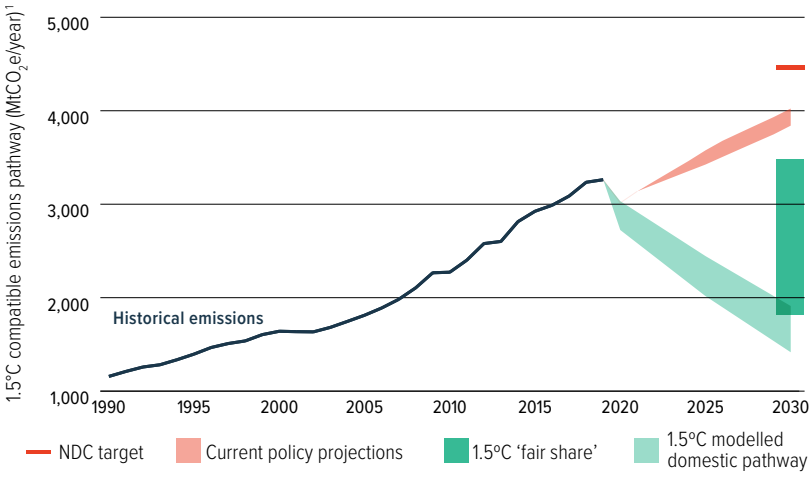
INDIA

Climate Transparency

CLIMATE TRANSPARENCY REPORT: COMPARING G20 CLIMATE ACTION 2022

1.5°C COMPATIBLE EMISSIONS PATHWAY

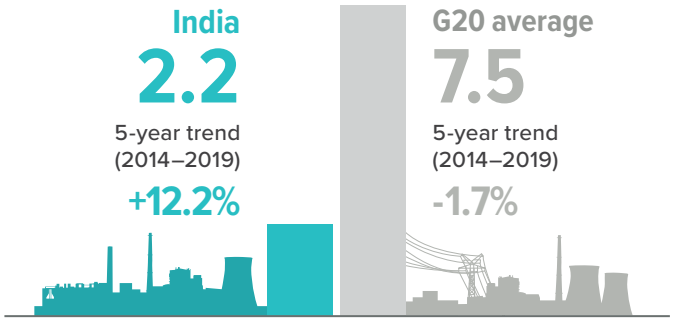


India's updated NDC includes a relative emissions intensity target, calculated to be approximately 4,443 $MtCO_2e$ (excl. LULUCF) or 284% above 1990 levels. To keep below the 1.5°C temperature limit, analysis by the 1.5°C Pathways Explorer shows that its emissions would need to be around 1,650 $MtCO_2e$ by 2030, leaving an ambition gap of about 2,793 $MtCO_2e$. Closing the gap between its 'fair share' and 1.5°C compatible modelled domestic pathway will require financial support.

Climate Action Tracker, 2022a, 2022b; Climate Analytics, 2022; Gütschow et al., 2021

PER CAPITA GREENHOUSE GAS (GHG) EMISSIONS BELOW G20 AVERAGE

tCO_2e/capita[2] in 2019



India's per capita emissions (including LULUCF) are approximately 30% of the G20 average. Total per capita emissions have increased by 12% from 2014 to 2019.

Gütschow et al., 2021; World Bank, 2022

RECENT DEVELOPMENTS

India announced a net zero target by 2070 and **revised the NDC to reduce emissions intensity of GDP by 45% by 2030 from 2005 levels** and achieve about 50% of its total installed capacity from non-fossil-fuel energy sources by 2030.

The Energy Conservation Act mandates a minimum share of "non-fossil-fuel" energy for heavy industries, transport, and buildings sectors, and **a carbon trading regulatory framework**. Committees to steer the sectoral decarbonisation process have been established.

At COP26, India supported the phasing "down" (not "out") of coal in the power sector as a short-term strategy, but the National Electricity Policy includes **plans for an additional 25 GW of coal capacity by 2026–2027.**

KEY OPPORTUNITIES FOR ENHANCING CLIMATE AMBITION

Increased investment in climate action in India will lead to job creation if aligned with domestic political imperatives as well as the achievement of multiple SDGs.

Mitigation actions can have significant health co-benefits, for example, **enhancing reliance on public transportation will reduce GHGs while also improving air quality**.

Resource-efficiency, particularly energy efficiency, has significant potential for **improved competitiveness and job creation**.

Contents

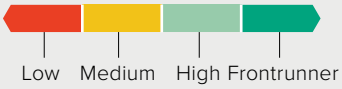
We unpack India's progress and highlight key opportunities to enhance climate action across:

Legend

Trends show developments over the past five years for which data are available. A red exclamation mark indicates negative trends from a climate protection perspective.

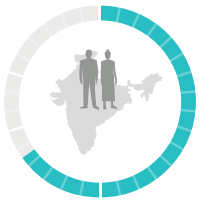
Decarbonisation Ratings[3] assess a country's performance compared to other G20 Members. A high score reflects a relatively good effort from a climate protection perspective but is not necessarily 1.5°C compatible.

Policy Ratings[4] evaluate a selection of policies that are essential pre-conditions for the longer-term transformation required to meet the 1.5°C limit.



SOCIO-ECONOMIC CONTEXT

Human Development Index



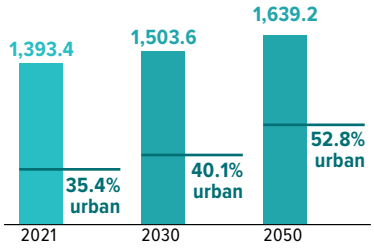
The Human Development Index (HDI) reflects life expectancy, level of education, and per capita income. India ranks medium.

0.65 medium

Data for 2019. UNDP, 2020

Population and urbanisation projections

(in millions)

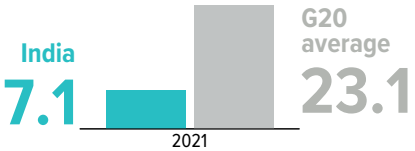


India's population is projected to increase by 18% by 2050 and become more urbanised with an urbanisation rate of 52.8%. It is projected to become the world's most populous country by 2023.

United Nations, 2018; World Bank, 2022

Gross Domestic Product (GDP) per capita

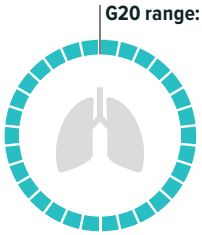
(thousand PPP constant 2015 international $ per person) in 2021



World Bank, 2021

Death rate attributable to ambient air pollution

(death rate per 1,000 population per year, age standardised) in 2019



1.64 per 1,000 people per year

Over 1.7 million people die in India every year due to stroke, heart disease, lung cancer and chronic respiratory diseases as a result of outdoor air pollution. This is the highest death rate in the G20.

Institute for Health Metrics and Evaluation, 2020

A JUST TRANSITION

In India, coal mining directly employs over 7 million people, while benefiting millions more through indirect employment. India's recent policy consideration of "no new coal plant" would significantly affect the livelihoods of these people. Revenue receipts of the major coal producing states (about 18.2% tax and non-tax revenue in 2019–2020), will also be significantly affected, further limiting their already low capacity to provide a cushion in the event of job losses. Further, these states are also low in renewable energy potential, making it challenging to source alternative energy sources and economic engagement, further aggravating regional disparities. These states are also not performing well with socio-economic indicators. Coal has been the central part of their economy, hence, the political will to phase out coal without external support is very low. Understanding the socio-economic impacts of coal phase-out in India is crucial for strategising policies towards an inclusive and sustainable transition.

Bhattacharya et al., 2021; Mitra, 2021; NITI Aayog, 2020; Pai et al., 2020

ADAPTATION

Paris Agreement: Increase the ability to adapt to the adverse effects of climate change and foster climate resilience and low-GHG development.

In 2020, India is estimated to have suffered an **average annual loss of about USD 87bn from extreme weather** events such as tropical cyclones, floods and droughts.

Indian rice production could decrease by 10–30%, and maize production could drop by 25–70% with temperature increases in a range of 1°C–4°C.

About 33% of India is drought prone and 50% of these areas face chronic drought. These droughts have not only intensified but also increased in frequency over the last few decades.

ADAPTATION NEEDS

Impacts of a changing climate

Exposure to Warming

0.4°C
Higher

Between 2017 to 2021, the average summer temperatures experienced by people in India were 0.4°C higher than the 1986–2005 average global mean temperature increase of 0.3°C.

Changes in the ability to work due to exposure to excessive heat

167bn **Labour hours lost**
39% **increase**

In 2021, heat exposure in India led to the loss of 167 billion potential labour hours, a 39% increase from 1990–1999.

Loss of earnings from heat-related labour capacity reduction

159bn **Loss in labour capacity (USD)**
5.4% **of GDP**

Extreme heat can make it unbearable or even dangerous to work in a range of economically important sectors. The potential income loss in 2021 – in the service industry, manufacturing, agriculture, and construction sectors – from labour capacity reduction due to extreme heat was USD 159bn in 2021 in India, or 5.4% of its GDP.

Romanello et al., 2022; World Meteorological Organization, 2022

Exposure to future impacts at 1.5°C warming and higher

Different levels of global warming are projected to have a wide range of impacts of varying severity across the world. The percentages at 1.5°C are calculated as an increase/decrease from the reference period of 1986–2006. Using the projected impacts at 1.5°C of warming as a reference, we compare impacts that may occur at higher levels of warming.

Climatic	**At 2°C**	**At 2.5°C**	**At 3°C**
Local **precipitation**: +5.8% at 1.5°C warming	1.7 times	2.3 times	2.9 times
Local **snowfall**: -13% at 1.5°C warming	1.7 times	2 times	2.4 times

In India, local precipitation is projected to increase by 6% from the reference period of 1986–2006, at 1.5˚C of warming. Under a 3°C warming scenario, precipitation will increase by 3 times the precipitation anticipated at 1.5°C of warming. The rainfall pattern in India has changed in the past 30 years impacting many economic activities, such as agriculture, forestry, and fisheries. Local snowfall in India is expected to decrease under a 1.5°C scenario by 13% when compared with the reference period's snowfall levels. At 3°C, the decrease is expected to be 2.4 times the 1.5°C scenario. Several areas of Hindukush Karakoram Himalaya, the main driver of the Indian monsoon and source of 10 major Asian rivers, have experienced declining snowfall and glacial retreat.

Fresh water	**At 2°C**	**At 2.5°C**	**At 3°C**
Surface run-off: +11.9% at 1.5°C warming	1.5 times	1.9 times	2.6 times
River discharge: +6.5% at 1.5°C warming	2.1 times	3.1 times	4.2 times
Total **soil moisture content:** +0.7% at 1.5°C warming	1.1 times	2.5 times	2.6 times

The percentage of surface run-off and river discharge is projected to increase by 12% and 6.5% above the reference period, respectively, at up to 1.5°C of warming. This increase would be 2.6 times and 4.2 more, respectively, at 3°C of warming. Soil moisture content would increase around 1% at 1.5˚C warming and 2.6 times more at 3°C. Increased precipitation along with change in land use with increased urbanisation is the main cause of increase in surface run-off in India. Prolonged waterlogging may alter the soil moisture content in many places.

Agriculture	At 2°C	At 2.5°C	At 3°C
Reduction in **maize yield**: -2.8% at 1.5°C warming	2.4 times	1.5 times	2.5 times
Reduction in **wheat yield**: -5% at 1.5°C warming	1.5 times	2.2 times	3.2 times

Two-thirds of Indian agriculture is rainfed, and thus highly prone to changes in rainfall. In a 1.5°C of warming scenario, the national maize and wheat yield is projected to decrease 3% and 5%, respectively. This loss may increase by a magnitude of 2.5 times for maize and 3.2 times for wheat at 3°C of warming. IPCC reports indicate a decline in rice production in India with rising temperatures.

Hazards	At 2°C	At 2.5°C	At 3°C
Number of people annually exposed to **heatwaves:** 142,077,808 at 1.5°C warming	1.6 times	2.3 times	2.8 times
Number of people annually exposed to **crop failures**: 1,731,218 at 1.5°C warming	3.4 times	4.9 times	5.5 times
Number of people annually exposed to **wildfires:** 1,209,250 at 1.5°C warming	2.7 times	3.9 times	4.2 times

India's early summer heatwaves have increased significantly. Under 1.5°C of warming around 142 million more people than the 1986–2006 average are projected to be annually exposed to heatwaves at 1.5°C of warming, and 2.3 times greater at 2.5°C. Annually 1.7 million more people than affected during the reference period are expected to be exposed to crop failures due to extreme weather at 1.5°C of warming, and 4.9 times more at 2.5°C. Small and marginal farmers, who comprise 85% of India's farmer population, are particularly vulnerable. Nearly 1.2 million people are annually exposed to forest fires at 1.5°C of warming, and 4 times more at 2.5°C.

Economic	At 2°C	At 2.5°C	At 3°C
Annual expected damage from **tropical cyclones:** +5.7% at 1.5°C warming	2.3 times	3.6 times	4.6 times
Annual expected damage from **river flood:** +48.8% at 1.5°C warming	0.8 times	1.8 times	5.1 times
Labour productivity due to heat stress: -5% at 1.5°C warming	1.6 times	2.1 times	2.7 times

Climate change-induced extreme weather events are causing significant economic losses across all sectors, with agriculture the most vulnerable, accounting for 16% of Indian GDP, and providing nearly half of the employment. Between 2016–2021, extreme events such as cyclones, flash floods, floods, and landslides caused damage to crops over 36 million hectares: a USD 3.75bn loss for farmers. The annual expected damage from tropical cyclones and river flooding at 3°C is 4.6 to 5.1 times that from 1.5°C. Labour productivity is projected to decline 5% from the 1986–2006 reference period, under 1.5°C of warming, 2.1 times more at 2.5°C, and 2.7 times at 3°C.

For further assessments of impacts under different warming scenarios, and a detailed explanation of the methodology, go to https://climate-impact-explorer.climateanalytics.org

Climate Analytics, 2021

ADAPTATION POLICIES

National Adaptation Strategies

Document name	Publication year	Fields of action (sectors)													Monitoring & evaluation process
		Agriculture	Biodiversity	Coastal areas and fishing	Education and research	Energy and industry	Finance and insurance	Forestry	Health	Infrastructure	Tourism	Transport	Urbanism	Water	
National Action Plan for Climate Change (NAPCC)	2008	✓	✓	✓	✓	✓		✓	✓	✓		✓		✓	NA

Nationally Determined Contribution (NDC): Adaptation

TARGETS

No specific target for adaptation in NDC.

ACTIONS

Actions are planned in relation to agriculture, water, biodiversity, coastal areas and fishing, education and research, energy and industry, health, infrastructure.

MITIGATION

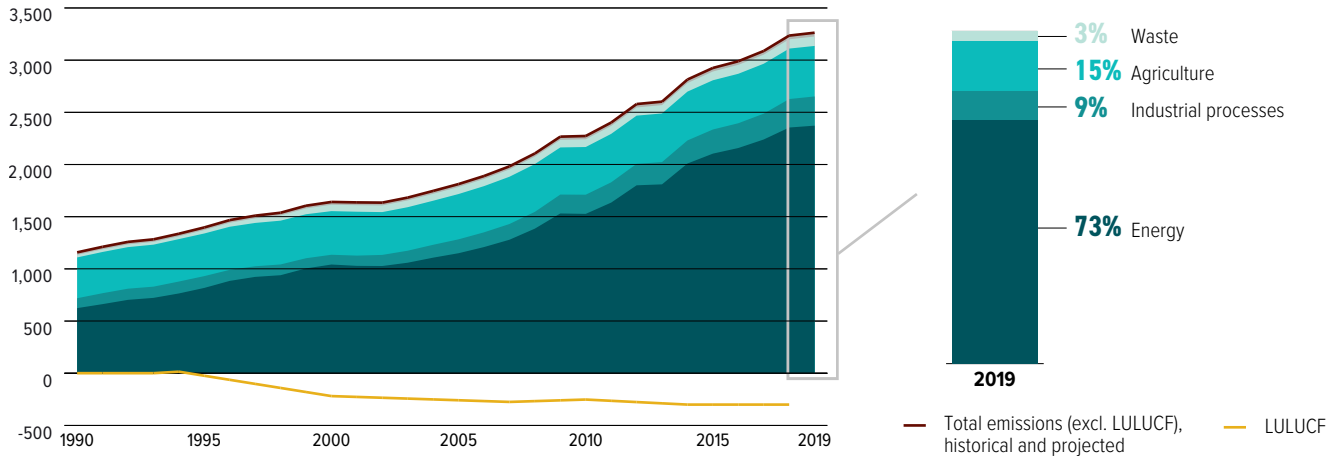
Paris Agreement: Hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit to 1.5°C, recognising that this would significantly reduce the risks and impacts of climate change.

EMISSIONS OVERVIEW

India's total **greenhouse gas emissions (excl. LULUCF) have increased by 182% (1990–2019)**. In the same period, its total methane emissions (excl. LULUCF) have increased by 10%.

GHG emissions across sectors[5]

Total sectoral GHG emissions ($MtCO_2e$/year)

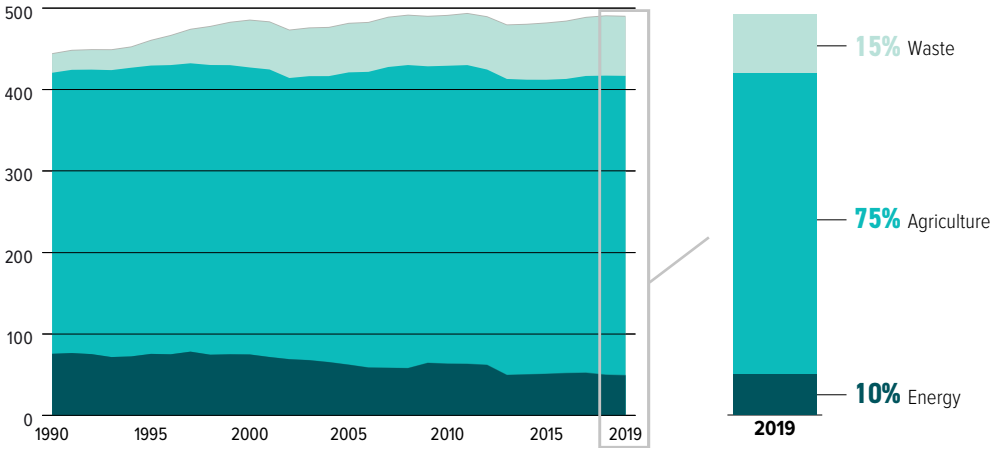


India's emissions (excl. LULUCF) increased by 182% between 1990–2019 to 3,262 $MtCO_2e$/yr. When considered by category, increases were largely due to a sustained increase in energy-related emissions: around a 280% increase between 1990–2019. While emissions from industrial processes and waste sectors are small in absolute terms (in $MtCO_2e$), when compared to the energy sector's emissions, they have increased significantly – 195% and 264%, respectively – during the same period.

Gütschow et al., 2021

Methane emissions by sector

Total CH_4 emissions ($MtCO_2e$/year)



India did not sign the Global Methane Pledge at COP26 in November 2021.

Participating countries pledged to undertake voluntary actions to contribute to a collective reduction of global methane emissions by at least 30% from 2020 levels by 2030. Further scrutiny of plans and implementation will be required.

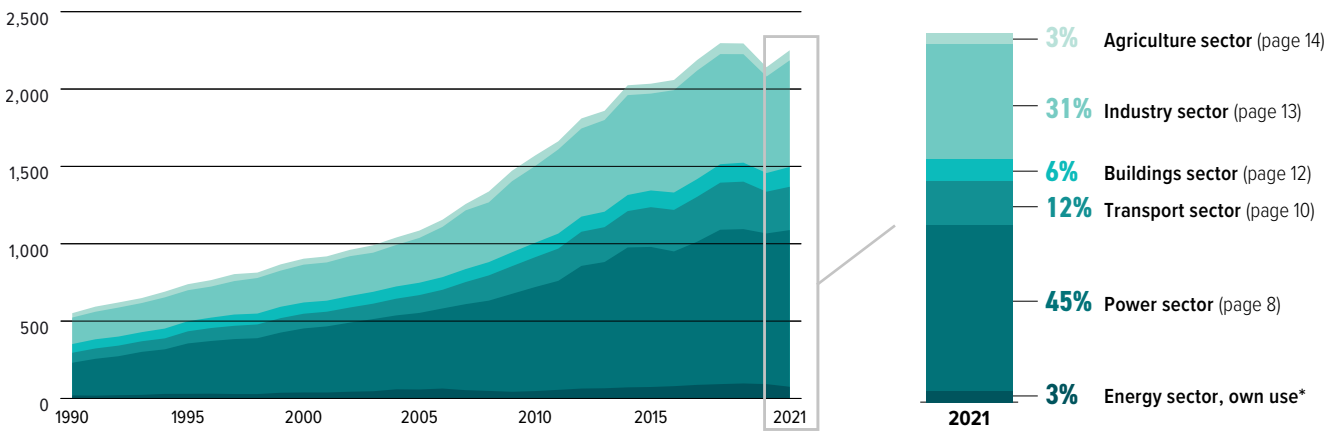
Methane is a potent, though short-lived, greenhouse gas, accounting for an estimated third of global warming. India's methane emissions (excl. LULUCF) increased by 10% between 1990–2019 to 491 $MtCO_2e$/yr*, most steeply between 1990–2000. The majority of India's methane emissions came from the agriculture sector in 2019, an unchanged trend since 1990. Energy sector methane emissions declined 7% between 1990–2019.

Climate and Clean Air Coalition, 2021; Gütschow et al., 2021

**Due to methodological differences, India's third Biennial Report estimates 20% less methane emissions in 2019.*

Energy-related CO_2 emissions by sector

Annual CO_2 emissions ($MtCO_2$/year)

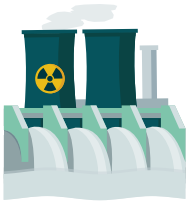


The largest driver of overall greenhouse gas emissions are CO_2 emissions from fuel combustion. In India, emissions have been increasing since 1990. Power generation is the largest contributor at 45%, followed by the industry and transport sectors at 31% and 12%, respectively.

Enerdata, 2022

**Includes energy-related CO_2 emissions from extracting and processing fossil fuels.*

ENERGY OVERVIEW



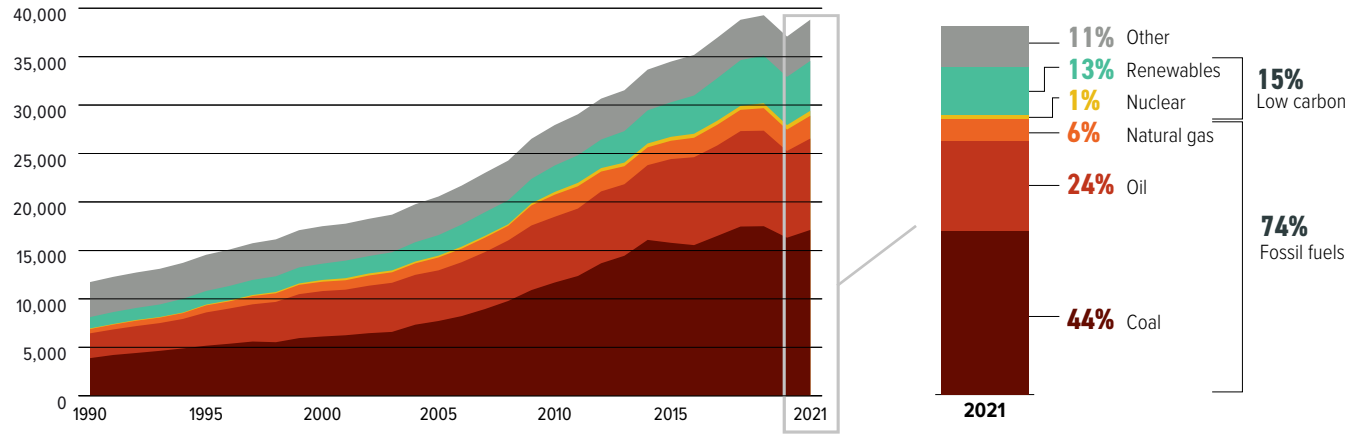
India's energy mix was still dominated by fossil fuels (74%) in 2021, and the carbon intensity has remained almost constant at around 58 tCO_2/TJ over the last 5 years. The share of renewable energy in total primary energy supply was 13% in 2021, mostly comprised of biomass.

The share of fossil fuels globally needs to fall to 67% of global total primary energy by 2030 and to 33% by 2050, and to substantially lower levels without carbon capture and storage.

Rogelj et al., 2018

Energy mix

Total primary energy supply (PJ)

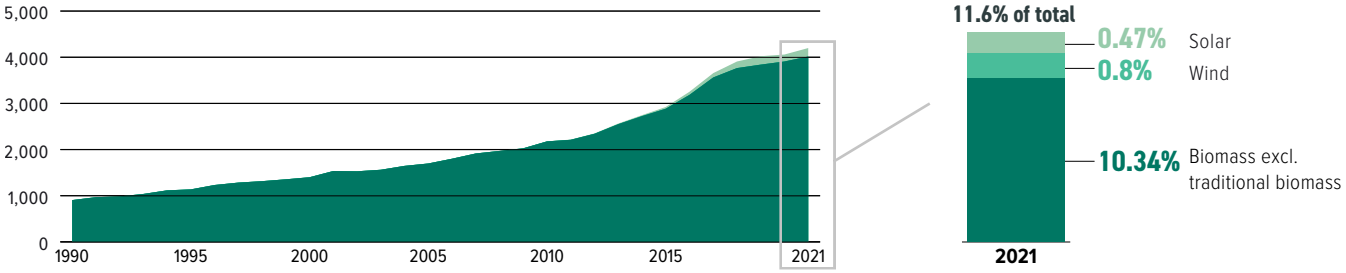


This graph shows the fuel mix for all energy supply, including energy used not only for electricity generation, heating and cooking, but also for transport fuels. Fossil fuels (oil, coal, and gas) make up 74% of India's energy mix, around 9% lower than the G20 average. Increased energy supply was mainly driven by increased coal from 1990–2010. The share of renewable energy has increased since 2015, from 10% to 13% in 2021, but still plays a marginal role in total energy supply.

Enerdata, 2022

Solar, wind, geothermal and biomass development

As a share of total primary energy supply (TPES) (PJ)

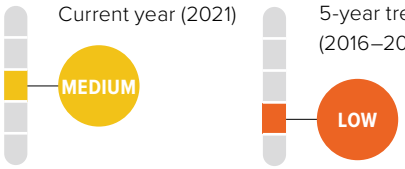


Solar, wind, geothermal and biomass, excluding traditional biomass, account for 11.6% of India's energy supply – the G20 average is 7.5%. The share in total energy supply has increased by around 19.5% in the last 5 years in India (2016–2021).

Enerdata, 2022

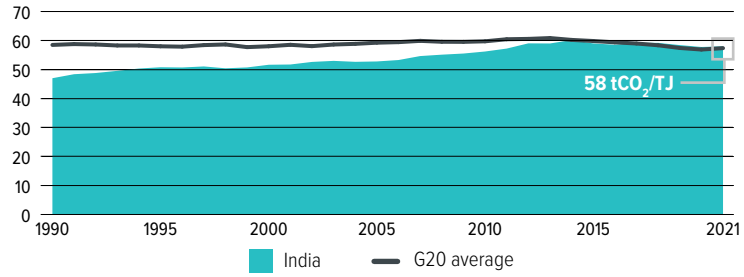
Note: Large hydropower and solid fuel biomass in residential use are not reflected due to their negative environmental and social impacts.

Decarbonisation: a high rating indicates more effort to decarbonise compared to other G20 Members



Carbon intensity of the energy sector

Tonnes of CO_2 per unit of TPES (tCO_2/TJ)



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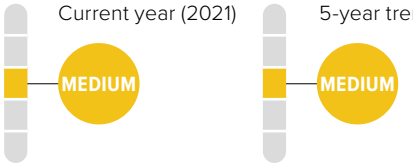
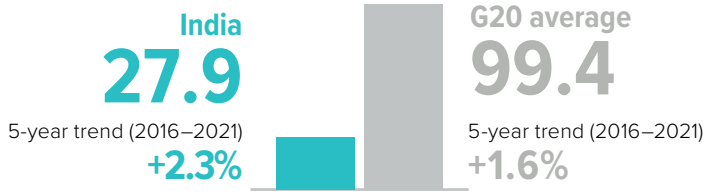


Carbon intensity is a measure of how much CO_2 is emitted per unit of energy supply. Emissions intensity in India in 2021 was 58 tCO_2/TJ, almost the same as the G20 average.

Enerdata, 2022

Energy supply per capita

TPES per capita (GJ/capita) in 2021



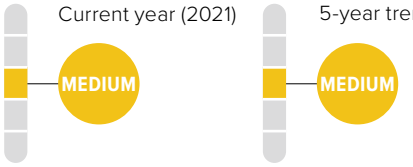
The level of energy supply per capita is closely related to economic development, climatic conditions and the price of energy. Energy supply per capita in India was 27.9 GJ in 2021, less than 30% of the G20 average. This is despite a growth of 2.3% between 2016 and 2021, compared to an increase of 1.6% in the G20 average over the same period.

Enerdata, 2022; World Bank, 2022

Energy intensity of the economy

(TJ/million US$2015 GDP) in 2021

Decarbonisation: a high rating indicates more effort to decarbonise compared to other G20 Members



This indicator quantifies how much energy is used for each unit of GDP. This is closely related to the level of decarbonisation, efficiency achievements, climatic conditions or geography. India's energy intensity is lower than the G20 average and has been decreasing at a slightly higher rate 7.3% (2016–2021) as compared to the G20 decrease of 6.3%.

Enerdata, 2022; World Bank, 2021

POWER SECTOR

Emissions from energy used to make electricity and heat

India is the third-largest producer of electricity after China and the US. India's electricity generation is dominated by coal, around 72% in 2021. India has a large coal pipeline and is currently constructing 32 GW of new coal capacity on top of its existing fleet of 203 GW. India has also announced an increase of installed "non-fossil-fuel" power generation capacity of 500 GW by 2030.

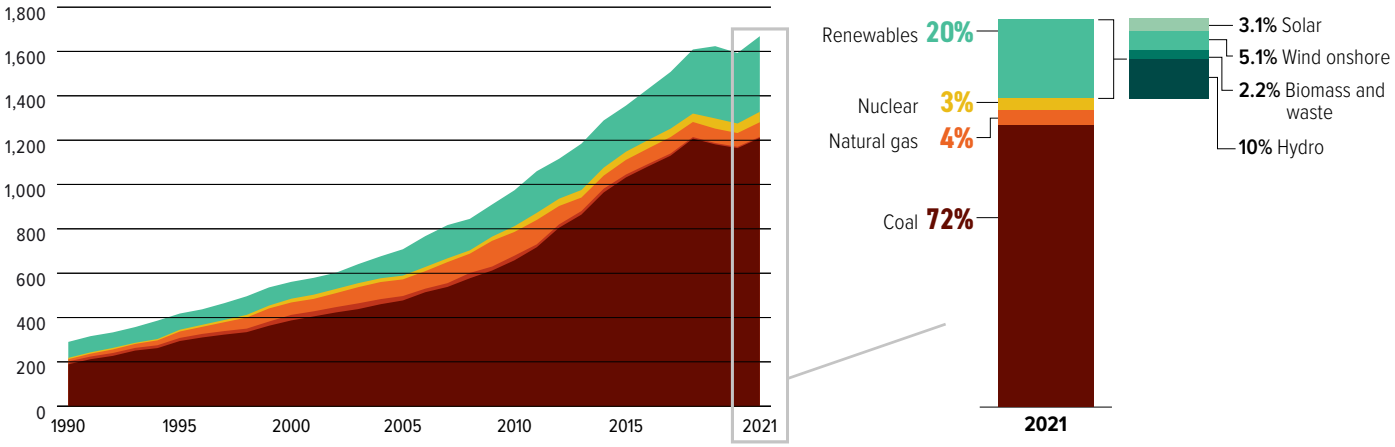
Power generation's share of energy-related CO_2 emissions in 2021: **45%** Direct

Worldwide, coal use for power generation needs to peak by 2020, and between 2030 and 2040, all the regions of the world need to phase out coal-fired power generation. By 2040, the share of renewable energy in electricity generation has to be increased to at least 75%, and the share of unabated coal reduced to zero.

Climate Action Tracker, 2020; Rogelj et al., 2018

Electricity generation mix

Gross power generation (TWh)

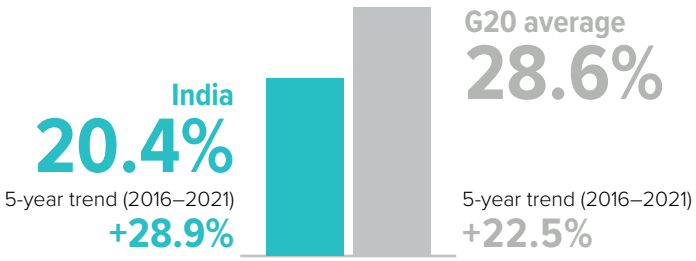


India generated around 77% of its electricity from fossil fuels in 2021, mainly from coal. The share of renewable energy has increased around 29% in the last five years (2016–2021) to 20% (including domestic large hydro) of the power mix in 2021. This is well below the G20 average of 29%.

Enerdata, 2022

Share of renewables in power generation

(incl. large hydro) in 2021



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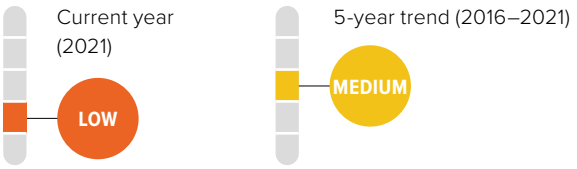
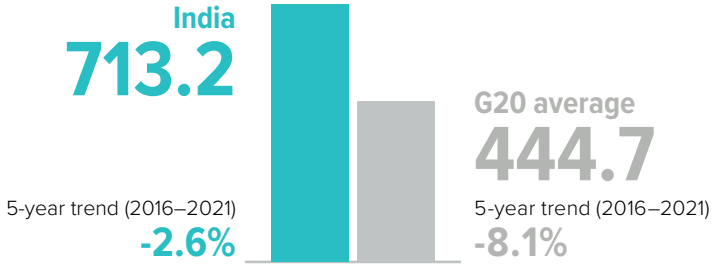


Enerdata, 2022

Emissions intensity of the power sector

(gCO_2/kWh) in 2021



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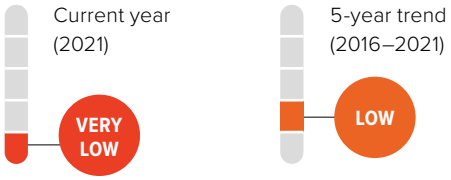
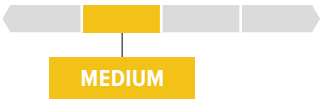


In 2021, the emissions intensity of electricity generation stood at 713 gCO_2/kWh, well above the G20 average of 445 gCO_2/kWh. Emissions intensity of power generation has been decreasing, but at a slow 5-year trend of around 2.6% (2016–2021), due to the high share of coal power.

Enerdata, 2022

POLICY ASSESSMENT

Renewable energy in the power sector

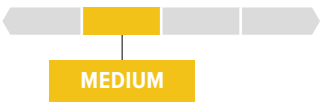


There has been a sustained increase in renewable installed capacity in India and, at COP26, India announced a goal to increase its "non-fossil-fuel" capacity to 500 GW by 2030.

The Indian government has rolled out a range of policy instruments to support the deployment of renewable energy, including regulatory policies aiming to reduce tax, enhance efficiency, tailor research and development initiatives and attract foreign investment. India currently devotes nearly 3% of its GDP to energy investment. Corporate and financial institutions have shown strong commitment to funding renewable energy investment, reaching a record USD 14.5bn in last financial year 2021–2022, an increase of 72% over the pre-pandemic period of 2019–2020.

CEA, 2021; Garg, 2022; IEEFA, 2022; World Economic Forum, 2022

Coal phase-out in the power sector



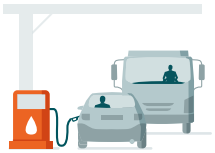
The Union Ministry of Power appointed a committee to update India's National Electricity Policy (NEP) even before India announced a net zero goal by 2070. The updated NEP is anticipated in 2022. At COP26, India insisted on the phrase "down" (not "out") of coal in the power sector as a short-term strategy. The Ministry of Power announced in May 2022 that 30,000 MW of thermal power will be replaced with renewables by 2025–2026.

The gap between demand for coal and availability from domestic sources is being supplemented by the high cost of coal imports, its price-volatility as well as energy security continue.

Ministry of Power, 2022a, 2022c

TRANSPORT SECTOR

Emissions from energy used to transport goods and people



Emissions from transport are still on the rise, representing 12% of India's energy-related CO_2 emissions in 2021. In 2018, 93% of passenger transport and 78% of freight transport went by road. Both sectors are still dominated by oil, and electric vehicles (EVs) make up only 0.4% of car sales.

Transport's share of energy-related CO_2 emissions in 2021:

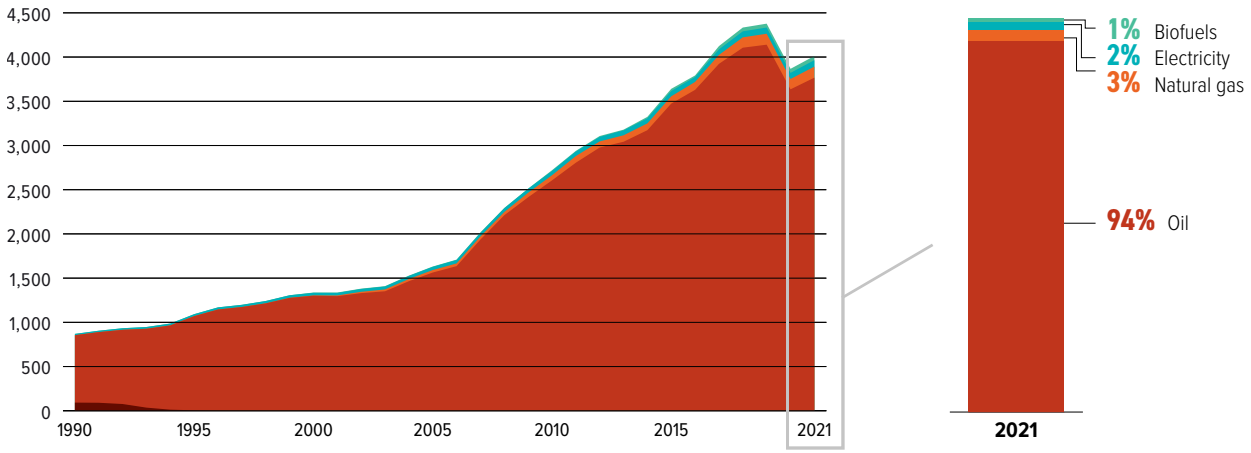
12.4% Direct **0.7%** Indirect

The share of low-carbon fuels in the transport fuel mix must increase to between 40% and 60% by 2040 and 70% to 95% by 2050.

Climate Action Tracker, 2020; Rogelj et al., 2018

Transport energy mix

Final energy consumption by source (PJ/year)

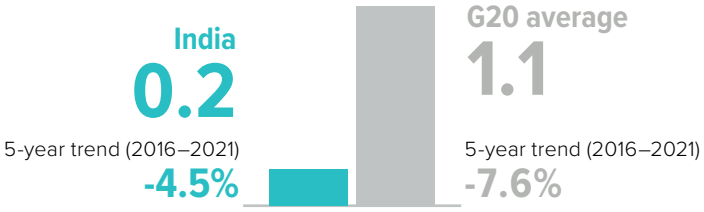


Electricity and biofuels make up only 3% of the energy mix in transport.

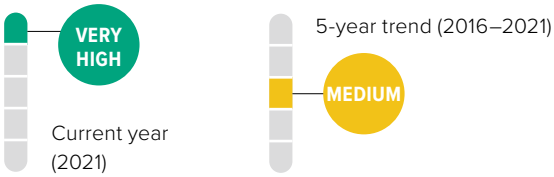
Enerdata, 2022

Transport emissions per capita

(excl. aviation) (tCO_2/capita) in 2021



Decarbonisation: a high rating indicates more effort to decarbonise compared to other G20 Members

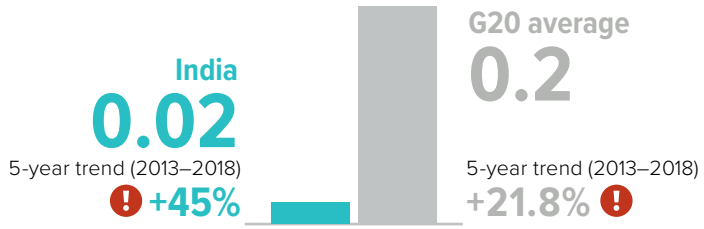


Per capita emissions in 2021 and the 5-year trend have been impacted by COVID-19 pandemic response measures and resulting economic slowdowns. For a discussion of broader trends in the G20 and the rebound of transport emissions in 2022, please see the Highlights Report at www.climate-transparency.org

Enerdata, 2022; World Bank, 2022

Aviation emissions per capita[6]

(tCO_2/capita) in 2018



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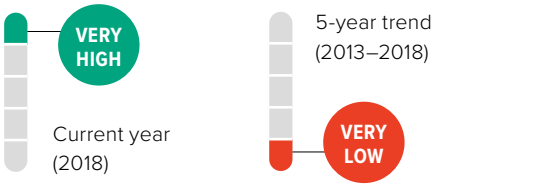
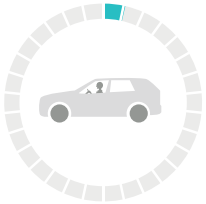


Enerdata, 2022; IEA, 2021a; World Bank, 2022

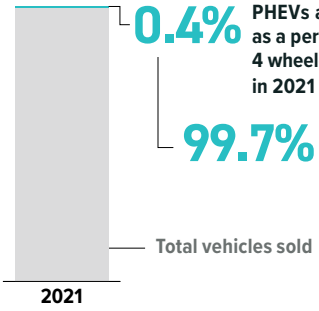
Motorisation rate



37
vehicles (incl. 2-, 3- and 4-wheelers) per 1,000 inhabitants in 2019.

Abdul-Manan et al., 2022

Market share of electric vehicles in new car sales (%)

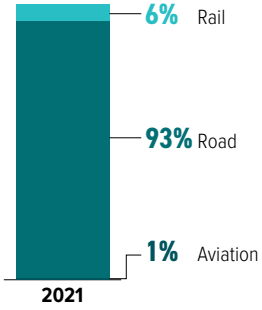


Battery-Electric Vehicles (BEVS) have greater emissions mitigation potential when they are powered by electricity produced by renewables because they have no internal combustion engine (ICE), whereas plug-in hybrids (PHEVs) still produce emissions when using the ICE.

IEA, 2022

Modal split passenger transport

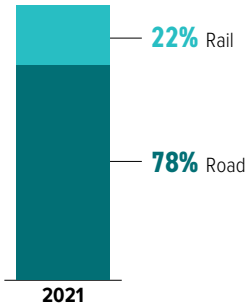
(% of passenger-km): road, rail and air



Enerdata, 2022

Modal split freight transport

(% of tonne-km): road, rail

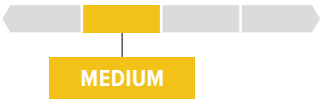


Due to data availability, only road and rail transport are included in the freight transport category. Other freight modes, e.g. waterways, are excluded due to lack of data for all countries.

Enerdata, 2022

POLICY ASSESSMENT

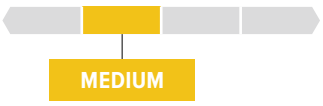
Phase out fossil fuel cars



The Faster Adoption and Manufacturing of Electric Vehicles in India (FAME I and II) scheme is a key component of India's EV strategy. The government provides financial support in various forms (purchase incentives, interest subvention, registration fee exemption, tax benefits) to reduce the upfront cost of buying EVs. EV charging infrastructure is also developing fast. A target of 20% ethanol blending by 2025 has been mandated, and pilot projects on hydrogen use in transport are ongoing. The new vehicle emission norms BS VI (skipping BS V) were introduced effective from April 2020. Government has also launched a voluntary vehicle scrappage policy to phase out old vehicles from Indian roads.

IBEF, 2021; Kala, 2022; Momin, 2021; NITI Aayog, 2021a, 2021b; NITI Aayog, TIFAC, 2022; PIB, 2021; Wangchuk, 2022

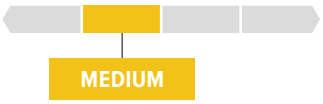
Phase out fossil fuel heavy-duty vehicles



A fuel efficiency standard for heavy-duty vehicles weighing more than 12 tonnes has been in effect since 2018. The fuel efficiency standards for commercial vehicles between 3.5 and 12 tonnes were announced by the Ministry of Power in 2019. Currently, India has proposed fuel consumption standards (FCS) for all vehicles, including light, medium, and heavy-duty motor vehicles, which are either manufactured or imported for sale in India. These norms are proposed to be implemented from 1 April 2023. However, the Indian government plans to use LNG in long-haul heavy-duty trucks and other similar automotive applications.

BEE, 2021b; DieselNet, 2021; The Economic Times, 2022; TransportPolicy.net, 2021

Modal shift in (ground) transport



Several national programmes, including the National Urban Transport policy and the Smart Cities Mission, aim to re-allocate road space to pedestrians rather than vehicles; incorporate urban transport at the urban planning stage; and develop safe walking and cycling options. Government programmes fund mass rapid transportation through light rail and metro routes. Under the Smart City Mission, initiatives like the Streets for People Challenge and the Cycles4Change Challenge aim to implement low-cost interventions like pop-up lanes, community cycle rental schemes, and cycle training programmes, to emphasise the importance of non-motorised transport. A number of cities are working towards establishing a Unified Metropolitan Transportation Authority in order to streamline initiatives and promote sustainable modes of transport at the city level.

ITDP, 2021a, 2021b; Ministry of Urban Development, 2016

BUILDINGS SECTOR

Emissions from energy used to build, heat and cool buildings

Direct emissions and indirect emissions from the buildings sector in India account for 5.1% and 15.9% of total energy-related CO_2 emissions, respectively. **Per capita emissions from the buildings sector are 4 times lower than the G20 average.**

Buildings sector's share of energy-related CO_2 emissions in 2021:

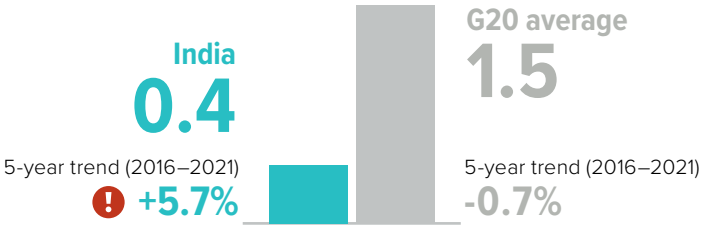
5.1% Direct **15.9%** Indirect

By 2040, global emissions from buildings need to be reduced by 90% from 2015 levels, and be 95–100% below 2015 levels by 2050, mostly through increased efficiency, reduced energy demand and electrification in conjunction with complete decarbonisation of the power sector.

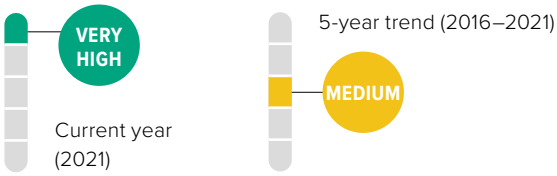
Climate Action Tracker, 2020; Rogelj et al, 2018

Buildings sector emissions per capita

incl. indirect emissions (tCO_2/capita) in 2021



Decarbonisation: a high rating indicates more effort to decarbonise compared to other G20 Members

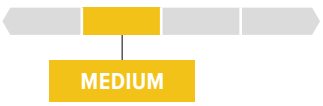


Buildings emissions occur directly (burning fuels for heating, cooking, etc.) and indirectly (from grid-electricity for air conditioning, appliances, etc.). Buildings-related emissions per capita are nearly 4 times lower than the G20 average (2021), reflecting the low energy consumption in the buildings sector due to lack of access to modern appliances as well as low proportion of formal buildings in the urban landscape. In contrast to the declining G20 average, India has increased per capita buildings sector emissions by 5.7% between 2016–2021, albeit from a very low base.

Enerdata, 2022; World Bank, 2022

POLICY ASSESSMENT

Near zero energy new buildings

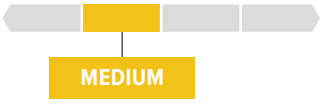


While there is no government policy for net zero buildings, there are some private initiatives to develop India's first net zero residential space.

With increasing summer temperatures, space cooling has become a major source of energy demand in urban buildings. Government initiatives like the Energy Conservation Building Code (ECBC), India Cooling Action Plan (ICAP), and voluntary initiatives on green building guidelines and a push for the adoption of thermal performance in building design and construction materials can help reduce the internal heat load and lower space cooling requirements in buildings. In addition, initiatives to promote energy-efficient appliances are contributing to moderating energy needs in buildings.

BEE, 2021a; Pimpalkhare, 2018; Shakti, 2021

Renovation of existing buildings



India's major stock of commercial buildings was built before the implementation and access to modern energy-saving technologies.

Energy Efficiency Services Limited (EESL), an initiative of the Ministry of Power, is implementing the Buildings Energy Efficiency Programme to retrofit commercial buildings with energy efficiency devices, delivering an estimated cumulative energy saving of 790 GWh, with avoided peak demand of 75.64 MW, cumulative emissions reduction of 0.65 $MtCO_2$ per year and an estimated cumulative monetary savings of INR 6.8bn in electricity bills.

Ministry of Power, 2022b; TERI, 2019

INDUSTRY SECTOR

Emissions from energy use in industry

Direct and indirect emissions from industry in India make up 30.6% and 18.7% of energy-related CO_2 emissions, respectively. **Industrial emissions intensity has declined over time, reflecting effective policies to improve industrial energy efficiency** over the years. Within the manufacturing sector, iron and steel industries and other non-metallic minerals account for 70% of CO_2 emissions.

Industrial emissions need to be reduced by 65–90% from 2010 levels by 2050.

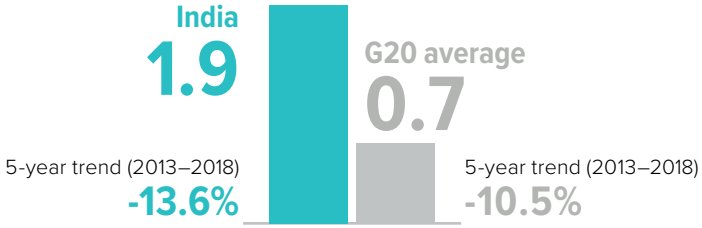
Rogelj et al., 2018

Industry sector's share of energy-related CO_2 emissions in 2021:

30.6% Direct **18.7%** Indirect

Industry emissions intensity[7]

($kgCO_2e$/USD2015 GVA) in 2018



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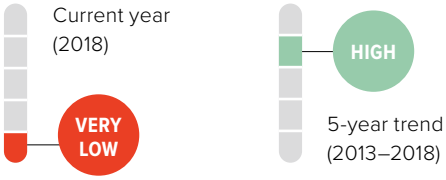


Enerdata, 2021; World Bank, 2022

Carbon intensity of steel production[8]

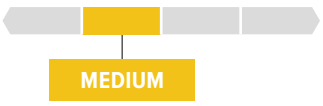
($kgCO_2$/tonne product) in 2019

Steel production and steelmaking are significant GHG emissions sources, and challenging to decarbonise.

Enerdata, 2022; World Steel Association, 2021

POLICY ASSESSMENT

Energy efficiency



One of the main energy efficiency instruments in India's industry sector is the Perform, Achieve and Trade (PAT) mechanism, which covers nearly 25% of energy use. In its first three cycles it has achieved total savings of nearly 100 $MtCO_2e$ emissions, and the mechanism is currently in its sixth cycle (ending in March 2023).

India has functional market-based mechanisms to promote renewable energy and energy efficiency. It is expected that a carbon-market mechanism will be announced soon.

India launched the National Hydrogen Mission in 2021. The mission provides for interlinkages with policies promoting renewable energy. For example, renewable energy consumed to produce hydrogen is eligible for compliance with the renewable purchase obligations.

BEE, 2017, 2021c, 2022; IEA, 2021b; Ministry of Power, 2022a; Shakti, 2021; Verma, 2021

LAND USE SECTOR

Emissions from land use change and forestry

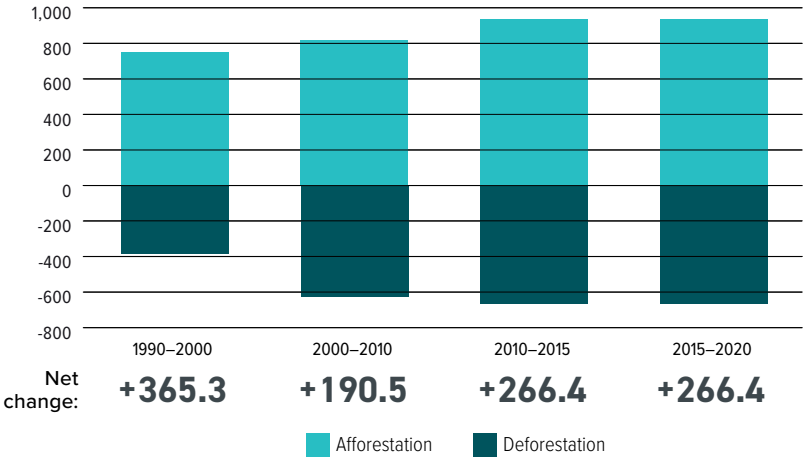
According to the Third Biennial Report to UNFCCC, India's LULUCF sector was a net sink of 308 $MtCO_2e$ in 2016. It is projected that **by 2050, half of the country's population will be urban, leading to significant changes to how the land is used and related emissions**.

Global deforestation needs to be halted and changed to net CO_2 removals by around 2030.

Rogelj et al., 2018

Annual forest expansion, deforestation and net change

Forest area change in 1,000 ha/year

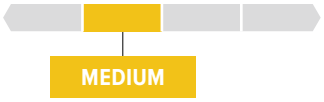


Between 2015–2020, India gained 266.4 kha of forest area per year. In its NDC, India has pledged to create an additional carbon sink of 2.5–3 billion tonnes of CO_2e by 2030.

Global Forest Assessment, 2020

POLICY ASSESSMENT

Target for net zero deforestation



The Forest Survey of India announced an increase of 2,261 km^2 in the total forest and tree cover from 2019–2021. A total of 554 km^2 of forest area has been diverted for non-forestry purposes in the last three years, mainly for mining, road construction and irrigation.

The National Mission for a Green India was launched to protect, restore and enhance India's forest cover as a response to climate change. Its target is to convert 10 mha of forest and non-forest land to increase forest cover and improve the quality of existing forest, sequestering 100 $MtCO_2e$ of carbon. A number of other policies and initiatives have been initiated, e.g. the National Afforestation Programme, a Compensatory Afforestation Fund, Green Highway Policy, National Agro-forestry policy and National Bamboo Mission.

Ministry of Environment, Forest and Climate Change, 2022a, 2022b; Press Trust of India, 2022

AGRICULTURE SECTOR

Emissions from agriculture

India has the largest cattle population in the world (38%) and **agricultural emissions are primarily from the digestive processes and manure of livestock (mainly cattle)**. Being one of the largest producers of rice and wheat, emissions from paddy field and use of nitrogen-based fertiliser have also contributed significantly to emissions from the agriculture sector.

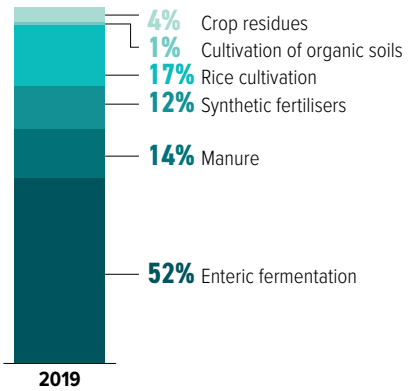
Methane emissions need to decline by 10% by 2030 and by 35% by 2050 (from 2010 levels). Nitrous oxide emissions (mainly from fertilisers and manure) need to be reduced by 10% by 2030 and by 20% by 2050 (from 2010 levels).

Rogelj et al., 2018

Emissions from agriculture

excluding energy emissions, in 2019

761.8
$MtCO_2e$ in 2019



In India, the largest sources of GHG emissions in the agriculture sector are enteric fermentation (52%), livestock manure (14%), use of synthetic fertiliser (12%) and rice cultivation (17%). Dietary changes for cattle, improving manure handling and storage, efficient use of fertilisers, as well as reductions in food waste, could all help reduce emissions from this sector.

FAO, 2022

MITIGATION: TARGETS AND AMBITION

The science from the IPCC on the risks of exceeding 1.5°C warming is clear. The UN science body has projected that to keep the 1.5°C goal alive, the world needs to roughly halve emissions by 2030.

However, despite the Glasgow Climate Pact (1/CMA.3) agreement to "revisit and strengthen" 2030 targets this year, progress on more ambitious targets has stalled. Without far more ambitious government action, the world is heading to a warming of **2.4°C with current 2030 targets** and even higher warming of **2.7°C with current policies**.

Climate Action Tracker, 2021a, 2022c; IPCC, 2022; UNFCCC, 2021

AMBITION: 2030 TARGETS

Nationally Determined Contribution: Mitigation

TARGETS

- India's NDC is a relative target of a 45% reduction in emissions intensity of GDP (compared to 2005 by 2030)
- At least 50% non-fossil-fuel electric power capacity by 2030

ACTIONS

- Promotion of greater use of renewables in the energy mix along with expansion of renewable installed capacity
- Enhancing energy efficiency
- Development of climate resilient urban centres
- Waste to energy
- Sustainable green transportation network
- Planned afforestation

Climate Action Tracker (CAT) evaluation of targets and actions

Critically insufficient	**Highly insufficient**	Insufficient	Almost sufficient	1.5°C Paris Agreement compatible

The CAT evaluates and rates several elements of climate action: policies and actions, targets and a country's contribution to climate finance (where relevant) and combines these into an overall rating.

The CAT rates India's climate targets and policies as "highly insufficient", indicating that India's climate policies and commitments are not consistent with the Paris Agreement's 1.5°C temperature limit.

Its updated emissions intensity target is "insufficient" when compared to India's 'fair share' contribution, an improvement of one category from last year's assessment of "highly insufficient". India's conditional NDC target is still "critically insufficient" when compared to a modelled 1.5°C emissions pathway for the country. India should adopt targets that will drive actual emissions reductions and accelerate climate policy implementation. The country will need international support to get onto a 1.5°C pathway.

This CAT analysis was updated in September 2022.
For the full assessment of the country's targets and actions, and the explication of the methodology, see www.climateactiontracker.org

Climate Action Tracker, 2022a

AMBITION: LONG-TERM STRATEGIES

The Paris Agreement invites countries to communicate mid-century, long-term, and low-GHG emissions development strategies. Long-term strategies are an essential component of the transition toward net zero emissions and climate-resilient economies.

Status	Announced during COP26, November 2021
Net zero target	By 2070
Interim steps	A 45% reduction by 2030 in emissions intensity of GDP, compared to 2005 levels.
Sectoral targets	At least 50% non-fossil-fuel electric power capacity by 2030

FINANCE

Paris Agreement: Make finance flows consistent with a pathway towards low-GHG emissions and climate-resilient development.

In 2020 India spent USD 6.9bn on fossil fuel subsidies, nearly 97% on petroleum. Subsidies in the energy sector have reduced over the last few years and shown a marked shift towards power transmission and distribution and away from oil and gas. Direct subsidies to renewable energy, however, are still lower than the fossil fuel subsidies.

Investment in green energy and infrastructure needs to outweigh fossil fuel investments by 2025.

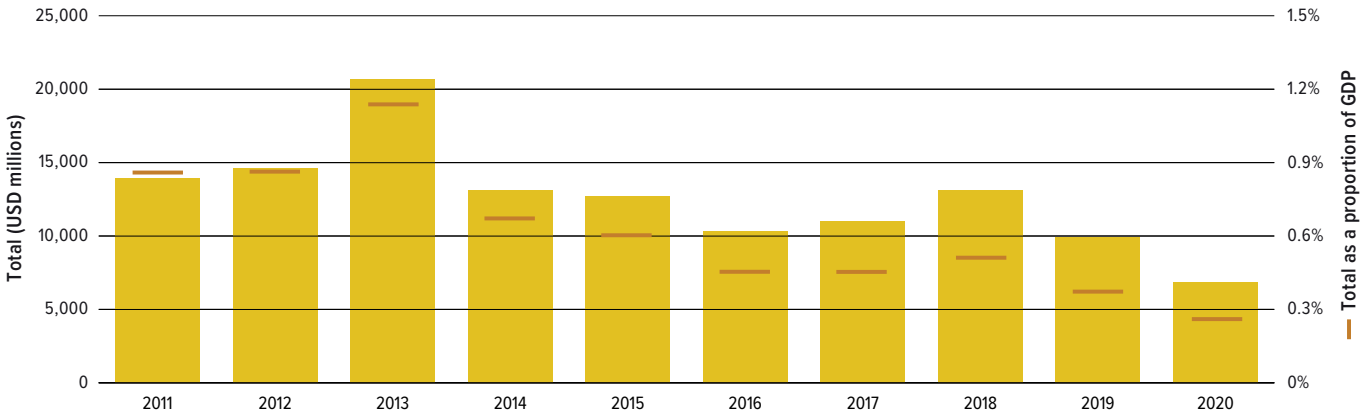
Rogelj et al., 2018

FISCAL POLICY LEVERS

Fiscal policy levers raise public revenues and direct public resources. Critically, they can shift investment decisions and consumer behaviour towards low-carbon, climate-resilient activities by reflecting externalities in the price.

Fossil fuel subsidies relative to national budgets

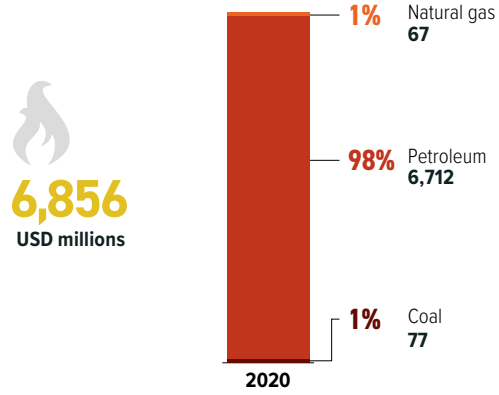
(USD millions)



OECD-IEA Fossil Fuel Support Database, 2022

Fossil fuel subsidies by fuel type

(USD millions) in 2020



Between 2011 and 2020, fossil fuel subsidies in India have, on average, declined, with 2020 marking the lowest total in the period at USD 6.9bn. These focused almost exclusively on consumption and on petroleum. Fossil fuel subsidies in India made up 2% of public spending in 2020.

The largest subsidy measure is a direct transfer aimed at consumers for the purchase of kerosene and LPG. This support has decreased dramatically since its peak in 2013 – when it included other petroleum products like diesel – thanks to government reform, which has gradually brought prices towards market rates while maintaining support for families below the poverty line. The next step in the government plan to reduce fossil fuel subsidies is to phase out kerosene completely so that the support only extends to LPG.

While OECD data does not include renewables, the IISD finds that although subsidies for coal, oil and gas have fallen in the past decade they are still considerably higher than those for renewables.

Aggarwal et al., 2022; Energy Policy Tracker, 2022; OECD-IEA Fossil Fuel Support Database, 2022

Carbon pricing and revenue

India does not have a national carbon tax or emissions trading scheme (ETS). Instead, it has trading mechanisms to promote energy efficiency (tradeable energy saving certificates under the PAT scheme) and renewable energy (tradeable certificates for compliance with the Renewable Purchase Obligations for distribution companies). These mechanisms indirectly put a price on carbon. India is expected to announce a domestic carbon trading platform soon. Some states (such as Gujarat) are considering the implementation of an ETS, with pilot phases currently ongoing.

In 2017, India phased out the earmarking of revenue from the Clean Environment Cess (taxing coal) for environmental purposes, subsumed under the introduction of the centralised Goods and Services Tax.

I4CE, 2022

FINANCIAL POLICY AND REGULATION

Through policy and regulation, governments can overcome challenges to mobilising green finance, including real and perceived risks, insufficient returns on investment, capacity and information gaps.

India is making progress towards instituting a system of green financial regulations. The country increasingly recognises climate risk as a priority in the financial system, as established in the Reserve Bank of India (RBI) Financial Stability Report of July 2021. The RBI also released a discussion paper on climate risk and mitigation opportunities for the financial institutions.

In January 2021, a coalition of the Reserve Bank of India (RBI), the Securities and Exchange Board of India (SEBI), the Pension Fund Regulatory and Development Authority (PFRDA) and the Insurance Regulatory and Development Authority of India (IRDAI) set up the Task Force on Sustainable Finance. This aims to define a framework and roadmap for sustainable finance in India, to suggest a draft taxonomy of sustainable activities and a framework of risk assessment. In May 2021, the RBI set up a Sustainable Finance Group to take the lead on regulatory initiatives for climate risk and sustainable finance.

Further progress has been made in the last year. In the February 2022 Budget Speech it was announced that a sovereign green bond will be issued in the next year to mobilise resources for green infrastructure and, in a March 2022 bulletin, the RBI issued its first public statement about green transition risks to Indian banks, suggesting that these should be closely monitored.

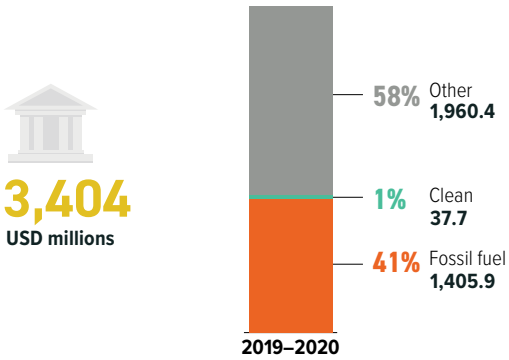
Ghosh, 2022; Sitharaman, 2022; Vaze, 2022

PUBLIC FINANCE

Governments steer investments through their public finance institutions, including via development banks both at home and overseas, and green investment banks. Developed G20 Members also have an obligation to provide finance to developing countries, and public sources are a key aspect of these obligations under the UNFCCC.

Public finance for energy

USD millions (2019–2020 average)



Between 2019 and 2020 India provided an average of USD 3.4bn in public finance per year to energy projects. Of this total, 41% went to fossil fuels – all to coal projects. The largest single support measure, at USD 2.9bn, was for 12 different hydroelectric power plant projects. Other significant investments included USD 2.6bn to two coal-fired power stations. These public finance measures were provided through the Power Finance Corporation and the Export-Import Bank of India.

Oil Change International, 2022

Provision of international public support

India is not listed in Annex II of the UNFCCC and is not formally obliged to provide climate finance and, therefore, while it may channel international public finance towards climate change via multilateral and other development banks, it has not been included in this report.

India's climate policy has been conditional on financial support from Industrialised countries. India's Department of Economic Affairs estimated that USD 2.5tn (at 2014–2015 prices) would be needed to implement India's NDC goals between 2020 and 2030. So far, however, India has mobilised 85% of climate finance from domestic sources.

Department of Economic Affairs, 2020

Endnotes

For more detail about sources and methodologies, please download the CTR Technical Note at: www.climate-transparency.org/g20-climate-performance/g20report2022

Where referenced, "Enerdata, 2022" refers to data provided in July 2022, and due to rounding, graphs may sum to slightly above or below 100%.

1 The '1.5°C compatible pathway' is derived from global cost-effective pathways assessed by the IPCC's SR15, selected based on sustainability criteria, and defined by the 5th–50th percentiles of the distributions of such pathways achieving the long-term temperature goal of the Paris Agreement. Negative emissions from the land sector and novel negative emissions technologies are not included in the assessed models, which consider one primary negative emission technology (BECCS). In addition to domestic 1.5°C compatible emissions pathways, the 'fair share' emissions reduction range would almost always require a developed country to provide enough support through climate finance, or other means of implementation, to bring the total emissions reduction contribution of that country down to the required 'fair share' level.

2 'Land use' emissions is used here to refer to land use, land use change and forestry (LULUCF). The Climate Action Tracker (CAT) derives historical LULUCF emissions from the UNFCCC Common Reporting Format (CRF) data tables, converted to the categories from the IPCC 1996 guidelines, in particular separating Agriculture from LULUCF, which under the IPCC 2006 Guidelines is integrated into Agriculture, Forestry, and Other Land Use (AFOLU).

3 The Decarbonisation Ratings assess the current year and average of the most recent 5 years (where available) to take account of the different starting points of different G20 Members.

4 The selection of policies rated and the assessment of 1.5°C compatibility are primarily informed by the Paris Agreement and the IPCC's 2018 SR15. The Policy Assessment Criteria table below displays the criteria used to assess a country's policy performance.

5 In order to maintain comparability across all countries, this report harmonises all data with PRIMAP 2021 dataset to 2018. However, note that CRF data is available for countries which have recently updated GHG inventories.

6 This indicator adds up emissions from domestic aviation and international aviation bunkers in the respective country. In this Country Profile, however, only a radiative forcing factor of 1 is assumed.

7 This indicator includes only direct energy-related emissions and process emissions (Scope 1) but not indirect emissions from electricity.

8 This indicator includes emissions from electricity (Scope 2) as well as direct energy-related emissions and process emissions (Scope 1).

Policy Assessment Criteria

	LOW	MEDIUM	HIGH	FRONTRUNNER
Renewable energy in power sector	No policies to increase the share of renewables	Some policies	Policies and longer-term strategy/ target to significantly increase the share of renewables	Short-term policies + long-term strategy for 100% renewables in the power sector by 2050 in place
Coal phase-out in power sector	No targets and policies in place for reducing coal	Some policies	Policies + coal phase-out decided	Policies + coal phase-out date before 2030 (OECD and EU28) or 2040 (rest of the world)
Phase out fossil fuel cars	No policies for reducing emissions from light-duty vehicles	Some policies (e.g. energy/emissions performance standards or bonus/ malus support)	Policies + national target to phase out fossil fuel light-duty vehicles	Policies + ban on new fossil fuel-based light-duty vehicles by 2035 worldwide
Phase out fossil fuel heavy-duty vehicles	No policies	Some policies (e.g. energy/emissions performance standards or support)	Policies + strategy to reduce absolute emissions from freight transport	Policies + innovation + strategy to phase out emissions from freight transport by 2050
Modal shift in (ground) transport	No policies	Some policies (e.g. support programmes to shift to rail or non-motorised transport)	Policies + longer-term strategy	Policies + longer-term strategy consistent with 1.5°C pathway
Near zero energy new buildings	No policies	Some policies (e.g. building codes, standards or fiscal/financial incentives for low-emissions options)	Policies + national strategy for near zero energy new buildings	Policies + national strategy for all new buildings to be near zero energy by 2020 (OECD countries) or 2025 (non-OECD countries)
Energy efficiency in industry	No policies	Mandatory energy efficiency policies cover more than 26–50% of industrial energy use	Mandatory energy efficiency policies cover 51–100% of industrial energy use	Policies + strategy to reduce industrial emissions by 75–90% from 2010 levels by 2050
Retrofitting existing buildings	No policies	Some policies (e.g. building codes, standards or fiscal/financial incentives for low-emissions options)	Policies + retrofitting strategy	Policies + strategy to achieve deep renovation rates of 5% annually (OECD) or 3% (non-OECD) by 2020
Net zero deforestation	No policies or incentives to reduce deforestation in place	Some policies (e.g. incentives to reduce deforestation or support schemes for afforestation/ reforestation in place)	Policies + national target for reaching net zero deforestation	Policies + national target for reaching zero deforestation by 2020s or for increasing forest coverage

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For more information on this country profile, please contact:

The Energy and Resources Institute (TERI)
Manish Shrivastava
manish.shrivastava@teri.res.in