

Trend Analysis of GHG Emissions in 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, namely- Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry & Other Land Use (AFOLU) and Waste.

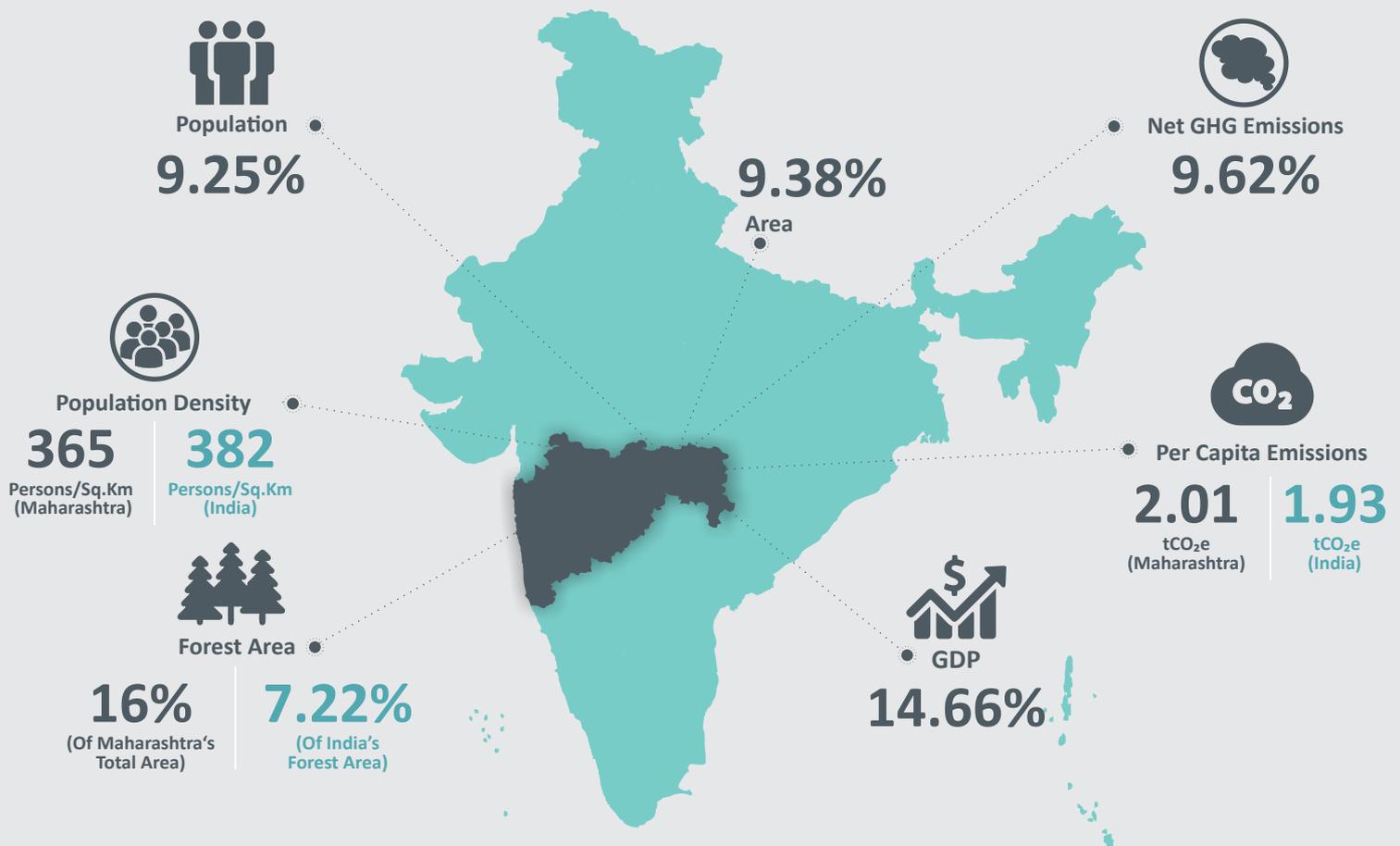
The Platform seeks to add value to the various ongoing GHG emission estimation efforts by helping address existing data gaps and data accessibility issues, extending beyond the scope of national inventories to state inventories, and by increasing the volume of analytics and policy dialogue on India's GHG emissions sources, profile, and related policies.

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



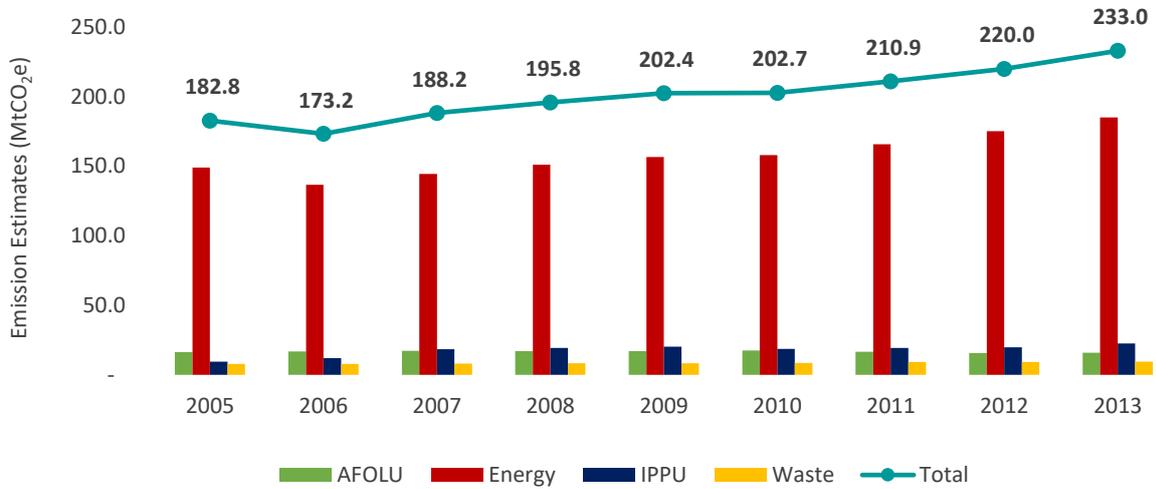
*Fuel combusted for Captive Electricity Generation (Auto-Producers) has been reported under Energy sector.

Maharashtra at a glance (2013)



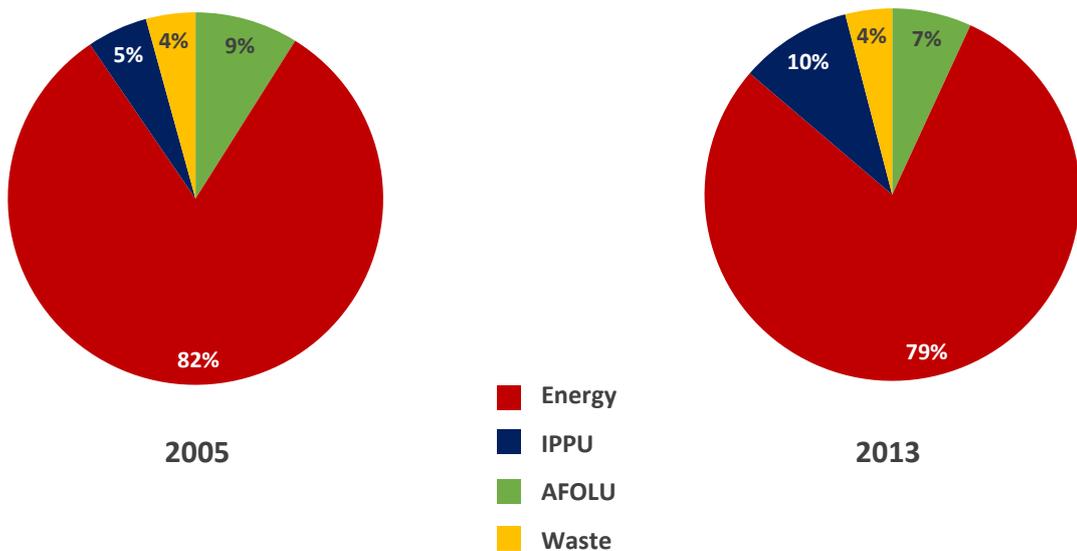
Economy-wide Emission Estimates

Figure 1: GHG Emission Estimates for Maharashtra (2005 to 2013)



Emissions of Maharashtra grew from 182.8 MtCO₂e to 233 MtCO₂e at an estimated CAGR¹ of 3.08% from 2005 to 2013². The Energy sector of Maharashtra remained the major contributor of GHG emissions across all the reference years as illustrated in Figure 1 above. In 2005, ~82% emissions emanated from the Energy sector while the remaining ~18% emissions belonged to the AFOLU (~9%), IPPU (~5%) and Waste (~4%) sectors respectively. In 2013, the share of emissions from the Energy sector reduced to ~79% and that of the AFOLU sector reduced to ~7%. However, the share of emissions from the IPPU sector doubled itself to ~10% in 2013. The sectoral share of the Waste sector remained unchanged in 2013 when compared to 2005.

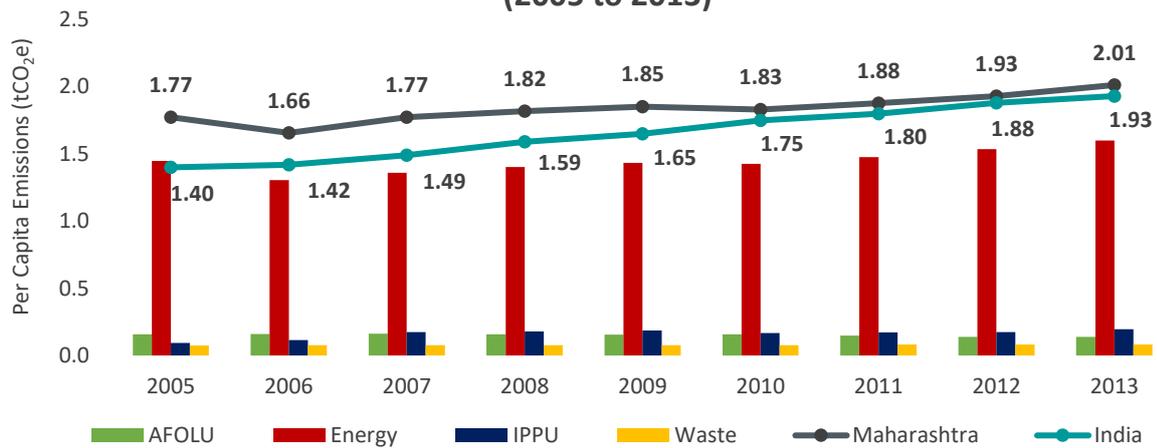
Figure 2: Sector-wise Contribution to Economy-wide GHG Emissions of Maharashtra



¹ Compound Annual Growth Rate

² Calendar year values have been considered for this analysis. For Global Warming Potential (GWP) calculations IPCC-ARII values have been considered.

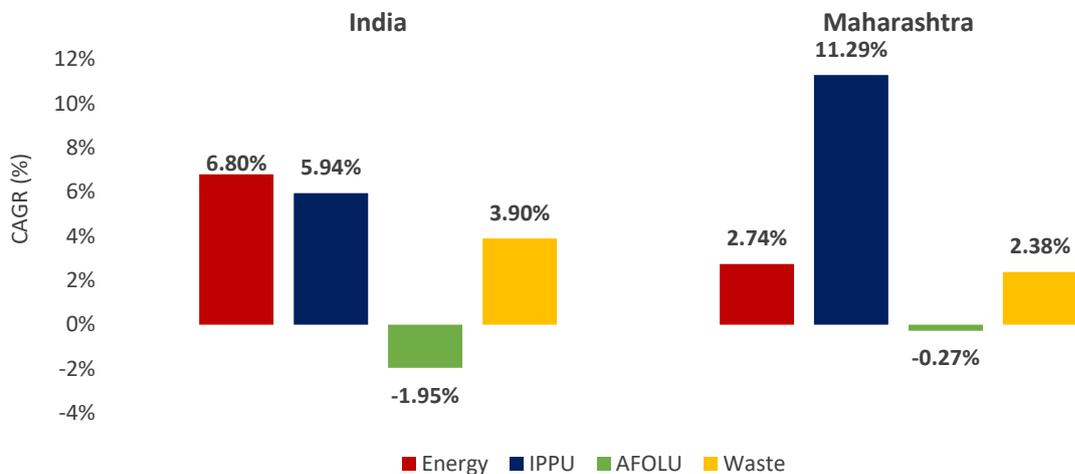
Figure 3: Per Capita GHG Emissions for Maharashtra and India (2005 to 2013)



Per Capita emissions from Maharashtra grew from 1.77 tCO₂e in 2005 to 2.01 tCO₂e in 2013. When compared to per capita emissions of India, Maharashtra recorded slightly higher per capita emissions throughout the reference period. However, by 2010, the per capita emissions of Maharashtra had almost come down to match the per capita emissions of the country from a significantly higher level in 2005 to start with, as illustrated in Figure 3 above. The observed CAGRs of the per capita emissions in India and Maharashtra were 4.07% and 1.59% respectively from 2005 to 2013.

Figure 4: Sector-wise GHG Emissions Growth Rate from 2005 to 2013

These growth rates have been compounded annually.



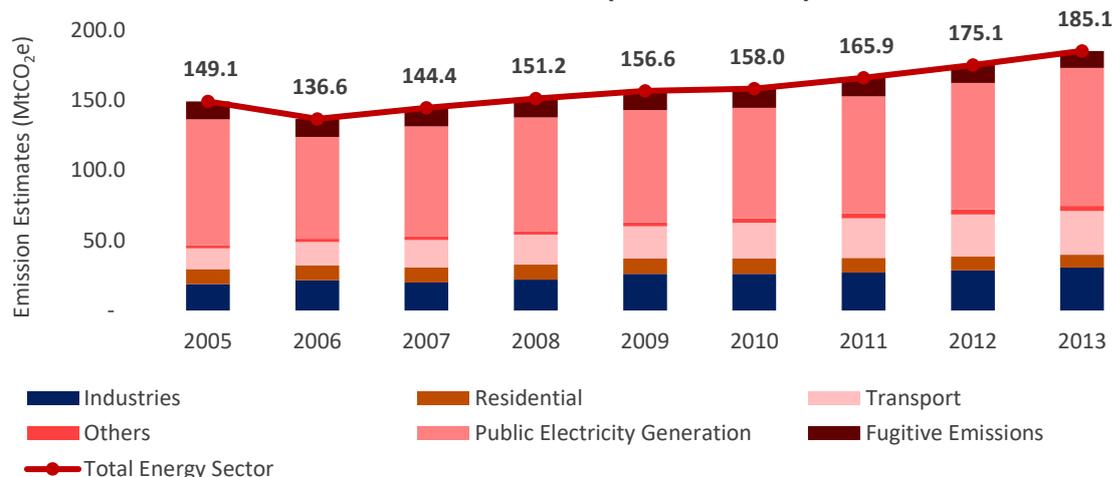
The IPPU sector in Maharashtra registered the highest CAGR of 11.29% from 2005 to 2013. This was followed by the Energy and Waste sectors, which had a relatively lower CAGR of 2.74% and 2.38% respectively, for the same period. Notably, the emissions of the AFOLU sector in Maharashtra declined, albeit very slowly, at the rate of 0.27% (compounded annually) from 2005 to 2013. As far as other sectoral trends are concerned, when compared to India's sectoral growth/decline rates, while the Energy and Waste sectors registered a lower growth rate, the AFOLU sector emissions also declined like India's AFOLU sector emissions, albeit at a much slower pace as shown in Figure 4 above. However, the IPPU sector emissions of Maharashtra grew twice as fast as the rate of growth of IPPU emissions of India



Energy Sector

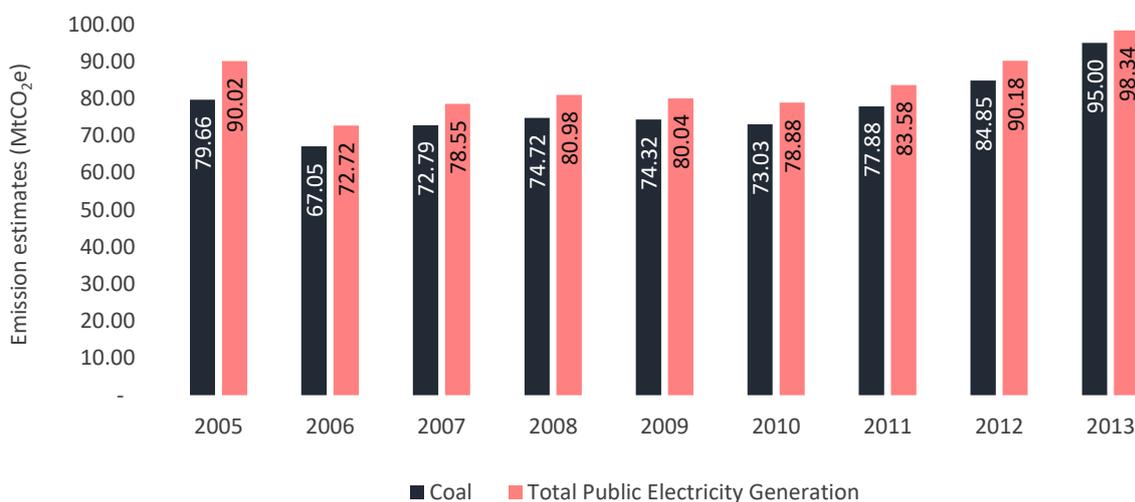
The Energy sector represented almost 79% of the total emissions of Maharashtra in 2013. In general, emissions from the Energy sector arise from two main sub-sectors – Fuel Combustion (Public Electricity Generation, Transport, Industries and Agriculture, Commercial and Residential categories) and Fugitive. In 2013, ~93% of Maharashtra’s Energy sector emissions emanated from Fuel combustion while ~7% emissions were Fugitive. Emissions from the Energy sector grew at a CAGR of 2.74% from 149.1 MtCO₂e in 2005 to 185.1 MtCO₂e in 2013 as illustrated in Figure 5 below. A slight dip in the overall Energy sector emissions was observed in 2006 owing to reduced Public Electricity Generation emissions.

Figure 5: GHG Emission Estimates for Energy Sector in Maharashtra (2005 to 2013)



Public Electricity Generation was a major category under the Fuel Combustion sub-sector with an average share of ~53% in Maharashtra’s Energy emissions portfolio followed by the Industries category which had an average share of ~15% during the reference period. Deep diving into the Public Electricity Generation sub-sector, majority of the emissions emanated from the combustion of Coal in Thermal Power Plants of Maharashtra with an average share of ~93% from 2005 to 2013 as shown in Figure 6 below. Notably, the emissions from this category grew at a CAGR of 1.11%, lower than the overall growth of emissions of the Energy sector of Maharashtra as a whole, from 90 MtCO₂e in 2005 to 98.3 MtCO₂e in 2013.

Figure 6: GHG Emission Estimates from Coal-based Power Generation (2005 to 2013)

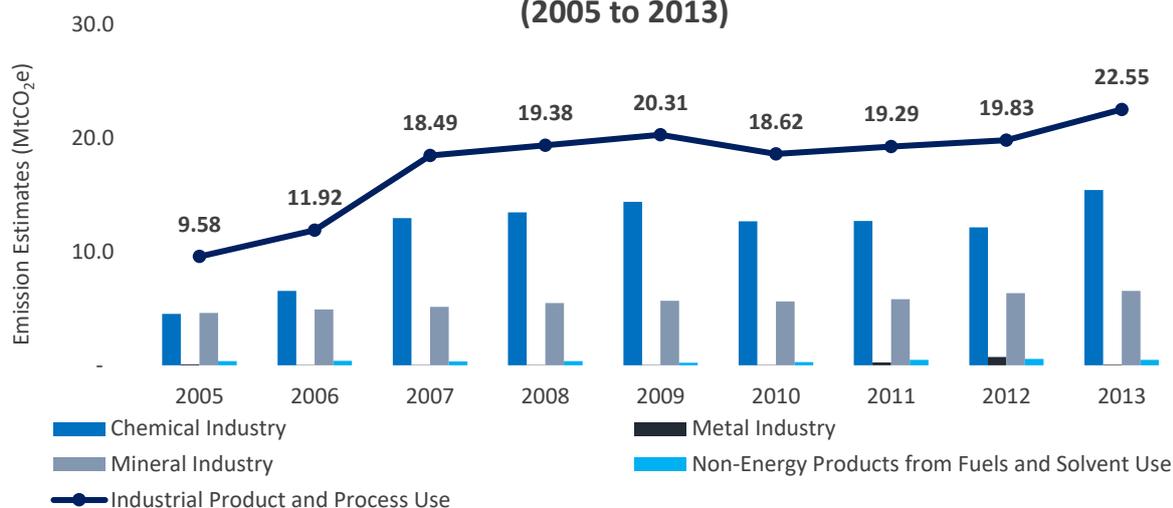




IPPU Sector

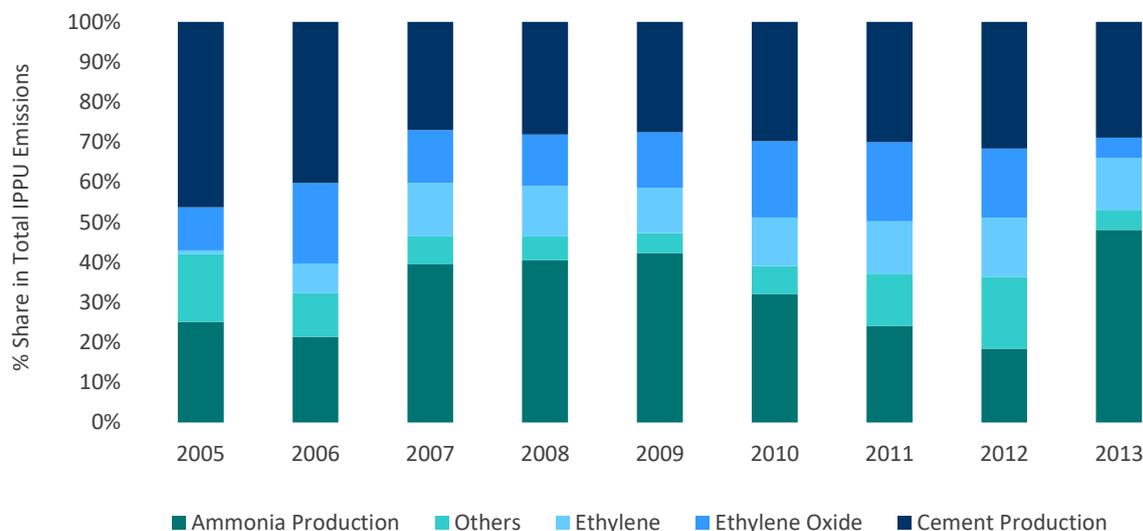
The IPPU sector represented ~10% of the total GHG emissions of Maharashtra in 2013. Emissions from the IPPU sector are largely driven by the Chemical, Metal, Mineral Industries and Non-Energy Products from Fuels and Solvent Use. Chemical Industry was the major contributor of GHG emissions of this sector with a share of ~69% in the total IPPU emissions of Maharashtra in 2013. Between 2005 and 2013, the overall IPPU emissions of Maharashtra rose at a CAGR of 11.29% from 9.58 MtCO₂e in 2005 to 22.55 MtCO₂e as shown in Figure 7 below. Notably, the IPPU emissions of Maharashtra were driven by emissions from the Chemical Industries during the reference period.

Figure 7: GHG Emission Estimates for IPPU Sector in Maharashtra (2005 to 2013)



However, disaggregation at a sectoral level indicates inconsistencies in reported production of Ammonia and Ethylene across the years. While the share of emissions from Cement Production gradually decreased since 2005, Ammonia Production emerged as a major emitter of GHGs. Notably, the share of GHG emissions from Cement Production declined from ~46% in 2005 to ~29% in 2013, while the share of Ammonia Production rose from ~25% in 2005 to ~48% in 2013.

Figure 8: Share of GHG Emissions from IPPU Categories (2005 to 2013)

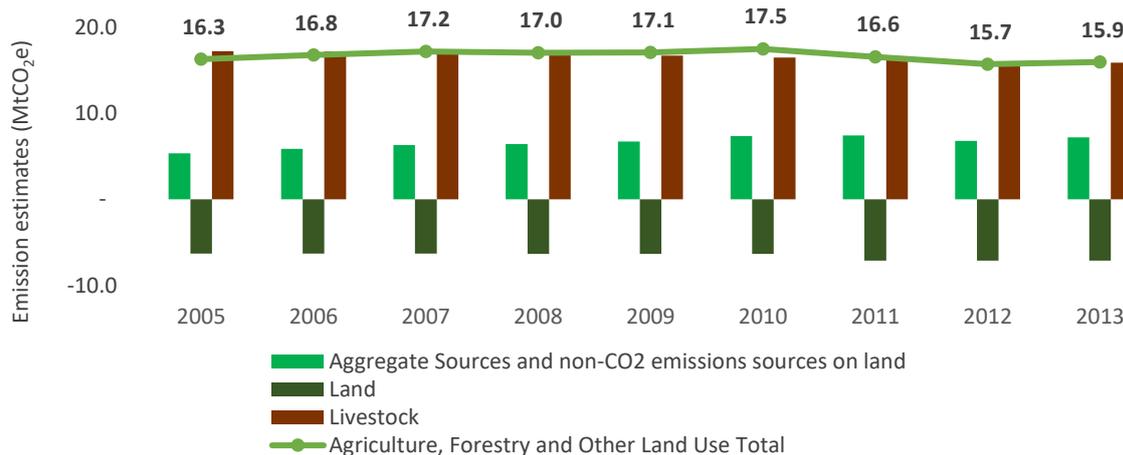




AFOLU Sector

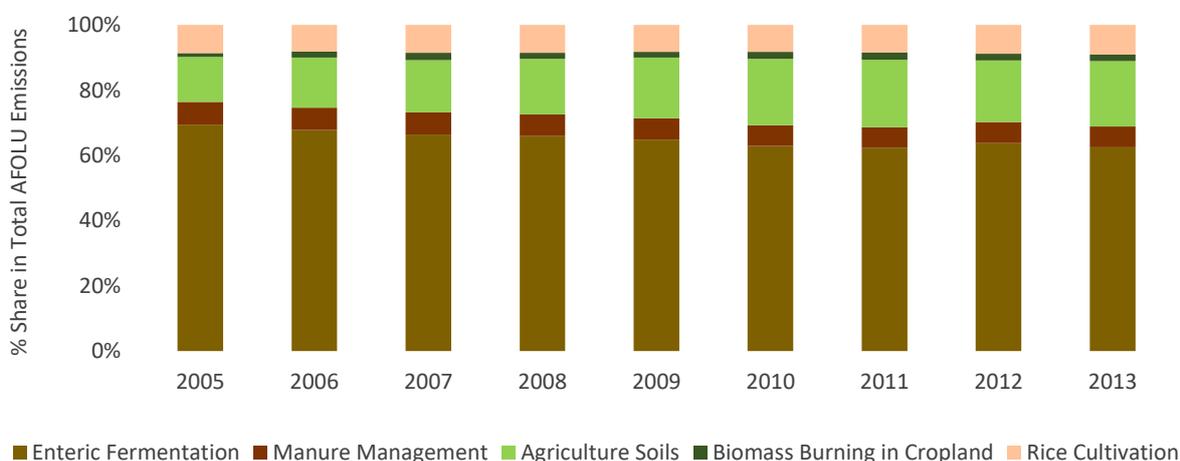
The AFOLU sector represented nearly 7% of the total emissions of Maharashtra in 2013. Emissions from the AFOLU sector arise from three main sub-sectors namely Livestock, Land and Aggregate sources and non-CO₂ emissions sources on land. Notably, the Land sub-sector was a sink of GHGs across all the reference years while the other sub-sectors were positive emitters of GHGs. Emissions from the AFOLU sector declined slowly at the rate of 0.27% from 16.3 MtCO₂e in 2005 to 15.9 MtCO₂e in 2013 as shown in Figure 9 below.

Figure 9: GHG Emission Estimates for AFOLU Sector in Maharashtra (2005 to 2013)



Out of the three sub-sectors, maximum emissions were registered from the Livestock sub-sector (Enteric Fermentation & Manure Management) across all the reference years. However, emissions from this sub-sector declined at a rate of 1.02% from 17.23 MtCO₂e in 2005 to 16.03 MtCO₂e in 2013. This was perhaps a reflection of decreased dairy and other associated activities in the animal husbandry sector of Maharashtra. If emissions of the AFOLU sector were considered without taking removals from the Land sub-sector into account, maximum emissions arose from Enteric Fermentation with an average share of ~65% followed by Agricultural Soils (~18%) across the reference period. Notably, the contribution of Enteric Fermentation reduced from ~69% in 2005 to ~63% in 2013 and that of Agricultural Soils rose from ~14% in 2005 to ~20% in 2013 as illustrated in Figure 10 below.

Figure 10: Share of GHG Emissions from AFOLU Categories (Excluding Land) (2005 to 2013)





Waste Sector

The Waste sector contributed to nearly 4% of the total emissions of Maharashtra in 2013. Municipal solid waste³, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. The Waste sector emitted 9.40 MtCO₂e in the year 2013 up from 7.78 MtCO₂e in 2005. The GHG emissions from the Waste sector grew at a CAGR of 2.38% from 2005 to 2013. However, a spike in the overall GHG emissions was observed in 2011 which can be attributed to higher Domestic wastewater emissions, which reflects changing trends in use of various treatment systems as reported in Census of India 2011.

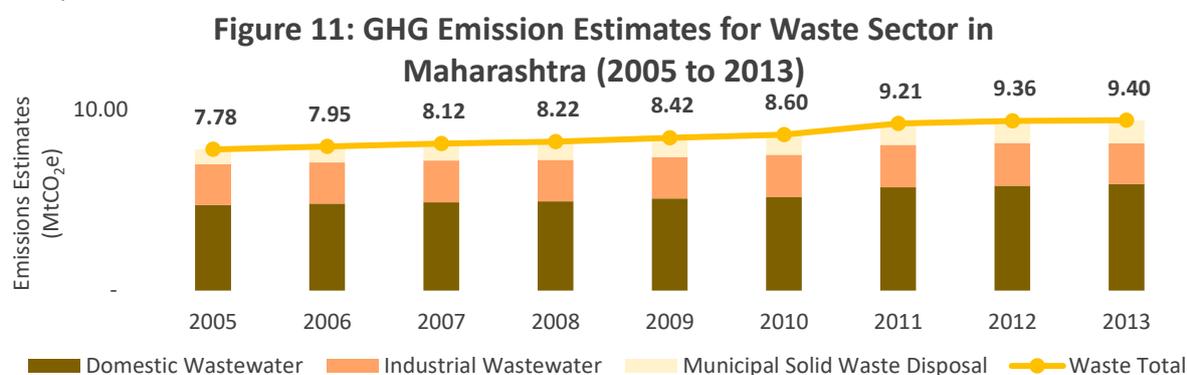


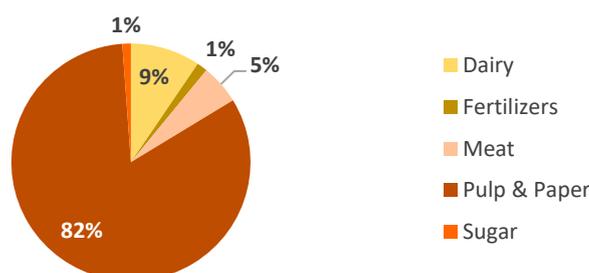
Figure 12: Category-wise Share of GHG Emissions for Waste Sector (in 2013)



Domestic Wastewater of the rural and urban areas of Maharashtra had a major share of ~63% in the total Waste sector emissions of Maharashtra in 2013. Nearly 53% of the Domestic Wastewater emissions emanated from the rural areas of Maharashtra in 2013. Discharge of untreated wastewater and use of septic tanks are key drivers of emissions in this sub-sector. Municipal Solid Waste contributed 14% of the emissions in 2013. Changing Solid Waste composition resulted in an increase in the GHG emissions generated from every tonne of solid waste disposed over the years in Maharashtra and emissions from this category increased at 5.69% (CAGR) from 0.82 MtCO₂e in 2005 to 1.22 MtCO₂e in 2013.

Industrial Wastewater represented ~24% of the total Waste sector emissions of Maharashtra in 2013. Deep diving into the various Industrial Wastewater categories, nearly 82% of the Industrial Wastewater emissions arose from the Pulp and Paper Industries followed by emissions from the Dairy (~9%) and Meat (~5%) Industries, respectively. The remaining ~2% emissions arose from the Sugar (1%) and Fertilizer (1%) Industries respectively in 2013 as shown in Figure 13 below.

Figure 13: Share of Emissions from Industrial Wastewater Categories (in 2013)



³ 'Refers to emission in urban areas. Emissions from solid waste disposal in rural areas are not considered, as disposal predominantly occurs in a dispersed manner and does not generate significant CH₄ emissions'



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:



An initiative supported by



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.

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