GHG Platform INDIA

Trend Analysis of GHG Emissions of MADHYA PRADESH

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

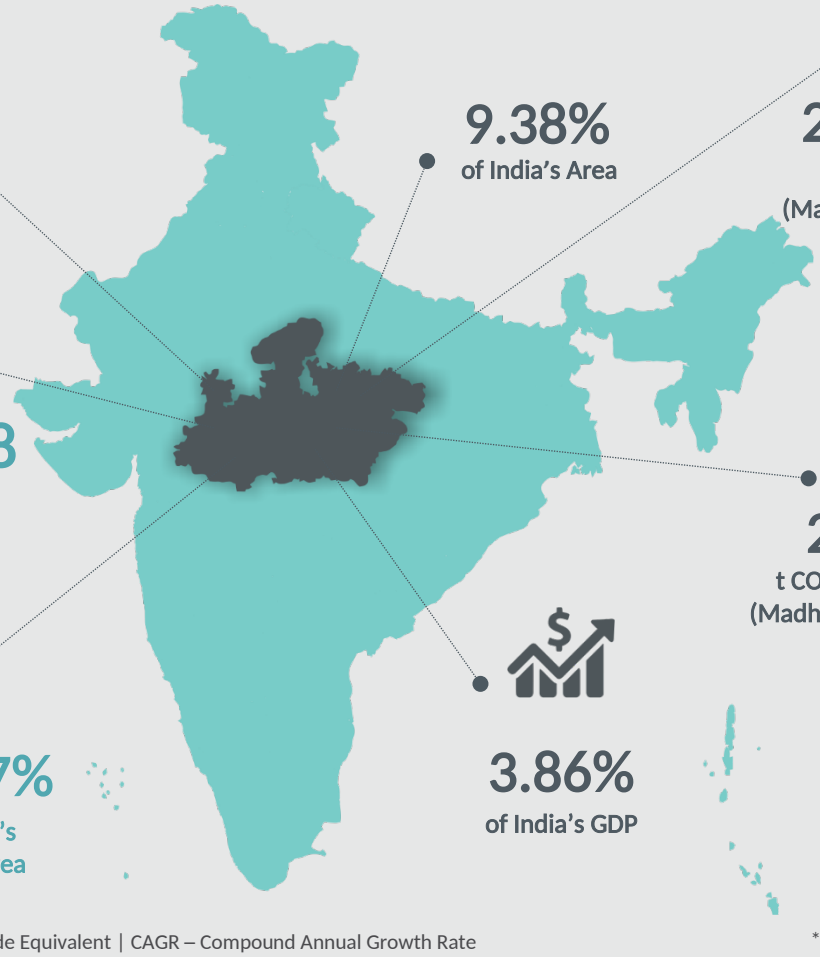
The Platform aims to add value to the various ongoing GHG emissions estimation efforts by addressing existing data gaps and data accessibility issues, broadening the scope of national inventories to include state inventories, and increasing the volume of analytics and policy dialogue on India's GHG emissions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

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

ENERGY | IPPU* | AFOLU | WASTE

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

Madhya Pradesh at a Glance (2018)



6.14% of India's Population

9.38% of India's Area

Net GHG Emissions
214.92 Mt CO_2e (Madhya Pradesh) | **7.28%** of India's emissions

Population Density
263.06 Persons/km² (Madhya Pradesh) | **401.48** Persons/km² (India)

Per Capita Emissions
2.65 t CO_2e/capita (Madhya Pradesh) | **2.24** t CO_2e/capita (India)

Forest Area
25.14% of Madhya Pradesh's Total Area | **10.87%** of India's Forest Area

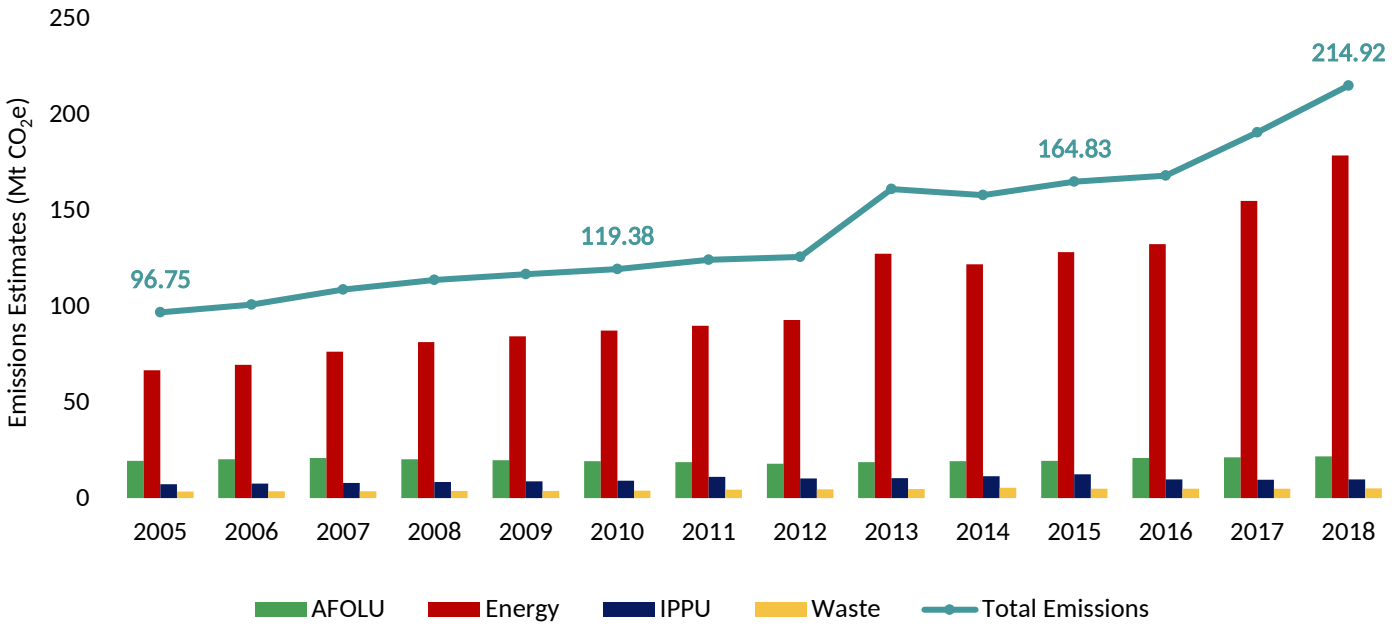
3.86% of India's GDP

Mt CO_2e – Million Tonnes of Carbon Dioxide Equivalent | CAGR – Compound Annual Growth Rate

*The map represents the data for 2018

Economy-wide Emissions Estimate

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



Emissions of Madhya Pradesh grew from 96.75 Mt CO_2e (in 2005) to 214.92 Mt CO_2e (in 2018) at an estimated CAGR of 6.33% as illustrated in Figure 1. In 2005, Energy sector represented ~69% of the total economy-wide emissions of Madhya Pradesh. The Agriculture, Forestry and Other Land use (AFOLU), Industrial Process and Product Use (IPPU) and Waste sectors accounted for ~20%, ~7% and ~4%, respectively. In 2018, the share of Energy sector emissions increased significantly to ~83%, while that of the AFOLU sector reduced to ~10%. The share of emissions from IPPU and Waste sectors reduced to ~5% and ~2%, respectively, in 2018 (see Figure 2).

Figure 2: Sector-wise Contribution (Mt CO_2e) and Percentage Share in Total Economy-wide GHG Emissions of Madhya Pradesh

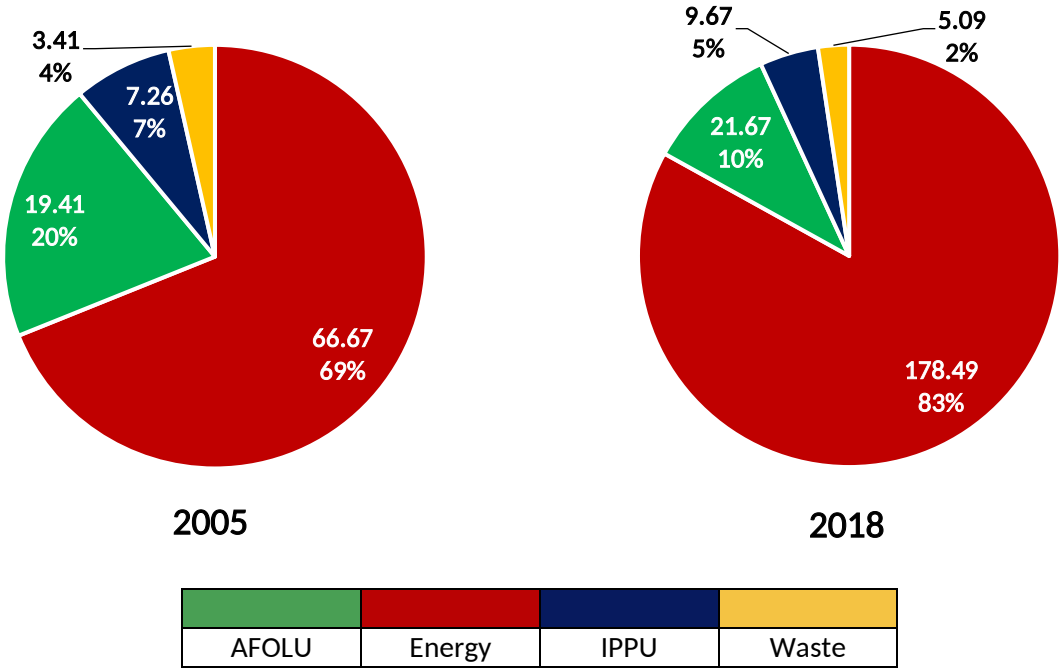
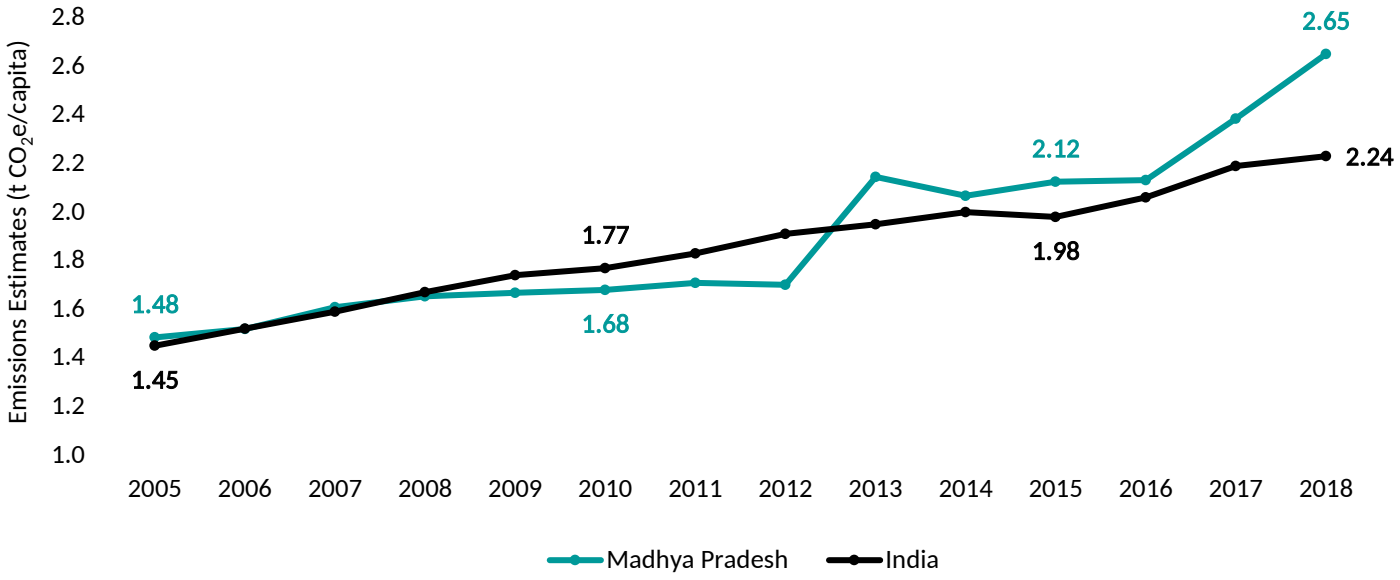


Figure 3: Per Capita Emissions of Madhya Pradesh and India (2005 to 2018)

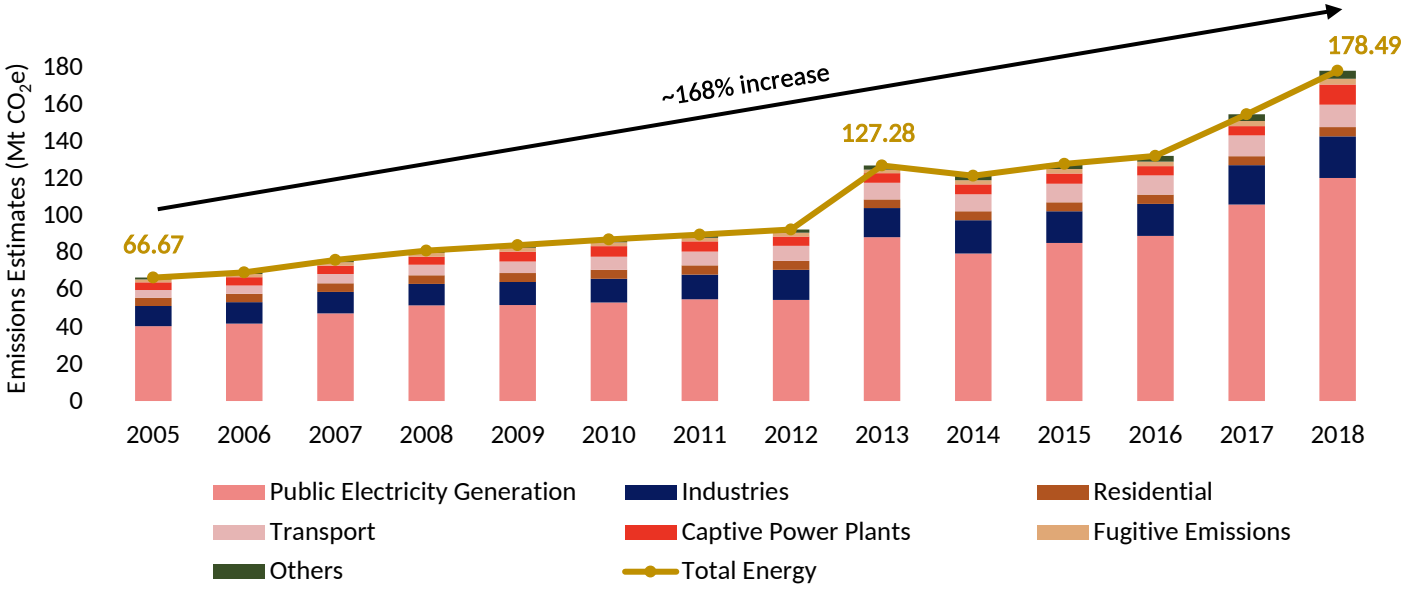


Madhya Pradesh's per capita emissions were in the same range as that of India between 2005 and 2008. Between 2008 and 2012, the state's per capita emissions were less than India's. However, in 2013, 2017 and 2018, the per capita emissions of Madhya Pradesh were much higher than that of India. Per capita emissions of Madhya Pradesh grew from 1.48 t CO_2e/capita in 2005 to 2.65 t CO_2e/person in 2018 at a CAGR of ~4.60%, which was higher than India's CAGR (~3.41%).

Energy Sector

The Energy sector emissions comprise of emissions from Fuel Combustion and Fugitive Emissions. Fuel Combustion includes the categories of emissions from Public Electricity Generation, Transport, Captive Power Plants, Industries, Agriculture, Commercial, and Residential categories. Fugitive Emissions are due to Fuel Production. In Madhya Pradesh, the Energy sector represented ~83% of total economy-wide emissions in 2018. Emissions from the Energy sector recorded a CAGR of 7.87% from 66.67 Mt CO_2e in 2005 to 178.49 Mt CO_2e in 2018 as shown in Figure 4.

Figure 4: GHG Emissions Estimates of Energy Sector- Madhya Pradesh (2005 to 2018)



Within the Energy sector, Public Electricity Generation (PEG) was the biggest contributor of GHG emissions with a share of 67% in 2018. This was followed by emissions from Industries (~13%), Transport (~7%), and Captive Power Plants (6%), as shown in Figure 5.

Within the Fuel Combustion sub-sector, emissions from Coal were the major contributor, with an average share of ~82% across the reference period (see Figure 6). This was followed by emissions from combustion of Liquid Petroleum Fuels, with an average share of ~15% between 2005 and 2018. Gaseous Petroleum Fuels and Other Fuels both had an average share of ~1%, each, in the Fuel Combustion emissions throughout the reference period.

Figure 5: Category-wise Emissions (Mt CO_2e) and Percentage Share in Total Energy Sector Emissions (2018)

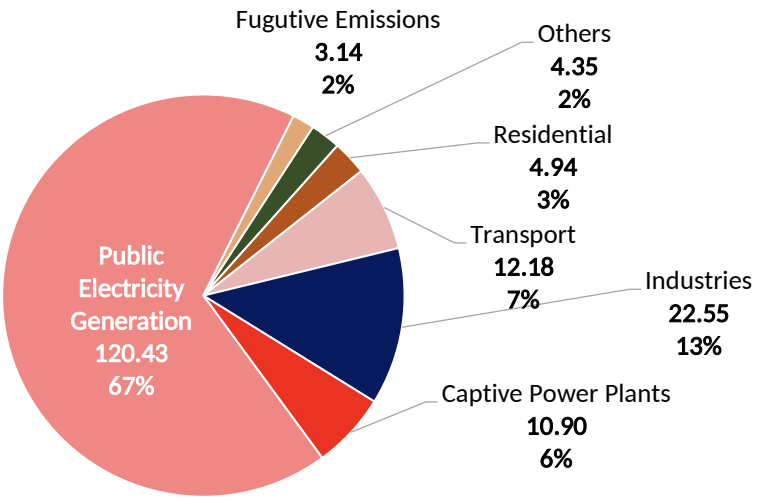
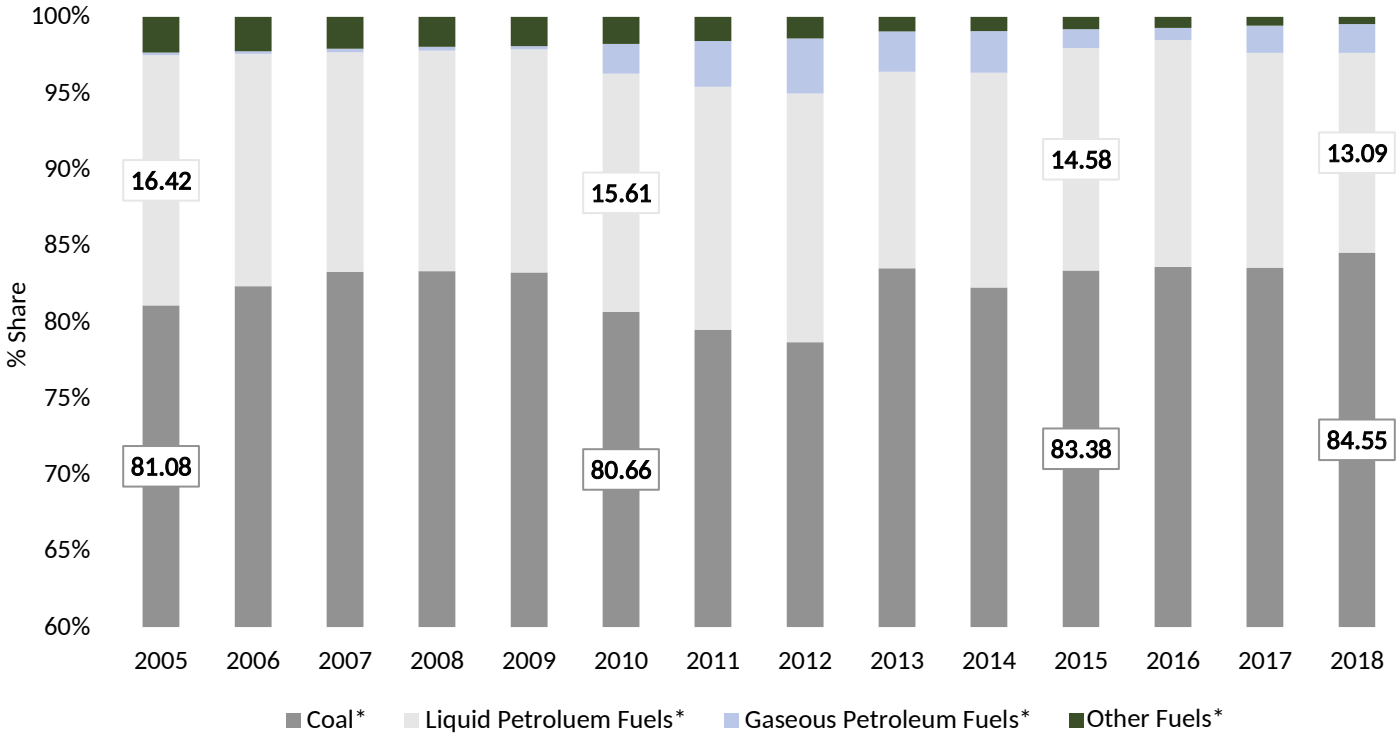


Figure 6: Percentage Share of GHG Emissions by Fuel Type due to Fuel Combustion in Energy Sector (2005 to 2018)



**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 Process and Product Use (IPPU) sector are largely driven by Chemical, Metal, Mineral Industries and Non-Energy Products from Fuels and Solvent Use. In Madhya Pradesh, the IPPU sector represented ~5% of the total economy-wide emissions in 2018. Between 2005 and 2018, the overall IPPU emissions increased at a CAGR of 2.23% from 7.26 Mt CO_2e in 2005 to 9.67 Mt CO_2e in 2018. The jump in emissions in 2011 can be attributed to the increase in emissions from Iron & Steel Production. Another peak was observed in 2015 due to an increase in emissions from Cement Production (see Figure 7). Mineral Industry emissions were the major contributor to IPPU emissions in Madhya Pradesh with ~92% share in 2018 (see Figure 8).

Figure 7: GHG Emissions Estimates of IPPU Sector - Madhya Pradesh (2005 to 2018)

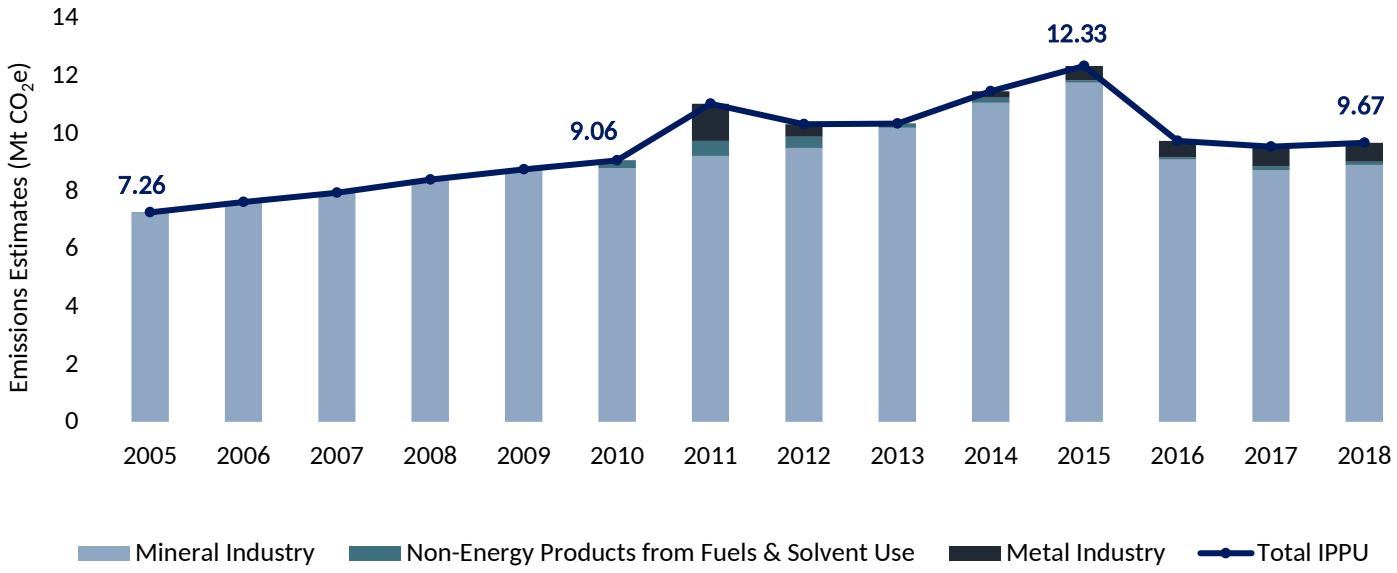
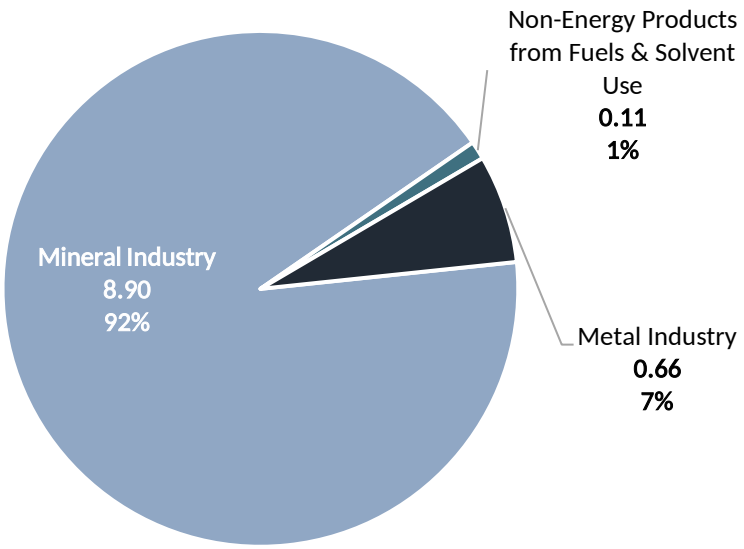
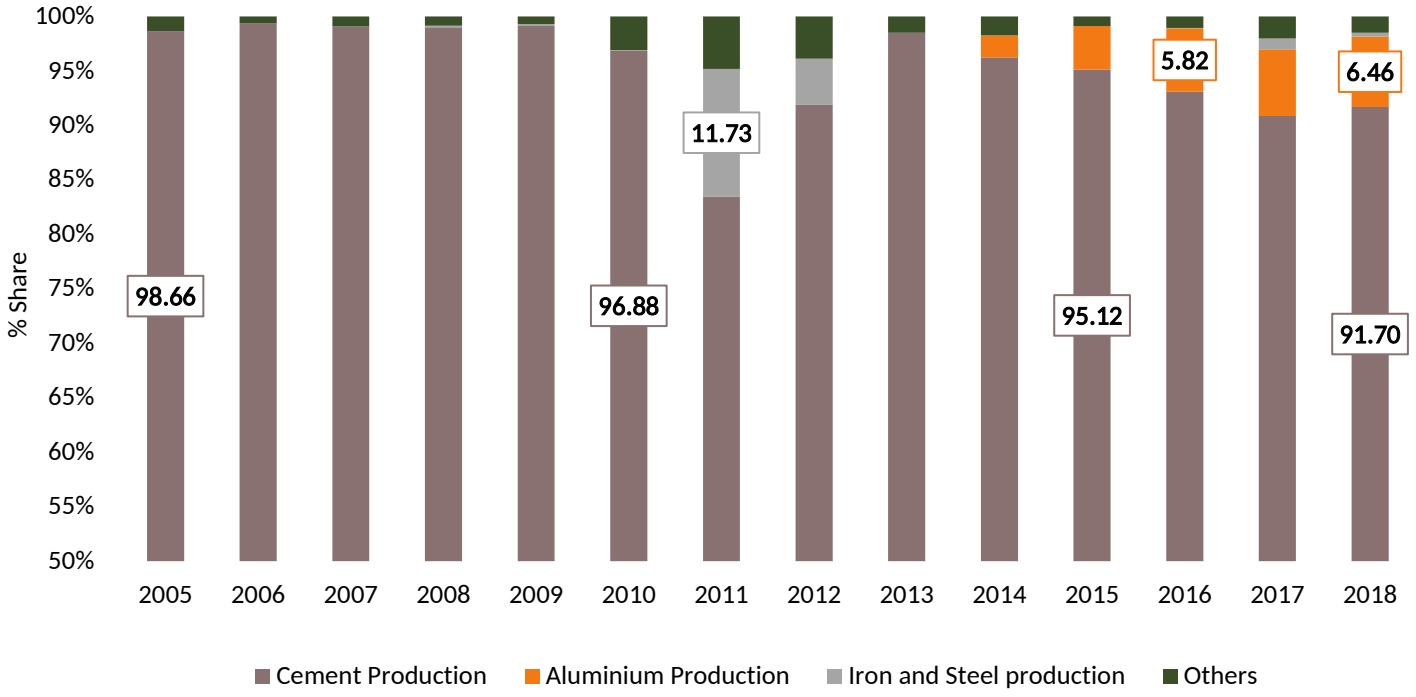


Figure 8: Sub-Sector Emissions (Mt CO_2e) and Percentage Share in Total IPPU Emissions (2018)



As seen in Figure 9, Cement Production held an average share of 95% in the overall IPPU sector emissions throughout the reference period. This was followed by Aluminium Production (2%) and Iron and Steel Production (1%). In 2011, the share of emissions from Iron and Steel Production category zoomed to ~12%, but subsequently declined. The emissions from Aluminium Production category also increased from 2% in 2014 to 6.46% in 2018 (see Figure 9).

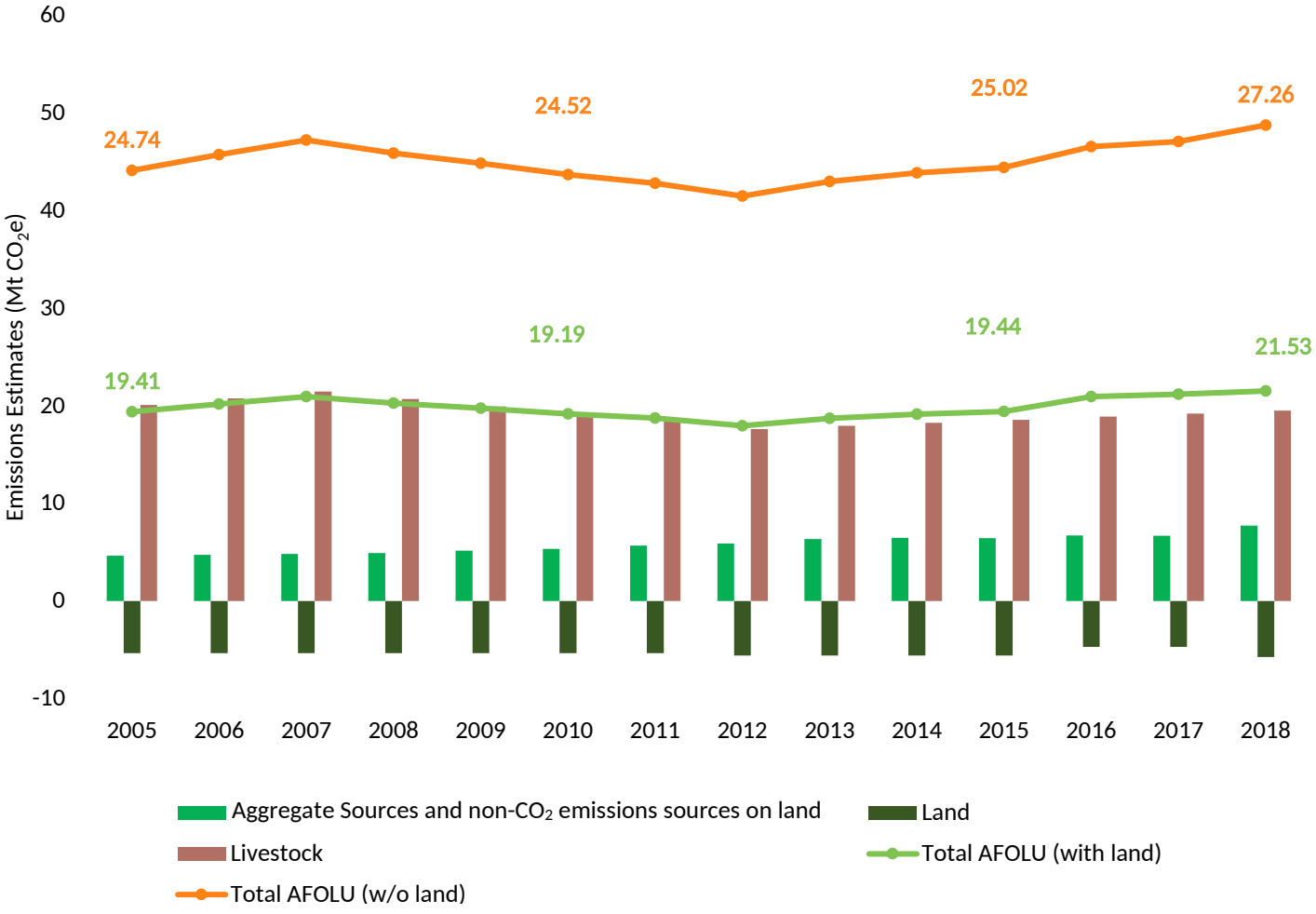
Figure 9: Percentage Share of GHG Emissions from IPPU Categories (2005 to 2018)



AFOLU Sector

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-CO_2 Emissions Sources on Land*. In Madhya Pradesh, the AFOLU sector represented ~10% of the total economy-wide emissions in 2018. The Livestock and Aggregate Sources and Non-CO_2 Emissions Sources on Land sub-sectors were net emitters of GHGs, while the Land sub-sector was a net sink for the entire reference period as shown in Figure 10. The average annual removals from the Land Sub-Sector in Madhya Pradesh during the reference period were 5.33 Mt CO2e, around 21.18% of the average annual gross AFOLU emissions (excluding Land Sub-sector). The net AFOLU emissions grew at a CAGR of 0.80% from 19.41 Mt CO_2e in 2005 to 21.53 Mt CO_2e in 2018.

Figure 10: GHG Emissions Estimate of AFOLU Sector - Madhya Pradesh (2005 to 2018)



The Livestock sub-sector had the maximum share of ~72% of gross AFOLU emissions (excluding Land sub-sector) in Madhya Pradesh in 2018. Within the Livestock sub-sector, Enteric Fermentation category was the major contributor to gross AFOLU emissions with a share of ~65% in 2018, as seen in Figure 11. However, emissions from this category declined marginally at a rate of 0.22% (compounded annually) from 18.22 Mt CO_2e in 2005 to 17.71 Mt CO_2e in 2018. Within the Aggregate Sources sub-sector, the categories of Rice Cultivation and Agriculture Soils were the top GHG contributors to gross AFOLU emissions with shares of 15% and 12%, respectively, in 2018. The emissions from Agriculture Soils and Rice Cultivation increased steadily at CAGRs of ~5.3% and ~3.7%, respectively, during the reference period, as seen in Figure 12.

** The sub-sector called 'Aggregate Sources and Non-CO_2 Emissions Sources on Land' includes emissions from Rice Cultivation, Agriculture Soils, and Biomass Burning in Cropland and Forestland.*

Figure 11: Category-wise Emissions (Mt CO_2e) and Percentage Share in Gross AFOLU Emissions (excluding Land sub-sector) (2018)

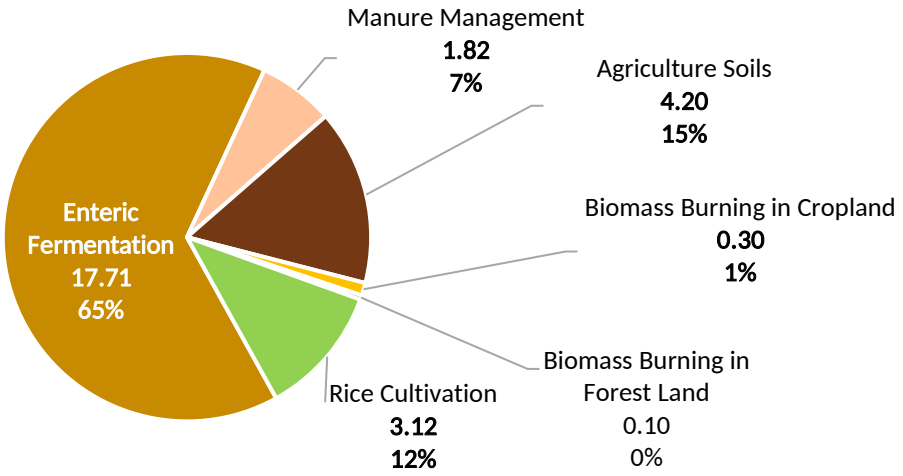
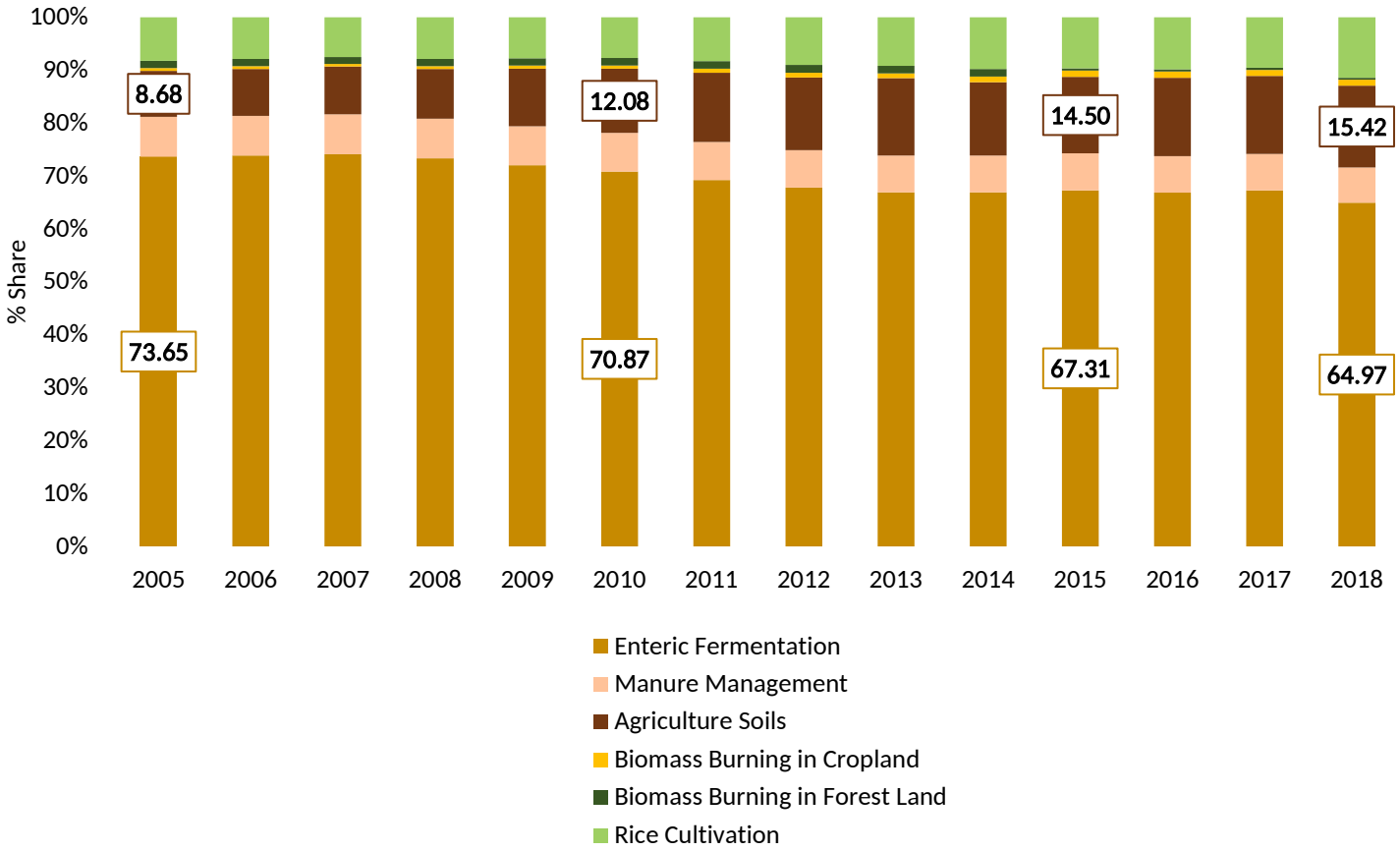


Figure 12: Category-wise Share of Gross AFOLU Emissions (excluding Land sub-sector) (2005 to 2018)



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 ~2% to the total economy-wide emissions in Madhya Pradesh in 2018. GHG emissions from the Waste sector of Madhya Pradesh grew at a CAGR of 3.13% from 3.41 Mt CO_2e in 2005 to 5.09 Mt CO_2e in 2018. There was a spike in emissions in 2014 which can be attributed to increase in emissions from Industrial Wastewater sub-sector (see Figure 13).

Figure 13: GHG Emissions Estimates of Waste Sector - Madhya Pradesh (2005 to 2018)

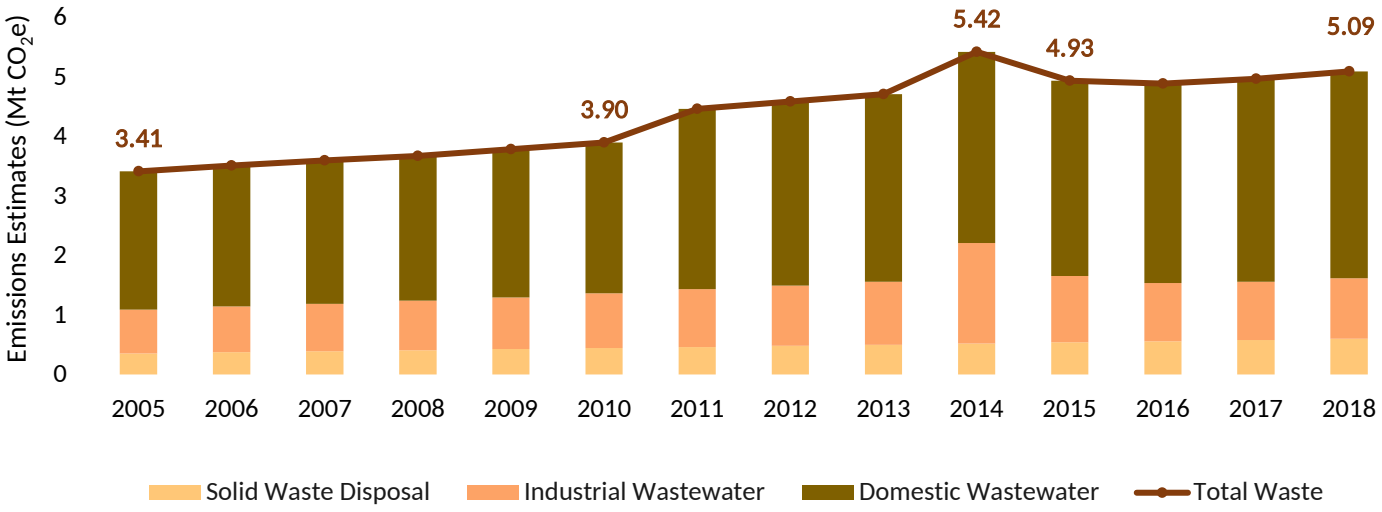
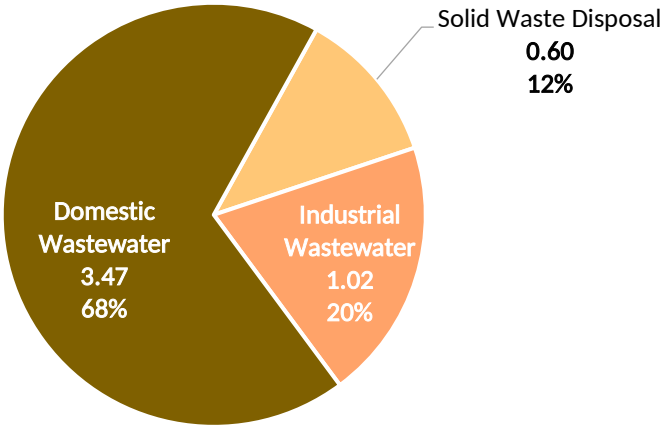


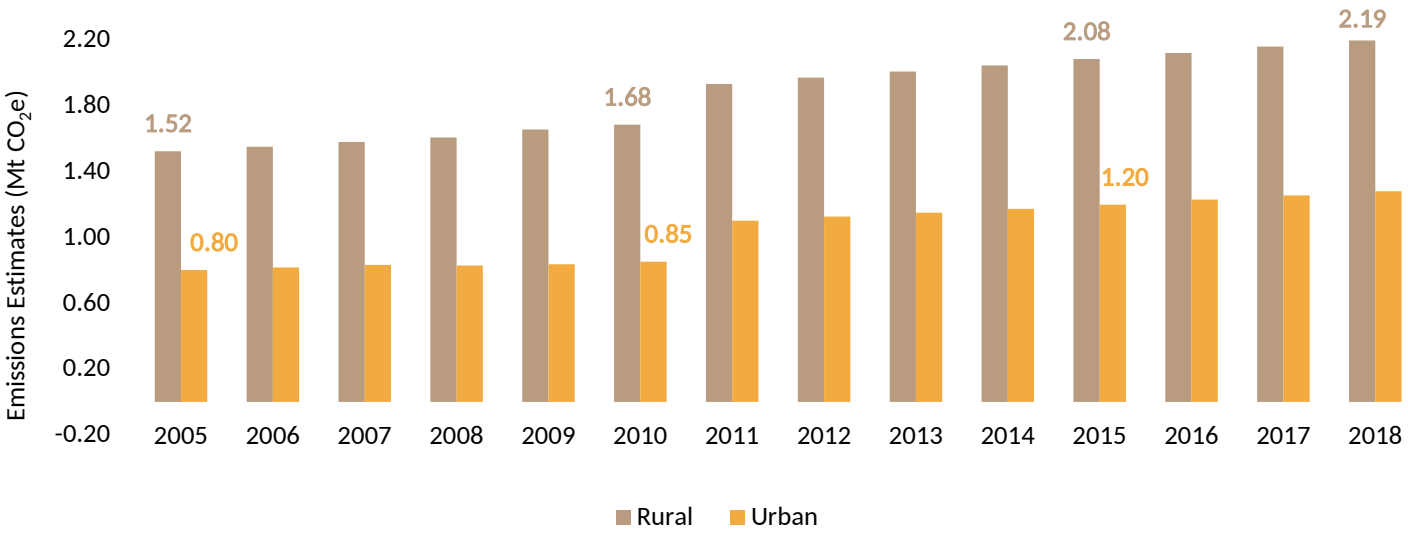
Figure 14: Sub-sector Emissions (Mt CO_2e) and Percentage Share in Total Waste Sector Emissions (2018)



Discharge of untreated wastewater and use of septic tanks are the key drivers of emissions in the Domestic Wastewater sub-sector. Domestic Wastewater represented ~68% of the total Waste sector emissions of Madhya Pradesh in 2018. Solid Waste Disposal contributed to ~12% of the emissions in 2018 which grew at a CAGR of 4.18% from 0.35 MtCO_2e in 2005 to 0.6 Mt CO_2e in 2018. Industrial Wastewater accounted for nearly 20% of Waste sector emissions in 2018 and grew at a CAGR of 2.51% from 0.74 Mt CO_2e in 2005 to 1.02 Mt CO_2e in 2018 (see Figure 14).

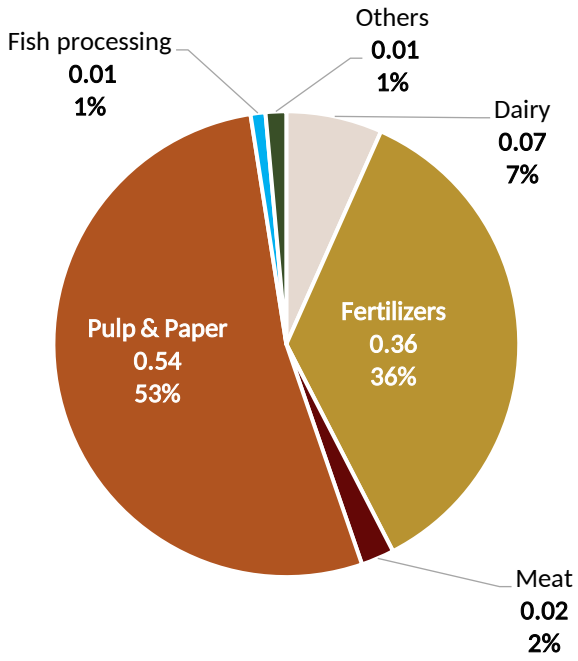
Emissions from Domestic Wastewater of both rural and urban areas of Madhya Pradesh increased at CAGR of 3.14% from 2.32 Mt CO_2e in 2005 to 3.47 Mt CO_2e in 2018. Almost 63% of Domestic Wastewater emissions were from rural areas of Madhya Pradesh in 2018, as shown in Figure 15.

Figure 15: Area-wise GHG Emissions Estimates of Domestic Wastewater (2005 to 2018)



The Pulp and Paper Industry was the major contributor to Industrial wastewater emissions with a share of ~53% in 2018. This was followed by Fertilizer industry (36%), Dairy (7%) and Meat Industry (~2%) as shown in Figure 16.

Figure 16: Category-wise Emissions (Mt CO_2e) and Percentage Share in Industrial Wastewater Emissions (2018)



GHG Platform INDIA

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.

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