

Trend Analysis of GHG Emissions of INDIA

GHG Platform India is a civil society initiative providing an independent estimation and analysis of India's Greenhouse Gas (GHG) emissions across key sectors.

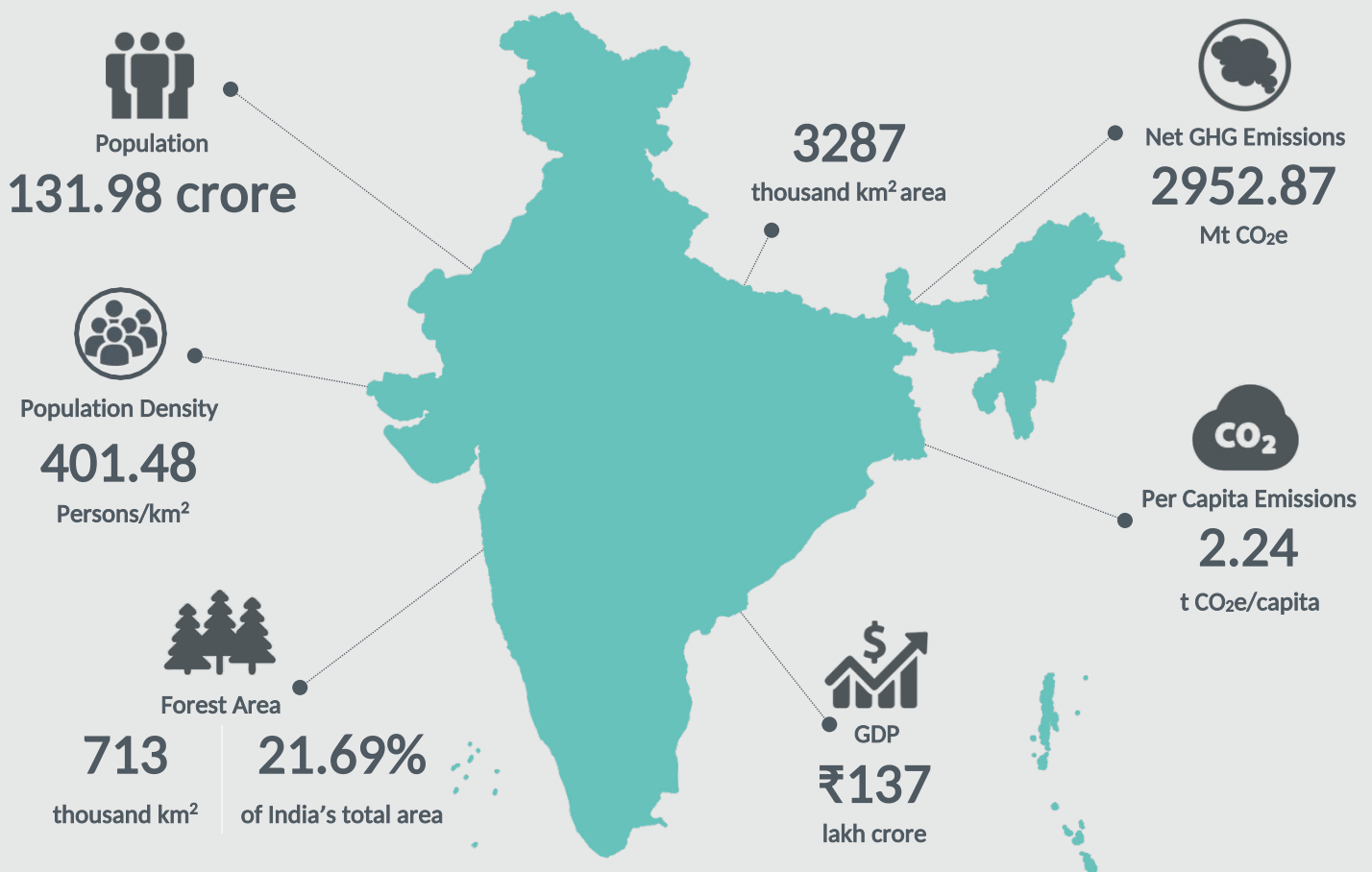
The Platform aims to add value to the various ongoing GHG emissions estimation efforts by addressing existing data gaps and data accessibility issues, broadening the scope of national inventories to include state inventories, and increasing the volume of analytics and policy dialogue on India's GHG emissions sources, profile, and related policies.

The initiative estimates and assesses GHG emissions and removals from the following sectors:



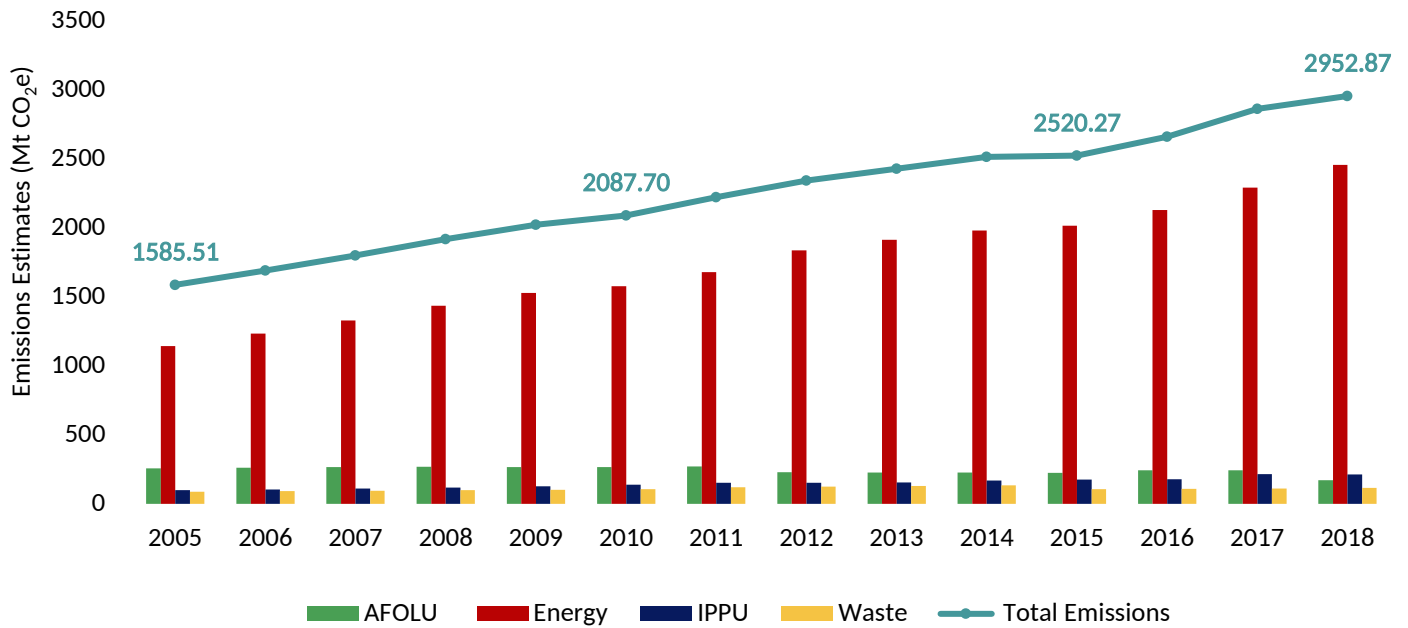
*Fuel combusted for captive electricity generation (auto-producers) and direct fuel combustion (industrial energy) has been reported under energy sector.

India at a Glance (2018)



Economy-wide Emissions Estimates

Figure 1: GHG Emissions Estimates of India (2005 to 2018)



India's emissions grew at a CAGR of 4.90% from 1585.51 Mt CO₂e in 2005 to 2952.87 Mt CO₂e in 2018 (see Figure 1). Energy sector was the major contributor to India's total economy-wide emissions across the reference period. In 2005, the share of Energy sector in India's economy-wide GHG emissions was ~72%, while Agriculture, Forestry and Other Land Use (AFOLU) sector accounted for 16%. Both Industrial Processes and Product Use (IPPU) and Waste sectors accounted for 6% each of economy-wide emissions in 2005. As can be seen in Figure 2 below, in 2018, the share of emissions from Energy sector increased to ~83%, while that of AFOLU and Waste sectors declined to ~6% and ~4%, respectively. IPPU's sectoral share increased by 1% during the reference period.

Figure 2: Sector-wise Contribution (Mt CO₂e) and Percentage Share in Net Economy-wide GHG Emissions of India

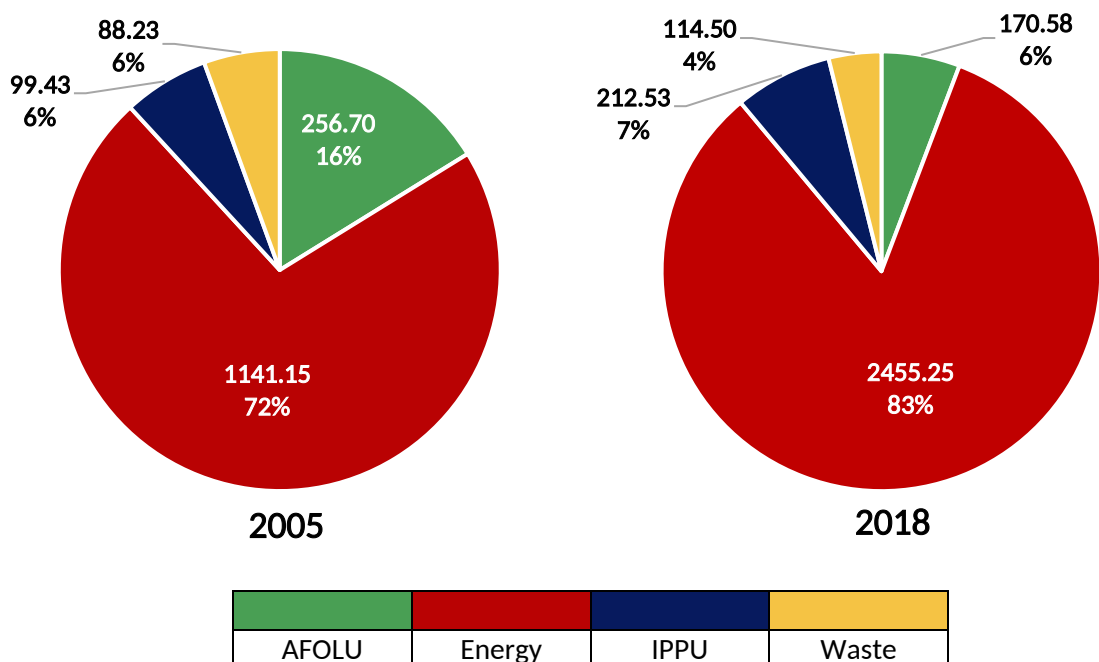
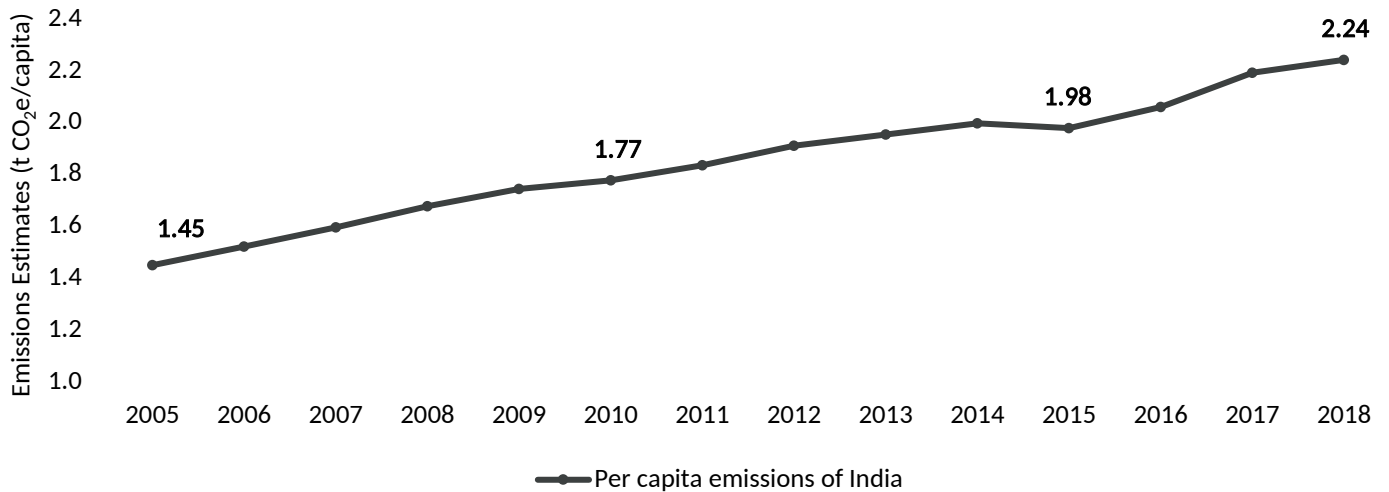
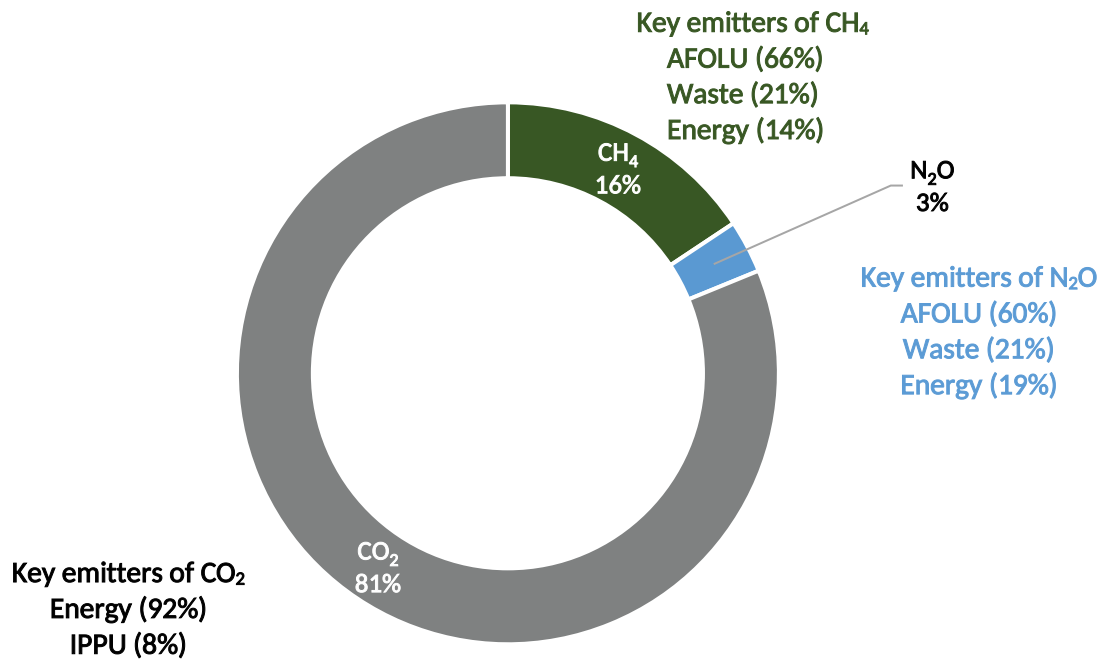


Figure 3: Per Capita GHG Emissions of India (2005 to 2018)



India's per capita emissions increased at a compounded rate of 3.41% from 1.45 t CO₂e per capita in 2005, to 2.24 t CO₂e per capita in 2018, as illustrated in Figure 3.

Figure 4: Percentage Share of Greenhouse Gases (in terms of CO₂e) in India's Economy-wide Emissions (2018)



Energy Sector



The Energy sector emissions comprise of emissions from Fuel Combustion and Fugitive Emissions. Fuel Combustion includes emissions from Public Electricity Generation, Transport, Captive Power Plants, Industries, Agriculture, Commercial, and Residential categories. Fugitive Emissions are due to Fuel Production. The Energy sector of India accounted for 83% of the economy-wide emissions in 2018. As illustrated in Figure 5, emissions from the Energy sector more than doubled from ~1141 Mt CO₂e in 2005 to ~2455 Mt CO₂e in 2018. This rise in the Energy sector’s emissions was majorly due to the increase in Fuel Combustion across various categories.

Figure 5: GHG Emissions Estimates of Energy Sector - India (2005 to 2018)

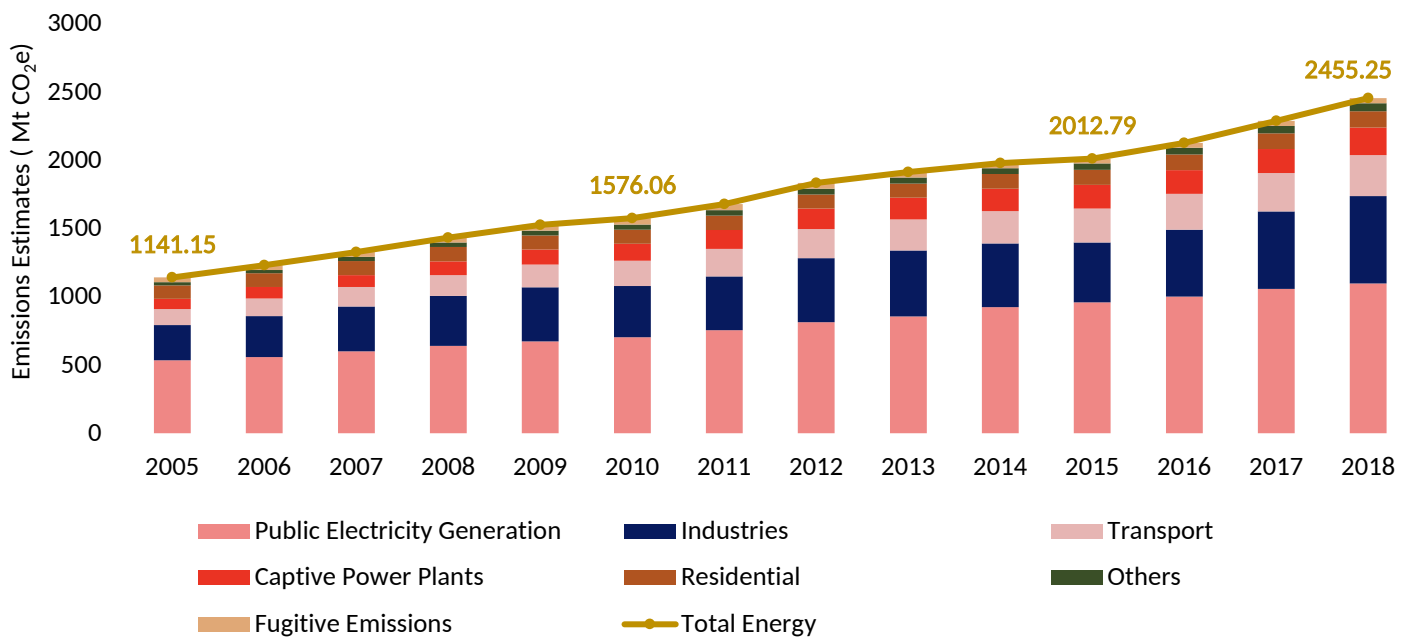
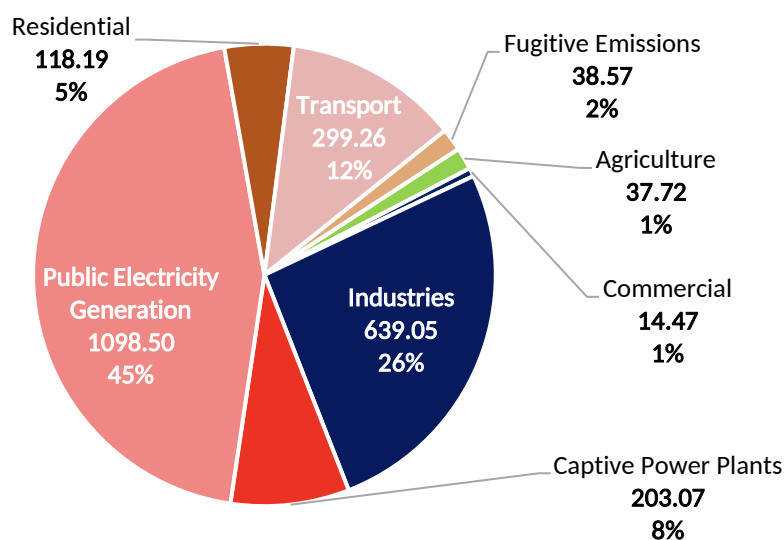


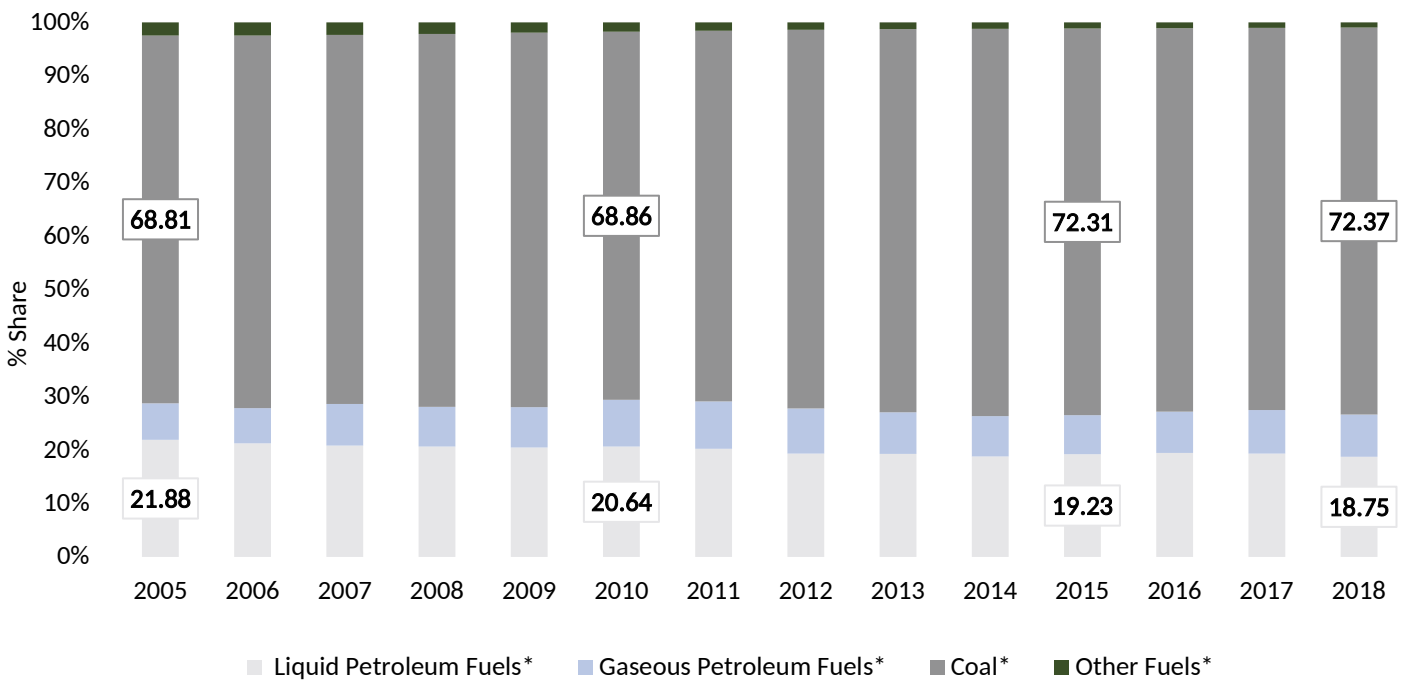
Figure 6: Category-wise Emissions (Mt CO₂e) and Percentage Share in Total Energy Sector Emissions (2018)



Within the Energy sector, Public Electricity Generation (PEG) category was the major contributor of GHG emissions with a share of ~45% of the total Energy emissions, in 2018. This was followed by Industrial Energy and Transport categories at ~26% and ~12%, respectively (see Figure 6).

Within the Fuel Combustion sub-sector, emissions from Coal continued to be the highest contributor with an average share of 71% during the reference period (see Figure 7). This was followed by Liquid Petroleum Fuels with an average share of 20%, between 2005 and 2018. Gaseous Petroleum Fuels had an average share of 8%, while Other Fuels contributed to less than 2% of the Fuel Combustion emissions throughout the reference period.

Figure 7: Fuel-wise Percentage Share in GHG Emissions from Fuel Combustion (2005-2018)



***Notes:**

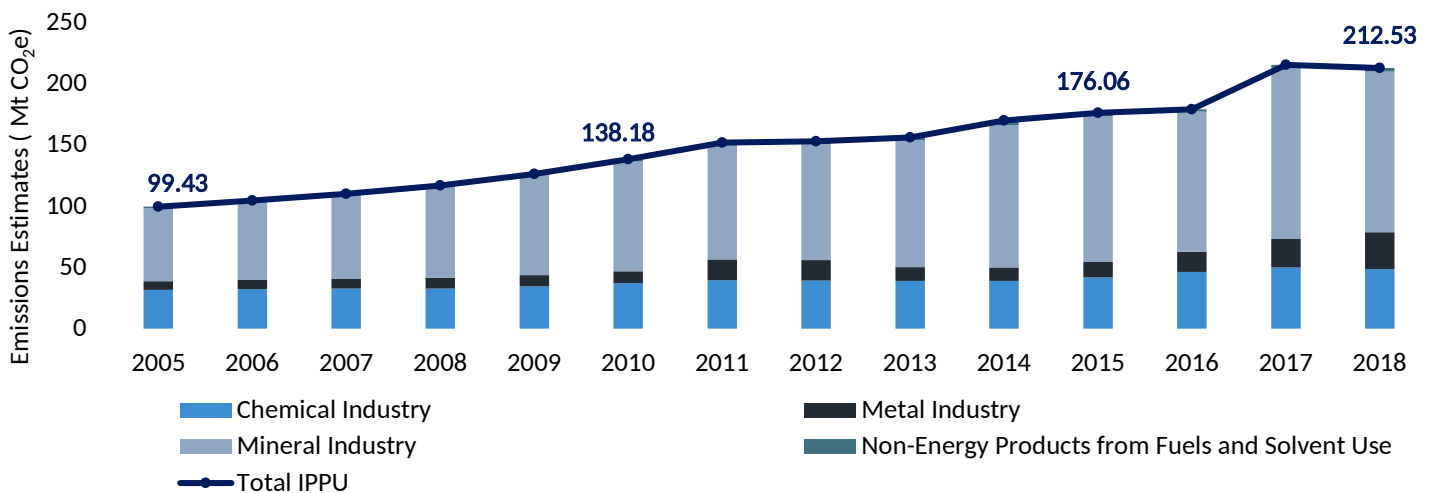
1. Coke is included in Coal because the bifurcation of pet-coke and coke was not available
2. Gaseous Fuels - natural gas, LPG and other gaseous fuels
3. Liquid Petroleum Fuels - ATF, diesel, kerosene, motor spirit and other liquid fuels
4. Other Fuels comprises of firewood and charcoal



IPPU Sector

Emissions from the Industrial Processes and Product Use (IPPU) sector are largely driven by Mineral, Chemical, Metal Industries and Non-Energy Products from Fuels and Solvent Use. IPPU sector represented ~7% of the total economy-wide emissions of India, in 2018. Between 2005 and 2018, the overall IPPU emissions more than doubled, having increased at a CAGR of 6.02% from 99.43 Mt CO₂e in 2005 to 212.53 Mt CO₂e in 2018. Mineral Industry was the major contributor to the IPPU sector emissions across the reference period. Emissions from Mineral Industry increased at a CAGR of 6.26%, from 59.48 Mt CO₂e in 2005, to 130.89 Mt CO₂e in 2018 (see Figure 8).

Figure 8: GHG Emissions Estimates of IPPU Sector - India (2005 to 2018)



Within the Mineral Industry sub-sector, emissions were primarily driven by Cement Production category throughout the reference years. This category's share in total IPPU emissions in 2018 was ~55%, down from ~59% in 2005 (see Figure 9). Ammonia Production emissions held a significant share of GHG emissions at 20.28% in 2005 but it gradually decreased to 11.88% in 2018. On the other hand, the share of emissions from Iron and Steel Production increased steadily, from 5.34% in 2005 to 11.12% in 2018. Since 2017, emissions from the category mentioned as Others, which includes Ethylene Oxide Production, Ethylene Production, Carbon Black Production, Aluminium Production, Lime Production, and Lubricant Use, also increased significantly, from 5.34% in 2005 to 11.12% in 2018, as illustrated in Figure 10.

Figure 9: Sub-sector Emissions (Mt CO₂e) and Percentage Share in Total IPPU Emissions (2018)

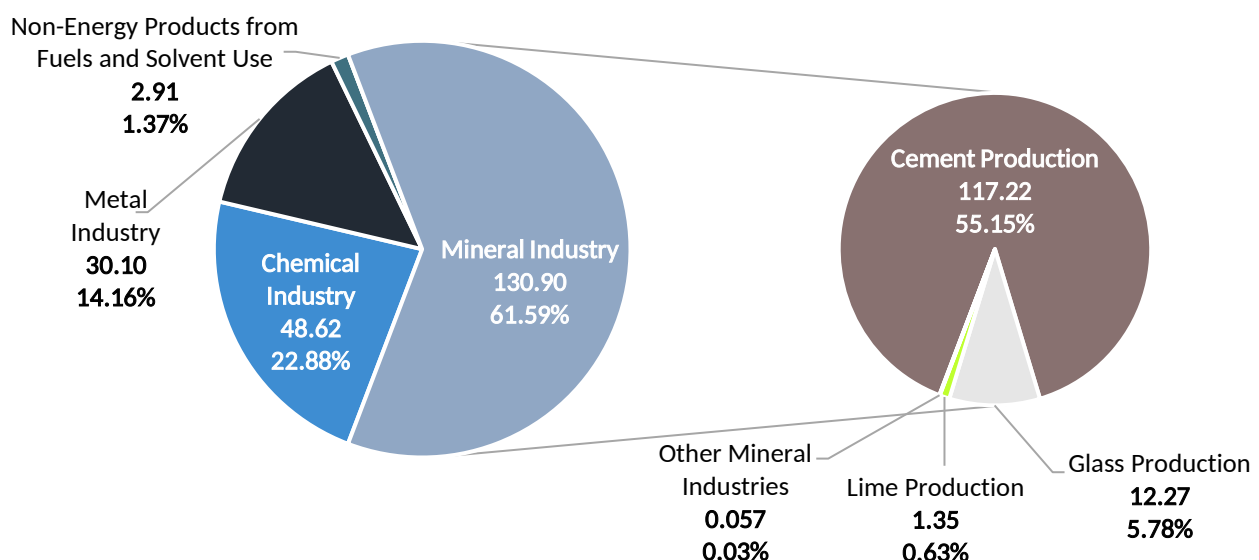
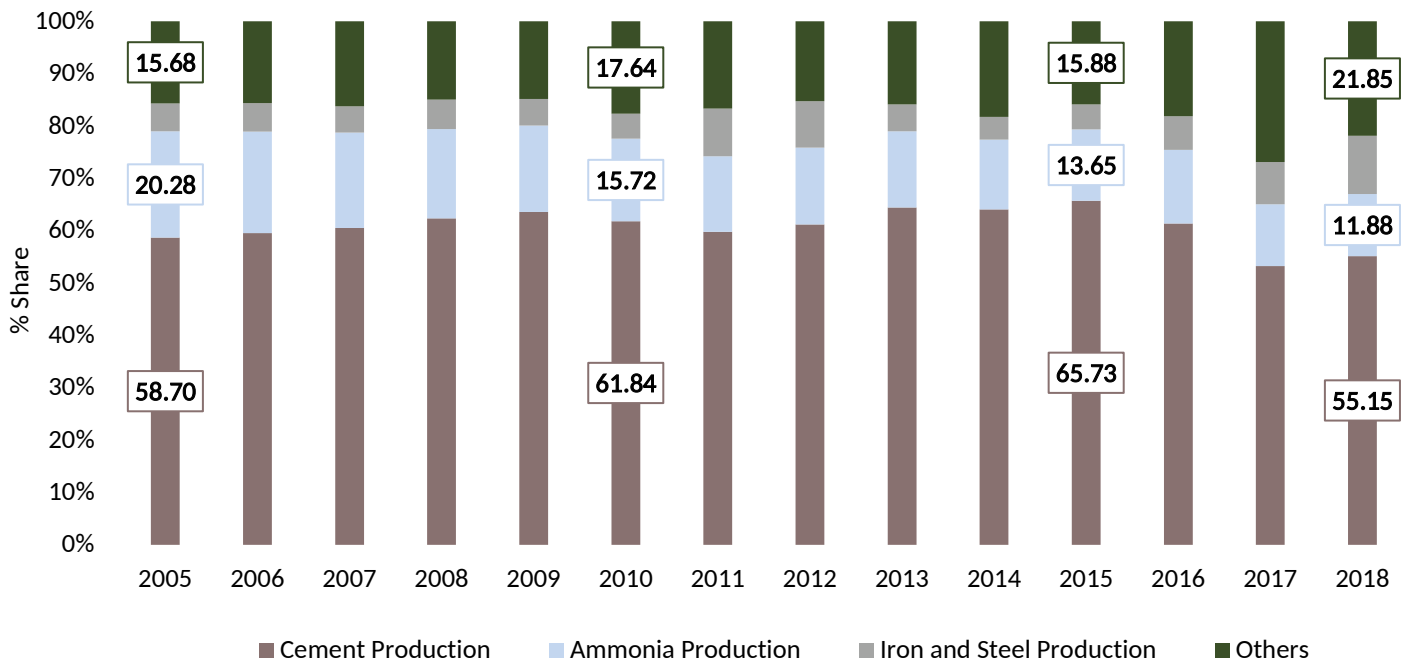


Figure 10: Percentage Share of GHG Emissions from IPPU Categories (2005 to 2018)





Emissions from the Agriculture, Forestry and Other Land Use (AFOLU) sector arise from three main sub-sectors, namely Livestock, Land and Aggregate Sources and Non-CO₂ Emissions Sources on Land*. Emissions from AFOLU sector represented nearly 6% of India's total economy-wide emissions in 2018. The net AFOLU emissions declined at a rate of 3.09% (compounded annually), from 256.70 Mt CO₂e in 2005, to 170.58 Mt CO₂e in 2018, as illustrated in Figure 11. In India, while the Livestock and Aggregate Sources and Non-CO₂ Emissions Sources on Land sub-sectors were net GHG emitters, the Land sub-sector was a sink across all the reference years. This was because of increase in removals due to Land Use and Land-Use Change practices. In particular, the significant increase in sink of the Land sub-sector, observed post 2017, can be attributed to increase in forest area as well as enhanced carbon stock density of forests, as reported by Forest Survey of India (2021)**. Overall, the average annual removals from the Land Sub-Sector in India during the reference period were 107.62 Mt CO₂e, which was around 31% of the average annual gross AFOLU emissions.

Figure 11: GHG Emissions Estimates of AFOLU Sector - India (2005 to 2018)

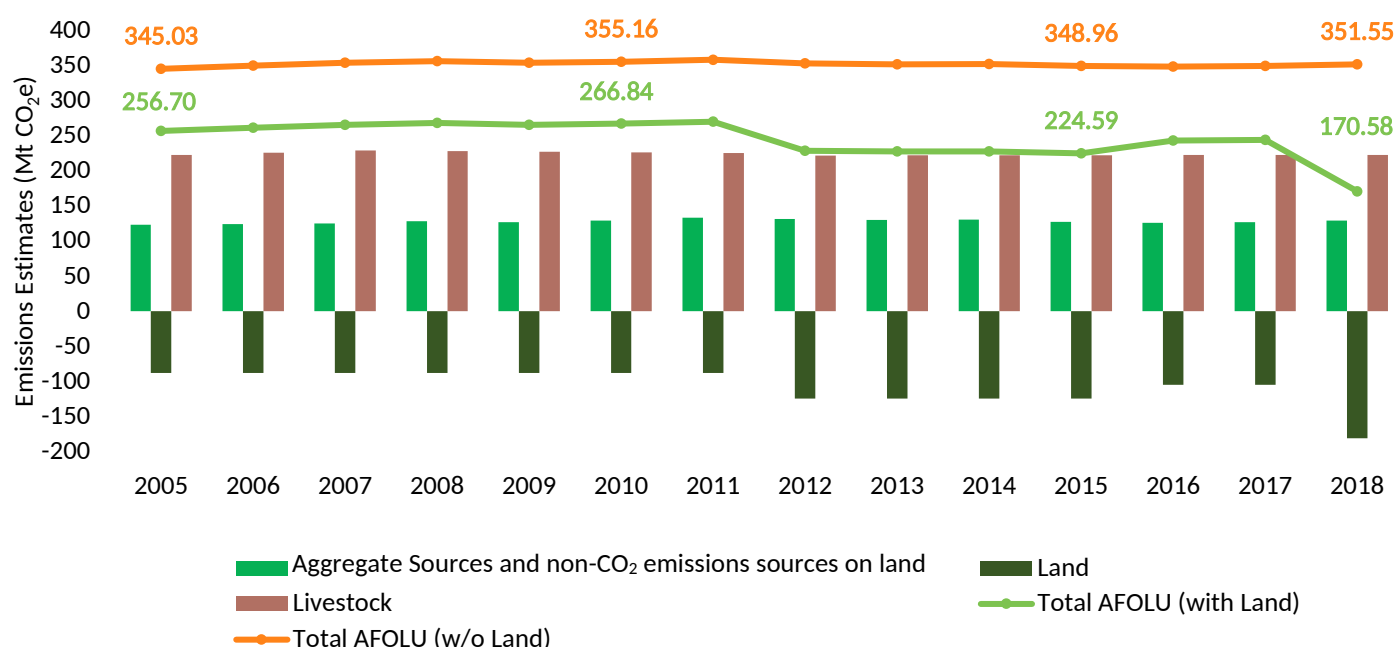
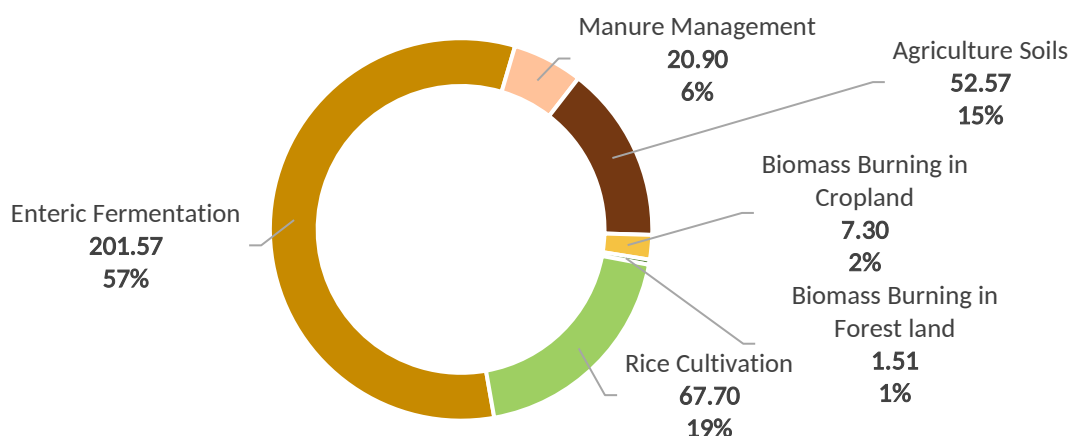


Figure 12: Category-wise Emissions (Mt CO₂e) and Percentage Share in Gross AFOLU Emissions (excluding Land sub-sector) (2018)



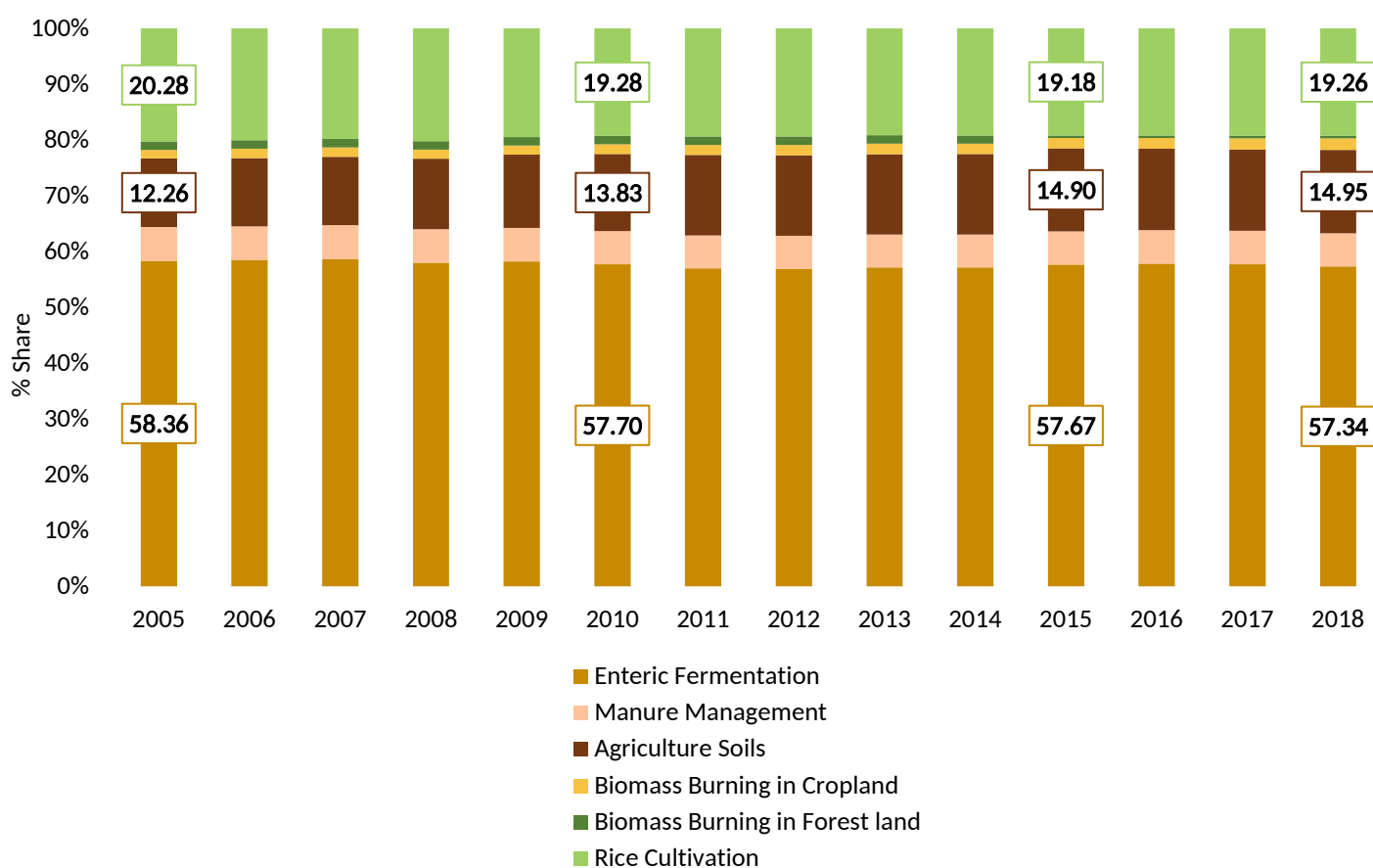
*The sub-sector called 'Aggregate Sources and Non-CO₂ Emissions Sources on Land' includes emissions from Rice Cultivation, Agriculture Soils, and Biomass Burning in Cropland and Forestland.

**FSI Report 2021 reports data for 2019

The Livestock sub-sector (Enteric Fermentation and Manure Management) was the major contributor to the gross AFOLU emissions (excluding Land sub-sector) from 2005 to 2018 with an average share of ~64% across the reference period. Within the Livestock sub-sector, Enteric Fermentation was the leading contributor to gross AFOLU emissions with a share of ~57% in 2018 (see Figures 12 and 13).

From the Aggregate Sources sub-sector, the categories of Rice Cultivation and Agriculture Soils were the major contributor. Share of Rice Cultivation emissions to gross AFOLU emissions decreased from ~20% in 2005 to ~19% in 2018. While, the share emissions from Agriculture Soils increased from ~12% in 2005 to ~15% in 2018, due to increase in fertilizer use (see Figure 13).

Figure 13: Category-wise Share of Gross AFOLU Emissions (excluding Land sub-sector) (2005 to 2018)





Waste Sector

Solid Waste Disposal, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. The Waste sector contributed to almost 4% of India’s total economy-wide GHG emissions in 2018. Waste sector emissions increased at a CAGR of 2.02%, from 88.23 Mt CO₂e in 2005, to 114.50 Mt CO₂e in 2018. An increase in the overall emissions of Waste sector was observed in 2011 due to growth in emissions from the Domestic Wastewater which reflects changing trends in use of various treatment systems, as reported in 2011 Census of India. Although emissions from the Industrial Wastewater sub-sector displayed an increasing trend until 2014, nearly 50% reduction of its emissions in 2015 led to a dip in overall Waste sector emissions. However, between 2015 and 2018 the emissions followed an increasing trend again (see Figure 14).

Figure 14: GHG Emissions Estimates of Waste Sector – India (2005 to 2018)

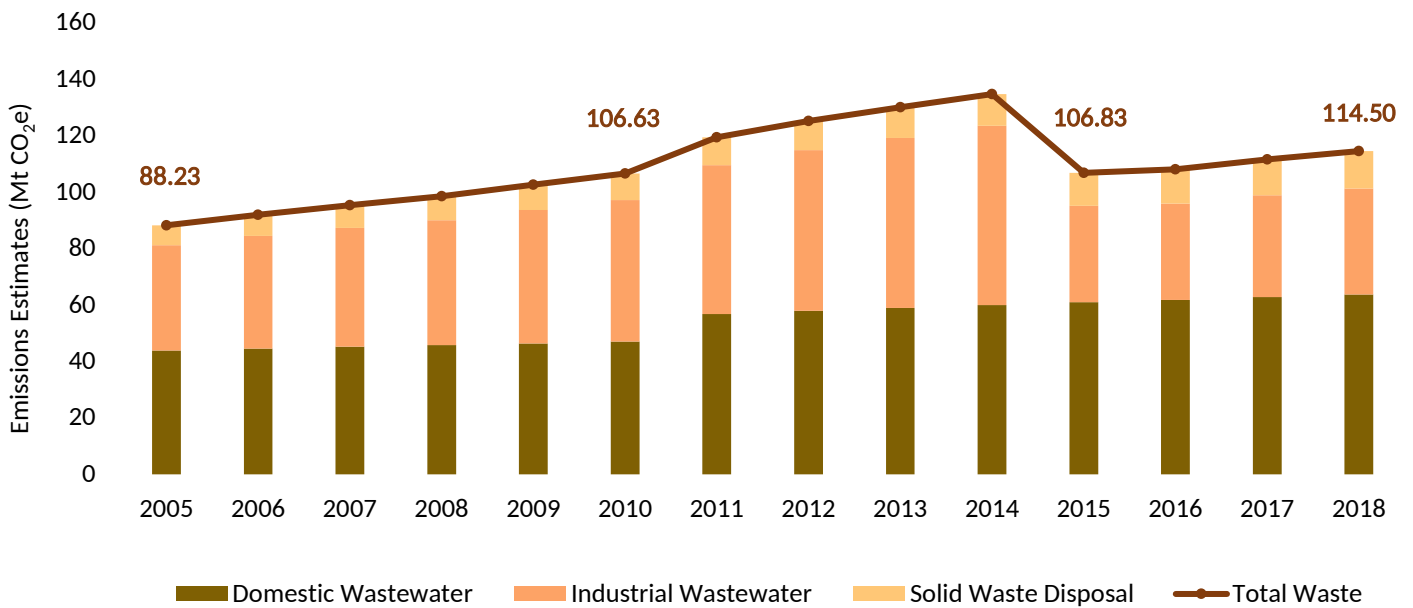
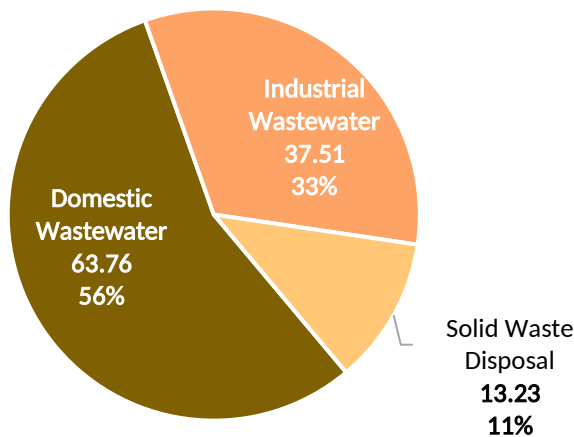


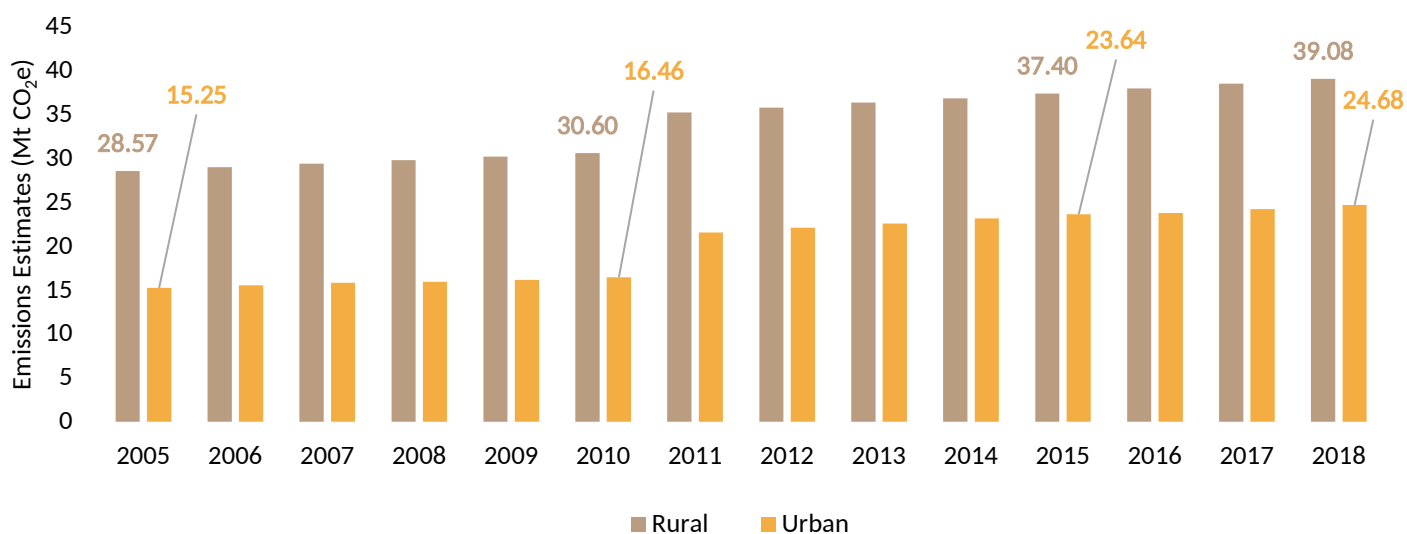
Figure 15: Sub-sector Emissions (Mt CO₂e) and Percentage Share in Total Waste Sector Emissions (2018)



Discharge of untreated wastewater and use of septic tanks are the key drivers of emissions due to Domestic Wastewater sub-sector. Domestic Wastewater had a major share of 56% in the total Waste sector emissions of India in 2018. Approximately 11% of the Waste sector emissions were from Solid Waste Disposal, which grew at an estimated CAGR of 4.97% from 7.05 Mt CO₂e in 2005 to 13.23 Mt CO₂e in 2018. Industrial Wastewater accounted for nearly 33% of Waste sector emissions in 2018 and increased nominally at a CAGR of 0.03% from 37.36 Mt CO₂e in 2005 to 37.51 Mt CO₂e in 2018 (see Figures 14 and 15).

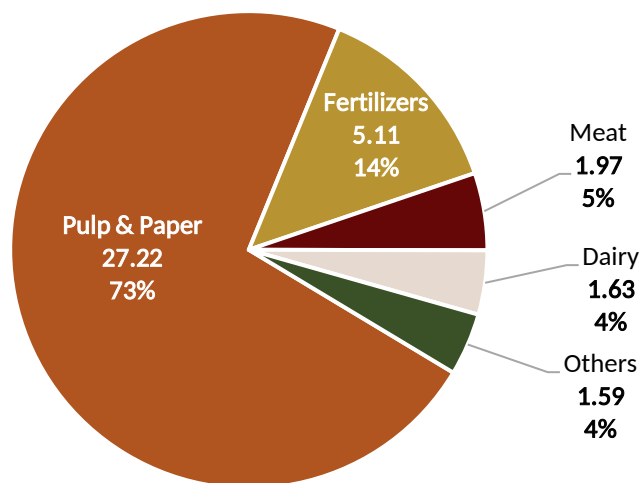
Emissions from Domestic Wastewater of both rural and urban areas grew at a CAGR of 2.93%, from 43.82 Mt CO₂e in 2005 to 63.76 Mt CO₂e in 2018. Almost 61% of Domestic Wastewater emissions were from the rural areas of India in 2018, as shown in Figure 16.

Figure 16: Area-wise GHG Emissions Estimates of Domestic Wastewater (2005 to 2018)



Pulp and Paper Production was a major contributor to Industrial Wastewater emissions with a share of 73% in 2018. This was followed by Fertilizers (~14%), Meat (~5%), and Dairy (~4%) industries as depicted in Figure 17.

Figure 17: Category-wise Emissions (Mt CO₂e) and Percentage Share in Total Industrial Wastewater Emissions (2018)





The GHG Platform India is a civil society initiative providing an independent estimation and analysis of India's Greenhouse Gas (GHG) emissions across key sectors, namely- Energy, IPPU, AFOLU and Waste.

The Platform comprises of the following civil society:



The **Council on Energy, Environment and Water (CEEW)** is one of South Asia's leading not-for-profit policy research institutions. It uses data, integrated analysis and strategic outreach to explain – and change – the use, reuse, and misuse of resources.

The **International Maize and Wheat Improvement Center (CIMMYT)** is the global leader in agricultural research for development in wheat and maize-based farming systems.

Center for Study of Science, Technology and Policy (CSTEP) is a not for profit research organisation incorporated in 2005 u/s 25 of The Companies Act, 1956.

ICLEI - Local Governments for Sustainability is a leading global network of over 1,500 cities, towns and regions committed to building a sustainable future.

Vasudha Foundation, set up in 2010, is a not for profit organisation, working in the clean energy and climate policy space.

Secretariat Contact

Vasudha Foundation, CISRS House, 14, Jangpura B,
Mathura Road, New Delhi - 110014, India
Phone No. - 011-24372680