FACTSHEET #1

Emission Intensity Tracking

ON THE ROAD TO COP 26

DISCUSSION PAPER SERIES

India's Climate Change Strategy

India's emission intensity commitment under Nationally Determined Contribution (NDC)

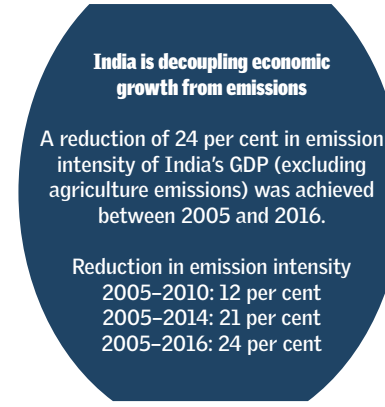
To reduce the emission intensity of its Gross Domestic Product (GDP) by 33 to 35 per cent below 2005 levels by 2030

1. The Paris Agreement (PA) set its goal to limit global warming to well below 2°C, preferably to 1.5°C, compared to pre-industrial levels.

2. India submitted its NDC on 02 November 2016 committing to '*reduce the emission intensity of its GDP by 33 to 35 percent by 2030 from 2005 level*'.

3. Earlier, India had declared a voluntary target of reduction of emission intensity, excluding emissions from the agriculture sector, by 20–25 per cent below 2005 levels by 2020. This was announced in the Indian Parliament on 28 April 2015 by the Union Environment Minister.

4. In February 2021, in the Third Biennial Update Report (BUR-3) to the United National Framework Convention on Climate Change (UNFCCC), India stated that it had achieved a 24 per cent reduction from the 2005 levels in emission intensity of GDP by 2016. This marks progress compared to its achievement of reducing emission intensity by 21 per cent by 2014, as stated in BUR-2.



5. Under mitigation actions, India has projected the following three major actions to meet its emission intensity reduction targets:
   a. Increase the share of non-fossil fuel in overall energy mix
   b. Improve energy efficiency measures
   c. Enhanced CO_2 removal through increasing forest and tree cover

6. India has a target of 175 GW on renewable energy capacity by 2022. Till 28 February 2021, the country had achieved 94 GW, comprising 25 per cent share in total installed capacity for power generation. If large hydro installed capacity is included (45 GW by February 2021), then India's non-fossil energy capacity is 139 GW—close to 38 per cent of installed capacity. In terms of generation of power, the picture is different as fossil energy continues to dominate.

Energy intensity, carbon intensity and emission intensity

Energy intensity: Energy intensity is defined as the amount of energy consumed for every unit of GDP. This includes all fuels used in the country. The energy intensity of the economy can be reduced by fuel shift from fossil to non-fossil fuels, energy efficiency measures, new and improved technologies, increased productivity, and shifts in overall production from sectors that use a lot of energy (like manufacturing or mineral processing) to others that do not (like services).

As per India Energy Outlook 2021 of the International Energy Agency (IEA)[1], the GDP of India has increased six-fold between 1990 and 2019, whereas final consumption of energy has only increased two and half times, indicating a rapid improvement of energy intensity in these three decades. This is primarily due to a shift away from biomass as primary fuel in the residential sector, the share of which reduced from 48 per cent (1990) to 18 per cent (2019), due to enhancement of electrification and liquified petroleum gas (LPG) penetration. Efficiency gains from biomass (with very low conversion efficiency of 5–10 per cent) to higher efficiency LPG and electricity is responsible for 60 per cent decline in energy intensity during the period. As per analysis given in BUR-2, India's energy intensity (at 2011–12 price level GDP) decreased from 0.2732 Mega Joule per rupee (MJ/INR) in 2011–12 to 0.2401 in 2016–17, indicating a reduction of more than 12 per cent in a span of five years. The decline is being attributed to the fact that GDP growth is faster than energy growth, which is made possible by a larger share of service sector growth in the country.

Carbon intensity: The carbon intensity of the economy is measured as carbon dioxide (CO_2) emissions per unit of GDP. It is dependent on the fuel mix (carbon intensity of the energy sector) and energy intensity. Theoretically, the lowest carbon intensity would be of a country that has the least use of fossil energy in its fuel mix and the energy that it uses, and has the best energy intensity—also dependent on the nature of the economy (service vs manufacturing for instance).

As per India Energy Outlook 2021 of the IEA India is the third largest global emitter of CO_2, despite low per capita CO_2 emissions. CO_2 contributes more than 78 per cent of India's total GHG emissions (2016), and the energy sector contributes more than 92 per cent of all CO_2 emissions from the country. The carbon intensity of the Indian power sector in the year 2020 was 725 grams of CO_2 per kWh (gCO_2/kWh). Though this was lesser than 830 gCO_2/kWh during

2012–13[2], it was still well above the global average of 510 gCO_2/kWh. This points to the dominance of inefficient coal power in India.

India's per capita CO_2 emission is low and will remain low as per the 'Stated Policy Scenario (STEPS)' analysis of IEA, but the overall growth by 2040 will be to the tune of 50 per cent compared with 2019.

Emission intensity: Emission intensity is defined as the total amount of greenhouse gas emissions emitted for every unit of GDP. Importantly, it counts emissions beyond those related to energy (such as emissions from agriculture), and greenhouse gases beyond carbon dioxide (such as methane). It is different from the energy intensity of the economy, which is how much energy a country uses to generate wealth—measured in terms of its GDP.

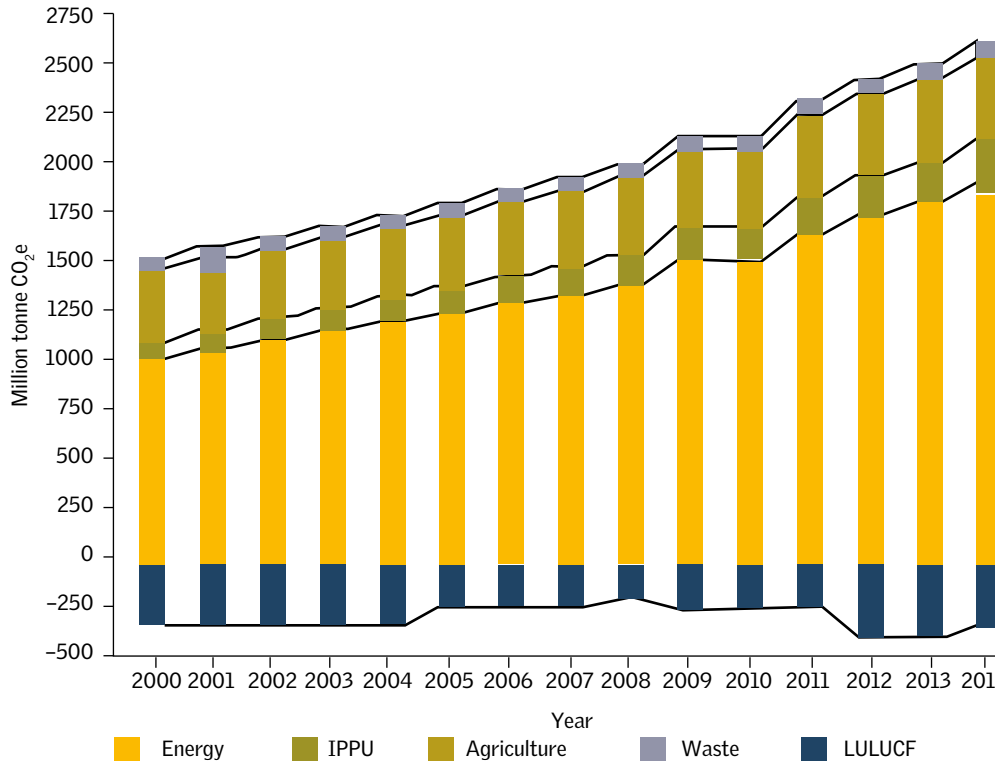
In 2009, when the Indian government (under the UPA[3] regime) was considering adopting the emission intensity target for the country, it had considered the fact that India's economy was becoming less energy intensive—there was a decline of 30 per cent between 1990 to 2005 (annual improvement was 1.7 per cent).

This is also the case worldwide. According to the IEA, the world economy in 2030 will be some 40 per cent larger than today but will use 7 per cent less energy. In its estimation for the net-zero scenario, IEA calculates that a major worldwide push to increase energy efficiency is an essential part of these effort to bring the annual rate of energy intensity improvements to average 4 per cent by 2030—about three times the average rate achieved over the last two decades.[4]

Emission intensity target: on track?

In 2015, the Indian government submitted its first biennial update report to the UNFCCC.[5] According to this report, India's emission intensity of GDP (excluding emission from agricultural sector) had decreased by 12 per cent between 2005 and 2010. The energy intensity of the economy had decreased at an annual rate of over 2.5 per cent between 2005 and 2012. Emission intensity of GDP was 35.14 kg CO_2e / 1000 INR (at constant 2004–05 prices) in 2005 which declined to 31.01 kg CO_2e / 1000 INR in 2010.

Graph 1: Time series of India's GHG emission inventory (2000–2014)

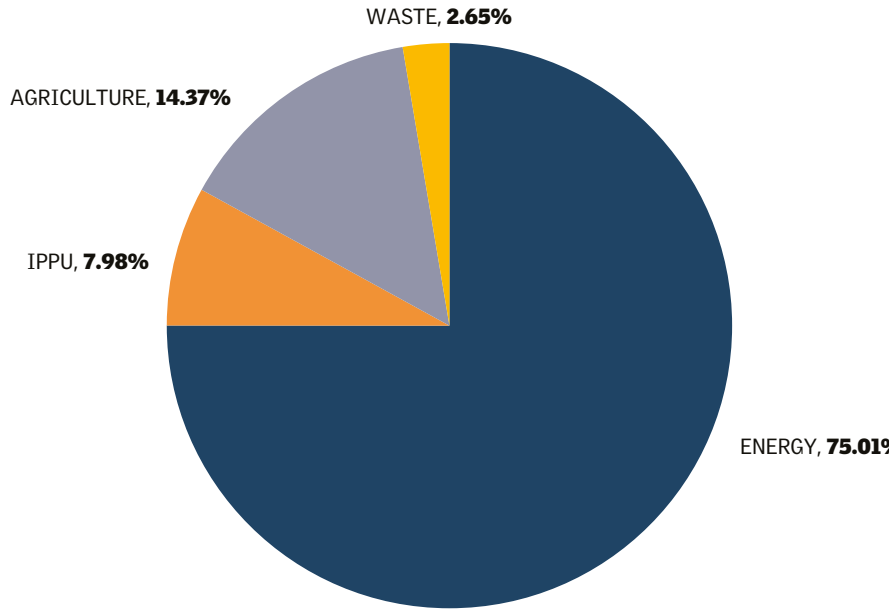


Source: Indian BUR-2

In 2018, India submitted BUR-2 to UNFCCC.[6] Indian emission inventory for the year 2014, as calculated in BUR-2, was over 2,607 million tonnes CO_2e of GHG, excluding land use, land use change and forestry (LULUCF). LULUCF sector remains a 'sink' in India. If LULUCF is included, the net national emissions were over 2,306 million tonnes CO_2e. The report established that India's emission intensity of GDP had reduced by 21 per cent during the period of 2005–2014.

BUR-3[7], submitted early 2021, shows India's GHG emissions were 2,839 million tonnes CO_2e, without LULUCF. LULUCF remains a net sink. After inclusion of LULUCF, GHG emissions of the country were 2,531 million tonnes CO_2e.

Graph 2: Sectoral contribution in India's GHG inventory (2016)



Source: Indian BUR-3

Emission inventory

The energy sector's contribution to total GHG emissions of India is the largest; in 2016 its contribution was more than 75 per cent. Agriculture is the second largest contributor with more than 14 per cent share. Agriculture emits methane (CH_4) and nitrous oxides (N_2O) and does not have any CO_2 contribution. Industrial Processes and Product Use (IPPU) contributes 8 per cent, in which CO_2's share of contribution is 73 per cent.

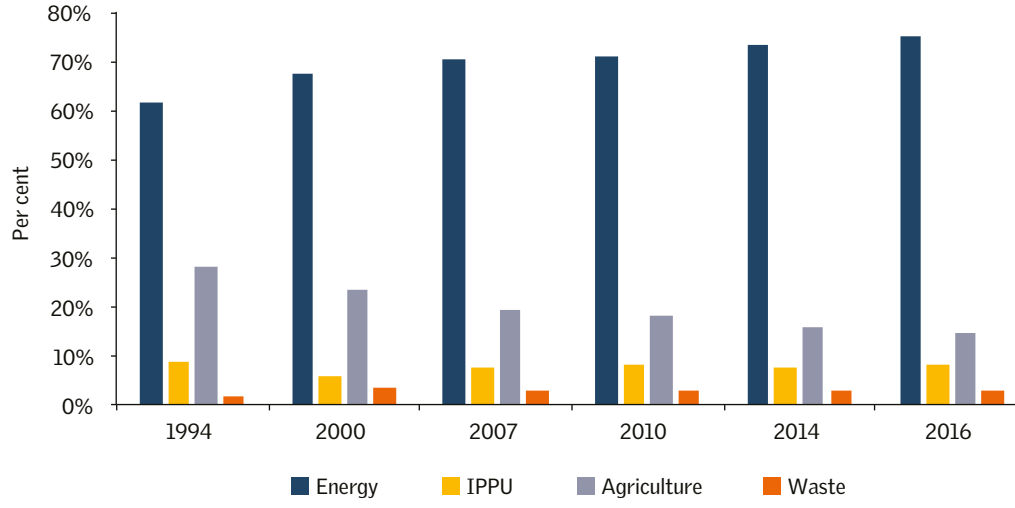
In a sectoral view of the emission inventory during 2005–2016, we can observe that emissions from the energy sector have gained considerable momentum, both in absolute emission as well percentage share of the overall emissions of India, in spite of electricity growth (CAGR 3.92) being slower than GDP growth (CAGR 8.17 per cent).[8] This reflects the high percentage of fossil fuels used in electricity generation (as of 2019, 80 per cent of total generation is from coal, gas and oil combustion.[9] The agriculture sector has shown a steady decline in its contribution, which can be primarily attributed to the increase in agricultural production due to high yields, improved cropping practices, and better management of livestock. IPPU (industrial sector) maintains a constant share and this implies a steady rise of emissions from the sector in line with the increase in absolute emissions

Table 1: India's emission inventory 2005–2016 (million tonnes CO_2e) and yearly increments (%)

Sector	Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2016
Energy	Total emission (MtCO2e)	1275	1307	1374	1398	1510	1510	1675	1748	1817	1910	2129
	Yearly change		3%	5%	2%	8%	0%	11%	4%	4%	5%	6%
Industrial Processes and Product Use (IPPU)	Total emission ($MtCO_2e$)	130	136	145	160	165	172	187	203	193	202	226
	Yearly change		5%	7%	10%	3%	4%	9%	9%	-5%	5%	6%
Agriculture	Total emission ($MtCO_2e$)	368	375	390	378	390	390	411	407	417	417	407
	Yearly change		2%	4%	-3%	3%	0%	5%	-1%	2%	0%	-1%
Waste	Total emission ($MtCO_2e$)	74	57	66	74	65	65	72	79	83	78	75
	Yearly change		-23%	16%	12%	-12%	0%	11%	10%	5%	-6%	-2%
LULUCF	Total emission ($MtCO_2e$)	-204	-205	-205	-169	-253	-253	-206	-370	-370	-301	-308
	Yearly change		0%	0%	-18%	50%	0%	-19%	80%	0%	-19%	1%
Total Emission of India	Total emission ($MtCO_2e$)	1643	1671	1770	1841	1877	1884	2121	2068	2139	2306	2531
	Yearly change		2%	6%	4%	2%	0%	13%	-2%	3%	8%	5%

Source: Indian BUR 2 & 3 to UNFCCC

Graph 3: Sectoral contribution in India's GHG inventory (1994–2016)



Source: CSE analysis of GOI data

of the country. This reflects the slow progress in emission intensity reduction from hard-to-decarbonize sectors such as iron and steel, and non-metallic industries such as cement which together contributes more than 62 per cent of the emissions from this sector.[10]

Calculating emission intensity

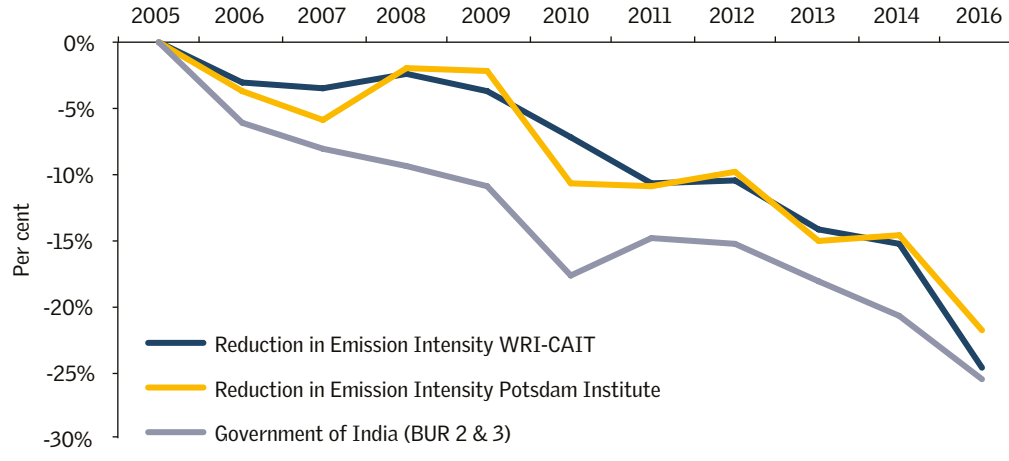
In the data published in BUR-2 and BUR-3, emission intensity has been calculated with GDP in INR (constant 2011–12 price level).

India's total GHG emission and respective GDP for the year 2005 gives an emission intensity of 0.0278 kg CO_2e/INR, which reduces to 0.0219 kg CO_2e/INR in 2014, and 0.0207 kg $C0_2e$/INR in 2016; this equates to the 21 per cent reduction of emission intensity by 2014 and 24 per cent by 2016.

CSE's analysis of GHG emission intensity takes emission inventory data from two reputed third-party data sources—the World Resources Institute (WRI-CAIT) and the Potsdam Institute. GDP (2011–12 constant price) data has been sourced from the Ministry of Statistics and Programme Implementation (http://mospi.nic.in).

There are differences between the emission intensity reduction rates derived from all the three sources, primarily due to difference of GHG emission inventories. However, the rates converge by 2016, indicating improvement in data transparency.

Graph 4: India's emission intensity reduction



Summary

India's emission intensity, which is a measure of the increased emissions per unit of GDP, has been declining at a rate of 1–2 per cent annually, as per GOI submissions to the UNFCCC.

According to this analysis, India is on track to meet its NDC (33–35 per cent reduction by 2030), which it has defined not in terms of absolute reduction in GHG emission but in terms of how much it will reduce emissions intensity as it grows economically. Between 2005–2016, emission inventory analysis from three sources—Government of India, WRI-CAIT and Potsdam Institute—shows that India has reduced emission intensity between 24–25 per cent. If the current rate of annual decline is extrapolated by a moderate 1 per cent, India may achieve a reduction between 39–40 per cent below 2005 level by 2030. However, the rate of growth in sectoral emissions is increasing and there could be a situation where the reduction in terms of intensity may start to decline.

References and endnotes

1. Anon 2021. *India Energy Outlook 2021*. World Energy Outlook Special Report, International Energy Agency. Accessed at https://iea.blob.core.windows.net/assets/1de6d91e-e23f-4e02-b1fb-51fdd6283b22/India_Energy_Outlook_2021.pdf
2. Anon 2018. *India Second Biennial Update Report to the United Nations Framework Convention on Climate Change*. Ministry of Environment, Forest and Climate Change, Government of India. Accessed at https://unfccc.int/sites/default/files/resource/INDIA%20SECOND%20BUR%20High%20Res.pdf
3. The United Progressive Alliance (UPA) is a coalition of political parties in India formed after the 2004 general election.
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India is not only on track to meet its NDC (33–35 per cent reduction by 2030) but may even exceed the commitment and achieve a reduction of 39–40 per cent if the current rate of annual decline is extrapolated by a moderate 1 per cent. However, the rate of growth in sectoral emissions is increasing and there could be a situation where the reduction in terms of intensity may start to decline.

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