4 COASTAL SHIPPING AND INLAND WATERWAYS

Rail and waterborne transport have the lowest emissions per kilometre and unit transported[58]. India has a long and contiguous coastline spanning 7,517 km, served by 12 major ports and 212 notified minor/ intermediates ports, and extensive navigable inland waterways. Currently, coastal and inland waterways contribute approximately 6% of the country's freight modal mix. There is an excellent opportunity to tap an environmentally friendly water-based modal transport, which can increase local trade and reduce freight transport carbon emissions and highway congestion.

To realize this potential, the Ministry of Shipping has undertaken various initiatives, including the relaxation of licensing requirements, priority berthing policies, and fiscal incentives. As a result, India has witnessed a steady growth of 11.3% in cargo movement on coastal routes from 2015-16 to 2018-19. In 2018-19, it handled 120 Million tonnes per annum (MTPA) of coastal cargo, which is expected to reach 250 MTPA by 2025[59].

Container Corporation of India (CONCOR) has started moving the consignments of Food Corporation of India (FCI) through coastal routes and will be assisting with logistical support for transporting cargo through inland waterways in the northeastern parts of India, with last mile connectivity through road and rail, which makes for consolidated cargo movement.

Despite shipping contributing a negligible share in emissions, in January 2022, the Ministry of Ports, Shipping and Waterways announced an initiative for green ports and green shipping under the Maritime India Vision 2030 to reduce the maritime industry's CO_2 emissions. The project aims to promote a green ecosystem, such as the use of renewable energy for port activities. The Ministry is also exploring possibilities for deploying fully electric and hydrogen-fuelled ferries on inland waterways for river cruise tourism.

05

INDIA'S CLIMATE ACTIONS – SUSTAINABLE HABITATS

05

INDIA'S CLIMATE ACTION – SUSTAINABLE HABITATS

The National Mission on Sustainable Habitats has identified five thematic areas, namely

Energy and Green Buildings - focuses on reducing energy consumption in India's real estate sector and the adoption of green building technologies.

Mobility and Air Quality - highlights strategies for developing comprehensive, energy-efficient, and cost-effective urban mobility plans.

Urban Planning, Green Cover, and Biodiversity - emphasises on integrated urban and regional planning approaches to climate-sensitive development. Preservation and rejuvenation of water bodies, green spaces, and eco-sensitive areas are central aspects under this theme.

Water Management - Emphasises on augmenting existing water resources by adopting rain-water harvesting (RWH), rejuvenation of water bodies, recycling / reuse of treated sewage, water conservation, and promoting the circular economy of water through development of City Water Balance Plans (CWBP).

Waste Management - focuses on the need for cities to prioritise actions for waste reduction and waste management and promote material recovery, waste-to-energy, and waste-to-compost plants.

5.1 GREEN BUILDINGS

The Indian government provides several incentives to encourage green buildings in India. It has also implemented a policy that requires all government buildings to be certified green. Central and state governments provide subsidies, tax exemptions, low-interest loans, and fast-track inspections and approvals for green-certified projects. Additionally, there are several incentives for renewable energy projects on buildings, which can reduce net carbon consumption. The government has also tightened regulatory compliances with respect to ESG reporting. These, and the benefits that investors see in sustainable initiatives, are driving a significant increase in green-certified buildings.

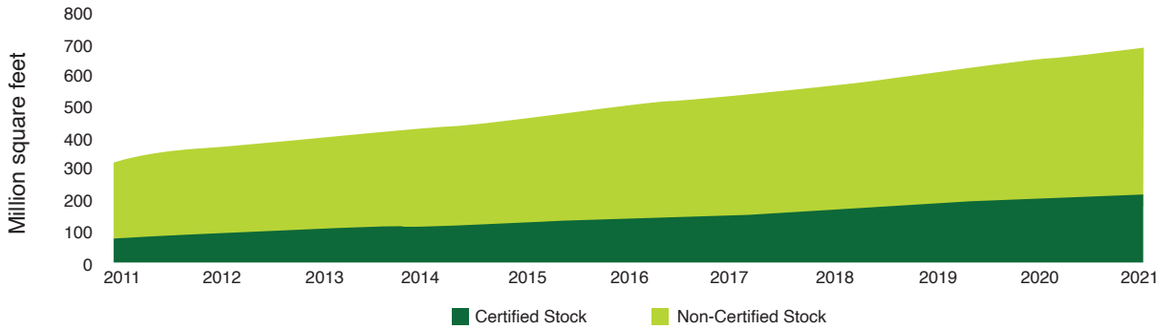
The Bureau of Energy Efficiency (BEE) launched the Energy Conservation Building Code (ECBC) in 2007 to establish minimum energy performance standards for commercial and large-scale residential buildings in India (connected load of over 100 kW or a contract demand of over 120 kVA). The implementation of the code lies with the State / Union Territory governments and has been made mandatory by some. The ECBC addresses energy conservation in the envelope of the construction (walls, roofs, windows) as well as operating energy requirements (heating, ventilation, air-conditioning, lighting, electric motors, etc.). The ECBC is updated regularly and keeps pace with technology advancements in the sector. As a primary policy driver for guiding building construction, it is a forward-looking code and will push the building sector towards near-zero energy targets. The code was last updated in 2017 and prioritises the integration of renewable energy and passive building design strategies as per local climate. Energy savings for ECBC-compliant buildings between 2018-22, covering an area of 59 million sq ft, was over 79 million units[60].

Similarly, a voluntary ECBC for residential buildings, ECO Niwas Samhita (ENS), was launched by the Ministry of Power and BEE in 2018. It aims to benefit the occupants and the environment by promoting energy efficiency in the design and construction of homes, apartments, and townships. Part I of the Code prescribes minimum standards for building envelope designs, and Part II looks at electro-mechanical and renewable energy systems. Fifty-four buildings with a total built-up area of 16.68 million sq ft have been certified under ENS and have resulted in energy savings of 2.42 million units[61].

There has been a 177% increase in green-certified office buildings in the country over a 10 year period, with 80 million sq ft certified in 2011 and 212 million sq ft in Q3 2021[62]. LEED (Leadership in Energy and Environmental Design) certification dominates certified stock, followed by IGBC (Indian Green Business Council) certification and GRIHA (Green Rating for Integrated Habitat Assessment).

The highest LEED certification, LEED Zero, recognizes projects that have reached net zero or net positive status in the categories of carbon, energy, water, or waste. In June 2023, India was announced as the top country with LEED Zero green building projects, outperforming both the US and China. The 73 LEED Zero certified projects encompass a wide mix of sectors, including office spaces, hospitality facilities, retail malls, industrial manufacturing projects, and data centres[63].

Green Building Stock added between 2011 and 2021

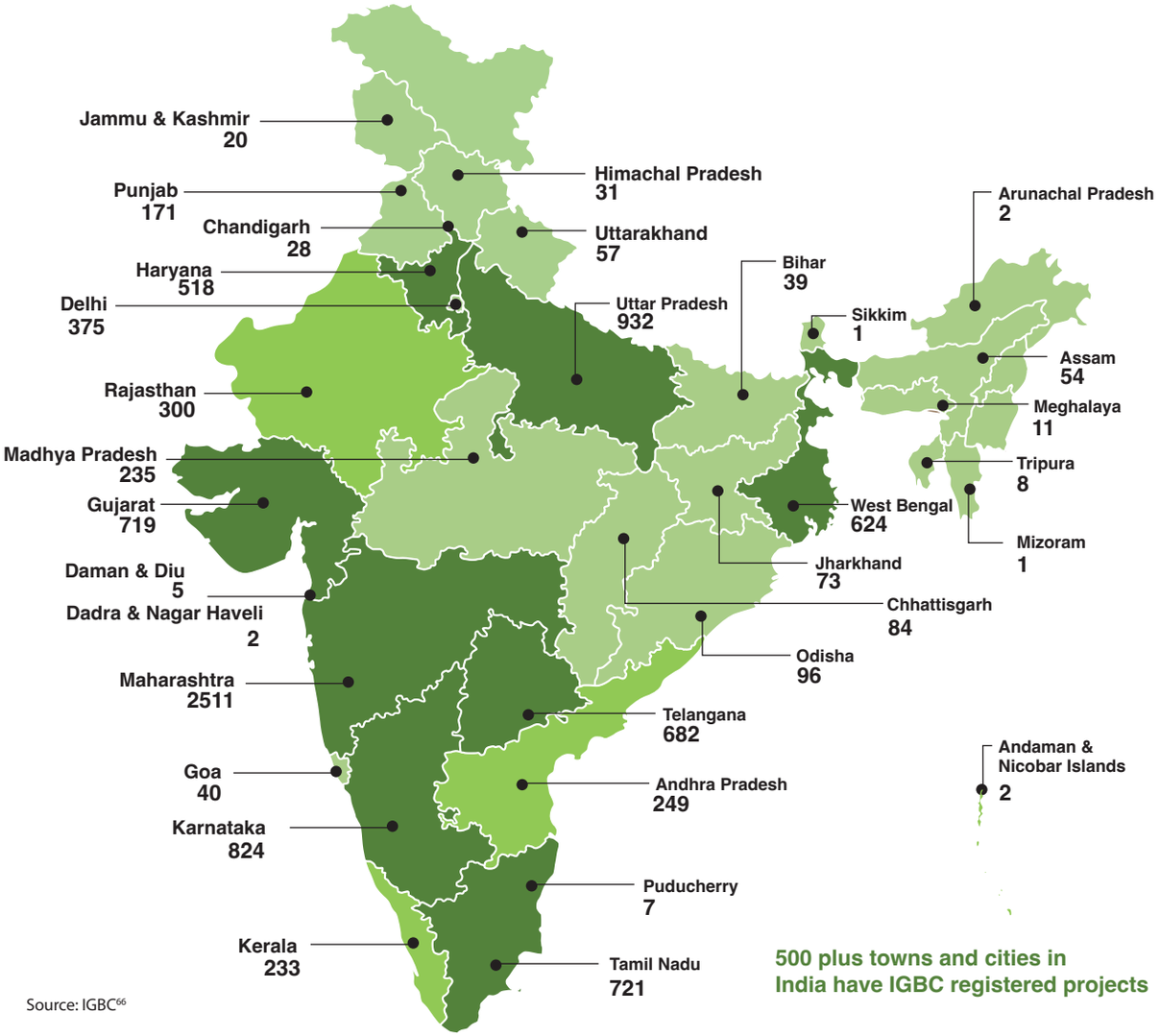


Source: CBRE Research[64]

IGBC reports also show a steep growth in green building certifications, with a national footprint of over 2.1 million homes, offices, and factories. They have also certified over 50 townships, 25 cities, and 35 villages as green. IGBC-certified built environments have conserved significant amounts of energy and water and have reduced annual CO_2 emissions by 19.2 million tonnes per million sq ft of built area[65].

IGBC Registered Projects

11,053 Registered Projects with 10.27 Billion sq ft. as on 1 June 2023



Source: IGBC[66]

500 plus towns and cities in India have IGBC registered projects

As on 31st March 2022, approximately 30 million sq ft has been certified by GRIHA contributing to an energy saving of 88 million units of electricity[67].

The National Building Energy Efficiency Programme (BEEP) has tapped into Swiss expertise and technology and tailored it to Indian requirements and come up with a country specific strategy to facilitate adoption of energy efficient and thermally comfortable buildings. BEEP initiatives have resulted in annual savings of 224 million kWh of electricity and avoided a peak demand of 75MW[68].

Similar to the star rating of appliances, BEE launched a star rating for existing buildings in 2009. Based on energy usage in the building over its area expressed in kWh/sqm/year, buildings are rated on 1-5 scale, with 5 star labelled buildings being most efficient. The labelling programme has been expanded to recognize net zero energy and net positive energy buildings, which get the Shunya or Shunya+ ratings respectively (shunya means zero). Until March 2022, 264 buildings have been awarded a star rating under this programme, resulting in energy savings of 261 million units and CO_2 emissions reduction of over 200,000 tonnes, between 2017-2022[69].

Buildings have also been brought under the Perform, Achieve and Trade (PAT) framework of energy efficiency, starting with hotels and airports. They have been introduced into the framework from PAT Cycle IV and with time, the programme will cover more buildings and incentivize them to reach set energy efficiency standards.

5.2 GLOBAL HOUSING TECHNOLOGY CHALLENGE

Pursuing the vision of transforming the residential construction sector, the Ministry of Housing and Urban Affairs initiated a Global Housing Technology Challenge to identify and mainstream a basket of innovative, sustainable and disaster-resilient construction technologies from across the globe. Of the identified 54 technologies, 6 Light House Projects using distinct technologies were selected to be piloted and showcased for further mainstreaming in the country. These technologies meet required quality standards and are time and cost-effective while meeting diverse geo-climatic needs and desired functional needs. Two of these projects have been completed in 2022, and the remaining four are in progress.

This Challenge, under the Affordable Sustainable Housing Accelerators – India (ASHA-India) initiative, also seeks to promote future technologies through incubation support and accelerator workshops, in order to foster an environment of research and development in the country. ASHA-India Centers will also help develop design guidelines, construction manuals, and other necessary guidelines relevant for effective use of such technologies in the region.

5.3 URBAN TRANSFORMATION

The Government of India has outlined key strategies for managing urban habitats in an integrated manner through its National Urban Policy framework. It has also drafted the Model Building Bye Laws (MBBL) in 2016, which incorporates sustainability provisions such as urban greening, rainwater harvesting, wastewater reuse and recycling, installation of rooftop solar electricity / water heating modules, water and energy efficiency, and waste management. Conformance is mandated for buildings built on plots above a specified size.

To mainstream sustainable development and climate actions in all urban investments and development activities, the Government has implemented many programmes, some important ones being the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Swachh Bharat Mission - Urban (SBM-U), and the Smart Cities Mission (SCM). In addition, it has launched many programmes to ensure that the urban poor have access to *pucca* housing, affordable rental housing, and sustainable livelihood opportunities, all of which promote well-being and inclusivity of urban residents.

It has also formulated an Ease of Living Index framework to assess well-being of citizens in Indian cities across a set of three pillars, namely, quality of life, economic ability, and sustainability. The assessment covers 14 categories and 50 indicators under these 3 pillars and its outcomes feed into fine-tuning urban policies and catalysing action to achieve broader development outcomes.

EASE OF LIVING INDEX OBJECTIVES

Assess and compare the outcomes achieved from various urban policies and schemes

Obtain the perception of citizens about their view of the services provided by the city administration

Generate information to guide evidence-based policy making

Catalyze action to achieve broader developmental outcomes including the Sustainable Development Goals

5.3.1 ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION

Atal Mission for Rejuvenation and Urban Transformation (AMRUT) was launched in June 2015 in 500 select cities and towns across India and focuses on the development of basic infrastructure in the sectors of water supply, sewerage and septage management, stormwater drainage, green spaces and parks, and non-motorized urban transport. Till December 2022, 13 million water tap connections and 10 million sewer connections have been provided through AMRUT[70]. The second phase of the scheme, AMRUT 2.0, launched in 2021, promotes circular economy of water through the development of City Water Balance Plans (CWBP) for each city. The CWBP focuses on recycling / reuse of treated sewage, rejuvenation of water bodies, water conservation and rainwater harvesting. Through this, the Mission aims to make cities water secure and ensure equitable distribution of water to all residents, which also reduces the unpaid labour and time poverty of urban poor women. The Mission is built on a foundation of technology and communication. Latest global technologies are being leveraged, and intensive information, education and communication (IEC) campaigns are being conducted to spread awareness among the residents on water conservation.

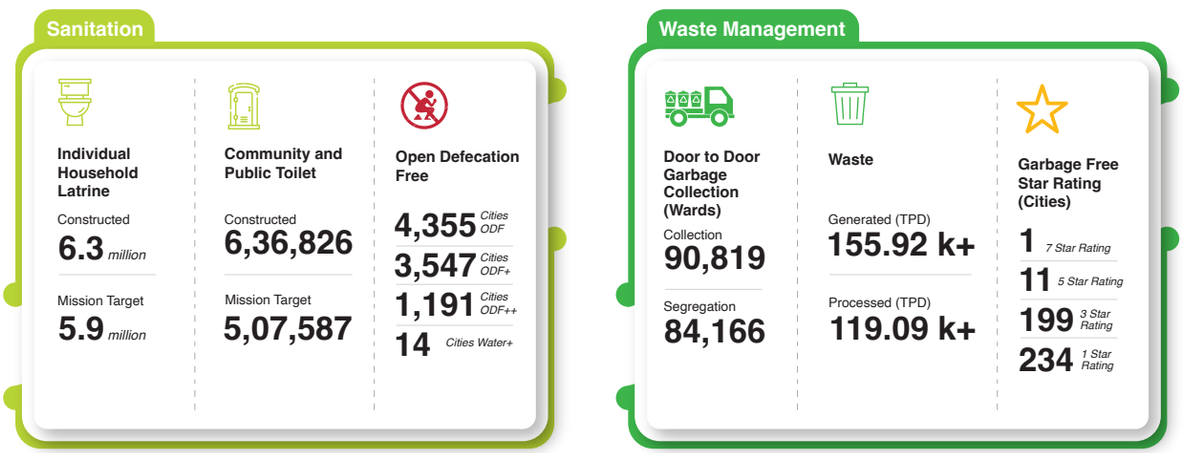
Surat Municipal Corporation has set an excellent example for the rest of the country by implementing a circular economy in its wastewater treatment system. 115 MLD of treated wastewater is sold for a variety of non-potable uses, generating almost USD 17 million (INR 1.4 billion) revenue for the city. The municipal corporation now endeavours to make Surat a net-zero liquid discharge city[71].

5.3.2 SWACHH BHARAT MISSION

The launch of Swachh Bharat Mission (SMB) on 2nd October 2014 placed the issue of sanitation, cleanliness, and hygiene at the centre of the Government's developmental agenda. Swachh Bharat Mission has three primary objectives: (a) achieving 100% Open Defecation Free (ODF) status, (b) ensuring 100% scientific Solid Waste Management (SWM), and (c) creating a sense of collective responsibility and behaviour change through *Jan Andolan*'s.

Divided into Urban and Rural Missions, there are almost 450000 villages certified as ODF Plus (villages that have sustained their ODF status, ensured solid and liquid waste management, and look visually clean) under SBM Rural.

Achievements under SBM Urban (as of October 2023)



Source: Swachh Bharat Mission - Urban[72].

Under the ambit of the Swachh Bharat Mission (Urban), the world's most extensive urban sanitation and cleanliness survey - Swachh Survekshan – has been conducted annually since 2016. To foster a spirit of healthy competition among towns and cities towards creating cleaner urban spaces, they are ranked in order of overall achievements of cleanliness. The primary goal of Swachh Survekshan is to encourage large-scale citizen participation and create awareness amongst all sections of society about the importance of working together towards making towns and cities better places to reside in – a key objective of Mission LiFE.

Indore – Cleanest city in India 6 times in a row

Indore's cleanliness model, based on Reduce, Reuse, and Recycle, met all the criteria of 100 percent door-to-door waste collection and 100 percent waste treatment making it the first city to gain a 7-star rating. The city has also successfully eliminated its legacy waste, and is a zero landfill city. Conscious citizens, businesses, and the Indore Municipal Corporation have created a people's movement that not only gets them awards and contributes to their well-being but is also remunerative.

1100 tonnes of municipal solid waste (MSW) are managed daily, with source segregation happening in 6 categories. Door-to-door collection with specially designed tippers ensures efficient processing of the collected waste. Wet waste is methanized in Asia's largest facility to produce bio CNG that runs some of the city's buses. With a capacity of 550 Mt per day, the plant can generate 17-18000 kg of bio CNG and 10t of organic manure.

Households and localities make compost with wet waste. Zero-waste events mark every community celebration. Schoolchildren have become brand ambassadors of cleanliness. Market associations have shifted to cleaner fuels and banned single-use plastics. Sewage treatment plants divert treated water to public gardens, farms, and construction sites, ensuring that rivers are not polluted and the city is water-positive. Legacy landfill sites have been bio-remediated and converted into green spaces.

The Municipal Corporation earned USD 1.73 million (INR 144 million) from waste disposal in 2021-22 and hope to earn USD 2.4 million (INR 200 million) this year.

Banking on Indore's credibility as the cleanest city in India, the municipal corporation issued Green bonds to help fund a solar power project that will meet their energy needs for water pumping and earn them carbon credits. This innovative financing mechanism is expected to reduce 126000 tonnes of CO_2 emissions annually, which is equivalent to planting 162000 trees[73].

5.3.3 SMART CITIES MISSION

Launched in June 2015, the Smart Cities Mission aims to apply 'smart solutions' to drive economic growth and improve the quality of life in Indian cities. 100 cities have been selected to be developed as Smart Cities through a two-stage competition. The focus is on sustainable and inclusive development, and citizens' aspirations were captured in the Smart City Proposals (SCPs) prepared by the selected cities.

Fundamental Principles of the Smart Cities Mission

While the scheme is funded by the Central and State Government / Urban Local Body, emphasis has been given to the participation of the private sector through Public Private Partnerships (PPP). The Smart Cities Mission has also partnered with the All India Council for Technical Education for The Urban Learning Internship Programme (TULIP), where problem-solving and critical thinking skills of the Indian youth are strengthened through hands-on, experiential learning internships in India's fast-growing urban ecosystem. Interns get to assist in research and fieldwork, and this mutually beneficial partnership helps students gain exposure to the functioning of cities, opens local governments to new solutions for the city, and creates a pool of talent for absorption in the market. An illustrative list of smart solutions that cities are working on is shown below. Smart cities are gender-responsive across all solutions offered.

SMART SOLUTIONS

E-Governance and Citizen Services
- Public Information, Grievance Redressal
- Electronic Service Delivery
- Citizen Engagement
- Citizens - City's Eyes and Ears
- Video Crime Monitoring

Energy Management
- Smart Meters & Management
- Renewable Sources of Energy
- Energy Efficient & Green Buildings

Waste Management
- Waste to Energy & Fuel
- Waste to Compost
- Waste Water to be Treated
- Recycling and Reduction of Construction and Demolition (instead of C&D)

Urban Mobility
- Smart Parking
- Intelligent Traffic Management
- Integrated Multi-Modal Transport

Water Management
- Smart Meters and Management
- Leakage Identification, Preventive Maintenance
- Water Quailty Monitoring

Others
- Tele-Medicine and Tele Education
- Incubation / Trade Facilitation Centres
- Skill Development Centres

To incentivise holistic, climate-responsive development, the ClimateSMART Cities Assessment Framework was launched in 2019. A first-of-its-kind Assessment Framework for cities, it aims at creating a green mindset in cities while they plan and undertake various developmental projects. The Framework includes several air and climate-relevant parameters, and guides cities to assess their own preparedness to tackle the menace of climate change and degrading air quality. Under the aegis of the National Institute for Urban Affairs (NIUA), a Climate Centre for Cities (C-Cube) has been set up to act as one-stop shop for climate informed actions and drive climate actions and in Indian cities.


CO_2

06

INDIA'S CLIMATE ACTIONS – CIRCULAR ECONOMY AND RESOURCE EFFICIENCY

06

INDIA'S CLIMATE ACTION – CIRCULAR ECONOMY AND RESOURCE EFFICIENCY

Value realization potential from circular business models by 2030

Source: Accelerating India's Circular Economy Shift, FICCI and Accenture Strategy[74]

A circular economy seeks to use, to its fullest extent, every resource it has, which calls for high resource efficiency, longer product lifecycles, the ability to recover resources and reuse them, and extract all possible energy it can provide. According to a study by FICCI and Accenture, the value realization potential from circular business models by 2030 can be around of USD 4.5 trillion of GDP globally and half a trillion dollars in India alone.

Resource efficiency and circular economies result in significant emissions reduction by reducing emissions released during mining, transportation, production, embedded energy in waste materials, and waste disposal. GHG emissions in India could be 23% lower in 2030 and 44% lower in 2050 compared with the current development scenario in just three sectors: vehicle manufacturing and mobility, food and agriculture, and cities and construction, according to the study conducted by the Ellen McArthur Foundation[75].

A circular economy provides a development model that is in the interest of sustainability, rising population, diminishing resources, and environmental concerns. It is, therefore, the need of the hour in contrast to the take-make-dispose approach of the linear economy model. Under India's G20 presidency and its Mission LiFE that encourages mindful consumption of resources, circular economy and resource efficiency have received a further boost in the country, as an important step towards sustainable businesses.

6.1 POLICIES AND ECOSYSTEM FACILITATION

The Government of India has been actively formulating policies and promoting projects to drive the country towards a circular economy. In October 2014, India launched the Swachh Bharat Mission to achieve the vision of a 'Clean India'. To promote and support its goals, the Solid Waste Management (SWM) Rules, Plastic Waste Management (PWM) Rules, E-Waste Management (EWM) Rules, and Construction and Demolition Waste Management (CDWM) Rules were all notified in 2016. It also issued the Steel Scrap Recycling Policy in 2019.

The Government further notified the Plastic Waste Management Amendment Rules, 2021, to prohibit by 2022, identified single-use plastic items with low utility and high littering potential.

Eleven sectors have been identified for priority action to expedite the country's transition from a linear to a circular economy. These include municipal solid and liquid waste, scrap metal, electronic waste, lithium-ion batteries, solar panels, gypsum, used oil, agriculture waste, tyre and rubber waste, end-of-life vehicles, and toxic and hazardous industrial waste. Comprehensive action plans for ten sectors, prepared by advisory groups comprising ministry officials, industry representatives, domain experts, and academia, have been finalised[76].

In addition to providing a conducive policy framework, the Government launched the Waste to Wealth Mission, one of the nine scientific missions of the Prime Minister's Science, Technology and Innovation Advisory Council (PMSTIAC) in 2020. The Mission will assist and augment the Swachh Bharat and Smart Cities projects by leveraging science, technology, and innovation to create circular economic models that are financially viable and streamline waste handling in the country. It aims to identify, develop, and deploy technologies to treat waste to generate energy, recycle materials, and extract resources of value.

Digitization provides powerful tools to track waste streams, ensure policy implementation, identify trends, and create platforms where ecosystem stakeholders can be brought together. It helps Urban Local Body (ULB) administrators make informed decisions and creates better material flow linkages. To facilitate this, the Ministry of Housing and Urban Affairs has implemented the *Sansaadhan* portal, which has been launched in eight cities[77]. National frameworks are under development for cities to report on progress in circular economy parameters in a unified manner.

6.2 MATERIAL RECOVERY FACILITIES

Appreciating the value of waste and in keeping with the Swachh Bharat Mission, ULBs have gone into public-private partnerships to set up material recovery facilities (MRFs) to handle fresh and legacy waste. Currently, there are more than 2,000 MRFs in India, and many more facilities are in the process of being set up[78]. The MRFs are designed as an integral part of a circular economy ecosystem for collection, weighing, segregation, and further processing of input wastes to create resources for other industries. The concept of MRFs is spreading to rural India as well and such facilities, catering to multiple Gram Panchayats (GPs), are coming up in different parts of the country.

Material Recovery Facility in rural Karnataka

Ever since it began operations in August 2021, the Material Recovery Facility (MRF) of Nitte GP (Karkala Taluk, Udupi district of Karnataka) has provided effective waste management services to 41 GPs in the Blocks of Karkala, Udupi, Kaup, and Hebri that come under the purview of this project.

Dry waste collected door-to-door within the project area is brought to Solid Waste Management (SWM) centres where it is weighed, packed, and sent to the MRF, which can handle ten tonnes daily. The waste is sorted into 25-30 different categories, and the sorted waste is compressed and baled. These are then sold to authorized recyclers. Non-recyclable waste is transported to cement factories, where it is co-processed.

The project has resulted in a significant reduction of waste dumping and public littering, and created a heightened awareness of waste segregation among the public. Currently the entire project is operating at 50% capacity and is revenue neutral, but can become remunerative, as it expands to full capacity utilization[79].

6.3 PRIORITY AREAS DURING G20 PRESIDENCY

India embraced four priority areas for the circular economy during its G-20 presidency

- Establishing an industry-led resource efficiency and circular economy coalition
- Circularity in the steel sector
- Extended Producer Responsibility (EPR) and
- Circular bioeconomy

Resource Efficiency and Circular Economy Coalitions

Collaboration is a crucial enabler for furthering circular economy business models and achieving systemic change. Collaboration should go beyond industry-specific value chain stakeholders and involve urban local bodies, informal waste collection networks, civil society organizations, and consumers. Knowledge sharing and material trading platforms on an international level are essential to create profitable recycling ecosystems. India has taken a leadership role in this.

The Resource Efficiency and Circular Economy Industry Coalition (RECEIC) was launched under India's G20 Presidency. Thirty nine companies headquartered in eleven countries have joined the coalition as its founding members. As a collaborative platform, RECEIC aims to facilitate knowledge-sharing, best practice sharing, and sustainable practices among the participating industries. The coalition has three guiding principles for scale – Partnerships for impact, Technology Cooperation, and Finance.

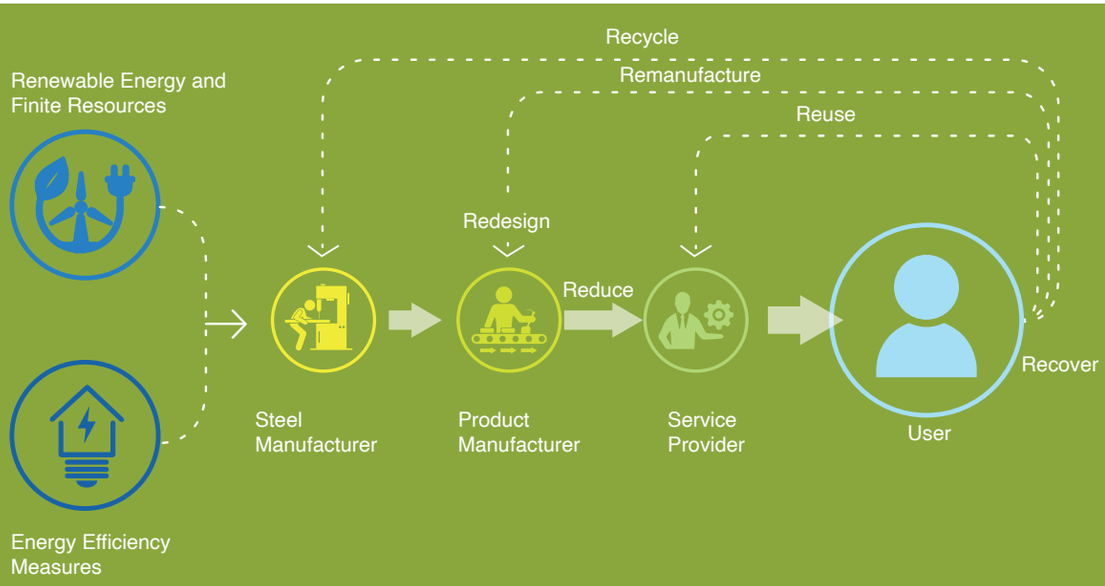
The business opportunity of providing a platform for industry to sell their non-core products or by-products produced as a result of their operations has been leveraged by some industries in India. Mjunction Services Limited, a joint venture (JV) of public and private steel companies, has evolved to become the world's largest e-marketplace for steel and India's biggest B2B e-commerce company. The JV has expanded to include almost 30 waste streams and idle assets. Mjunction has increased its business volumes from USD 13.8 million in 2002 to USD 20.16 billion in 2016. Participating companies save money by utilizing by-products and getting access to idle assets in the market, and what was the industry's waste stream is now becoming feedstock for other industries[80]. Such circular economy coalitions are being expanded to an international scale as well.

Circularity in the Steel Sector

Steel scrap recycling is at the core of a shift towards greater circularity in the steel sector. The Ministry of Steel has issued the Steel Scrap Recycling Policy in 2019 with the aim of

- Ensuring processing and recycling of ferrous scrap in an organised, safe, and environmentally friendly manner.
- Ensuring the production of high-quality ferrous scrap for quality steel production, thus minimizing dependency on imports.
- Conserving natural resources and saving energy, leading to reduced GHG emissions and
- Creating a vibrant and responsive ecosystem of circularity in the steel industry

The policy also envisages a framework for facilitating and promoting the establishment of metal scrap recycling centres across India.



Six Rs of a Circular Steel Economy[81]

- Reduce: Using alternative materials can enable a product to provide the same services with less materials or greater efficiency.
- Redesign: Products may be designed to use less steel. Measures such as lightweighting using high-strength steel can drastically reduce the steel required in a product.
- Remanufacture: Repair and refurbishments allow a product to be sold for original use in primary and secondary markets.
- Reuse: A product in its original form can be used to perform the same function more than once. Business models may grant such products access to secondary markets.

- Recover: Recovery involves collecting and sorting material that cannot be reused or remanufactured since its serviceable life has ended or the function it served is no longer needed.
- Recycle: Through the process of recycling, metal may be transformed from an end-of-life product into a newly usable commodity. Recycling steel saves significant energy and carbon emissions relative to producing new steel. Steel can be recycled multiple times without loss of quality or functionality; it can even be recycled to improve its quality to suit a new service or end use.

Extended Producer Responsibility (EPR)

The main laws governing EPR compliance in India are:

- Plastic Waste Management Rules (PWMR)
- E-waste (Management) Rules (EWMR)
- Battery Waste Management Rules
- Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2022 (for Waste Tyre)

Source: Ministry of Environment, Forest and Climate Change[82]

EPR in the plastics economy is possible only if the plastic can be collected and recycled. To design a viable circular economy for plastics, one must ensure the minimization of single-use plastics, which have numerous adverse environmental and health impacts since they are not easy to collect, segregate, clean, and recycle.

India has, through the Plastic Waste Management Rules, 2016 and the Plastic Waste Management Amendment Rules, 2021, banned a variety of single-use plastic items that have low utility and high littering potential. Apart from stringent enforcement and awareness campaigns across the country, the Government is also assisting Medium, Small, and Micro Enterprises to produce and market alternatives to the banned single-use plastic items. Rapid penetration of these alternatives is vital to successfully implementing the ban.

EPR guidelines coupled with the prohibition of identified single-use plastic items with effect from 1st July 2022, are cardinal steps towards reducing pollution and litter caused by plastic waste. They also strengthen the circular economy of packaging by promoting the development of alternatives to plastics, and providing a conducive ecosystem for their adoption by businesses. In a significant first, the guidelines allow for the sale and purchase of surplus EPR certificates, thus setting up a market mechanism for plastic waste management. EPR is being implemented through a customized online platform that allows tracking and monitoring of EPR obligations.

India is also constructively engaging with other like-minded countries to strengthen the negotiations for an international legally binding instrument to end plastic pollution, pursuant to the historic United Nations Environment Assembly (UNEA) 5.2 resolution.

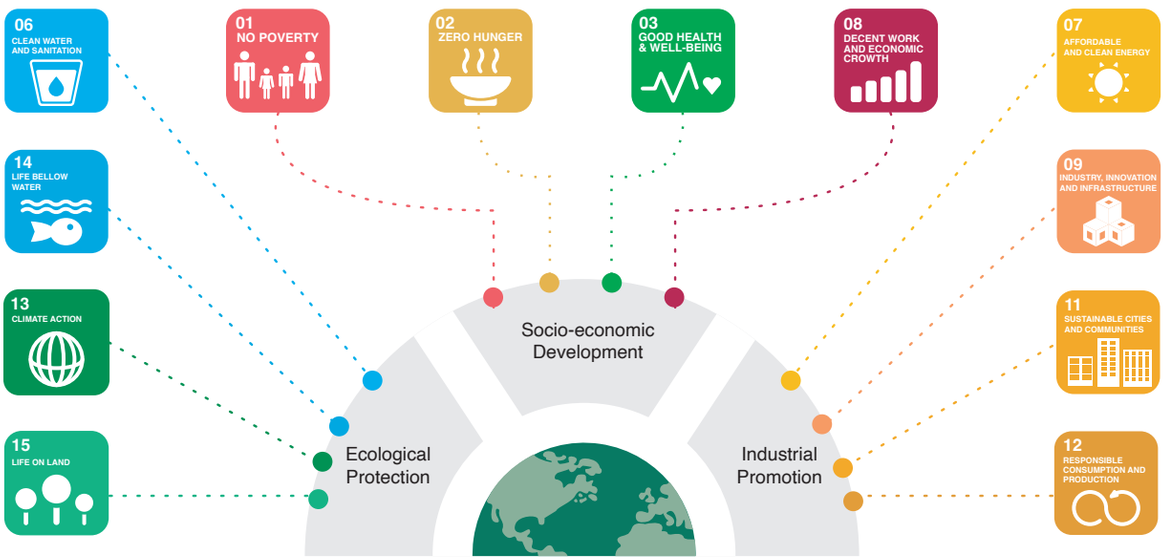
Banned Single-Use Plastic Items

Circular Bioeconomy

India acknowledges that the adoption of a circular bioeconomy has a positive impact on the achievement of SDGs as well as on climate stewardship. It is, therefore, strengthening its strategies and policies to harness value from waste through efficient business models.

The Central and State Governments are actively involved in policies and programmes related to waste-to-energy systems and nutrient recovery from faecal sludge, municipal solid wastes, and crop residues. They are enabling market conditions, improving access to finance, promoting public-private partnerships, and providing support to small and medium scale businesses to encourage a circular bioeconomy.

Circular Bioeconomy and its relation to Sustainable Development Goals



Source: Biotechnology Industry Research Assistance Council[83]

6.4 MISSION LiFE

Mission LiFE - Lifestyle for Environment - an India-led global mass movement to nudge individual and community action to protect and preserve the environment was launched in October 2022. Keeping in view the fact that along with the advocacy and awareness, other supportive measures are also required, the Government of India has developed a three-pronged strategy i.e.

- Embedding sustainability in the production and consumption cycle
- Institutionalising the concept of LiFE in the administrative framework and through regulatory provisions
- Incentivising green investments

Extended Producer Responsibility (EPR) Rules, applicable to manufacturers and brand owners, encourage companies producing electronic and electrical products to reduce their EPR obligations by setting up repair and refurbishing facilities. As companies mainstream repair and refurbishment, it can change the use-and-throw mindset to repair-recycle-reuse across the value chain.

The **Green Credit Programme (GCP)** is envisaged to incentivise positive environmental actions of various stakeholders through a market-based mechanism. It will also help realise the objectives of Mission LiFE, which promotes sustainable lifestyles, production, and consumption. The Programme was announced in the Union Budget of 2023-24. The Rules were notified on 13th October 2023 under the Environment (Protection) Act, 1986.

GCP will be implemented in a phased manner. Initially, activities in the eight identified sectors namely **Tree Plantation, Water-harvesting, Sustainable Agriculture, Waste Management, Air Pollution Reduction, Mangrove Conservation and Restoration, ECO Mark, and Sustainable building and infrastructure** will be covered under the mechanism. For each activity, methodologies would be developed for generating and issuing every unit of Green Credit.

The government has notified the draft Rules under the revised **ECO Mark Scheme**, instituted for labelling environmentally friendly products. The products would be jointly certified by the Bureau of Indian Standards and the Central Pollution Control Board so that consumers would not only be assured of the quality but would also be sure that the product design and production process is such that it minimises environmental impact through measures like the use of low carbon energy, higher percentage of recycled material, etc.

Sustainability in tourism has been taken up through **'Travel for LiFE'.** India hosted the 46th edition of Pacific Asia Travel Association (PATA) Travel Mart in October 2023. PATA Travel Mart (PTM), which saw the participation of around 1000 delegates, is a major international trade exhibition catering to the tourism sector and it serves as a platform for trade interactions between buyers and sellers, PTM 2023 included thought provoking knowledge sessions at PATA Forum and youth engagement at the PATA Youth Symposium.

07

INDIA'S CLIMATE ACTIONS

WATER

Credits: Adobe stock

07

INDIA'S CLIMATE ACTIONS - WATER

India receives an average of 4000 BCM (billion cubic metres) of precipitation annually, but only 28.1% of it can be utilized, with the remaining lost due to evapotranspiration, topographical constraints, and the uneven distribution of water resources over space and time[84]. By 2030, the country's water demand is projected to be twice the available supply, implying severe water scarcity for hundreds of millions[85].

Most of India's precipitation occurs between June and September, and the country's GDP, food, and water security depend largely on this monsoon season. Climate change is already impacting water availability in the country, and the situation will only worsen. Since the 1950s, the Indian Meteorological Department has reported a decline in annual rainfall in at least fourteen states covering more than 50% of the country. Seasonally, monsoon rainfall is reportedly decreasing in more than twenty states[86]. Sustainable water management helps build resilience and adaptive capacity in societies to the impacts of climate change and in a vulnerable country like India, it assumes critical importance. In cognisance of this, there are multiple ongoing efforts to ensure SDG 6.1 targets of achieving universal and equitable access to safe and affordable drinking water for all, are met in record time.

The Government of India has established the National Water Mission under the National Action Plan on Climate Change to conserve water, minimise wastage, and ensure its more equitable distribution, both across and within States, through integrated water resources development and management. The Mission has many sub-missions and schemes, a few of which are elucidated here. It covers the entire gamut of water missions – safe water to all, groundwater, rainwater harvesting, surface water structures, dams, rivers and water for irrigation.

7.1 JAL JEEVAN MISSION – TAP CONNECTION TO EVERY HOME

Envisioned to provide safe and adequate drinking water through a functional household tap connection (FHTC) to every rural household in India, the Jal Jeevan Mission (JJM), launched in 2019, has been seeing a remarkable pace of implementation. As of September 2023, out of 194 million rural households in the country, 130 million (67%) have tap water supply. Rural household tap connection coverage has increased from 32 million households when the Mission was announced in 2019 to 130 million in just four years[87].

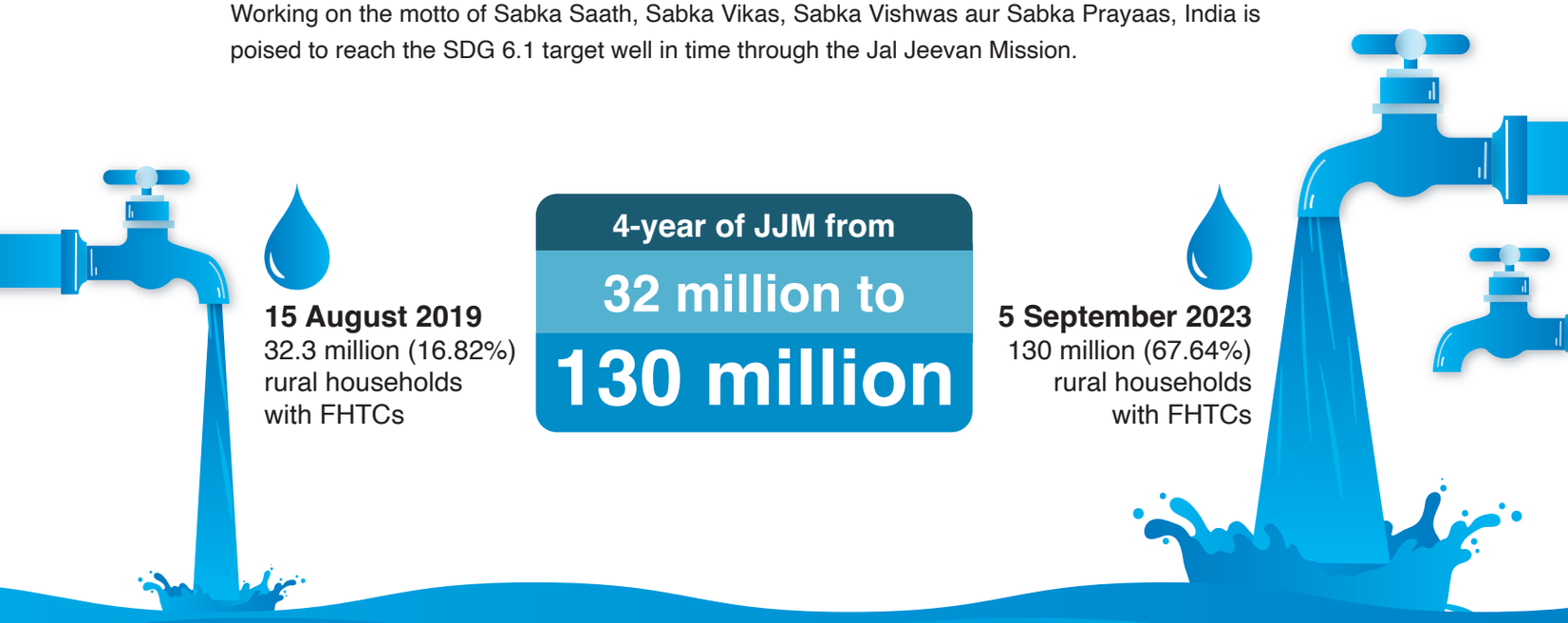
According to the World Health Organization (WHO), implementation of the Jal Jeevan Mission would result in averting

- almost **400000** diarrhoeal disease deaths,
- **114 million** Disability Adjusted Life Years (DALY) from diarrhoeal disease, resulting in estimated cost savings of **up to USD 101 billion,** and
- wastage of **66.6 million** person-hours daily, spent by women for water collection[88]

The relentless efforts of the Central and State governments in bringing safe water to all have also resulted in provision of tap water supply to 89.04% of schools and 84.88% of Anganwadi centres in the country, as of 20 September 2023[89].

The programme also mandatorily implements source sustainability measures such as recharge and reuse through greywater management, water conservation, and rainwater harvesting. The Jal Jeevan Mission is based on a community-centric approach and Information, Education, and Communication (IEC) is a vital component. The Mission works towards making the community take ownership of their water resources and allied infrastructure. It is also developing human resources that can take care of plumbing, electrical, water treatment, catchment protection, and operation and maintenance of infrastructure in the short and long term.

Working on the motto of Sabka Saath, Sabka Vikas, Sabka Vishwas aur Sabka Prayaas, India is poised to reach the SDG 6.1 target well in time through the Jal Jeevan Mission.



7.2 ATAL BHUJAL YOJANA (ATAL JAL) – GROUNDWATER MANAGEMENT

With a mission to democratise groundwater governance, Atal Bhujal Yojana, a community-led, sustainable groundwater management scheme, was launched by the Jal Shakti Ministry in 2020 across seven states, which

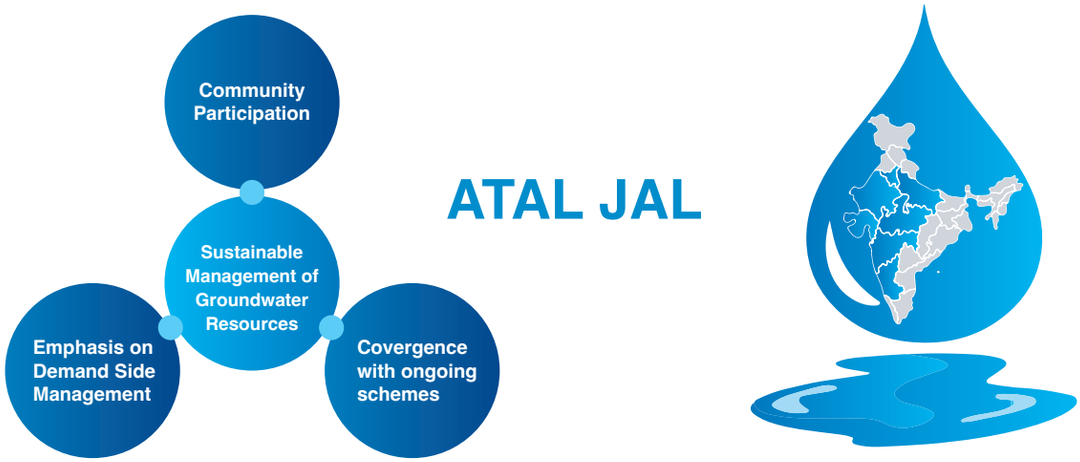
- Provides decision support tools for groundwater management
- Strengthens community-based institutions to foster management
- Helps improve water use efficiency and enhance groundwater recharge
- Encourages decentralised decision-making

At a GP level communities are being empowered to understand water budgeting and prepare water security plans. Data is collected using a mobile app and is shared with all stakeholders in a transparent manner.Good practices of water efficiency are shared through intensive training and awareness programmes. The communities are also given modern technologies, which help them implement water conservation and understand their water use patterns.

All GPs covered in this scheme have prepared their water budgets, containing information about the present annual available water and required water. They have also prepared holistic water security plans with proposed interventions that can make their GPs water secure. These are now being implemented in the field by various departments.

The scheme aims at smart and water-efficient agricultural practices like drip and sprinkler irrigation, crop rotation, soil moisture monitoring, etc. Accordingly, it targets to bring 0.45 million ha area under water efficient use. More than 50% of the target has been achieved by 2022-23[90].

The Atal Jal scheme has made significant progress in promoting efficient agricultural practices, contributing to the goal of doubling farmers' income. As advocated by Mission LiFE, it is bringing about behavioural changes to promote judicious water use and paving the way for a water-secure future, benefitting both present and future generations.



7.3 JAL SHAKTI ABHIYAN: CATCH THE RAIN (JSA:CTR) – RAINWATER HARVESTING

Jal Shakti Abhiyan (JSA), launched in 2019, is a time-bound national call to action conducted annually during the monsoon season to improve water security in water-stressed districts, through the creation and restoration of water conservation and rainwater harvesting structures. A collaborative effort of various Ministries and Departments of the Central and State Governments, the campaign involves local communities in water conservation and recharge efforts. Creation and restoration of water harvesting structures are supplemented with other water conservation efforts such as intense afforestation, watershed management and the introduction of water-efficient techniques and technologies in agriculture.A specially developed mobile application using multi-temporal satellite data is used to enumerate, geo-tag and monitor the assets created under the scheme, including check dams. A GIS based planning approach is undertaken to scientifically develop GP level water plans, which are then implemented by local communities. Jal Shakti Kendras are set up in all districts to provide assistance and disseminate information.

To date, under Jal Shakti Abhiyan: Catch The Rain, more than ***10 million water*** conservation works have been undertaken, including construction and maintenance of rainwater harvesting and groundwater recharge structures, renovation of traditional water harvesting structures, de-silting of and removal of encroachment around tanks and lakes, creation of new check dams and ponds, rejuvenation of small rivers and rivulets, watershed development, revival of wetlands, protection of flood banks and water catchment areas, and spring shed development. Under the project, around ***1300 million intensive afforestation works*** have been carried out. JSA: CTR - 2023 acknowledges the significant role that water plays in women's empowerment, and women Water, Sanitation and Hygiene (WASH) champions were honoured during the campaign's launch.

JSA-CTR Intervention progress (4 March 2023 - 30 October 2023)

Water Conservation and Rainwater Harvesting Structures
Total completed and ongoing projects -
Nearly 1 million

Renovation of Traditional Water Bodies
Total completed and ongoing projects -
Nearly 250,000

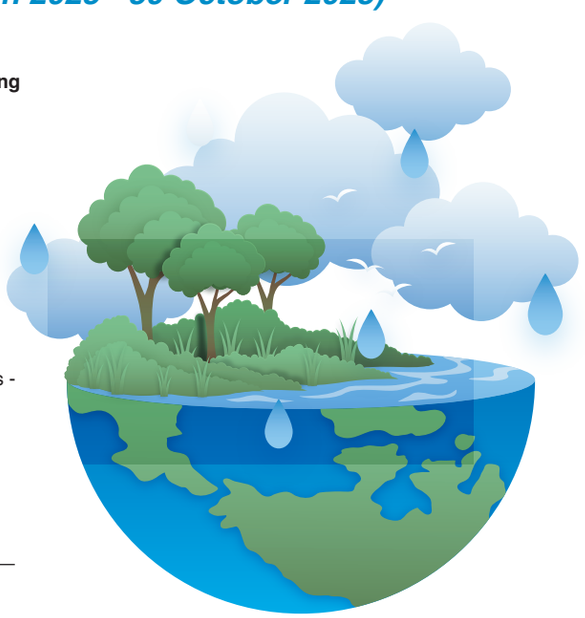
Reuse and Recharge Structures
Total completed and ongoing projects -
Nearly 550,000

Watershed Development
Total completed and ongoing projects -
Nearly 1.2 million

Intensive Afforestation
Total completed and ongoing projects -
Over 64 million

Nearly **50,000 Training** Programmes reaching out to
750,000 participants

Enumeration of Water Bodies -
Over 2.4 million



Source: JSA-CTR Dashboard[91]

7.4 MISSION AMRIT SAROVAR – MANAGEMENT OF SURFACE WATER BODIES

Mission Amrit Sarovar was launched in April 2022 to commemorate 75 years of Indian independence[92], with the objective of developing and rejuvenating 75 water bodies in each district of the country.

Over 100000 water bodies have been identified for rejuvenation, of which work has been completed in over 67000 sites.

7.5 DAM REHABILITATION AND IMPROVEMENT PROJECT

India ranks third globally, with 5334 large dams in operation and about 411 under construction. Since April 2012, the government has been working on improving the safety and operational performance of selected dams using a system-wide management approach. 223 dams were taken on under the first phase of the project, and 736 dams will be undertaken in the subsequent two phases between 2021-2031. This scheme has also generated opportunities for Indian professionals to provide technical support to other countries in dam rehabilitation.

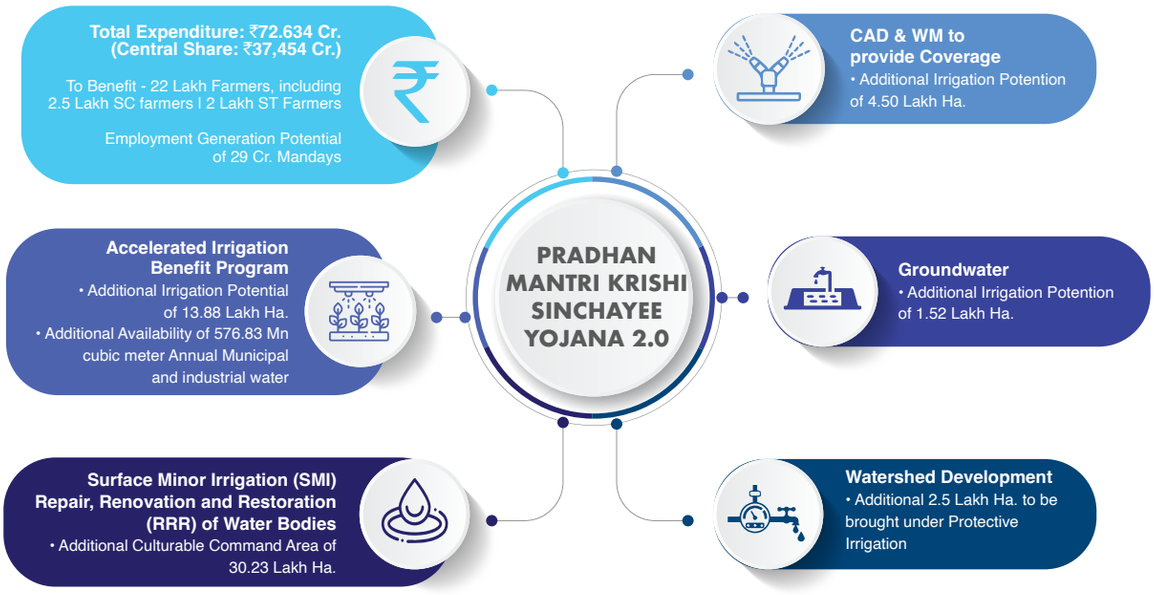
7.6 PRADHAN MANTRI KRISHI SINCHAYEE YOJANA (PMKSY) – EFFICIENT IRRIGATION

PMKSY was launched in 2015 to achieve convergence of investments in irrigation at the field level. It seeks to improve agricultural water use efficiency, introduce precision irrigation and other sustainable water conservation practices, enhance the recharge of aquifers and expand cultivable area under assured irrigation. It has many sub-components, including renovation and restoration of water bodies, watershed development, per drop more crop, etc. The scheme is also exploring the feasibility of reusing treated municipal wastewater for peri-urban agriculture.

A new Springshed Development Programme has been initiated under this scheme to rejuvenate springsheds in mountainous regions to help address the ecological, economic, and biodiversity security of these regions.

- Between 2015-16 and 2022-23, surface minor irrigation projects have covered **374000 ha** and **140000 ha** of water bodies have been repaired / renovated / restored.
- **7.8 million ha** have been covered under micro irrigation under the Per Drop More Crop sub-component, with **3.05 million ha** covered in the past **3 years.**
- **248000 ha** have been brought under protective irrigation practices, under the water conservation sub-component in the past **3 years**[93]**.**
- The scheme aims to achieve a **20%** increase in on-farm water use efficiency, freeing up nearly 50 BCM of water, which is the current storage capacity of 146 nationally monitored reservoirs. The move will help the country cover **70 million ha** with water-efficient micro-irrigation technologies[94].
- India's National Watershed Management Programme, the world's second largest watershed programme and now a component of PMKSY, has supported over **6000 watershed projects** covering an area of almost **30 million ha**. Work has been completed in 27 million ha and has resulted in an increase in the groundwater table and cropping intensity.

Farmers' annual income has **increased up to 70%** due to an increase in milk production and farm output[96].


Total Expenditure: ₹72.634 Cr.
(Central Share: ₹37,454 Cr.)
To Benefit - 22 Lakh Farmers, including 2.5 Lakh SC farmers I 2 Lakh ST Farmers
Employment Generation Potential of 29 Cr. Mandays
CAD & WM to provide Coverage
• Additional Irrigation Potention of 4.50 Lakh Ha.
Accelerated Irrigation Benefit Program
• Additional Irrigation Potential of 13.88 Lakh Ha.
• Additional Availability of 576.83 Mn cubic meter Annual Municipal and industrial water
PRADHAN MANTRI KRISHI SINCHAYEE YOJANA 2.0
Groundwater
• Additional Irrigation Potention of 1.52 Lakh Ha.
Surface Minor Irrigation (SMI) Repair, Renovation and Restoration (RRR) of Water Bodies
• Additional Culturable Command Area of 30.23 Lakh Ha.
Watershed Development
• Additional 2.5 Lakh Ha. to be brought under Protective Irrigation

7.7 NAMAMI GANGE – RIVER REJUVENATION

Namami Gange is a holistic, scientific river basin based approach to rejuvenating river Ganga, a river that has considerable economic, environmental and cultural significance in India. Launched in 2014-15 as a 'Flagship Programme', it has been recognized as one of the top 10 Ecosystem restoration initiatives in the world at the Conference of Parties to the UN Convention on Biological Diversity in December 2022. Declared a World Restoration Flagship, it has been hailed as a case study for other countries battling river pollution.

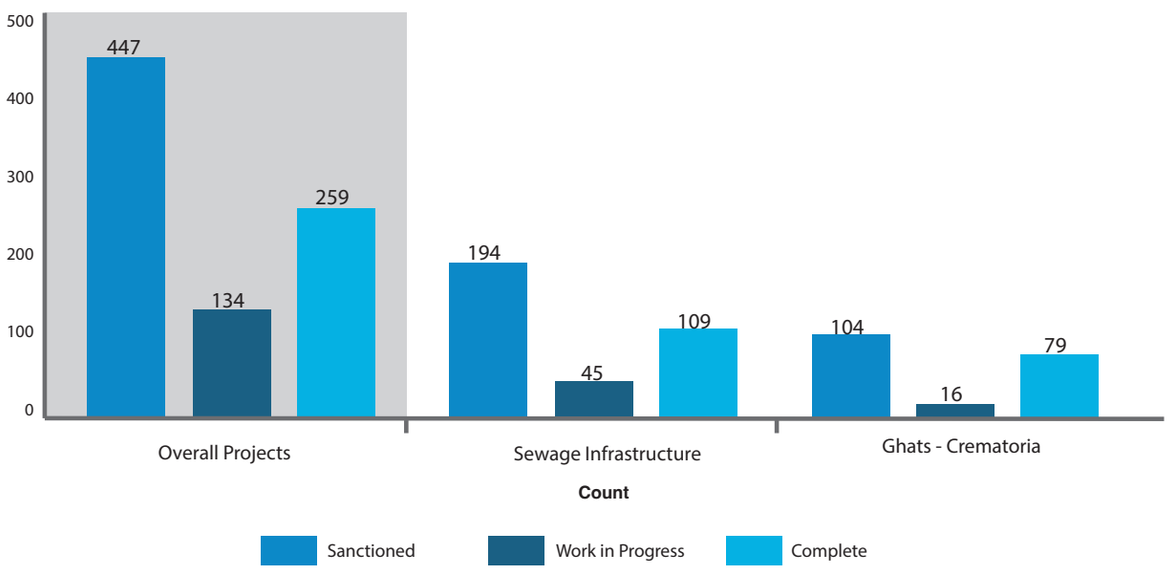
Already, 1,500 km of the 2,525 km river have been rejuvenated and 30,000 ha of native forests have been restored. The project is working towards restoring 135000 ha of natural landscape along the river and is expected to help sequester 15 million tons of carbon by 2030.

One of the most important factors in the success of Namami Gange has been the entire-government approach insisted on by the Prime Minister. The multi-sectoral, multi-dimensional and multi-stakeholder nature of the project requires cooperation among various departments at the local, state and central levels and has been possible due to exemplary planning and support provided by the government. With a committed budget of USD 4.5 billion (INR 425 billion), 442 projects have been sanctioned, of which 259 have been completed. Much of the funding is going towards sewage and industrial effluent treatment. New treatment plants are to handle over 5 billion litres of wastewater daily[96].

Farmers are being encouraged to replace chemical fertilizers and pesticides with natural options, as well as switch to less water-intensive farming techniques. Increased productivity of the soil has been observed, and water consumption has reduced.

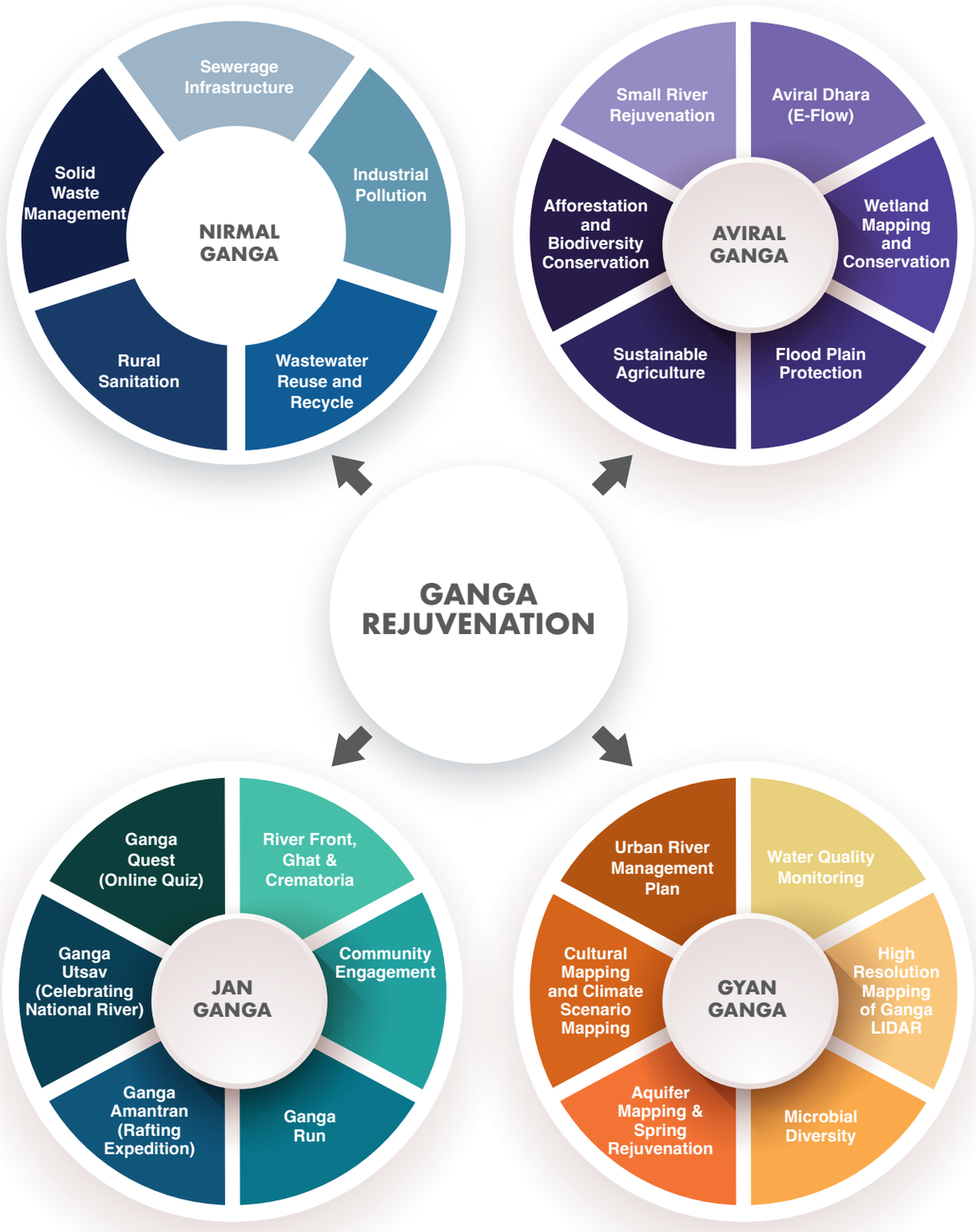
Sightings of endangered river dolphins and other wildlife have increased as the river stretches are becoming cleaner.

Namami Gange Project Status (31 August 2023)



Source: Namami Gange dashboard[97]

Namami Gange Components



08

INDIA'S CLIMATE ACTIONS

FOOD SECURITY

Credits: Adobe stock

08

INDIA'S CLIMATE ACTIONS - FOOD SECURITY

Global warming and its resultant temperature rise, changing precipitation patterns, and greater frequency of extreme events are affecting food productivity worldwide. According to an IPCC special report, global crop and economic models project an increase in cereal prices by up to 29% in 2050 due to climate change, impacting consumers globally through higher food prices. Low-income consumers are particularly at risk, with models projecting up to 183 million additional people at risk of hunger compared to a no climate change scenario[98]. Fruit and vegetable production, a key component of healthy diets, is also vulnerable to climate change, with heat stress causing yield losses, impaired product quality, and increased wastage. Reduced food availability due to lower yields and reduced access to food due to increased prices affect vulnerable and developing populations the most.

Besides climate change, supply chain disruptions and economic fallouts of international events also impact food security. High food commodity prices in 2021 were a significant factor in pushing 30 million additional people in low-income countries towards food insecurity[98].

Agriculture and food systems are critical to global climate change responses, both from the point of view of adaptation and mitigation. Combining supply-side actions, such as efficient production, transport and processing, with demand-side interventions, such as modification of food choices and reduction of food loss and waste, reduces GHG emissions and enhances the resilience of food systems. To implement these, enabling conditions need to be created through policies, markets, institutions and governance.

India's agriculture sector is highly vulnerable to climate change, and the country is taking steps to make it more climate-resilient by grounding it in traditional ecological approaches and using technology to improve productivity and reduce losses. Through its National Mission on Sustainable Agriculture and National Water Mission, Indian agriculture is focusing on adaptive technologies and the development of stress-tolerant varieties of crops, along with better agro-advisory services so that farmers can make informed decisions. Risk-sharing and transfer mechanisms such as crop insurance are increasing the resilience of farmers against increasing extreme events. Increasing production of fibre-rich coarse grains such as millets and low-energy animal-sourced food such as fish are improving nutrition among the masses.

8.1 INDIA'S MILLET (SHREE ANNA) MISSION

Millets (Shree Anna) are rich in complex carbohydrates, fibre and iron. They grow with very little water (about 70% less water than rice), and these hardy cereals can be grown without chemicals because major pests do not attack them. Millets were common on Indian plates before rice and wheat replaced them, and the government is working on a mission mode to change the status quo and bring millets back into regular diets. This will help address the nutrition and food security of the country at a time when climate change is impacting our water resources as well as the agricultural output and income of the farming community.

A twin engine of the Central and State Governments is pushing up millet production and consumption. The Central Government is focusing on increasing demand through relentless outreach on its health benefits and creating a Centre of Excellence for sharing research, technologies and best practices through the sector. State governments, on the other hand, are working with farmers' producer organizations, providing them financial support, training, certification, value addition and marketing of produce, to strengthen supply.

India declared 2018 as the 'National Year of Millets' and launched its 'National Millet Mission' in the same year. Mindful of its numerous benefits for the health of the planet and the human race, the year 2023 has been declared as the International Year of Millets by the United Nations, based on India's proposal.

In March 2023, India hosted the Global Millets Conference, where over 100 countries participated. The recently concluded G20 Summit dinner hosted by the President of India was a gastronomic delight featuring a wide variety of millets in every course, including dessert.

Guyana is embarking on a collaboration with India for scalable millet production by earmarking 200 acres of land for exclusive millet production, where India will provide technical guidance and support. India exported around USD 75 million worth of millets in 2022-23[100], and domestic consumption has increased 23% between 2018 and 2022[101].

Walking the talk, the Parliament canteen has introduced millet dishes in its menu. Top FMCG (Fast Moving Consumer Goods) companies have increased their millet-based products, and many start-ups are building their brands around these nutri-cereals. The Indian Institute of Millet Research and the Central Food Technological Research Institute are working with corporations and NGOs to create millet products that are tasty and easy to cook. As health awareness is growing, the hospitality sector is jumping on the bandwagon and millet based dishes are now common in many hotels and restaurants. States like Karnataka have introduced millets in the Public Distribution System as well as in the mid-day meals provided to school children, and it is likely that others will follow suit.

India's Millet Mission is a blessing for the 25 million small and marginal farmers growing these environmentally sustainable cereal crops. States like Odisha, Assam, Karnataka, Tamil Nadu etc. have rolled out policies to support millet farmers and increase land area under millet cultivation. Many rice-growing farmers have taken to millet farming as a second crop and are seeing good yields.

-Millets-

ABOUT

- Small-grained cereals also known as coarse grains
- Rich source of minerals, gluten-free and low glycemic index
- Among the first crops to be domesticated - evidence of millet consumption dates back to the Indus Valley Civilisation (3,000 BC)
- Typically sown at the beginning of the monsoon season
- Drought-tolerant
  Grown in arid and semi-arid regions of India, Require minimal water, pesticides and fertilizers

INDIA AND MILLETS

One of the World's Largest Millet Producer

41% of global production in 2020[102]

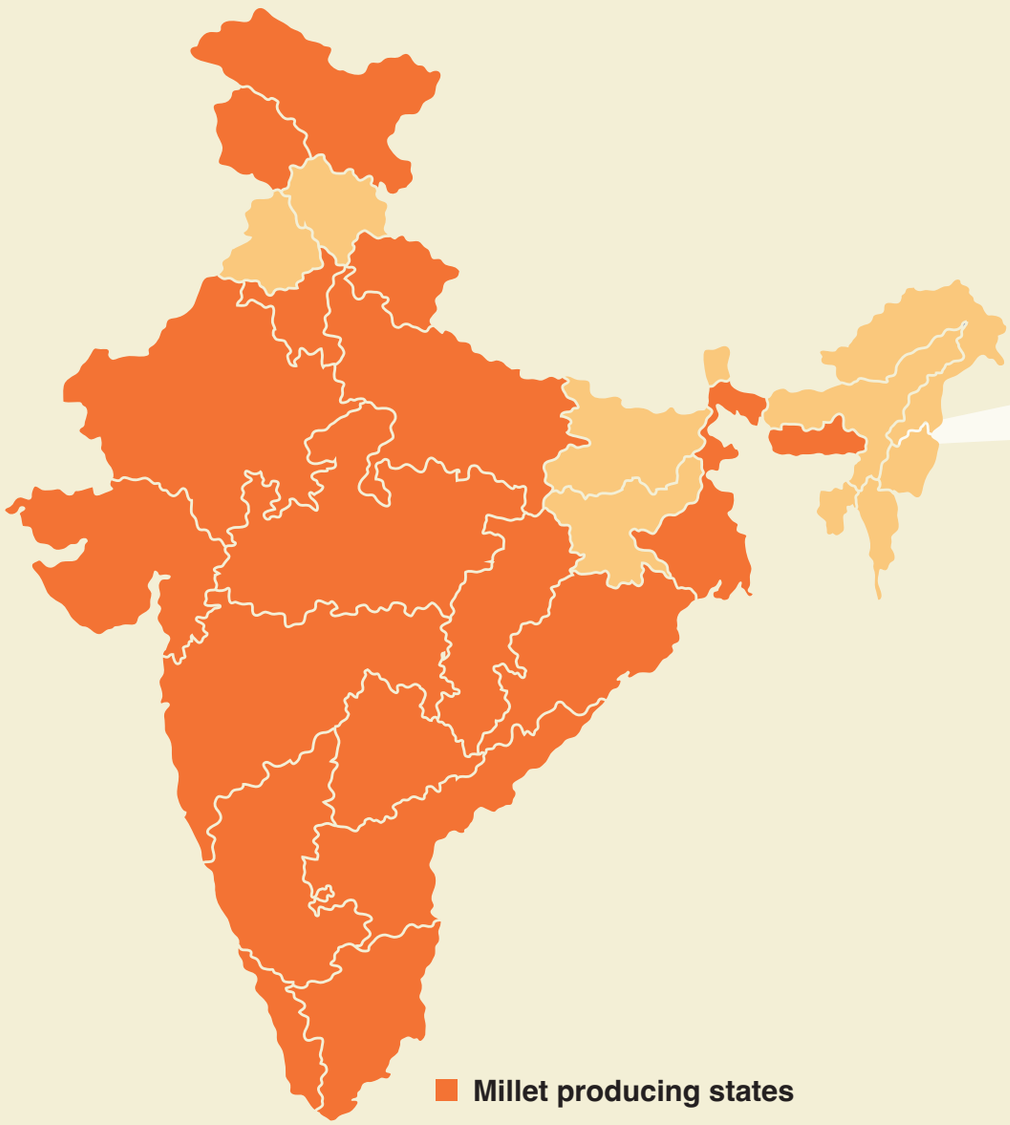
5th largest exporter in 2020[103]

Top Millets Producing States

Rajasthan, Karnataka, Maharashtra, Uttar Pradesh, Haryana and Gujarat

GOVERNMENT INITIATIVES

- Promoting millets at the national and international level through 'Year of Millets' and 'National Millet Mission'
- Organizing Millet Trade Fairs to facilitate interaction between producers, buyers and exporters
- Promoting millets in the Public Distribution Scheme and Mid-day meal Scheme
- Price Support Scheme for financial assistance to farmers.
- Organizing Millet Start-up Innovation challenges
- Providing assistance for post-harvest value addition to millets and branding millet products



Foxtail Millet I Finger Millet I Barnyard Millet I Browntop Millet
Little Millet I Kodo Millet I Pearl Millet I Proso Millet I Sorghum

8.2 INTEGRATED DEVELOPMENT OF HORTICULTURE

The horticulture sector in India contributes about 30.4% to the country's Gross Domestic Product (GDP) while using only 13.1% of the gross cropped area, thereby being a very productive and significant contributor to the Indian economy[104]. India has emerged as a global leader in the production of a variety of fruits and is the second largest producer of fruits and vegetables. Besides, India has maintained its dominance in the production of spices, coconut and cashew nut[105].

Appreciating the need for the agricultural sector to adapt to the vagaries of climate change, the Mission for Integrated Development of Horticulture (MIDH) is being implemented from 2014-15 with the objective of infusing technologies and systems that will make the sector more climate resilient. The Mission helps set up nurseries and tissue culture units for the production of quality seeds, tubers, bulbs and other planting materials, as well as poly-houses and greenhouses to improve productivity and grow high value vegetables and fruits throughout the year. It helps farmers expand their operations by training them in bee-keeping, mushroom cultivation and other allied remunerative activities. MIDH encourages, assists and certifies farmers moving towards organic farming, helps them with mechanization of their processes and creates infrastructure for post-harvest management and marketing of their produce. A focus area of operation is to ensure that farmers are water efficient and water sufficient.

MIDH has 51 centres of excellence, and 42 of these are in collaboration with Israel, a pioneer in developing sustainable technologies and solutions for all agricultural sectors. The centres provide Indian farmers with rapid transfer of new technologies that are adapted to local conditions. They have trained over 120,000 farmers, and the centres produce more than 40 million premium quality seedlings and saplings annually[106].

Significant progress has been made in increasing land under protected cultivation, and between 2014-15 and 2022-23, an additional 272482 ha of land has been covered with poly-houses, greenhouses and plastic mulching[107]. The government is collaborating with multi-lateral institutions to help increase the income and climate resilience of farm households in different states. These collaborations offer opportunities for crop diversification, climate adaptation and equal economic and social development across the state's rural areas. They support horticulture value chains, which will have a positive impact on food security.

Other key initiatives of the government are:

Comprehensive crop insurance coverage for non-preventable natural disasters through the Pradhan Mantri Fasal Bima Yojana

Cluster development programmes that leverage the geographical specialisation of horticulture clusters, which help create scale and enhance the value chain

Several schemes launched by The Ministry of Food Processing Industries, aimed at **creation of cold chain infrastructure, agro-processing clusters,** backward and forward linkages, preservation infrastructure, and Mega Food Parks

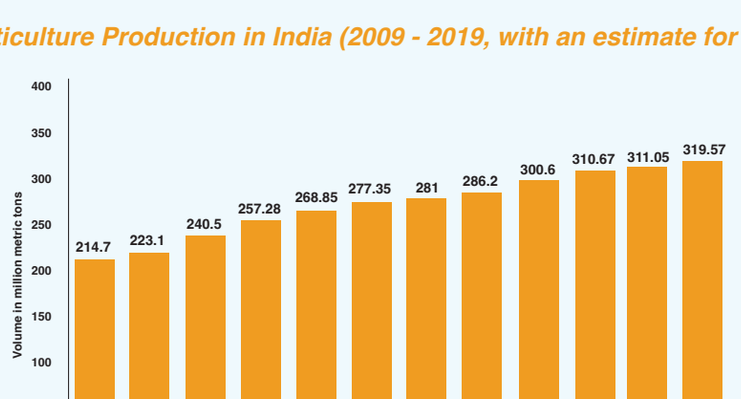
Post-harvest infrastructure schemes to reduce post-harvest losses

A **Land Lease Act** to help legalise leasing and allow tenants access to insurance and credit

Soil Health Cards to promote soil health

Clean Plant Programme (CPP) initiated with the aim of ensuring access to **disease free horticulture planting material** for global competitiveness of the Indian horticulture sector.

Horticulture Production in India (2009 - 2019, with an estimate for 2020)



Source: Statista[108]

8.3 NATIONAL INNOVATIONS IN CLIMATE RESILIENT AGRICULTURE (NICRA)

A unique project which brings all sectors of agriculture, viz., crops, horticulture, livestock, fisheries, natural resource management and extension scientists on one platform, NICRA has the following objectives:

- to undertake strategic and applied research on climate change adaptation and mitigation
- to validate, demonstrate and assess the impact of climate resilient technologies on farmers' fields and
- to strengthen the capacity of scientists, farmers and other stakeholders in climate-resilient agriculture

Almost 75 research institutes and universities, as well as several NGOs, are involved in the project.

Significant achievements of the project include studies on the impact of elevated temperature and CO_2 on essential food crops, livestock, fisheries, soil carbon, pests and diseases. 1752 climate-resilient crop varieties tolerant to abiotic stresses like drought, flood, heat waves, etc. have been developed. Location-specific GHG inventory and carbon sequestration potential of different production systems have been established. Risk and vulnerability of Indian agriculture to climate change has been assessed at a district level, as per the latest IPCC reports. These assessments are used to prioritise resources related to climate actions in agriculture. Agricultural contingency plans are ready for 650 districts. Climate-induced pest and disease outbreaks in the country were studied in nine crops to build pest and disease forewarning models. Web-enabled and mobile applications for pest forewarning have been developed.

Location-specific technologies that can impart resilience against climatic vulnerability are being demonstrated in 151 climatically vulnerable districts across the country. Village level institutional mechanisms such as Village Climate Risk Management Committees (VCRMC), custom hiring centres of farm machinery, etc,. are established to improve the timeliness of operations during the limited window periods of moisture availability in rainfed areas, and to promote small farm mechanisation. These interventions have helped farmers reduce yield losses and enhanced their adaptive capacity against climatic variability.

A large-scale capacity-building program on climate resilient agriculture is being undertaken with the involvement of more than 2200 scientists and research scholars across the country. These resilient practices are being adopted by communities and spreading beyond NICRA villages. In the last ten years, 16958 training programs have been conducted throughout the country under the NICRA project to educate stakeholders on various aspects of climate change and resilient technologies, covering 514816 stakeholders. This has enabled wider adoption of climate-resilient technologies and minimised yield loss due to extreme weather[109].

8.4 ORGANIC FARMING

To improve soil health and build climate resilience in the agricultural sector, the Government of India has been promoting organic farming in the country through two dedicated schemes namely, Paramparagat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development for North Eastern Region (MOVCDNER), since 2015-16. Both schemes provide end-to-end support to farmers engaged in organic farming, i.e., in production, certification, processing, packaging, and marketing. PKVY is being implemented in all States except the North Eastern States. MOVCDNER scheme is implemented exclusively in the North Eastern states.

The government has initiated a Large Area Certification (LAC) programme since 2020-21 to certify large traditional / default organic areas such as hills, islands, tribal or desert belts with no history of genetically modified crops and agrochemical use.

Since 2015-16, an area of 1.18 million ha has been brought under organic farming through PKVY and 0.17 million ha through MOVCDNER[110].

Sikkim Organic Mission

Sikkim is a small Himalayan state in northeast India. A biodiversity hotspot, its fragile mountainous ecosystem is environmentally unsustainable for intensive mechanical farming. In early 2003, to preserve its natural resource capital, the state's legislative assembly passed a resolution to adopt organic farming exclusively. The Sikkim Organic Mission gathered momentum in 2010, and today, the state is the first democratic model of organic farming in the world.

In the preparatory stage between 2003 and 2010, several pilot programmes supporting organic farming were implemented, including compost preparation, manufacture of organic fertilizers and pesticides, etc., and farmers were trained in organic farming practices. Beginning in 2005, the government worked on reducing the demand for chemical fertilizers and pesticides by reducing their subsidies by 10 per cent annually, and all subsidies were finally phased out by 2008. Simultaneously, they also reduced the supply of fertilizers by reducing and eventually banning (in 2014) the import into the state. The solid political will exercised by the state government, along with the provision of a practical road map and policies with well-defined targets, have been vital to the mission's success. The certification of farms according to international standards also gave farmers a goal to aim for and has been another factor in the accomplishments of this mission.

Other actions under the Sikkim Organic Mission included:

- The development of export markets
- Setting up organic seed banks with efficient production and distribution
- Establishing seed and soil testing laboratories
- Opening local organic outlets
- Instituting centres of excellence to demonstrate organic farming methods and oversee trials

The MOVCDNER scheme provided support to farmers in the form of planting materials, inputs, and mechanization, as well as financial assistance to Farmer Producer Cooperatives (FPCs) to develop infrastructure for aggregation, storage, and value-addition. The scheme also enabled the organic certification of FPCs under the National Programme for Organic Production (NPOP), allowing FPCs and traders to export their products from Sikkim.

Impact:

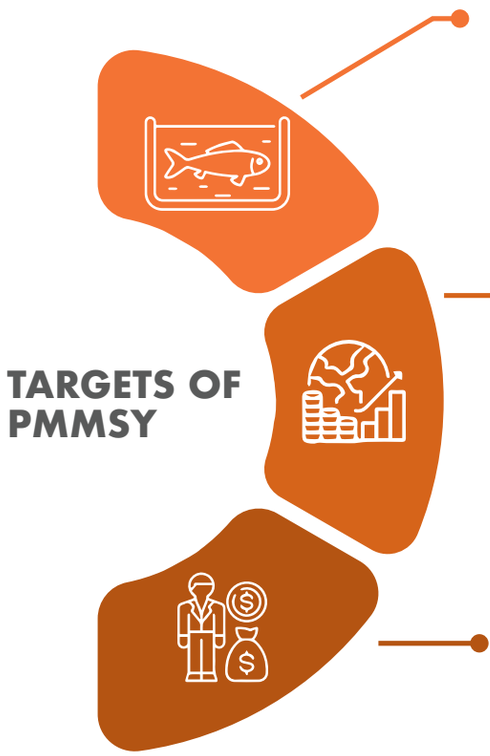
In Sikkim, 100 per cent of the farmlands are certified organic today. This transition has benefitted more than 66,000 farming families practising organic and agroecological farming on more than 76,000 ha of land. The benefits include better health, rural development, and sustainable tourism in the state. By including an understanding of organic farming in the school curriculum, generations of locals will understand and want to follow sustainable farming practices from a young age. The Sikkim Organic Mission is receiving attention from other Indian states and other Asian countries, and many State governments have announced action plans and funding for organic farming[111].

8.5 PRADHAN MANTRI MATSYA SAMPADA YOJANA

Pradhan Mantri Matsya Sampada Yojana (PMMSY) is a holistic development scheme for the fisheries sector in India. Its precursor was the Blue Revolution, launched in December 2015 as a centrally sponsored scheme with an outlay of USD 360 million (INR 30 billion) over five years (2015-16 to 2019-20) to catalyse the development and management of the Fisheries Sector. By 2018-2019, fish production increased by 34%, productivity per hectare increased by 43% and exports increased by 39%[112].

Under PMMSY, the central government allocated a further USD 2.4 billion (INR 200 billion) in 2020 for five years, committing the biggest ever investment in the history of Indian fisheries. As it completes three years, PMMSY has successfully infused technology into traditional fishing, inspiring many women and youth to venture into entrepreneurship in fisheries. Today, young women entrepreneurs from the Kashmir Valley are efficiently rearing cold-water rainbow trout and aquapreneurs in Nellore have become successful shrimp exporters.

PMMSY has empowered fisherwomen to explore remunerative options and alternate livelihoods, such as ornamental fisheries, pearl culture and seaweed cultivation. Fisheries are also moving to non-traditional areas, and almost 20000 ha of fresh pond area is being brought under inland aquaculture, even in land-locked states. This scheme has covered thirty-five States and Union Territories, and 1.6 million people have benefitted directly and indirectly. A recently launched USD 15 million (INR 1.2 billion) seaweed park will promote seaweed cultivation in 136 coastal villages of the country. Many marine species rely on seaweed for survival, and it has the potential for many medicinal and industrial uses.



Fish Production and Productivity

- Increasing fish production to 22 million metric tonnes by 2024-25 from 13.75 million metric tonnes in 2018-19.
- Enhancing aquaculture productivity to 5 tonnes per hectare from the current national average of 3 tonnes.
- Augmenting domestic fish consumption from 5 kg to 12 kg per capita.

Economic Value Addition

- Increasing contribution of fisheries sector to the Agriculture GVA to about 9% by 2024-25 from 7.28% in 2018-19.
- Doubling export earnings to USD 12 billion (INR 1 trillion) by 2024-25 from USD 5.5 billion (INR 466 billion) in 2018-19.
- Facilitating private investment and growth of entrepreneurship in the fisheries sector.
- Reduction of post-harvest losses from the reported 20-25% to about 10%.

Enhancing Income and Employment Generation

- Generating 5.5 million direct and indirect employment opportunities along the value chain.
- Doubling the incomes of fishers and fish farmers.

09

INDIA'S CLIMATE ACTIONS

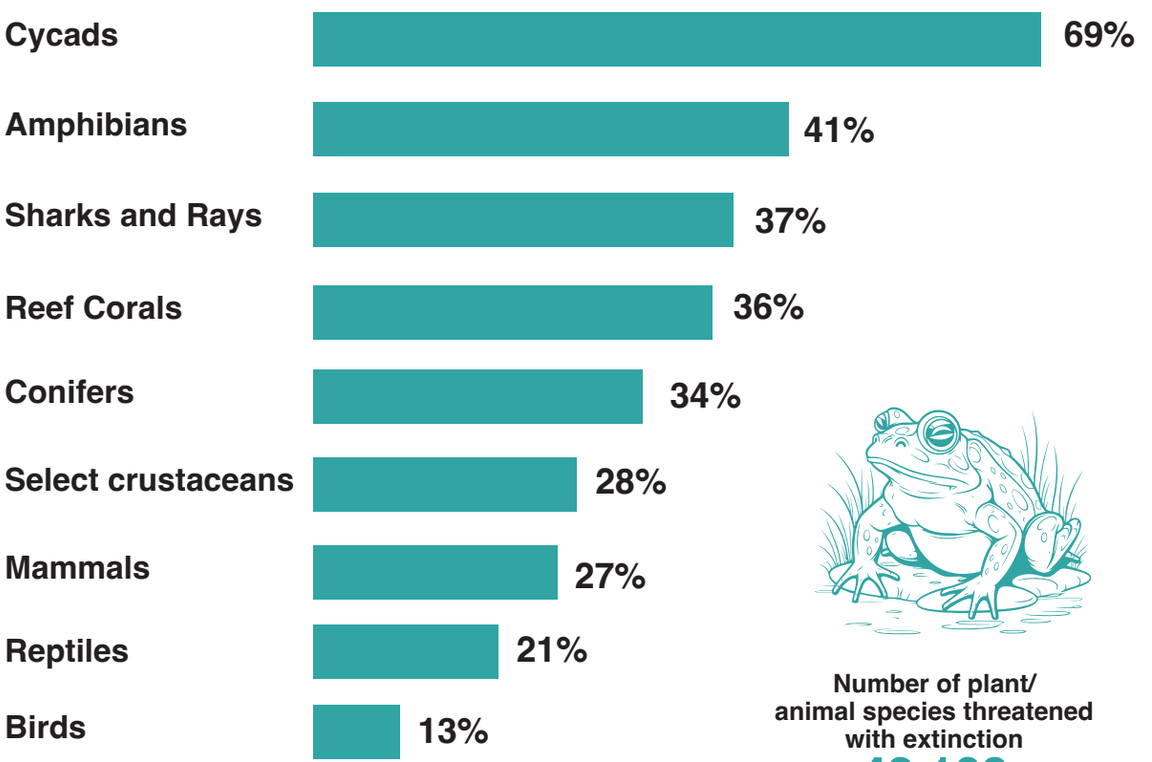
BIODIVERSITY CONSERVATION

Credits: Adobe stock

09

INDIA'S CLIMATE ACTION - BIODIVERSITY CONSERVATION

Percentage of assessed species threatened with extinction (2023)



Number of plant/ animal species threatened with extinction

42,108

Based on the assessment of 150,308 species

Source: IUCN[113]

Climate change is a significant factor in the decline of biodiversity by altering marine, terrestrial, and freshwater ecosystems worldwide. Rising temperature increases the risk of species extinction. The international global framework to address the issue of biodiversity loss is the UN Convention on Biological Diversity, within which Parties adopted the Kunming Montreal Global Biodiversity Convention in December 2022. Within the framework of SDG, goal 15 deals with the protection of ecosystems, managing forests and halting biodiversity loss.

India is home to some of the most fascinating and iconic wildlife in the world. It is one of 17 mega-diverse countries, harbouring 7-8% of the recorded species of the world, including about 91,200 species of animals and 45,500 species of plants that have been documented in its ten bio-geographic regions. India also possesses a high rate of species endemism and is globally ranked tenth in birds, seventh in amphibians and fifth in reptile endemism[114]. It has parts of four biodiversity hotspots in the world. India is also recognized as one of the eight Vavilovian centres of origin and diversity of crop plants, having more than 300 wild ancestors and close relatives of cultivated plants, which are still evolving under natural conditions.

India has a vast coastline of over 7,500 km, and the wide range of coastal habitats are characterized by rich and unique biodiversity. Forests and trees cover 24.62% of the geographical area of the country, with over 16 major forest types and 251 sub-types[115]. India is also a frontrunner in the conservation of wetlands. As a Contracting Party to the Ramsar Convention, India has 75 Ramsar sites covering an area of 13,26,677 ha in the country.

The country has established an impressive network of 998 Protected Areas comprising 106 National Parks, 567 Wildlife Sanctuaries, 105 Conservation Reserves and 220 Community Reserves covering a resounding total area of area of 173629.52 sq km, which is approximately 5.28% of the total geographical area of the country. It works on a 'landscape-based approach' to conservation, and its Integrated Development of Wildlife Habitats (IDWH) plan supports conservation activities not just in protected areas but in regions contiguous with protected areas as well.

Project Tiger, Project Elephant, Project Snow Leopard, Project Rhino and Project Crocodile are examples of flagship initiatives by the Union Government for enabling species recovery, protection and conservation of wildlife and their habitats.

The Government of India has also taken initiatives to support in-situ conservation of medicinal plants through the establishment of Medicinal Plants Conservation and Development Areas (MPCDAs) throughout the country. The establishment of MPCDAs is pioneering work being done by India towards the conservation of globally significant and red-listed medicinal plant species and the restoration of forest landscapes.

India has made remarkable efforts at a national level to improve and protect its biodiversity. In 1976, the Indian Government passed the 42nd Amendment to the Constitution to include environmental protection as a constitutional mandate. It has implemented various policies and plans for biodiversity conservation and has made several national and international commitments that demonstrate the country's resolve further the conservation of its globally significant biodiversity.

9.1 NATIONAL COMMITMENTS TOWARDS ACHIEVING INTERNATIONAL TARGETS

India has voluntarily stated / agreed to stringent commitments at a national level to protect biodiversity. Some key national commitments include:

A set of National Biodiversity Targets aligned with the Aichi targets, agreed by all parties to the Convention on Biological Diversity.

UNCCD

At the 14th Conference of Parties to the United Nations Convention to Combat Desertification in 2019, India committed to restoring an additional 5 million ha of degraded land by 2030, raising the total land area to be restored to 26 million ha.

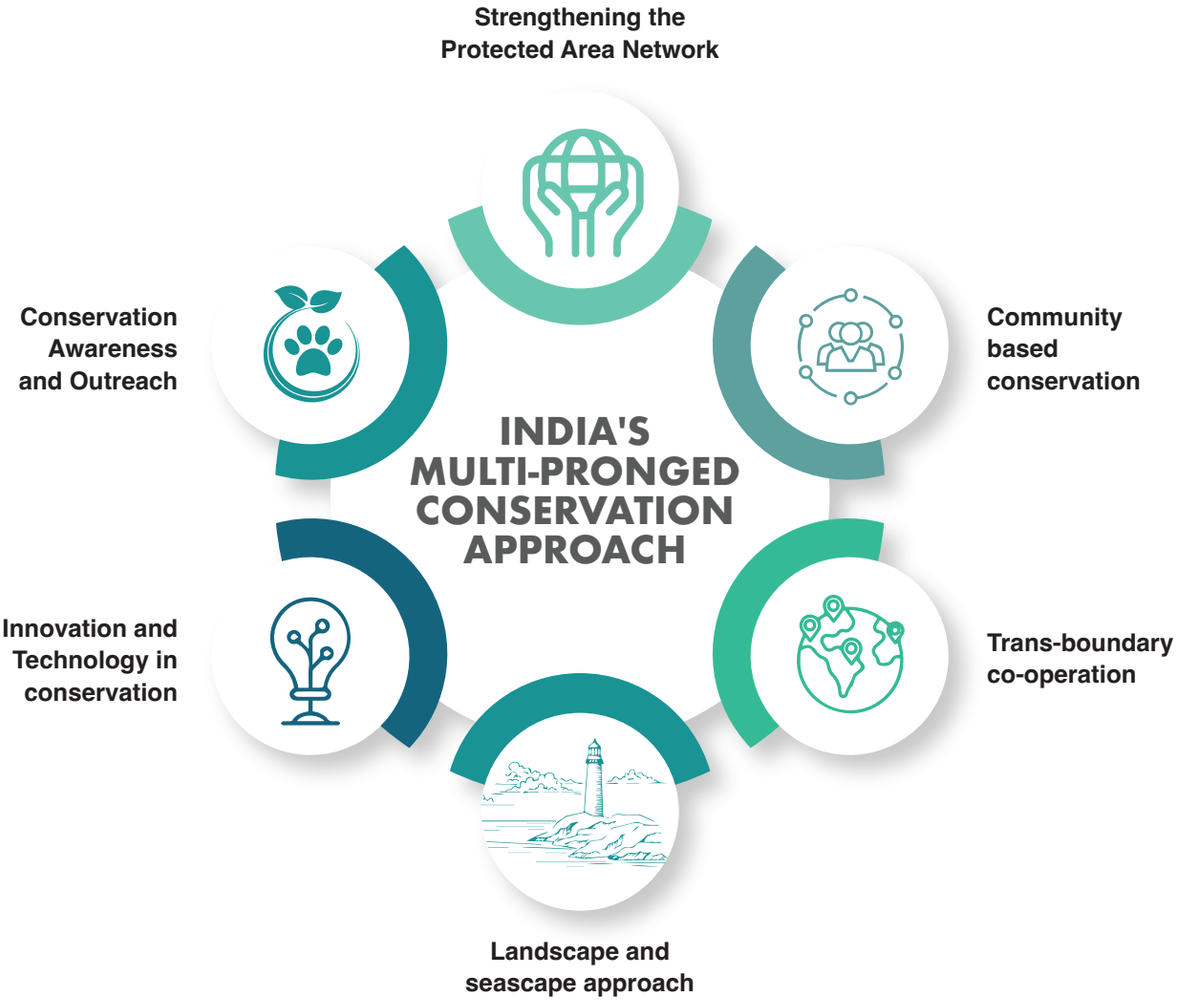
India was one of the first countries to commit to the 2030 Sustainable Development Goal target of achieving land degradation neutrality.

In its NDC to the UNFCCC, India committed to create an additional carbon sink of 2.5 to 3 billion tons of CO_2 equivalent through additional forest and tree cover by 2030.

India has adopted the Kunming-Montreal Global Biodiversity Framework, which has 4 broad global goals and 23 global targets. Most prominent among these is a target to conserve 30% of the world's land and oceans by 2030 – widely referred to as the '30×30' target. India aspires to contribute to this through a well-connected network of protected areas and Other Effective area-based Conservation Methods (OECMs).

9.2 SPECIES RECOVERY AND CONSERVATION

India has undertaken intense efforts towards wildlife conservation and species recovery. These efforts have evolved with time, and focus not just on a species but on overall landscape and habitat conservation. The country has been using a multipronged conservation approach so that sustained outcomes are achieved in optimal timeframes. Some of these actions are listed below:



Initially, the efforts were centred on keystone species – species that play a pivotal role in the health of their entire ecosystem, without which the ecosystem would cease to exist in its current form – which included apex predators and large herbivores. Conservation of these species, therefore has a trickle-down effect on the conservation of a variety of other species that share their habitat.

Protecting the habitats of keystone species also helps climate change impacts. Healthy rivers, forests, mangroves and grasslands limit the severity of floods and droughts, sequester carbon and provide livelihoods. Hence, a large landscape approach towards conservation has multiple benefits for both biodiversity and humankind.

As the conservation efforts of keystone species started bearing fruit, the attention has been shifted to other endangered species. Projects to increase their numbers have been designed along the lines of successful conservation projects for the keystone species. India is working on the recovery of 25 species under the IDWH plan.

Over a span of 16 years, the wild tiger count in India has increased 124% - from 1411 (in 2006) to 3167 (in 2022). India has the distinction of having the maximum number of tigers in the world compared to other tiger-range countries.

India is party to the Global Snow Leopard and Ecosystem Protection (GSLEP) Programme, which works through an alliance of all twelve snow leopard range countries, civil society organizations, multi-lateral institutions, scientists, local communities, and the private sector.

The Asiatic Lion survives in the wild today only in India, and timely protection measures have helped increase their numbers to over 700 in the Gir Protected Area Network and downlisting of the species from Critically Endangered in the 1990s to Endangered in 2008 by the IUCN. Conducive corridors of forested patches have been created, and the Asiatic Lion Landscape now covers approximately 30,000 square km distributed over nine districts of Saurashtra.

India launched Project Elephant in 1992 to safeguard the Asian elephant, its habitat, and corridors. India is home to 29,964 Asian elephants as per the 2017 census, accounting for almost 60% of the world's population, which roam around 33 elephant reserves spanning 16 states of the country. Scientific research in Project Elephant was not restricted to disease management and anatomical studies of the Asian Elephant, but also included the development of high-yielding varieties of paddy that the elephant doesn't relish or the development of elephant-proof storage bins, among others, to reduce man-animal conflicts.

The conservation of the great Indian one-horned rhinoceros (Rhinoceros Unicornis) is one of the greatest conservation success stories in Asia, and the species has been downgraded by the IUCN Red List from Endangered to Vulnerable. With barely 75 of these large mammals in 1905, their numbers increased to 2700 by 2012, and a bi-annual survey conducted in 2022 puts their current numbers at 4014.

The sighting of a nest of a female gharial with 28 hatchlings on the banks of the Mahanadi in Odisha in May 2022 is one of the first reports of gharial breeding in the wild in four decades in the state. Gharials are also being sighted for the first time in many years in stretches of the Ganga, Yamuna, Kosi and Brahmaputra rivers, which speaks well for conservation efforts.

The brow antlered deer or dancing deer known as the Sangai (Rucervus eldii) is listed as Endangered in the IUCN Red List. It was thought to have become extinct around 1950, but during a census conducted for the IUCN in 1953, six of them were found on a floating landmass in Loktak Lake in Manipur. Since then the Government has taken many steps to conserve this species, and its population in 2016 was 260.

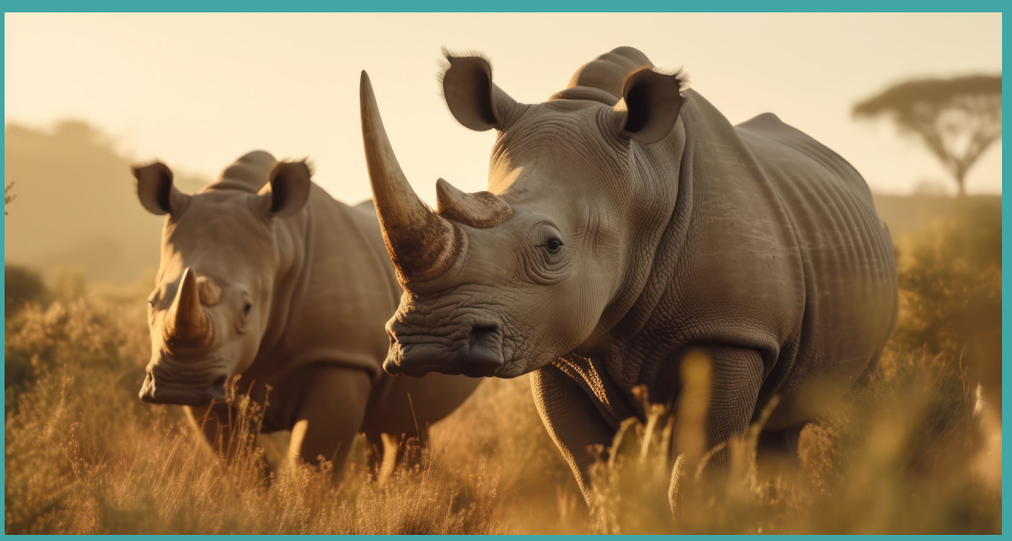
Kanha National Park and Tiger Reserve (KNPTR) has spearheaded the conservation of the hard ground or southern swamp deer (Rucervus duvaucelii branderi), and its numbers have increased from 66 in 1967 to 800 in 2020.

India has identified all its significant sea turtle nesting habitats as 'Important Coastal and Marine Biodiversity Areas' and included them in the Coastal Regulation Zone (CRZ) -1. Over 500,000 turtles laid eggs over only four days in 2023 in Gahirmatha Marine Sanctuary, the world's largest rookery of sea turtles. The Forest department and green activists believe that a record number of hatchlings might have emerged and made their way into the sea.

Cognisant of the number of Great Indian Bustards (GIB) being electrocuted, the Supreme Court of India has ordered power companies in Rajasthan and Gujarat to lay underground wiring for all electricity distribution projects and install bird diverters on existing lines in the GIB's priority habitat regions.

In September 2021, the Government of Tamil Nadu demarcated a 450 sq km stretch where the country's first dugong conservation reserve has come up.

Involvement of local communities can play a substantial role in conserving wildlife habitats, as shown by the Monpa and Brokpa communities of Lumpo and Muchut villages in Arunachal Pradesh, who religiously patrol the core and buffer zones of the red panda habitat to monitor biodiversity, prevent hunting and dismantle snares. This has helped reduce poaching significantly.



9.3 FOREST COVER

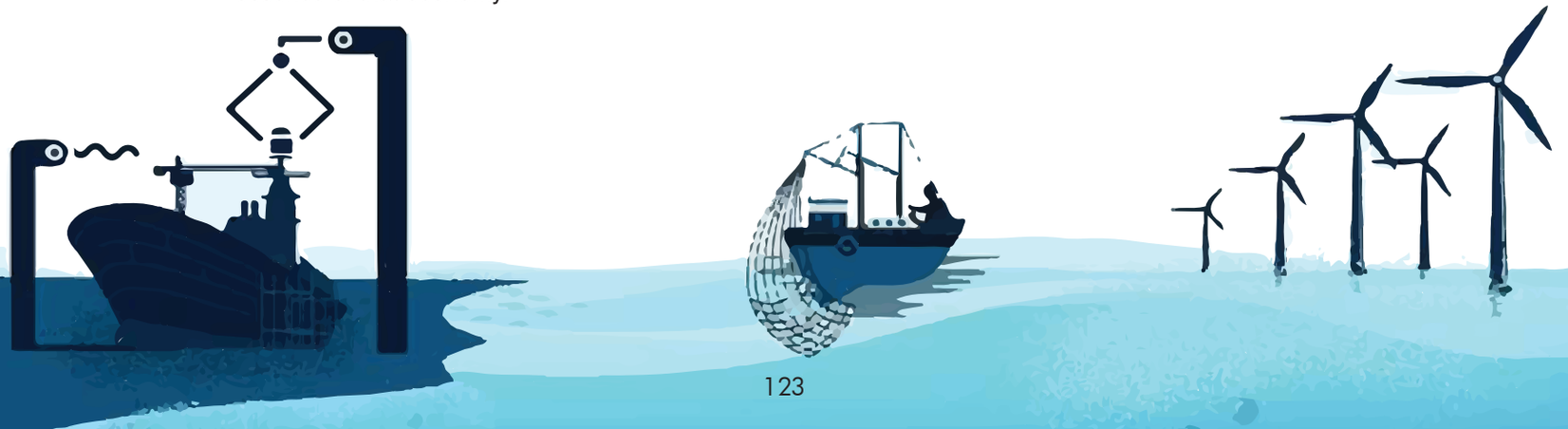
According to the Forest Survey report of 2021, the forest and tree cover of the country is 80.9 million ha, which is 24.62% of the geographical area of the country. Compared to the estimate of 2019, this marks an increase of 2,261 sq km over two years. Seventeen States / Union Territories have more than 33 % of their geographical area under forest cover, with five having more than 75% under forest cover. Total carbon stock in the country's forest is estimated to be 7,204 million tonnes, an increase of 79.4 million tonnes compared to 2019. The annual increase of carbon stock is 39.7 million tonnes. The total mangrove cover in the country is 4,992 sq km, an increase of 17 sq km since the 2019 survey[116].

The biennial assessment of forest cover in the country is done using Indian Remote Sensing Satellite data and information from collateral sources. Interpretation of the satellite data is followed by rigorous ground-truthing. An intensive quality check and quality assurance exercise is also carried out. The survey captures thematic and geographical information, which provides valuable data for policy planning and sustainable management of forest and tree resources in the country. The Forest Survey of India has also mapped climate change hotspots in Indian forests using computer-based models.

The Government encourages plantation drives across the country, including various metropolitan cities, through programmes and schemes such as Nagar Van Yojana (NVY), School Nursery Yojana, Compensatory Afforestation Fund Management and Planning Authority (CAMPA), National Afforestation Programme (NAP), National Mission for a Green India (GIM), etc. These promote urban forestry, tree plantation on vacant lands and bunds, on farmlands, etc., by involving local communities, NGOs, educational institutions, local bodies, and others.

9.4 BLUE ECONOMY

Focus area of India's G20 Presidency, the Blue Economy recognizes the importance of ocean resources for economic growth. The country will soon release a policy outlining the vision and strategy for India to protect, conserve and utilize its marine resources sustainably. With a coastline of over 7500 km and an exclusive economic zone of over 2 million sq km, India's coastal economy currently sustains almost 5 million fisherfolk, but opportunities are far greater[117]. The blue economy policy aims to increase the contribution of the blue economy to India's GDP, which would require combating the impacts of climate change on oceans, and protecting and enhancing the biodiversity that is the essence of that economy.



9.5 THE ROLE OF COMMUNITIES IN ECOSYSTEM CONSERVATION

Local communities play a vital role in wildlife conservation. In a populous country like India, where land and resource constraints result in frequent human-wildlife interactions, conservation projects need to be inclusive and consider the needs and traditional knowledge of local indigenous communities. Several communities like the Bishnoi, Maldhari and Gujjar have enshrined beliefs and practices which foster biodiversity protection. Protectionist conservation projects do not allow for healthy and genetically resilient growth of wildlife beyond the carrying capacity of the exclusive zone. The role of local communities in enhancing conservation efforts is therefore gaining significance.

Engaging communities in wildlife conservation in the present day is often challenging and time-consuming. It requires perseverance and close interaction between multiple players, including government departments, scientists, non-governmental organizations and all members of the local community.

Over many years of implementing participatory management of wildlife habitats, India has many stellar examples of community-driven habitat restoration and wildlife conservation. A few of these, from different parts of the country, with varied stakeholders and drivers, and covering a variety of fauna are showcased here.

9.5.1 COMMUNITY EFFORTS IN THE CONSERVATION OF A CRITICALLY ENDANGERED BIRD SPECIES

Forests around the Eaglenest Wildlife Sanctuary in Arunachal Pradesh, governed and managed by the Bugun tribe, are teeming with rare wildlife, including the elusive red pandas, Himalayan black bears, Asian elephants, marbled cats, clouded leopards, yellow throated martens and Bhutan glory butterflies. The rarest of them all is the Bugun Liocichla (Liocichla bugunorum), a critically endangered bird species, with only 14-20 individuals believed to exist worldwide.

The bird's discovery catapulted the Bugun tribe and their community forests into a birding spotlight, leading to a series of conservation activities. Volunteer naturalists did a meticulous mapping of the area's fauna especially the birds, amphibians, reptiles and butterflies. The community got talking about the need for conserving the local forests, water resources, flora and fauna. The villagers are now increasingly mindful of cutting trees near the rare bird's habitat and of protecting the watershed to prevent flooding and landslides.

They have moved their farms away from the locations where the bird is found, and only genuine nature enthusiasts are welcomed to the ecotourism camp, which was set up in 2006.

Over time, the villagers decided to make 17 sq km of their land into a community reserve, and the Singchun Bugun Village Community Reserve came into being in 2017. The reserve is patrolled by local youth, and the extraction of non-timber forest products is regulated by the Joint Management Committee. The Reserve's staff conduct numerous wildlife conservation awareness camps for students and teachers.

The Singchun Bugun Village Community Reserve has received multiple awards for having the best-conserved community forests, and for being an outstanding biodiversity conservation model. Indian Forest Service officers visit Singchun to understand the process of setting up the Reserve and the factors that make it such a success.

9.5.2 BIODIVERSITY CONSERVATION THROUGH ECOTOURISM

Mangalajodi is a village on the northern banks of the Chilika Lake, Asia's largest brackish water lake and a Ramsar site. The village abuts a freshwater marsh with reed beds, shallow waters and hard ground. A birding hotspot through the year, in the winters, it transforms into a birder's paradise with thousands of migratory water birds from as far as Northern Russia and Mongolia descending on these marshes.

Until the mid-90s, the village was infamous for bird poaching, which was a major source of livelihood for the villagers. Considered a delicacy and a rich source of protein, the water birds fetched good money in the market, as did their eggs. In 1997, a non-governmental organization began a slow process of protecting the birds. They built trust with the community by listening to them and forging friendships. They created awareness on the impacts of poaching on the entire ecosystem and showed them the prospect of a respectable lifestyle with income generated from ecotourism instead of poaching.

By 2000, a bird protection committee was formed. As poaching reduced, the number of birds in the marshes by the village increased, and by 2005, tourists started coming to see the migratory birds. The poachers who knew the wetlands like the back of their hands turned into birding guides. The committee now has 25 members who patrol the creek and bunds and keep track of the number and location of nests and eggs. They coordinate with scientists who visit the area for research studies, which also increases their knowledge of ecosystem functioning.

In 2009, the Mangalajodi Ecotourism Trust was set up. Requisite ecotourism related training was given to villagers. Several homestays and ecotourism cottages have come up in the village. A visitor's centre has been set up and awareness programmes are held for school children and other target audiences. Further ecotourism measures are being discussed.

In September 2020, apart from 500 thousand birds recorded in Mangalajodi, the Chilika wetland registered 1.14 million birds during the season. The Government of Odisha has recognised efforts in the village through many awards.

9.5.3 RESTORATION OF FOREST HABITAT IN NORTH SHAHDOL FOREST DIVISION FOR LONG-TERM TIGER CONSERVATION

The Central Indian Landscape encompasses 14 protected areas, including 11 tiger reserves and is recognized as a region with one of the best potential for tiger conservation. It has some of the largest contiguous forested areas that are connected through wildlife corridors, allowing tigers to move between the many reserves, which helps improve the genetic diversity of the big cats in the region.

The Bandhavgarh and Sanjay-Dubri tiger reserves in the Central Indian Landscape are connected through wildlife corridors that extend across the North Shahdol Forest Division. The forested areas in this division were increasingly fragmented due to cattle grazing, which affected the wild ungulate population, and changed of land use from forested areas to agricultural fields. There was, therefore, an urgent need to establish a viable corridor for wildlife movement in this region, free from such anthropogenic pressures.

The Madhya Pradesh Forest Department, and a non-profit organization initiated a 'Forest Habitat Restoration project' in 2018 to restore degraded forest patches over an area of 80 hectares. Project planning was done with a variety of stakeholders, including the National Highway Authority of India, the Indian Railways, the Revenue Department and the Public Works Department, among others, to ensure that infrastructure projects are appropriately aligned, without impacting the wildlife corridors.

A multi-disciplinary landscape approach was adopted, and local villagers were involved in all project activities. Selected plots were cleared of invasive weeds, and 40000 saplings of native tree and bamboo species were planted. The local communities regularly monitored the plantation sites, and grazing and trespassing were prohibited. The past four years have shown encouraging results of forest growth. The project plan considered community needs, and saplings were not planted deliberately in specific areas. These areas have seen luxurious growth of local grasses and shrubs after the removal of the invasive weed species, and provide the villagers with adequate fodder for livestock. The grazing in forested areas has reduced, bringing down human-wildlife conflict situations. Similar work has commenced on a further
100 acres.

9.5.4
URBAN REWILDING

The Aravali Biodiversity Park covering, 380 acres, has come up on what was once many quartzite stone quarries. It's an example of the power that ordinary people can have, to effect positive change in their surroundings. iamgurgaon, a citizen's initiative in the city of Gurugram in Haryana, part of the National Capital Region, is the driving force behind this project and has established the largest public-private partnership to reforest 380 acres of barren quarried land belonging to the state government.

The forests of the Aravali hills act as a green barrier, preventing the spread of the Thar desert. The canopy cover on these hills regulates precipitation, helps recharge groundwater, and is a rich habitat for biodiversity. It is home to leopards, wolves, varieties of deer, cranes, coots, pelicans and other fauna. Excessive mining destroyed the green cover in this region and in 2004, the Supreme Court of India, recognizing the ecological importance of the Aravalis, banned mining here. Over the last 18 years iamgurgaon has rallied more than 20000 citizen volunteers, 50 schools and 70 corporations to convert mining pits bereft of any soil cover into a lush biodiversity park. More than 115,000 native trees of over 400 different species have been planted, some of which are rare and endangered species. The park has diverse micro-habitats including woodlands, grasslands and wetlands, which have brought back rich avifauna into the region, including 201 species of birds, a variety of amphibians, reptiles, moths, butterflies, beetles, bugs, ants, spiders and animals such as the nilgai, golden jackal, jungle cat, Indian hare, grey mongoose, striped palm squirrel, house shrew, Indian bush rat, flying fox and the Indian small civet. The Aravali Biodiversity Park has become a wintering ground for many migratory birds from Central Asia and beyond. Studies have been conducted to establish a baseline for monitoring future park restoration activities.

A gravity based drip irrigation system covers an area of 75 acres, saving 4 million litres of water annually. Two ponds have been created to restore the wetlands, which now recharge groundwater. Grey water from sewage treatment plants is also used to reduce the water footprint of the park.

Programmes are conducted regularly to encourage the engagement of the community with natural wilderness. These include nature walks and school-based awareness and activity programmes. Corporates are provided space for team building and volunteering activities

and an amphitheatre allows for the city to enjoy cultural activities in natural surroundings. The park management is working on setting up an interpretation centre to enrich the visitor experience.

The Aravali Biodiversity Park is the result of a unique public-private partnership model where local volunteers from urban communities have been the force behind change and have been supported in their efforts by the local government and corporations. It is a stellar example of 'of the people - for the people - by the people', a principle enshrined in the Constitution of India.

10 INDIA'S CLIMATE ACTIONS FISCAL INITIATIVES

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INDIA'S CLIMATE ACTION - FINANCING GREEN TRANSITION

With existing socio-economic challenges, India needs a people-first development paradigm to move towards a climate-secure future, and become a leading voice on climate action for the Global South. India's recent Union Budgets have embedded sustainability at its core as a way of running its growth engine. The Union Budget 2023-24 has a strong focus on initiatives that promote sustainable development and address key environmental issues. With programmes around green fuel, climate-friendly farming, green buildings, low-carbon mobility, and policies for efficient energy use across various economic sectors, the 2023-24 Budget lays a strong foundation for green growth – a step in the right direction for enabling climate action in India. Greening the economy is one of the top priorities for the country.

10.1 INDIA'S GREEN COMMITMENT THROUGH SUSTAINABLE FINANCE

India launched its first Sovereign Green Bonds (SGBs) issuance on January 25, 2023, which witnessed active participation from global as well as domestic investors. SGBs amounting to 1.91 billion USD (INR160 billion) have been issued in the last financial year for mobilising resources for green infrastructure projects. India has issued these bonds in two tranches of USD 959 million (INR 80 billion) each on 25th January 2023 and 9th February 2023 respectively. The proceeds are being deployed into public sector projects that contribute to expanding renewable energy production and reducing the carbon intensity of its economy.

Green bond proceeds allocated to renewable energy will support the roll-out of well proven renewable energy technologies, and research and development of new technologies, to help in India's energy transition journey.

Other projects eligible for funding from the SGBs include sustainable water and waste management, energy efficiency, green buildings, climate change adaptation, sustainable management of living natural resources and biodiversity conservation.

Apart from SGBs, the private sector and local governments have also issued Green Bonds, which have amounted to USD 21 billion as of February 2023. Private green bond issuers include corporates, utilities, banks and financial sector and industries. Ghaziabad Nagar Nigam, a civic body in Uttar Pradesh, was the first Indian local government to issue green bonds in 2021 and the Indore Municipal Corporation has issued green bonds amounting to USD 87 million in 2023.

Following the Sovereign issuance of green bonds, some Indian States are working on raising funds in a similar manner to address energy transition, sustainable land use, and increasing resilience to climate change impacts.

10.2 GREEN GROWTH IN THE UNION BUDGET 2023-24

The focus of the Indian Budget of 2023-24 is to support India in its vigorous pursuit of the 'Panchamrit' (five nectar elements) and net-zero emissions by 2070. India is implementing many programmes on clean energy transition, energy efficiency and greening of agriculture, mobility and habitats, among other sectors. It is also making great strides in biodiversity conservation to help mitigate the impacts of climate change. The Government is ensuring adequate budget provisions for the same through its green growth components.

Financing India's Progress towards its Climate Goals

Pradhan Mantri Programme for Restoration, Awareness, Nourishment and Amelioration of Mother Earth (PM-PRANAM)

to be launched to promote alternative fertilizers and the balanced use of chemical fertilizers

500 new 'Waste to Wealth' plants

to be established under the GOBARdhan Scheme to promote a circular economy

Green Credit Programme

to be notified under the Environmental Protection Act, to incentivise sustainable actions

Sustainable Ecosystem development

Mangrove Initiative for Shoreline Habitats and Tangible Incomes (MISHTI) to be taken up for mangrove plantation along the Indian coastline

Amrit Dharohar to be implemented to protect and wisely use wetlands

Other Initiatives

Setting up 10,000 bio-input resource centres to facilitate adoption of natural farming

Promotion of energy transition and energy storage projects

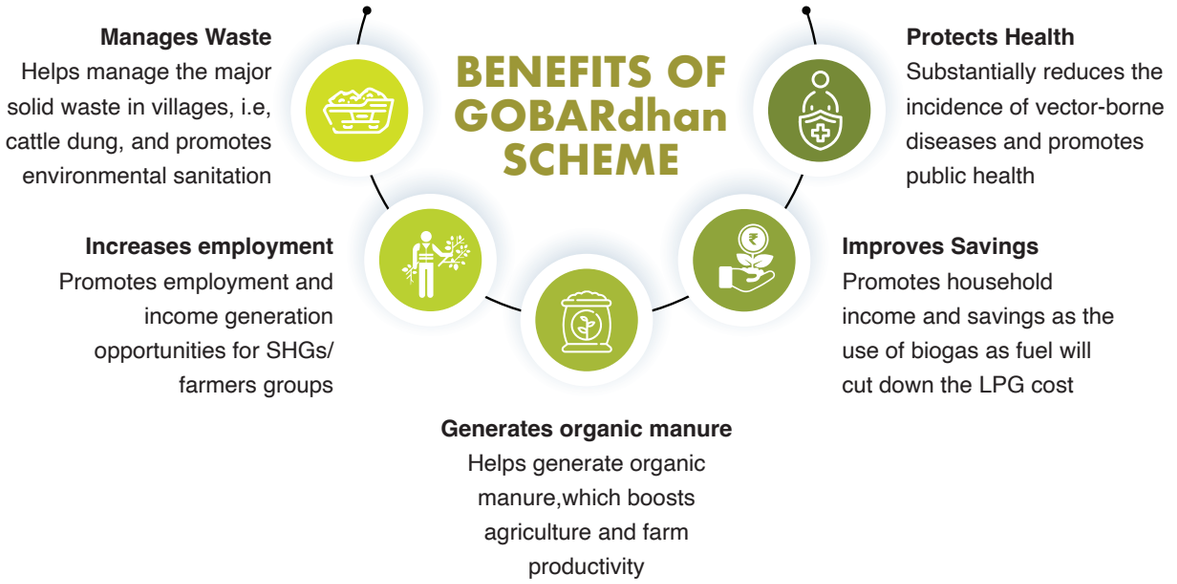
Promotion of coastal shipping for energy effcient transportation

Funds allocated for fleet replacement of government vehicles

10.3 GREEN GROWTH ELEMENTS OF THE UNION BUDGET 2023-24

GOBARdhan (Galvanizing Organic Bio-Agro Resources Dhan) scheme

An outlay of INR 100 billion has been allocated to the establishment of 500 new 'waste to wealth' plants under this scheme for promoting a circular economy and the production of bio-energy. These will include 200 compressed biogas plants (75 in urban areas and 125 in rural areas), and 300 community or cluster-based plants.



In due course, a 5% Compressed Bio-Gas mandate will be introduced for all organizations marketing natural and bio gas.

Green Hydrogen Mission

India has set its sights on becoming energy independent by 2047 and achieving Net Zero by 2070. To achieve this target, increasing renewable energy use across all economic spheres is central to India's energy transition. Green Hydrogen is considered a promising alternative for enabling this transition. Hydrogen can be utilized for long-duration storage of renewable energy, replacement of fossil fuels in industry, clean transportation, and potentially also for decentralized power generation, aviation, and marine transport.

An outlay of USD 2.36 billion (INR 197 billion) is provided to facilitate the development of green hydrogen production capacity of at least 5 MMT (Million Metric Tonne) per annum by 2030, with an associated renewable energy capacity addition of about 125 GW in the country. This has the potential to reduce nearly 50 MMT of annual greenhouse gas emissions and make the country assume technology and market leadership in this sunrise sector.

Energy Transition and Storage Projects

An allocation of USD 4.2 billion (INR 350 billion) is provided for priority capital investments towards energy transition and net zero objectives, and energy security. Energy storage technologies, with their ability to provide grid management services, will play a critical role in India's energy transition, as it aims to increase its renewable power generation capacity.

Battery Energy Storage Projects

Battery Energy Storage Systems with capacity of 4,000 MWh will be supported with Viability Gap Funding that is designed to provide capital support to public-private partnership projects, which would otherwise not be financially viable.

Renewable Energy Evacuation

An investment of USD 2.49 billion (INR 207 billion), including central support of USD 1 billion (INR 83 billion) has been provided for generation of 13GW renewable energy in Ladakh and strengthening the interstate transmission system for evacuation and grid integration of the same.

Green Credit Programme

To realize the vision of Mission LiFE and create a mass movement of planet-friendly actions that will help India achieve its net zero goal of 2070, the Government of India has notified the Green Credit Program (GCP) on 13th October 2023. The GCP is an innovative market-based mechanism designed to incentivize voluntary environmental actions across diverse sectors, by various stakeholders like individuals, communities, private sector industries, and corporations.

In its initial phase, the GCP focuses on two key activities: water conservation and afforestation. A user-friendly digital platform will streamline the processes for registration of projects, their verification, and the issuance of Green Credits.

PM-Programme for Restoration, Awareness, Nourishment and Amelioration of Mother Earth (PM-PRANAM)

The PM-PRANAM scheme has been announced to incentivize States and Union Territories to promote alternative fertilizers and the balanced use of chemical fertilizers. Over the next three years, the scheme will facilitate 10 million farmers to adopt natural farming. For this, 10,000 Bhartiya Prakritik Kheti Bio-Input Resource Centres will be set up, creating a distributed national-level natural micro-fertilizer and natural pesticide manufacturing network.

Mangrove Initiative for Shoreline Habitats & Tangible Incomes (MISHTI)

Mangrove Initiative for Shoreline Habitats & Tangible Incomes (MISHTI) envisages comprehensive exploration of possible areas for development of mangroves covering ..... approximately 540 sq km spreading across 11 States and 2 Union Territories, during five years commencing from 2023-24. The scheme aims for mangrove planting along the country's coastline and on salt-pan beds wherever

feasible, through convergence of funds from existing rural employment guarantee schemes and compensatory afforestation funds. It also aims to share best practices on plantation techniques, conservation measures, management practices and resources mobilization through public-private partnerships

Amrit Dharohar

Highlighting the importance of local communities in conserving the wetland ecosystem, the Amrit Dharohar scheme aims to promote the unique conservation value of wetlands. The objectives inter-alia are integrated management and community stewardship of wetlands for green growth. This scheme will be implemented over the next three years to encourage optimal use of wetlands, and enhance bio-diversity, carbon stock, eco-tourism opportunities, and income generation for local communities. It seeks to build convergence on wetland management with relevant Ministries and departments, State Governments, research and academic institutions, and the industrial sector across the country.

Coastal Shipping

Coastal shipping has been promoted as an energy-efficient and lower cost mode of transport, both for passengers and freight, through Public-Private Partnership mode with viability gap funding. This will result in the accelerated growth of coastal infrastructure, leading to holistic development of coastal areas. Under the Sagarmala Scheme, Ministry of Ports, Shipping and Waterways has partially funded 171 projects worth USD 1.3 billion (INR 109 billion) across coastal States and UTs. These include projects from various categories such as modernisation of existing ports and terminals, new ports / terminals, Roll On, Roll Off / RoPax & tourism jetties, enhancement of port connectivity, inland waterways, lighthouse tourism, industrialization around ports, skill development, technology centres, etc.

Vehicle Replacement

Special emphasis has been laid on the fleet replacement policy, by allocating adequate funds to scrap old vehicles of the Central Government and provide support to States in replacing old vehicles and ambulances.

The government has proposed several measures to support the country's transition to a low-carbon economy through the promotion of clean energy. The nation's future economic, social, and sustainable trajectory has been established by this year's budget. The government has promoted thematic funds for blended finance with the objective of encouraging important sunrise sectors in climate action, digital economy, pharma and agri-tech. The government has also extended its efforts towards thematic funds for accelerating investments in clean tech companies, MSMEs, and hard-to-abate sectors of the economy such as steel and cement, to drive the country on a sustainable trajectory.

To sum up, the Union Budget clearly signals the Government's commitments to allocate and align funds for climate and energy investments through several measures and reflects India's continued commitment to act for the planet by weaving green growth in its developmental pathways.

LIST OF ABBREVIATIONS

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
ASHA-India	Affordable Sustainable Housing Accelerators – India
ATAL JAL	Atal Bhujan Yojana
BCM	Billion Cubic Metres
BEE	The Bureau of Energy Efficiency
BEEP	National Building Energy Efficiency Programme
BESS	Battery Energy Storage System
BS-IV	Euro IV equivalent
BS-VI	Euro VI equivalent
C-Cube	Climate Centre for Cities
CAFE norms	Corporate Average Fuel Efficiency / Economy
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CBD	Convention on Biological Diversity
CBG	Compressed Biogas
CDRI	The Coalition for Disaster Resilient Infrastructure
CDWM	Construction and Demolition Waste Management
CEA	Central Electricity Authority
CEMILAC	Centre for Military Airworthiness and Certification
CFLs	Compact Fluorescent Lamps
CITES	Convention on International Trade in Endangered Species of wild flora and fauna
CMS	The Convention on Migratory Species
CoE	Centres of Excellence
CONCOR	Container Corporation of India
COP 26	26th Conference of Parties
COP21	21st Conference of Parties
CRZ	Coastal Regulation Zone
CWBP	City Water Balance Plans
DFC	Dedicated Freight Corridors
DSM	Demand Side Management
EC	Energy Conservation
ECBC	Energy Conservation Building Code
EEFP	Energy Efficiency Financing Platform
EESL	Energy Efficiency Services Limited
ENS	ECO Niwas Samhita
EPR	Extended Producer Responsibilit
ESCerts	Energy Saving Certificates
ESCO	energy service company
EWM	E-Waste Management
EWMR	E-waste (Management) Rules
FAME	Faster Adoption and Manufacturing of Hybrid and EV
FCI	Food Corporation of India

FEEED	Framework for Energy Efficient Economic Development
FHTC	Functional Household Tap Connection
FMCG	Fast Moving Consumer Goods
FPCs	Farmer Producer Cooperatives
GBA	Global Biofuel Alliance
GCP	Green Credit Programme
GDP	Gross Domestic Product
GHG	Greenhouse gas
GIB	Great Indian Bustards
GIM	Green India Mission
GIM	National Mission for a Green India
GOBARdhan	Galvanizing Organic Bio-Agro Resources Dhan
GPs	Gram Panchayats
GRIHA	Green Rating for Integrated Habitat Assessment
GSLEP	Global Snow Leopard and Ecosystem Protection
GVW	Gross Vehicles Weight
GW	giga-watt
IAF	Indian Air Force
IBCA	International Big Cat Alliance
ICAP	India Cooling Action Plan
ICE	Internal Combustion Engine
ICLs	incandescent lamps
IEA	International Energy Agenc
IEC	Information, education and communication
IGBC	Indian Green Business Council
IMF	International Monetary Fund
INBAR	International Network for Bamboo and Rattan
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
ISA	nternational Solar Alliance
IUCN	International Union for Conservation of Nature
IWC	International Whaling Commission
JJM	Jal Jeevan Mission
JSA	Jal Shakti Abhiyan
JV	joint venture
KNPTR	Kanha National Park and Tiger Reserve
KSPDCL	Karnataka Solar Power Development Corporation
LAC	Large Area Certification
LeadIT	Leadership Group on Industry Transition
LED	light emitting diode
LEED	Leadership in Energy and Environmental Design
LiFE	Lifestyle for Environment
LPG	Liquified Petroleum Gas
LT-LED	Low Emission Development
MBBL	Model Building Bye Laws
MEEP	Municipality Energy Efficiency Programme

MIDH	Integrated Development of Horticulture
MISHTI	Mangrove Initiative for Shoreline Habitats & Tangible Incomes
MMT	Million metric tonnes
MOVCDNER	Mission Organic Value Chain Development for North Eastern Region
MPCDAs	Medicinal Plants Conservation and Development Areas
MRFs	Material Recovery Facilities
MSW	Municipal Solid Waste
MTEE	Market Transformation for Energy Efficiency
Mtoe	Million tonnes oil equivalent
MTPA	Million tonnes per annum
MW	Megawatt
NAP	National Afforestation Programme
NAPCC	National Action Plan on Climate Change
NAPCCHH	National Action Plan for Climate Change & Human Health
NCAP	National Clean Air Programme
NCQG	New Collective Quantified Goal
NDC	Nationally Determined Contribution
NICRA	National Innovations in Climate Resilient Agriculture
NIUA	National Institute for Urban Affairs
NMEEE	The National Mission for Enhanced Energy Efficiency
NMSA	National Mission for Sustainable Agriculture
NMSH	National Mission on Sustainable Habitat
NMSKCC	National Mission on Strategic Knowledge for Climate Change
NMST	National Mission on Sustainable Transport
NPOP	National Programme for Organic Production
NSM	National Solar Mission
NTFPs	Non-Timber Forest Products
NVY	Nagar Van Yojana
ODF	Open Defecation Free
OECMs	Other Effective area-based Conservation Methods
OSOWOG	One Sun One World One Grid
PAT	Perform, Achieve and Trade
PATA	Pacific Asia Travel Association
PKVY	Paramparagat Krishi Vikas Yojana
PLI	Production Linked Incentive
PM 10	Particulate Matter10
PM KUSUM	Pradhan Mantri Kisan Urja Suraksha Evam Utthan Mahabhiyan
PM-PRANAM	Pradhan Mantri Programme for Restoration, Awareness, Nourishment and Amelioration of Mother Earth
PMKSY	PRADHAN MANTRI KRISHI SINCHAYEE YOJANA
PMMSY	Pradhan Mantri Matsya Sampada Yojana
PMSTIAC	Prime Minister's Science, Technology and Innovation Advisory Council
PMUY	Pradhan Mantri Ujjwala Yojana
PPP	Public Private Partnerships

PTM	PATA Travel Mart
PWM	Plastic Waste Management
R&D	research and development
RECEIC	Resource Efficiency and Circular Economy Industry Coalition
rkm	Route Kilometres
RPO	The Renewable Purchase Obligation
RTS	Roof Top Solar
SAF	Sustainable Aviation Fuel
SAPCC	State Action Plans on Climate Change
SATAT	Sustainable Alternative Towards Affordable Transportation
SAUBHAGYA	Pradhan Mantri Sahaj Bijli Har Ghar Yojana
SBM	Swachh Bharat Mission
SBM-U	Swachh Bharat Mission - Urban
SCM	Smart Cities Mission
SCPs	Smart City Proposals
SDGs	Sustainable Development Goals
SEC	Specific Energy Consumption
SGBs	Sovereign Green Bonds
SLNP	Street Lighting National Program
SPM	Summary for Policy Makers
SWM	Solid Waste Management
TOE	tonnes oil equivalent
TULIP	Technical Education for the Urban Learning Internship Programme
UJALA	Unnat Jyoti by Affordable LEDs for All
ULB	Urban Local Body
UNCCD	UN Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEA	United Nations Environment Assembly
UNESCO – WHC	The United Nations Education Scientific and Cultural Organization – World Heritage Committee
UNFCCC	United Nations Framework Convention on Climate Change
UTs	Union Territories
VCRMC	Village Climate Risk Management Committees
WHO	World Health Organization

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