



ISSUE BRIEF

THE ROAD FROM PARIS: INDIA'S PROGRESS TOWARDS ITS CLIMATE PLEDGE

India is on track to meet its Paris Agreement targets – to reduce emissions by 33% to 35% of its gross domestic product (GDP) by 2030 from 2005 levels and achieve 40% of installed power capacity from non-fossil fuels by 2030.¹ With solar and wind energy at the heart of India's climate goals, the country aims to install an ambitious 175 gigawatts (GW) of renewable energy by 2022 and 450 GW by 2030 – 20% more than India's current electricity grid capacity.² India is halfway toward meeting its 175 GW by 2022 goal, with renewables reaching 88 GW, representing 23.5% of India's total installed capacity.³ Even with the COVID-19 economic downturn, India remains committed to achieving its nationally determined contributions (NDC).⁴

National Overview

India is the world's third-largest greenhouse gas (GHG) emitter and second most populous country. India's total emissions in 2019 were 132 million tonnes of carbon dioxide equivalent and emissions have been on the decline for the first time in forty years.⁵ The country's per capita emissions remain low, at 1.94 tCO₂/capita – less than half the global average of 4.2 tCO₂/capita.⁶ India has grown into an economic powerhouse with an average growth rate of 6.7% GDP over the last decade.⁷ With the COVID-19 economic slowdown, India's GDP is expected to contract by 4.5% to 10% in 2020 but is expected to recover by 2025.⁸

Renewable energy (solar, wind, and biomass power) accounted for over 24% of India's total installed electricity capacity as of July 2020.⁹ Factoring in large hydro and

nuclear, India's non-fossil fuels totaled 38% of the country's installed capacity. Renewables are growing faster than fossil fuels with the share of renewable energy capacity increasing from 13% to 24% (36 GW in July 2015 to 88 GW in July 2020). While thermal power still accounts for the majority of India's power supply, the share of thermal capacity declined by 8%, from 70% to 62% (192 GW thermal capacity of 276 GW total installed capacity in July 2015 as compared to 231 GW thermal capacity of 372 GW total installed capacity in July 2020).¹⁰ While the Indian government recognizes the need to expand efforts for creating an "additional carbon sink" of 2.5 to 3 billion tonnes of carbon dioxide equivalent, India's forest and tree cover has increased by only 5,188 km², yielding a 42.6 million tonne carbon sink increase.¹¹



INDIA WILL CUT ITS EMISSIONS INTENSITY BY 33-35% OF 2005 LEVELS BY 2030.



Climate Highlights – 2020

Rapidly Growing Renewables

- The share of installed capacity from renewable energy (not including large hydro) sources increased from 13% to 24% (36 GW in July 2015 to 88 GW in July 2020) while the share of thermal capacity declined from 70% to 68%.¹²
- During the COVID-19 economic slowdown, renewable energy's share of generation rose due to the higher day-by-day operating costs of thermal power plants and the decline in total power demand.¹³

Lowest Solar Tariffs to Date

- Reaching one of the lowest tariffs in the world, in July 2020 India's solar tariffs dropped to ₹ 2.36 (\$0.0316)/kWh for a 2 GW project in Karnataka, showing that the cost of solar has reached 20% to 30% lower than thermal power tariffs.¹⁴
- India took encouraging steps towards Round-The-Clock (RTC) renewable power supply in May 2020 with a discovered tariff of ₹ 2.90 (\$0.0386)/kWh for a Solar Energy Corporation's RTC tender.¹⁵

Advancing Electric Mobility

- Under Phase-II of Faster Adoption and Manufacture of (Hybrid and) Electric Vehicles (FAME) Scheme, India allocated ₹ 10,000 crore (\$1.4 billion) for advancing electric mobility in public transportation fleets, four-wheelers, and three-wheelers, and privately owned two-wheelers, as well as, electric vehicle charging infrastructure.¹⁶

Energy Efficient Buildings

- Thirteen states have notified the Energy Conservation Building Code (ECBC) with four states including a detailed

compliance program and five states incorporating the ECBC into their state bye-laws.¹⁷

New Temperature Set Points for Air Conditioners

- The Bureau of Energy Efficiency (BEE) employed a new default temperature of 24°C (75.2°F) for all indoor air conditioning units.

Air Pollution

- While air pollution levels remain high, the COVID-19 lockdown in April to May 2020 led to dramatic reductions in PM_{2.5}, PM₁₀, NO₂, and CO; the largest declines occurred in Bangalore (86% in PM_{2.5}), Delhi (70% in PM₁₀), Ahmedabad (67% in NO₂), and Nagpur (63% in CO).¹⁸

Assessment of Climate Change over the Indian Region report

- India's Ministry of Earth Sciences (MOES) released the *Assessment of Climate Change over the Indian Region*, which highlights how both flooding and droughts are projected to be more frequent due to an increase in average temperature, aerosol concentration levels, and variation in precipitation.¹⁹

Emerging Policy Developments

- The Ministry of Environment, Forest and Climate Change (MOEFCC) released a Draft Environmental Impact Assessment Notification, superseding the 2006 version and proposing new rules on industrial projects; the Ministry of Power released the Draft Electricity (Amendment) Bill 2020 to increase private players in the market.²⁰

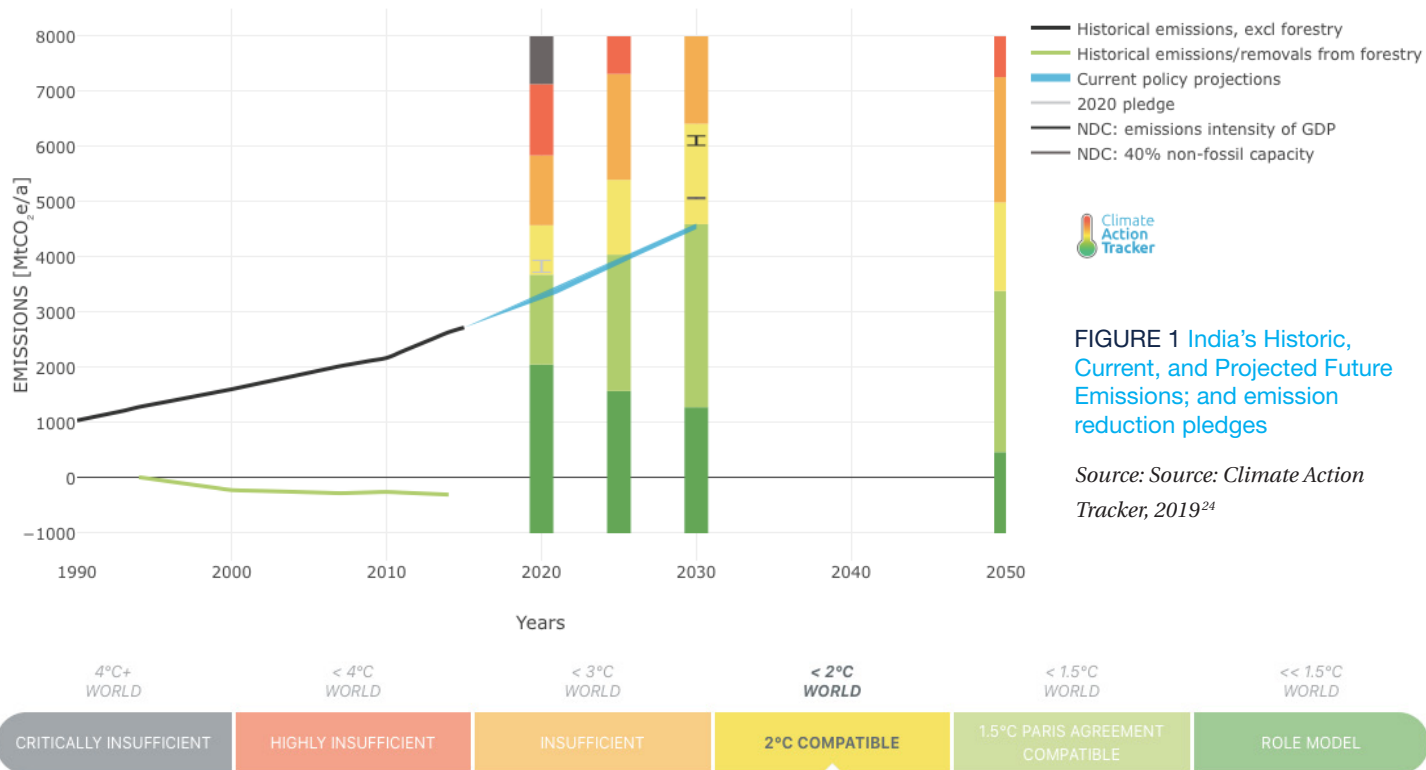
India's Paris Agreement Targets

In 2015, 196 nations came together to approve the Paris Agreement during the 21st session of the Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC). The Paris Agreement aims to limit global temperature rise to well below 2°C and to make best efforts to hold warming to 1.5°C. Countries as part of the Paris Agreement submitted Nationally Determined Contributions (NDCs) detailing plans to cut emissions to meet the global temperature goal.²¹

Ratifying the Paris Agreement in 2016, India's pledge lays out a comprehensive approach to limit climate impacts while fostering economic growth. India's pledge includes the following commitments:

- To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.

- To adopt a path that is climate-friendly and cleaner than the one followed hitherto by others at a corresponding level of economic development.
- To reduce the emissions intensity of its GDP by 33 to 35% by 2030 from 2005 level.
- To achieve 40% cumulative electric installed power capacity from non-fossil-fuel energy sources by 2030 with the help of technology transfer and low-cost international finance including support from the Green Climate Fund.
- To create an additional carbon sink of 2.5 to 3 billion tonnes of carbon dioxide equivalent through additional forest and tree cover by 2030.
- To better adapt to climate change by enhancing investments in development programs in sectors vulnerable to climate change, particularly agriculture, water resources, the Himalayan region, coastal regions, health, and disaster management.



- To mobilize domestic funds and new or additional funds from developed countries to implement the above mitigation and adaptation actions, in view of the resources required and the resource gap.
- To build capacities, create a domestic framework and international architecture for quick diffusion of cutting-edge climate technology in India and collaborative research and development for such future technologies.²²

India's 2030 NDC is one of the few rated by the Climate Action Tracker as compatible with limiting temperature rise to below 2°C.²³

National Action

India's National Action Plan on Climate Change (NAPCC) aims to chart a low carbon development path for India. The plan has eight missions, focusing on solar, energy efficiency, sustainable habitat, water, ecosystems, forest cover, sustainable agriculture, and climate research. The NAPCC outlines India's strategic mission to promote sustainable economic development while encouraging private sector action on climate mitigation and adaptation.²⁵ This national plan lays a foundation for achieving India's Paris Agreement targets while balancing national priorities.

Renewable Energy

India has committed to achieving 175 GW of renewable energy by 2022, including 100 GW of solar and 60 GW of wind, 10 GW from biomass, and 5 GW from small hydropower.²⁶ In 2019, India increased its target to 450 GW renewable energy by 2030, over five times India's current installed renewables capacity and more than India's current total installed capacity (370 GW).²⁷ India announced a non-fossil goal of 220 GW at the 2020 International Solar Alliance Summit; this target includes large hydro, nuclear, and renewables.²⁸ As of July 2020, India is halfway toward meeting its 175 GW by 2020 target, with renewables (including solar, wind, small hydro, biomass cogeneration, and waste to energy) reaching 88 GW, representing 23.5% of India's total installed capacity.²⁹

Solar Energy

The National Solar Mission aims to install 100 GW of solar energy by 2022, which is part of India's long-term goal to install 450 GW of renewable energy by 2030.³⁰ While these goals are ambitious, India's solar energy potential is considerable, with an estimated 750 GW.³¹

India's solar energy capacity increased to 35 GW as of July 2020.³² The added solar capacity for FY20 was 2.1 GW, which was 24% less than the targeted 3 GW.³³ Despite the rapid growth in recent years, the solar market is facing challenges from COVID-19, such as disrupted supply chains, labor

availability constraints, and reduced power demand.³⁴ The solar industry is also experiencing challenges with safeguard duties on solar modules, manufacturing, safeguard duties, land availability, the uncertainty of power purchase agreements, and outstanding dues from distribution companies that have slowed solar capacity additions.³⁵

Tariffs for solar energy projects reached their lowest point in July 2020 at ₹ 2.36 (\$0.0316)/kWh. The Spanish company Solarpark Corporacion Tecnologica had the lowest bid for a 2 GW project in Karnataka.³⁶ In comparison, the lowest thermal power tariff by a three-company bid was ₹ 3.26 (\$0.0436)/kWh in February 2020.³⁷ Solar tariffs have reached 20% to 30% below the cost of existing thermal power in India.³⁸ India took encouraging steps towards Round-The-Clock (RTC) renewable power supply in May 2020.³⁹ Solar Energy Corporation's (SECI) discovered a tariff of ₹ 2.90 (\$0.0386)/kWh for its RTC renewable tender, the first of its kind in India.⁴⁰ India remains one of the most attractive markets for renewable energy.⁴¹ By sustaining a transparent and competitive market through its reverse auction system, India has been able to drive down the levelized cost of solar despite high borrowing costs and a limited number of available subsidies.⁴²

Wind Energy

India aims to install 60 GW of wind energy by 2022 with 55 GW of onshore wind and 5 GW of offshore wind. India is currently the world's fourth-largest wind energy market, with nearly 38 GW of installed capacity, as of July 2020.⁴³

Wind energy amounts to over 10% of India's total installed power capacity. Installed wind capacity nearly doubled from 2015 to 2020, increasing by 14 GW.⁴⁴

Recently, however, the wind energy market in India has slowed because of unsustainably low tariffs, resulting from policy shifts in the feed-in tariffs (FiT) to reverse auctions and tariff caps.⁴⁵ The first 1 GW offshore wind project in the Gulf of Khambhat in Gujarat has been delayed and may relocate to Tamil Nadu.⁴⁶ India will likely miss its global offshore wind target of 5 GW by 2022.⁴⁷ Yet, the opportunity for continued growth in wind power generation is promising, with an estimated 700-1500 GW of onshore wind energy potential and an estimated 70 GW of offshore wind potential.⁴⁸

Solar and Wind Energy Job Growth

Achieving India's 175 GW of renewable energy by 2022 target could employ over 300,000 workers and create 1 million job opportunities in the country.⁴⁹ To develop a skilled workforce and meet the renewable industry's needs, the Government of India established the Skills Council for Green Jobs (SCGJ) under the National Skill Development Mission in 2015. As of July 2020, SCGJ has trained over 2,400 certified trainers for renewable energy jobs; developed 39 new curriculum/qualification packs for solar, wind, and waste-to-energy; and issued 14 new handbooks. Over 330 renewable energy training centers have been established as of July 2020, with an additional 76 centers planned for 2021.⁵⁰

India's COVID-19 Stimulus – May 2020

India's initial ₹ 20 lakh crore (\$260 billion) stimulus package in response to the COVID-19 economic downturn represents 10% of India's GDP in 2019-2020. However, only ₹ 1.4 lakh crore will be additional cash outgo, and the direct fiscal stimulus represents roughly 1% of the GDP.⁵¹ While more needs to be done to be a "green stimulus," the stimulus package called "Atmanirbhar" strives for greater self-reliance to improve India's domestic capacity. To ensure liquidity in the economy, the Reserve Bank of India undertook several measures to ease credit flow from banks and other financial institutions in the country.⁵² While green transportation, green construction, or renewable energy are not directly mentioned, the stimulus allocations may be used to promote these initiatives indirectly, as analyzed by NITI Aayog.⁵³ Investments in local manufacturing, energy efficiency, and renewable energy generation can create jobs, improve infrastructure, and spur sustained economic growth.⁵⁴ NITI Aayog highlights the following initiatives:

- The Atmanirbhar stimulus package focuses on improving India's domestic production capacity and could enhance the photovoltaic and electric vehicle supply chains by reducing reliance on imports.⁵⁵
- Micro Small Medium Enterprises (MSMEs) are a part of stimulus aid, and funds allocated to MSMEs could cover electric vehicle auto component manufacturing.⁵⁶
- India plans to lend ₹ 90,000 crore (\$13 billion) to distribution companies, potentially helping the renewable energy sector by ensuring timely payments to solar generators.⁵⁷
- The stimulus allocates ₹ 30,000 crore (\$4 billion) to agriculture and rural development, and funds allocated to these businesses could be used for solar pumps and solar irrigation, reducing reliance on diesel generation.⁵⁸

COVID-19 and Clean Energy Opportunities

India is battling multiple crises, including the COVID-19 economic downturn and the climate crisis. The national lockdown resulted in a short-term decline in commercial and industrial energy load. Policy decisions regarding tariffs, capacity expansion, asset retirement, and financial management made in response to COVID-19 economic decline will shape the direction of the energy market in India for years to come. Continuing to expand clean energy can help stimulate the economy, curb climate change, and improve air quality.⁵⁹ The following policy actions would support clean energy expansion as part of the economic recovery, as analyzed by The Energy and Resources Institute:

- Share of India's renewable energy capacity can exceed 45% by 2030 if renewable energy curtailments are minimized, battery storage is promoted, and interstate power transfers are prioritized.⁶⁰
- The short-term decline in energy demand introduced opportunities for fossil fuel asset retirement and new tariff determinations, providing further opportunities for renewable energy sources to become a part of the grid mix.⁶¹
- Enhanced flexibility from coal fleets can reduce wind and solar energy curtailments, which could result in renewables reaching 26% of the load share by 2030 with no additional costs.⁶²
- Investments in the research and development of battery storage technologies can yield a dramatic increase in the utilization of renewable energy and would ease the daily cycling of thermal assets.⁶³
- India can capitalize on its integrated grid through power transfers between states with a high volume of renewable assets and those with predominantly thermal power assets.⁶⁴
- Tariffs of RTC solar power or renewables plus storage are expected to become cheaper while new coal plants may have fewer takers.

Energy Access and the Power Sector

India prioritized energy access with the Saubhagya Yojana program, which provides ₹ 18,000 crore (\$2.5 billion) for electrification expansion. The program aimed to electrify every household by December 2018, and according to government estimates published in March 2019, India had achieved nearly 100% household electrification with only a small portion of households in Chhattisgarh remaining.⁶⁵ While India has made tremendous progress in electrification, energy poverty remains. Providing access to clean and affordable electricity remains to be a challenge in villages with high reliance on diesel generators and solid fuels.⁶⁶

Estimates suggest that expenses from diesel for irrigation can amount to 30% to 50% of agriculture production costs.⁶⁷ India has 30 million irrigation pumps across the country – 70% electrical and 30% diesel.⁶⁸ To promote solar-based irrigation, India launched Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) in 2019.⁶⁹ The scheme has three key objectives, enhanced in the February 2020 budget announcement – to establish 10 GW of ground-mounted grid-connected decentralized renewable energy plants by 2022, to install over 2 million standalone solar-powered agricultural pumps, and to install an additional 1.5 million grid-connect solar-powered agriculture pumps. The government has allocated ₹ 34,422 crores (around \$5 billion) for the PM KUSUM scheme. If the targets of the scheme are achieved, more than 25.7 GW of solar capacity can be added by 2022.⁷⁰

For rural cooking, Pradhan Mantri Ujjwala was initiated in 2011 to provide liquefied petroleum gas (LPG) to the nearly 70% of Indians who relied upon biomass for cooking.⁷¹ As of July 2019, 8.3 million connections were made under the program. However, challenges to refill LPG cylinders remain, which results in recipients returning to biomass cooking.⁷² Efforts are underway to improve the LPG refill process and to subsidize the cost of LPG cylinders. As part of the COVID-19 recovery efforts, qualified beneficiaries can receive three LPG cylinders from April to September 2020.⁷³

Energy Efficiency

With skyrocketing urbanization, the demand for buildings, appliances, and industry is rising. Buildings and industry already account for over 70% of India's annual energy usage.⁷⁴ With India's growing economy, advancing energy efficiency will be critical to save energy, increase energy access, and combat pollution.

Buildings

Residential and commercial buildings in India account for nearly 30% of total electricity consumption and is expected to increase to 48% by 2042.⁷⁵ In 2017, the Bureau of Energy Efficiency (BEE) released an updated Energy Conservation Building Code (ECBC).⁷⁶ The ECBC sets minimum energy standards for commercial buildings and designates state agencies to certify and enforce ECBC by notifying the code. As of August 2020, thirteen states, including Andhra Pradesh, Haryana, Karnataka, Kerala, Odisha, Puducherry, Punjab, Rajasthan, Telangana, Uttarakhand, Himachal Pradesh, Uttar

Pradesh, and West Bengal have notified ECBC. Five states have incorporated the ECBC into their bye-laws; these states include Andhra Pradesh, Haryana, Punjab, Telangana, and Uttar Pradesh. Four states have taken additional steps to add transparent compliance processes and enforcement mechanisms; these states include Andhra Pradesh, Karnataka, Telangana, and Uttar Pradesh.⁷⁷

Over 225 commercial buildings have been certified under BEE's Star Rating Program.⁷⁸ India ranks third in the world for Leadership in Energy and Environmental Design (LEED) certification with more than 1,400 LEED-certified buildings, including schools, hospitals, offices, residential buildings, and more.⁷⁹ If states across India adopt energy-saving building codes and leading developers go beyond minimum code requirements for commercial buildings, an estimated 3,453 TWh of electricity could be saved cumulatively by 2030, equivalent to powering 358 million Indian homes annually between 2014 and 2030.⁸⁰

Green Appliances and Sustainable Cooling

India has made significant progress on energy-efficient appliances. Established in 2006, BEE's Standards and Labeling Program consists of both mandatory and voluntary schemes for 26 major appliances, including refrigerators, air conditioners, tube lights, color televisions, and electric geysers etc.⁸¹ India has a specific program for addressing lighting and has successfully implemented one of the most extensive light-bulb replacement programs in the world. As of August 2020, the Ujala program distributed 366 million LED lights resulting in an annual emission reduction of 38.5 million tonnes of carbon dioxide equivalent.⁸²

As of January 2020, India requires that all room air conditioners have a default temperature setpoint of 24°C (75.2°F), potentially resulting in significant energy savings.⁸³ The Bureau of Energy Efficiency has also released an updated room air conditioner standard that requires an Indian Seasonal Energy Efficiency Ratio (ISEER) of 3.3-5.0 for split air conditioners and an ISEER of 2.7-3.5 for window air conditioners effective January 2021.⁸⁴

Given the skyrocketing demand for cooling in South Asia, India was the first country to release The India Cooling Action plan (ICAP) in 2019, a comprehensive plan that prioritizes efficient, climate-friendly, and affordable cooling for all.⁸⁵ India's major inverter air conditioning market has been proactive in its efforts to reduce the amount of hydrofluorocarbons (HFCs) that are used in air conditioning units, leapfrogging to more climate-friendly R32 coolant. Cool roofs, energy-efficient buildings, and cold-chain improvements are also part of the ICAP, aimed to reduce the demand for cooling.

Industrial Energy Efficiency

The National Mission for Enhanced Energy Efficiency (NMEEE) aims to improve efficiency in industry and implement demand-side management programs. The main program, Perform Achieve Trade (PAT) scheme, establishes an energy trading program for high emitting industries – cement, aluminum, steel, iron, textiles, and paper and pulp. Under PAT Cycle I from 2012-2015, over 31 million tonnes of carbon dioxide equivalent were avoided.⁸⁶ PAT Cycle II from 2016-2019, which included an expanded list of sectors, is expected to avoid an additional 31 million tonnes of carbon dioxide equivalent emissions. PAT Cycle III seeks to cover six energy-intensive sectors: thermal power plants, cement, aluminum, pulp and paper, iron and steel, and textile. Under PAT Cycle III energy consumption is projected to be lowered by 3% annually for regulated industries. PAT Cycle IV and V are notified and seek to expand the certified energy trading to more industry sectors.⁸⁷ India is a major industrial and hub globally and the decarbonization of industry will be critical for India to continue to chart a low-carbon future. India has taken steps to form international alliances to help curb emissions in hard-to-abate sectors such as steel and cement.⁸⁸

Transportation Sector

Even though walking remains the top mode of mobility in India, the transportation sector still accounts for upwards of 16% of total carbon equivalent emissions and over 33% of particulate matter pollution.⁸⁹ As of 2019, India is the world's fourth-largest market for vehicle sales by volume – including two-wheelers, three-wheelers, passenger vehicles, and commercial vehicles – totaling 26.3 million, experiencing a 5.1% increase from 2019 to 2020.⁹⁰

Vehicle Emissions Standards

India adopted BS VI vehicular and fuel emission standards as a part of its Auto Fuel Policy. Effective April 2020, India now has ultra-low sulfur fuel (10 ppm) in use across the country. The BS VI emission norms for 2-wheelers are also among the most stringent in the world. The BS VI emissions standards will result in up to 40% reduction in PM emissions and 43% reduction in NOx compared to BS IV emission standards.⁹¹ Real Driving Emission (RDE) testing will be implemented in 2023 to prevent the use of cheating devices and regulate vehicle emissions. Additionally, Corporate Average Fuel Efficiency (CAFE) standards, aimed at increasing the efficiency of internal combustion engine (ICE) vehicles, came into effect for light-duty vehicles in 2020 and are due to be tightened in 2023.⁹² For heavy-duty vehicles phase I standards came into effect in 2018, and phase II will be effective April 2021.⁹³

Electric Vehicles

With just 246,000 electric vehicles (EV) sold in 2020 (less than 1%), India ramped up its investment in electric mobility with FAME-II, which provides ₹ 10,000 crore (\$1.4 billion) for demand incentives, charging infrastructure subsidies, and battery storage manufacturing.⁹⁴ Spanning over three years from 2019 to 2022, FAME-II will provide both demand and supply incentives to promote the electrification and market penetration of electric public buses, commercial vehicles, four-wheelers, three-wheelers, and privately owned two-wheelers. The scheme will offer incentives to manufacturers that invest in developing EV components, provide tax subsidies, and provide incentives for setting up charging stations. In addition, the scheme requires half of the vehicle parts to be locally sourced in India.⁹⁵ The National Electric Mobility Mission Plan 2020 aims to subsidize the cost and facilitate the sale of 6 to 7 million hybrid and electric vehicles over five years.⁹⁶ To strengthen battery storage, the National Mission on Transformative Mobility and Battery Storage is designed to support the battery and EV component manufacturing.⁹⁷

In early 2020, the Indian government approved the set-up of 2,636 publicly-funded charging stations in 62 cities across 24 states and union territories.⁹⁸ State and municipalities have also begun to lead the way on electric vehicle incentives and policies. Eight states, including Andhra Pradesh, Haryana, Kerala, Maharashtra, Tamil Nadu, Telangana, Uttarakhand, and Uttar Pradesh have a draft or final electric vehicle policy, and 19 states and union territories have published tariffs for electric vehicle charging. The state policies are also offering incentives to manufacturers that invest in developing EV components, provide tax subsidies, and offer incentives for setting up charging stations.⁹⁹

Public Transit

India's railway network is the fourth-largest in the world and is second in terms of rail passenger volume.¹⁰⁰ India is working to electrify its rail network, and in July 2020, Indian Railways announced that it would target net-zero carbon emissions by 2030.¹⁰¹ Currently, 12 Indian cities have metro rail networks – Ahmedabad, Bengaluru, Chennai, Delhi, Gurgaon, Hyderabad, Jaipur, Kochi, Kolkata, Lucknow, Mumbai, and Nagpur. India has a rail network of over 68,155 km, including a 660 km network of metro rail, which have proven to be an efficient means of transportation considering energy consumption, space occupancy, and numbers transported.¹⁰² Public buses and private buses are also a growing form of transportation, and in 2017 there were 1.7 million privately owned and 1.5 million public busses.¹⁰³ Several states and cities have programs for expanded electric bus fleets, including Gujarat, Maharashtra, New Delhi, Telangana, Uttar Pradesh, Rajasthan, and Kerala under FAME-II.¹⁰⁴

Mobilizing Green Investment

Over \$250 billion in investment is needed between 2023 and 2030 to achieve India's target of 450 GW of clean energy by 2030.¹⁰⁵ In the near term, India needs over \$80 billion in investments for renewable energy infrastructure (without transmission lines) to meet its 175 GW by 2022 target.¹⁰⁶

India is working to provide funding for clean energy through government programs, private investments, and international climate finance. However, public funds by themselves will not produce the capital required; catalytic finance is needed to help expand the clean energy market. Catalytic finance leverages limited public funds to bring in greater private investment. Catalytic financial mechanisms and institutional facilities such as “green windows” can be effective in transforming the India clean energy market. The Indian Renewable Energy Development Agency Limited (IREDA), a leading financial institution, is planning to pilot the first green window in India to develop and implement catalytic finance solutions.¹⁰⁷ India's support for the green window could attract more concessional funding and open up the Indian clean energy market to new classes of international investors.

Green bonds are another beneficial investment instrument. IREDA and National Thermal Power Corporation (NTPC) have used masala bonds to increase the number of green bonds in the market. By 2019, ₹ 52,000 crore (\$7 billion) of green bonds were issued in India, amounting to roughly 20 issuances. Apart from IREDA and NTPC, Greenko, ReNew Power, Azure Power, Tata Cleantech and Adani Green Energy have been integral to issuing green bonds.¹⁰⁸

Power distribution companies (DISCOMs) have been adversely affected due to short-term power demand declines and high cash losses amid the COVID-19 pandemic. The DISCOM debt has risen to ₹ 1.3 lakh crore (\$18 billion).¹⁰⁹ Market reports suggest that debt could increase to ₹ 4.5 lakh crore (\$66 billion) in FY 2021.¹¹⁰ As a part of the economic stimulus measures, the national government has extended a ₹ 90,000 crore (\$13 billion) liquidity line to DISCOMs. The loan will help DISCOMs pay outstanding dues owed to power generation companies through March 2020. Power Finance Corporation and Rural Electrification Corporation (both public sector institutions) will co-finance the loan.¹¹¹

In the wake of the COVID-19 economic slowdown capital investments will prioritize economic development and job creation. The economic recovery is an opportunity to increase public investment in clean energy. Historically low oil prices represent an opportunity to reduce fossil fuel subsidies in an effort to free up public capital and redefine future energy consumption trends.¹¹²

Climate Resilience and the Assessment of Climate Change over the Indian Region

The Ministry of Earth Sciences (MOES) *Assessment of Climate Change over the Indian Region* highlights the impacts of climate change on the Indian subcontinent. It finds that average temperatures have increased, precipitation during the monsoon has decreased, extreme heat and rainfall events have become more frequent, resulting in both more flooding and more droughts. The report calls for a greater emphasis on scaled adaptation and mitigation responses, recommending increased monitoring, research, and continued investment in partnerships that promote community resilience.¹¹³

- India's average temperature has increased by 0.43°C from 1986 to 2018, which is projected to increase the total duration of heatwaves to 40 days by the end of the twenty-first century under a business-as-usual high emission scenario.¹¹⁴
- Monsoon precipitation (June to September) has declined by approximately 6% from 1901 to 2015, more than 60% of agricultural land in India is not irrigated, and any inconsistency or reduction in rainfall can have cascading consequences on crop yields.¹¹⁵
- The rise in mean surface temperature over India increases the frequency and intensity of warm days and warm nights which can trigger temperature-related illness and fatalities.¹¹⁶
- It is very likely that by 2050, global mean sea level (GMSL) will rise by 26 cm, relative to 1986-2005, which would exacerbate the destructive potential of storm surges from cyclone storms.¹¹⁷
- The Himalayan and Tibetan plateau have experienced substantial warming, which is significant as this region has the most extensive ice cover outside of the poles, and snowmelt accounts for a large portion of India's freshwater supply.¹¹⁸

Strengthening Climate Resilience and Addressing Air Pollution

Extreme Heat

The National Heat Guidelines developed by the National Disaster Management Authority, Indian Meteorological Department and partners expand heat action plans to states and cities in India. The city of Ahmedabad implemented South Asia's first-ever heat action plan in 2013, providing an early warning and preparedness system to increase residents' resilience to extreme heat events. Since then, more than 23 states and over 100 cities in India have followed suit.¹¹⁹

Climate solutions, such as cool roofs, are critical for protecting communities from extreme heat, as included in heat action plans and the ICAP.¹²⁰ Cool roofs are shown to yield a 2°C to 5°C reduction in indoor air temperature; the cities of Ahmedabad and Hyderabad are developing city-wide cool roofs program pilots.¹²¹ India also implemented the National Adaptation Fund for Climate Change, which was established in 2015 to help states become more resilient to the adverse effects of climate change. States can submit project proposals to the NAFCC program and will then receive subsequent program funding.¹²²

Air Quality

India's National Clean Air Program (NCAP), released in 2019, aims to reduce particulate matter by 20% to 30% by 2024, compared to 2017 levels.¹²³ Under the program, 122 cities have been asked to prepare city-level action plans by the Central Pollution Control Board to meet the specified NCAP

targets. The city-specific plans are primarily standalone measures without an airshed component, and the NCAP provides limited budgetary allocation.¹²⁴ Several cities, such as Ahmedabad, Pune, and New Delhi, have developed city clean air plans, including a focus air quality index (AQI) and health risk communications. In addition, several states are expanding the New Delhi's Graded Response Action Plan to respond to air pollution emergencies, including odd and even license plate programs, shutting down thermal power plants, limiting construction and industrial activities, and other measures.¹²⁵

The NCAP is the first of its kind national level policy formulated to address air quality in Indian cities. It is a significant intervention to address air quality, however, state-level implementation and budgetary allocation are needed to achieve NCAP goals.

The Fifteenth Finance Commission report for 2020-2021 recommends a new grant program for ambient air quality improvements. The grant program targets fifty million plus cities and Urban Agglomerations (UAs). The Finance Commission recommends ₹ 4,440 crore per grant used for air quality improvement measures, monitoring, and local body capacity building.

The COVID-19 lockdown and decline in mobile and industrial activity had a temporary but dramatic effect on air quality in India. An official report by the Central Pollution Control Board (CPCB) found a striking 46% drop in PM_{2.5} and 50% PM₁₀ levels in Delhi during the national lockdown period (between 25 March 2020 to 15 April 2020).¹²⁶ From April to May 2020, PM_{2.5}, PM₁₀, NO₂, and CO dropped across India's metropolitan cities while ozone

increased in some areas. The largest declines occurred in Bangalore (86% in PM_{2.5}), Delhi (70% in PM₁₀), Ahmedabad (67% in NO₂), and Nagpur (63% in CO).¹²⁷

International Engagement

Stepping up climate cooperation, India and France launched the International Solar Alliance (ISA) during the Paris Agreement. The ISA aims to mobilize more than \$100 billion by 2030 to promote solar power globally. As of June 2020, 120 nations have affirmed their participation in the alliance.¹²⁸ The International Solar Alliance recently launched a plan “One Solar One World and One Grid” (OSOWOG) that will connect 140 countries through a connected grid that will be used to transfer solar power.

India was critical in achieving the Kigali amendment to the Montreal Protocol to phase down hydrofluorocarbons (HFCs), which have thousands of times of the global warming potential of carbon dioxide.¹²⁹ To support the construction of climate-resilient infrastructure in countries, India launched an International Coalition for Disaster Resilient Infrastructure (CDRI) at the September 2019 Climate Action Summit in New York.¹³⁰ India also co-created the Leadership Group for Industry Transition, a cooperative to promote innovation and technology exchange. The

initiative will target steel, cement, and aviation to reach net-zero emissions from heavy industry by mid-century.¹³¹ In March 2020, this collaborative was extended to support energy research and innovation, and India and Sweden established a co-funding mechanism to support the research and development of smart grid technologies.¹³²

The next Conference of the Parties (COP) is scheduled for November 2021. The aim of COP 26 will be to assess the progress made under the Paris Agreement and encourage countries to enhance their NDCs. While COP 26 was postponed due to COVID-19, the delay gives parties more time to develop more ambitious targets and accelerate low-carbon initiatives going into COP 26.

India remains a critical international stakeholder when it comes to increasing ambition and charting a low carbon future. India's commitments under the Paris Agreement are robust as India plans to reduce its emissions intensity by 33% to 35% of its GDP by 2030 from 2005 levels. Recently, Prime Minister Modi announced that India would strengthen its climate targets through enhanced climate action plans in India's NDC.¹³³ India has been an engaged stakeholder to the Paris Agreement, and this commitment helps confirm that India is dedicated to increasing ambition on climate change.



Kurnool Solar Park in Andhra Pradesh;
Photo credit: NRDC

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SEWA is a trade union registered in 1972. It is an organisation of poor, self-employed women workers. These are women who earn a living through their own labour or small businesses. Constituting 93 percent of the labour force, these are workers of the unorganised sector. SEWA organises women to ensure that every family obtains full employment. By self-reliance we mean that women should be autonomous and self-reliant, individually and collectively, both economically and in terms of their decision-making ability. We follow the principles of satya (truth), ahimsa (non-violence), sarvadharmā (integrating all faiths, all people) and khadi (propagation of local employment and self reliance). For more information visit <http://www.sewa.org>.

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