

Trend Analysis of GHG Emissions of MAHARASHTRA

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

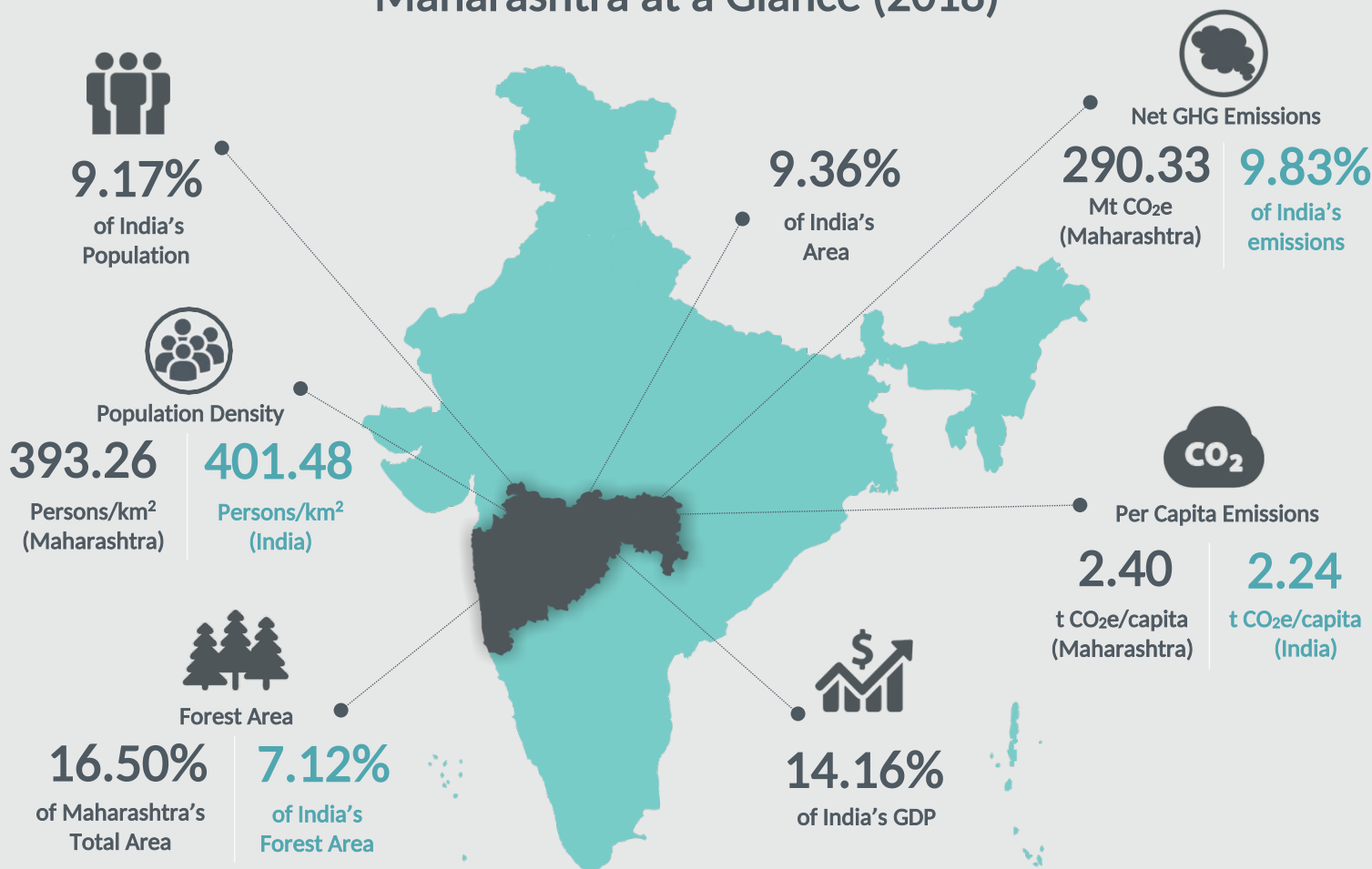
The Platform aims to add value to the various ongoing GHG emissions estimation efforts by addressing existing data gaps and data accessibility issues, broadening the scope of national inventories to include state inventories, and increasing the volume of analytics and policy dialogue on India's GHG emissions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

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



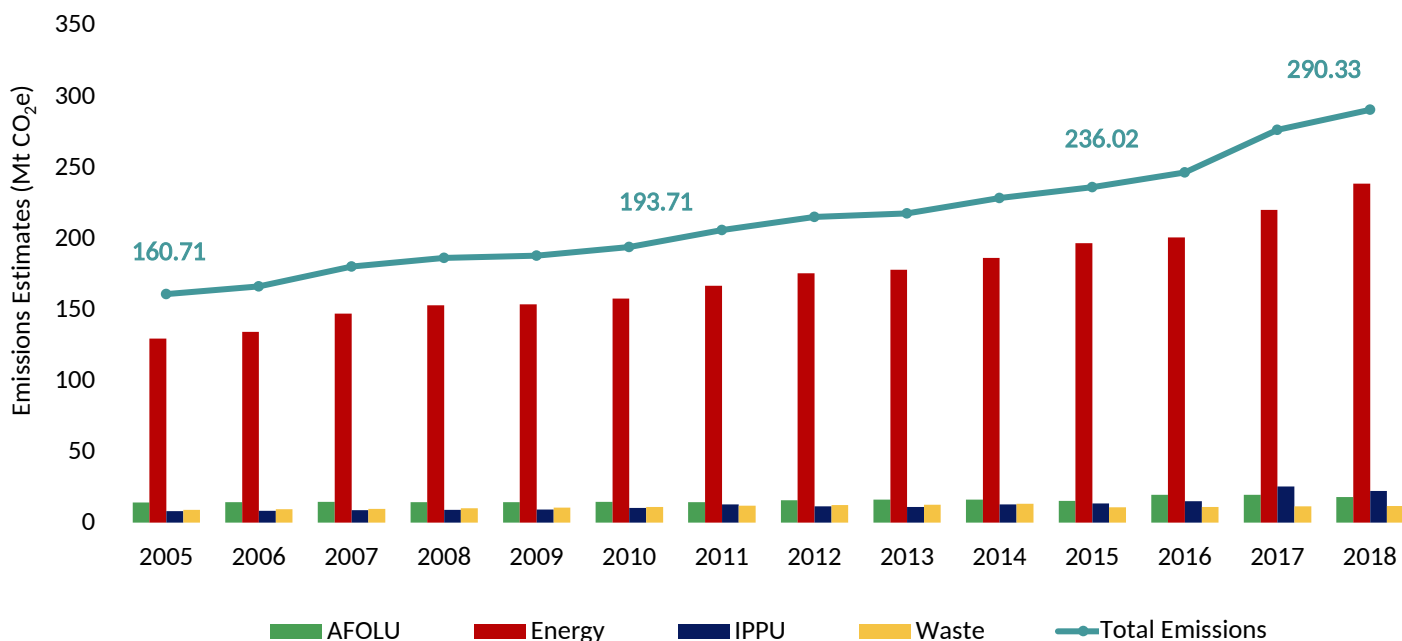
*Fuel combusted for captive electricity generation (auto-producers) and direct fuel combustion (industrial energy) has been reported under Energy sector.

Maharashtra at a Glance (2018)



Economy-wide Emissions Estimates

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



Emissions of Maharashtra increased at a rate of 4.65% (compounded annually) from 160.71 Mt CO₂e in 2005 to 290.33 Mt CO₂e in 2018 (Figure 1). During the reference period, Maharashtra's emissions increased rapidly due to an increase in emissions from the Energy sector. The Energy sector accounted for ~80% of Maharashtra's total economy-wide emissions in 2005. The Agriculture, Forestry and Other Land Use (AFOLU), Industrial Processes and Product Use (IPPU) and Waste sectors accounted for ~9%, 5% and ~6%, respectively, of the total emissions in 2005. As shown in Figure 2, the Energy and IPPU sectors increased their share of emissions to ~82% and 8%, respectively, in 2018, while the AFOLU and Waste sectors decreased to ~6% and ~4%, respectively.

Figure 2: Sector-wise Contribution (Mt CO₂e) and Percentage Share in Total Economy-wide Emissions of Maharashtra

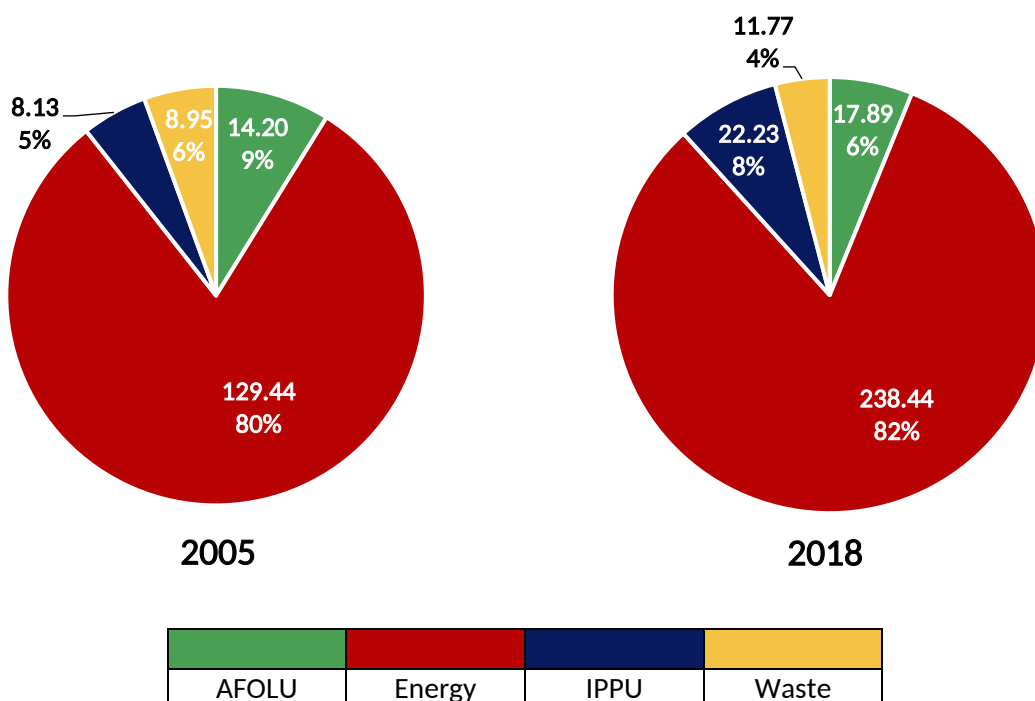
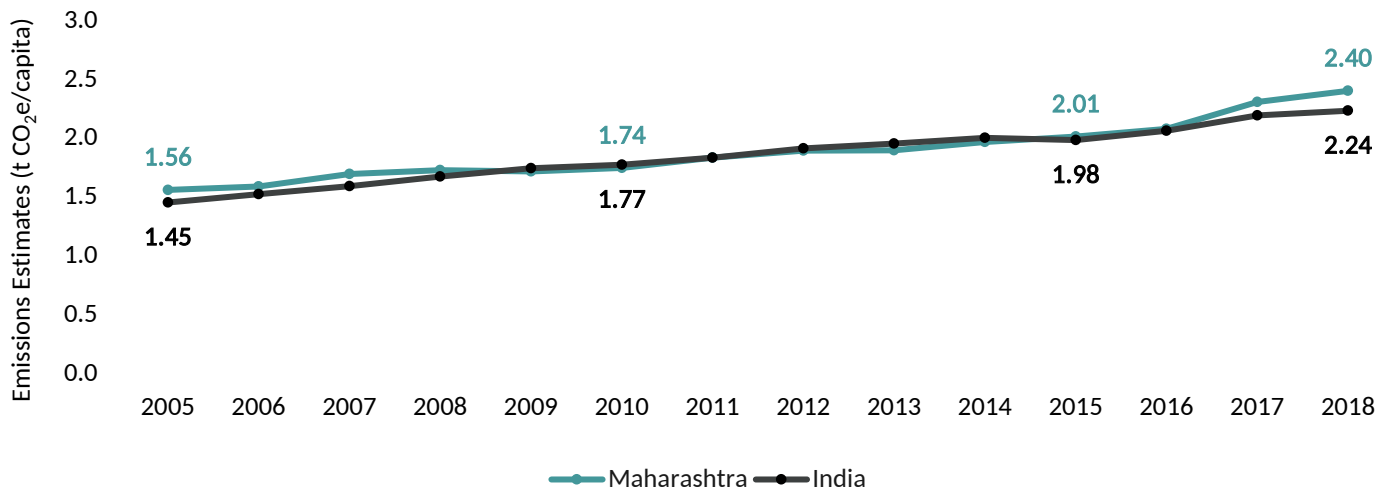


Figure 3: Per Capita GHG Emissions of Maharashtra and India (2005 to 2018)



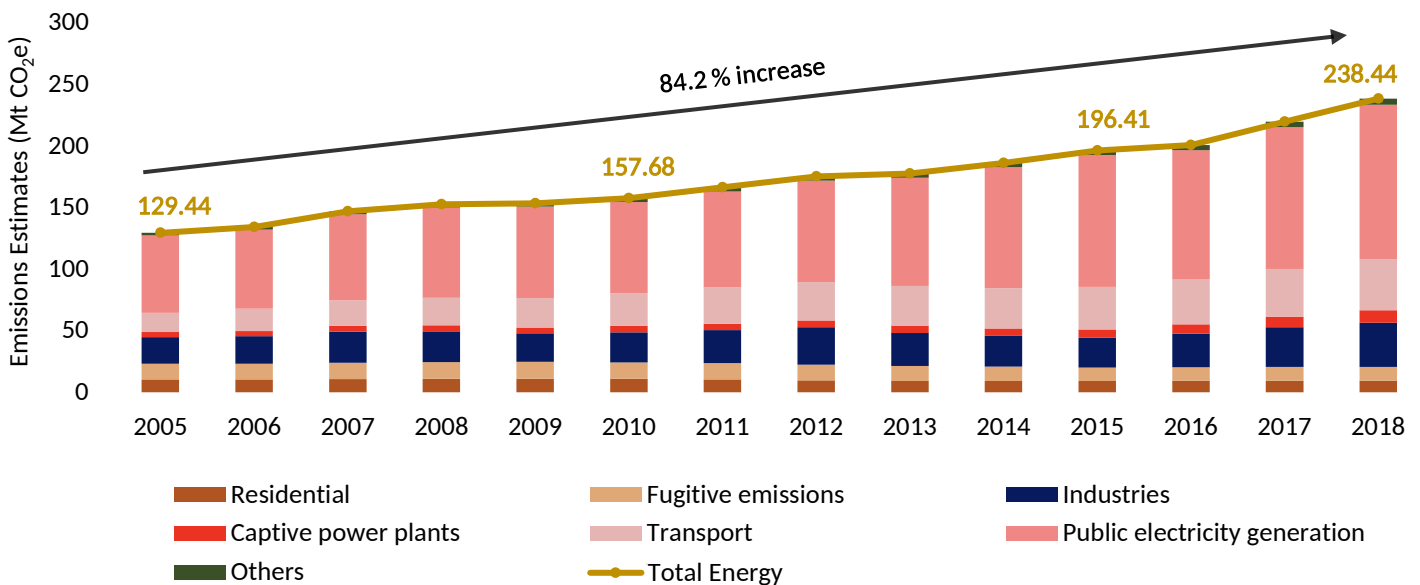
For the majority of the reference years, Maharashtra's per capita emissions were quite close to India's per capita emissions. However, they increased at a compounded rate of 3.38% from 1.56 t CO₂e/capita in 2005 to 2.40 t CO₂e/capita in 2018, which was slightly lower than that of India (~3.41%).



Energy Sector

Energy sector emissions include emissions from fuel combustion as well as fugitive emissions. Emissions from fuel combustion are included in the Public Electricity Generation, Transportation, Captive Power Plants, Industries, Agriculture, Commercial, and Residential categories. Fuel production is the source of fugitive emissions. In 2018, Maharashtra's Energy sector accounted for ~82% of the total economy-wide emissions. Figure 4 shows that emissions from the Energy sector increased at a CAGR of 4.81% from 129.44 Mt CO₂e in 2005 to 238.44 Mt CO₂e in 2018.

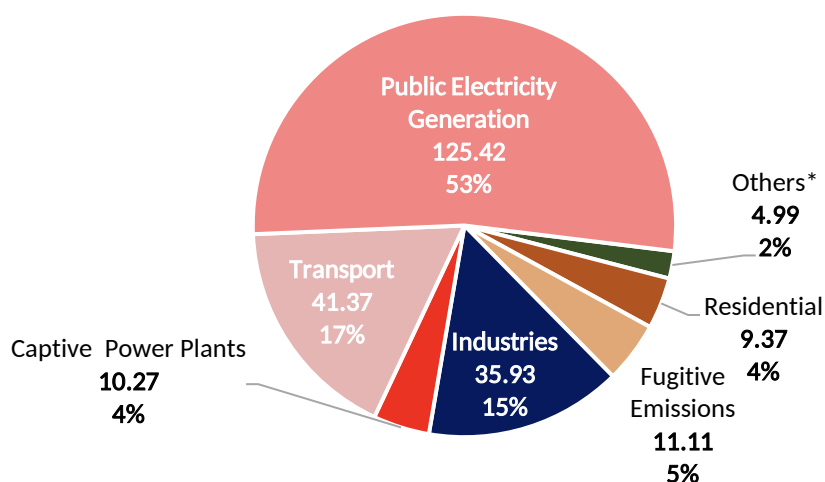
Figure 4: GHG Emissions Estimates of Energy Sector - Maharashtra (2005 to 2018)



Within the Energy sector, Public Electricity Generation (PEG) was the largest contributor of GHG emissions, accounting for ~53% of total Energy emissions in 2018. This was followed by Transport and Industrial Energy categories, with contribution of 17% and 15%, respectively (see Figure 5).

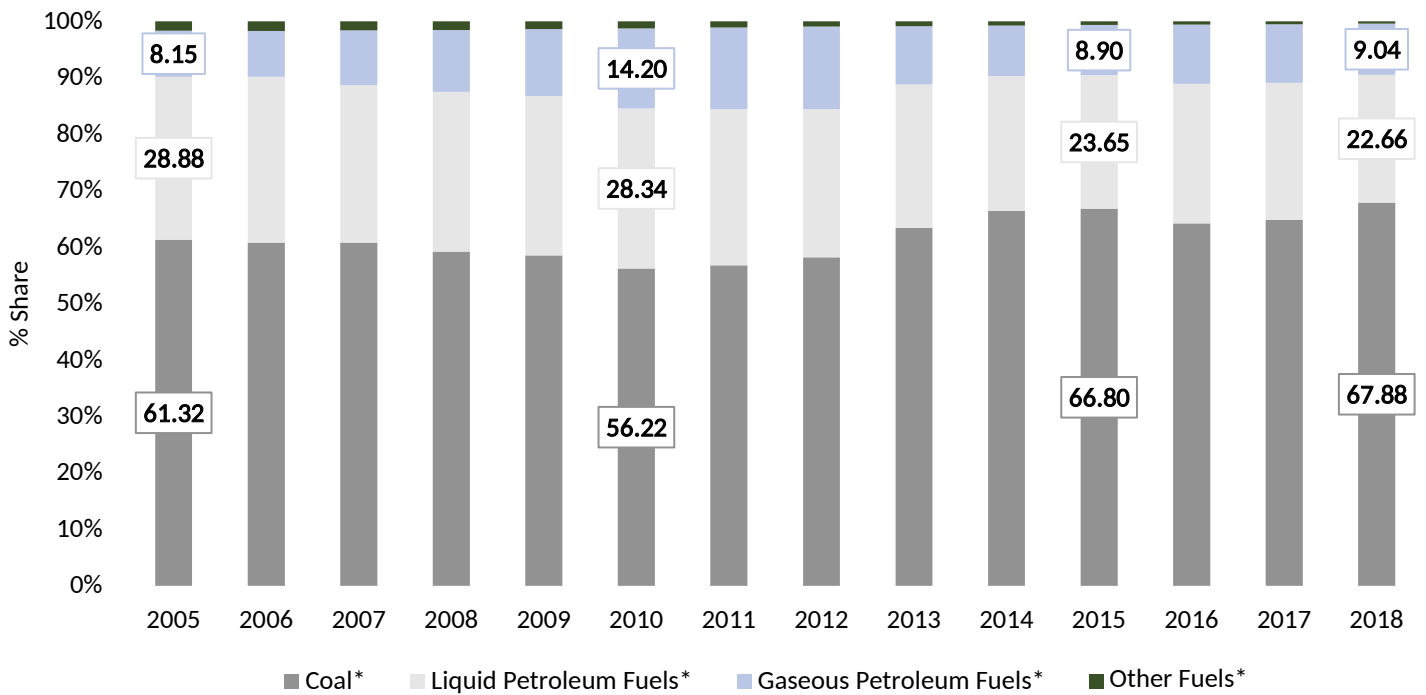
Within the Fuel Combustion sub-sector, Coal was the most common fuel used in the state, with an average share of ~62% of total Energy emissions, across the reference years (see Figure 6). Between 2005 and 2018, emissions from the combustion of Liquid Petroleum Fuels and Gaseous Petroleum Fuels had average shares of ~26% and ~11%, respectively.

Figure 5: Category-wise Emissions (Mt CO₂e) and Percentage Share in Total Energy Emissions (2018)



*Others include emissions due to Fuel Combustion in Agriculture, Fisheries and Commercial categories.

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 Processes and Product Use (IPPU) sector are largely driven by Chemical, Metal, Mineral Industries and Non-Energy Products from Fuels and Solvent Use. In Maharashtra, the IPPU sector accounted for ~8% of the total economy-wide emissions in 2018. Overall, IPPU sector emissions increased at a compounded rate of 8.04% between 2005 and 2018, rising from 8.13 Mt CO₂e in 2005 to 22.23 Mt CO₂e in 2018. Mineral Industry emissions peaked in 2017 due to an increase in emissions from the Glass Production category. However, emissions from the Glass Production category fell from 9.21 Mt CO₂e (2017) to 3.61 Mt CO₂e (2018).

Figure 7: GHG Emissions Estimate of IPPU Sector - Maharashtra (2005 to 2018)

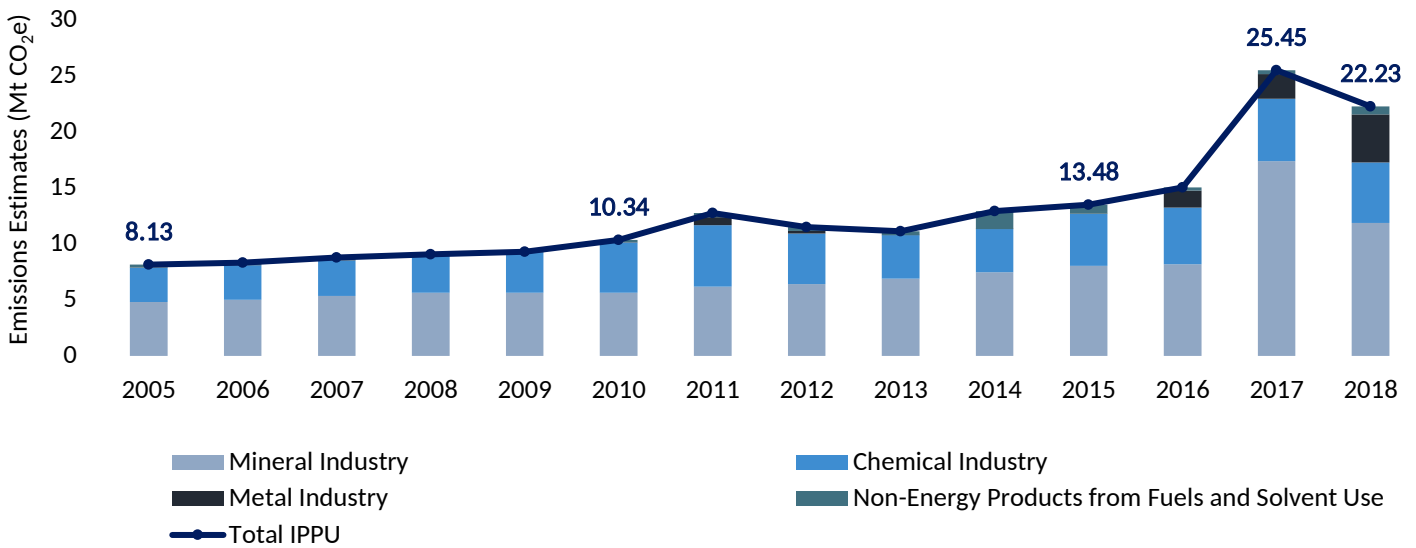


Figure 8 depicts a detailed trend of GHG emissions by various IPPU categories. In 2018, Cement Production, a major contributor to IPPU emissions, accounted for ~37% of total IPPU sector emissions, followed by Glass Production (16%) (see Figures 8 and 9 below).

Figure 8: Percentage Share of GHG Emissions from IPPU Categories (2005 to 2018)

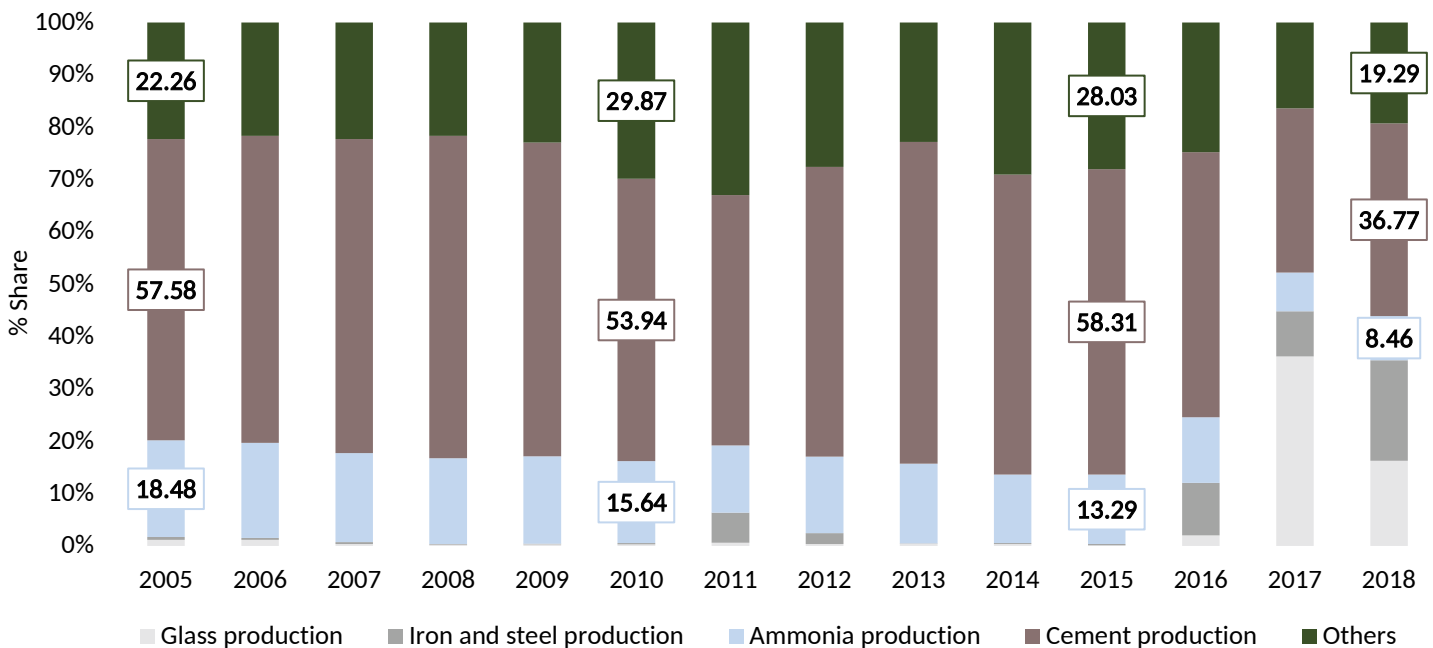
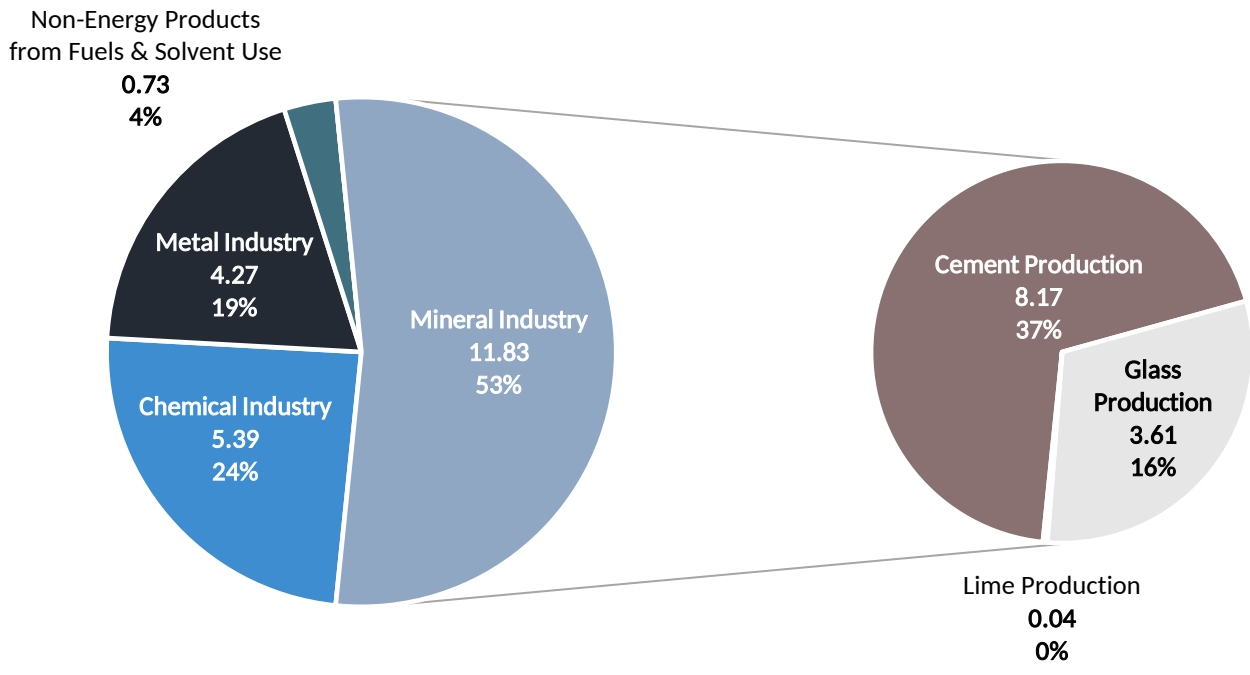


Figure 9: Sub-Sector Emissions (Mt CO₂e) and Percentage Contribution in Total IPPU Emissions (2018)



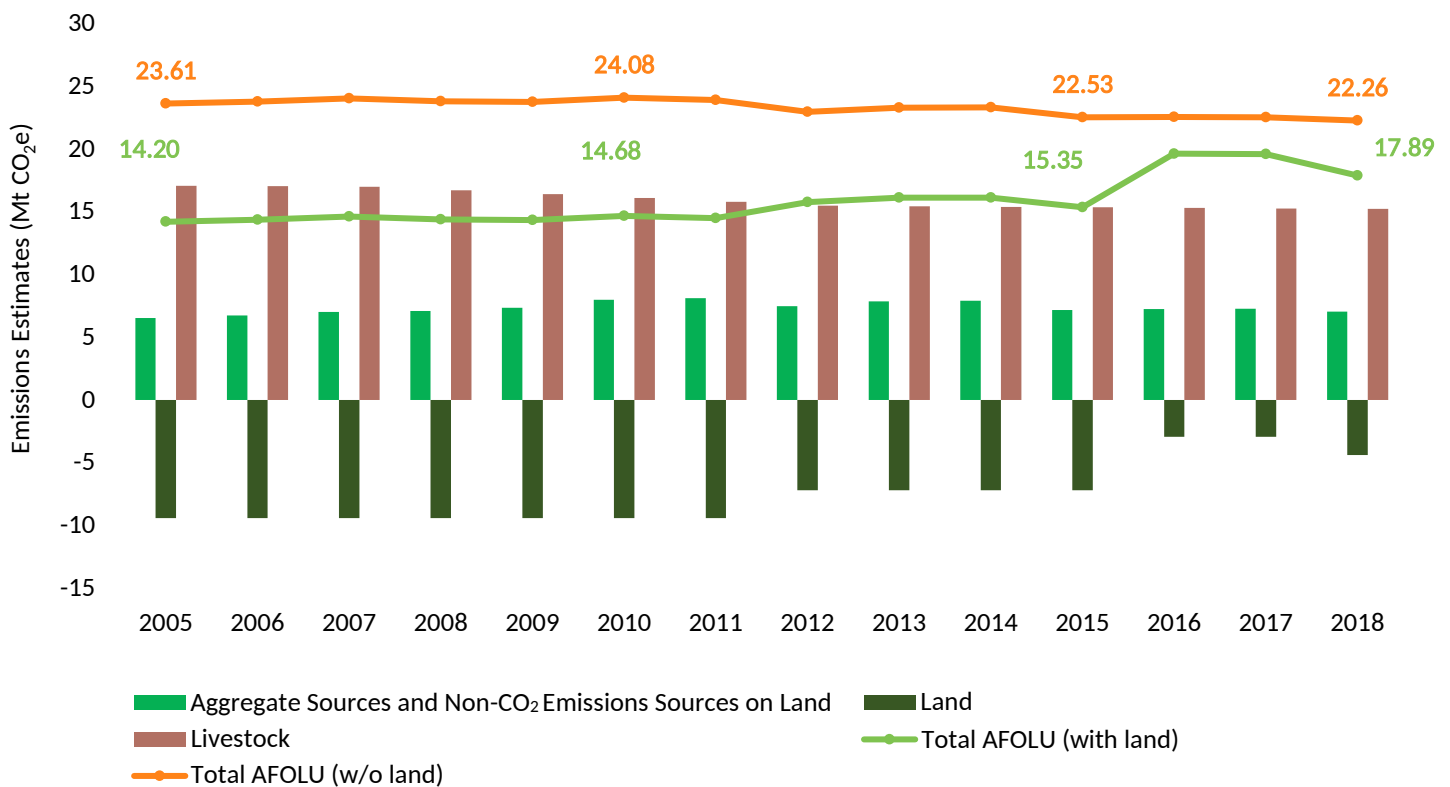


AFOLU Sector

Emissions from the Agriculture, Forestry and Other Land Use (AFOLU) sector arise from three main sub-sectors: Livestock, Land and Aggregate Sources and Non-CO₂ Emissions Sources on Land*. AFOLU sector emissions represented ~6% of the total economy-wide emissions of Maharashtra. While the Livestock and Aggregate Sources and Non-CO₂ Emissions Sources on Land sub-sectors were net GHG emitters, the Land sub-sector was net sink, throughout the reference period.

The total AFOLU emissions increased at CAGR of 1.79% between 2005 and 2018. This was due to decrease in removals from the Land sub-sector, particularly post 2015. The average annual removals from the Land sub-sector in Maharashtra during the reference period were 7.48 Mt CO₂e, around ~32% of the average annual gross AFOLU emissions.

Figure 10: GHG Emissions Estimates of AFOLU Sector - Maharashtra (2005 to 2018)



The Livestock sub-sector had the maximum share of ~68% of the gross AFOLU emissions (excluding Land sub-sector) of Maharashtra in 2018. Within the Livestock sub-sector, the Enteric Fermentation category was the major contributor to gross AFOLU emissions, with an average share of ~62%, across the reference period. However, emissions from this category declined at a rate of 0.88% (compounded annually) from 17.08 Mt CO₂e in 2005 to 15.22 Mt CO₂e in 2018.

From the Aggregate Sources sub-sector, Agriculture Soils and Rice Cultivation were the top contributors to gross AFOLU emissions with average shares of ~31% and ~2%, respectively, during the reference period. The share of emissions from Agriculture Soils in gross AFOLU emissions increased from ~15.6% in 2005 to ~19.4% in 2018, while the share of emissions from Rice Cultivation remained nearly constant throughout the reference period (see Figures 11 and 12).

*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.

Figure 11: Category-wise Emissions (Mt CO₂e) and Percentage Share in Gross AFOLU Emissions (excluding Land sub-sector) (2018)

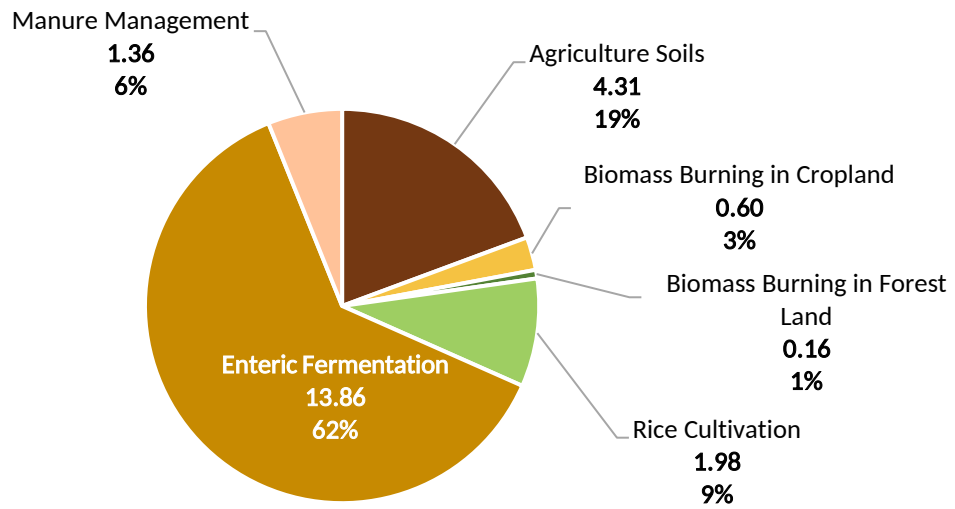
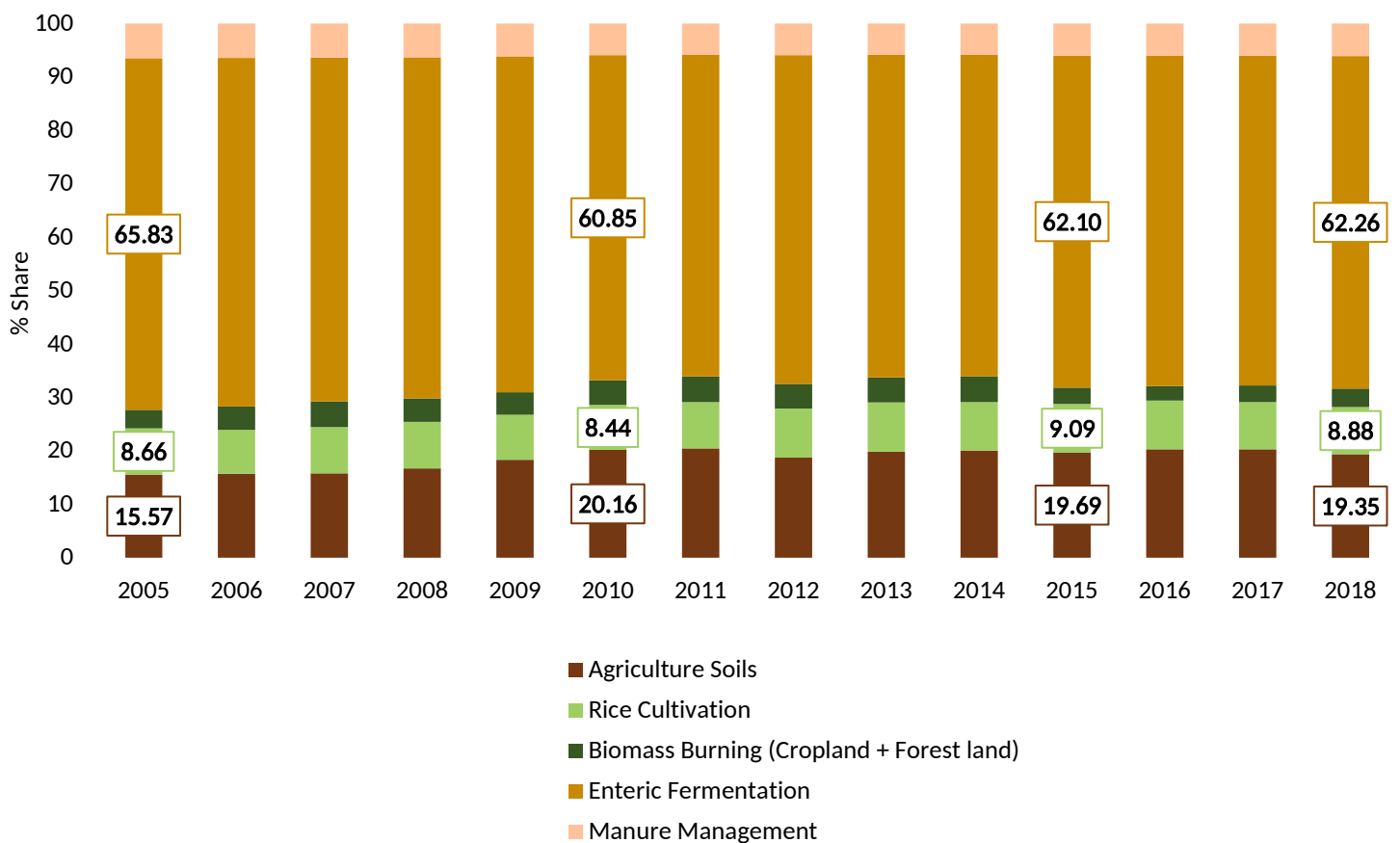


Figure 12: Category-wise Share of Gross AFOLU GHG Emissions (excluding Land sub-sector) (2005 to 2018)





Waste Sector

Solid Waste Disposal, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. In 2018, the Waste sector contributed nearly 4% of Maharashtra's total economy-wide emissions. GHG emissions from Maharashtra's Waste sector increased at a CAGR of 2.13% from 8.95 Mt CO₂e in 2005 to 11.77 Mt CO₂e in 2018. There was a dip in emissions in 2015 which can be attributed to decline in emissions from the Industrial Wastewater sub-sector reported in that year (see Figure 13).

Figure 13: GHG Emissions Estimate of Waste Sector - Maharashtra (2005 to 2018)

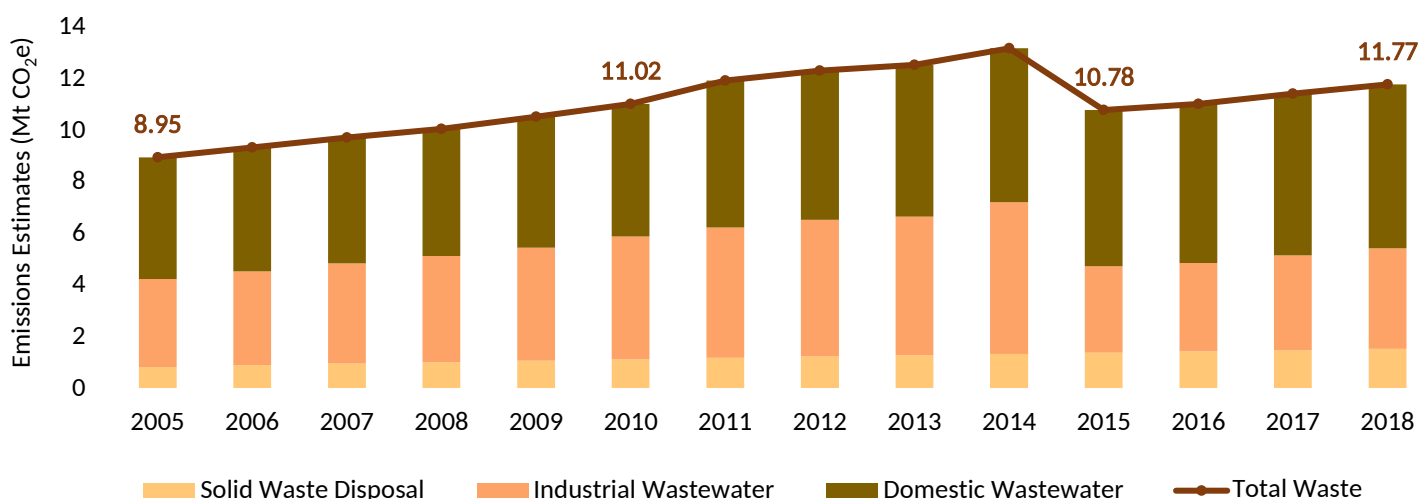
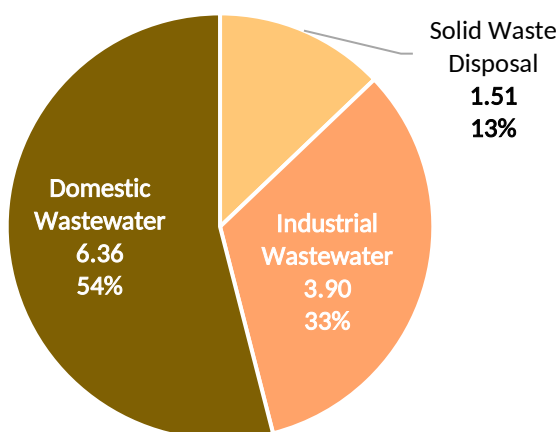


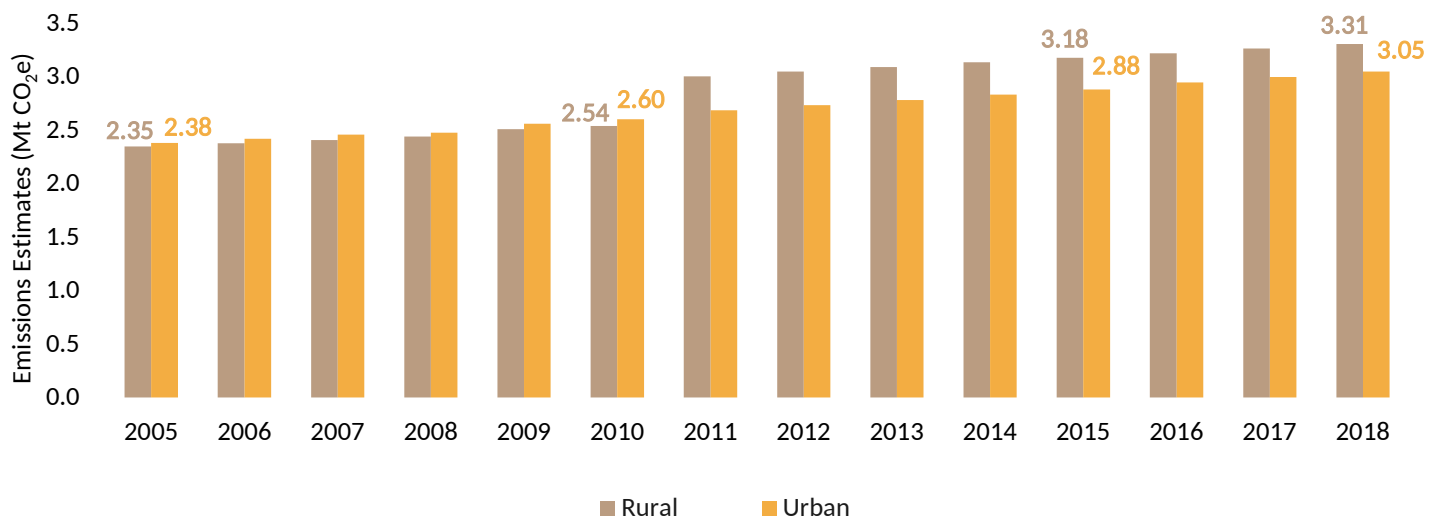
Figure 14: Sub-sector Emissions (Mt CO₂e) and Percentage Share in Total Waste Sector Emissions (2018)



Discharge of untreated wastewater and use of septic tanks are the key drivers of emissions due to Domestic Wastewater sub-sector. Domestic Wastewater emissions had a share of 54% in the total Waste sector emissions of Maharashtra in 2018. Approximately 13% of the Waste sector emissions were from Solid Waste Disposal, which grew at an estimated CAGR of 4.88% from 0.82 Mt CO₂e in 2005 to 1.51 Mt CO₂e in 2018. Industrial Wastewater accounted for nearly 33% of Waste sector emissions in 2018 came from Industrial Wastewater, which increased at a CAGR of 1.05% from 3.40 Mt CO₂e in 2005 to 3.90 Mt CO₂e in 2018 (see Figure 14 above).

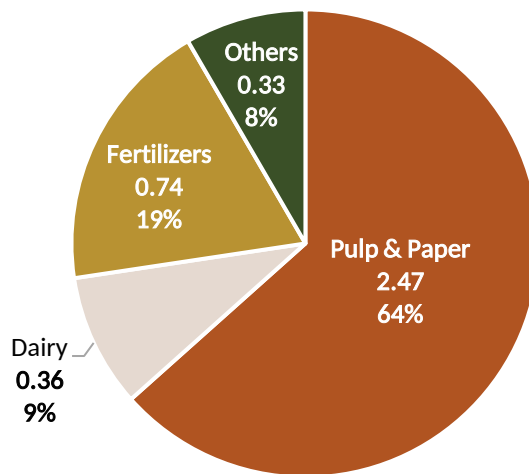
Emissions from Domestic Wastewater of both rural and urban areas grew at a CAGR of 2.30% from 4.73 Mt CO₂e in 2005 to 6.36 Mt CO₂e in 2018. Almost 51% of Domestic Wastewater emissions were from the rural areas of Maharashtra in 2018 as shown in Figure 15 below.

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 ~64% in 2018. This was followed by Fertilizers Industries (~19%) and Dairy (~9%) as illustrated in Figure 16 below.

Figure 16: Category-wise Emissions (Mt CO₂e) and Percentage Share in 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

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