

Trend Analysis of GHG Emissions in WEST BENGAL

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:



ENERGY



IPPU*



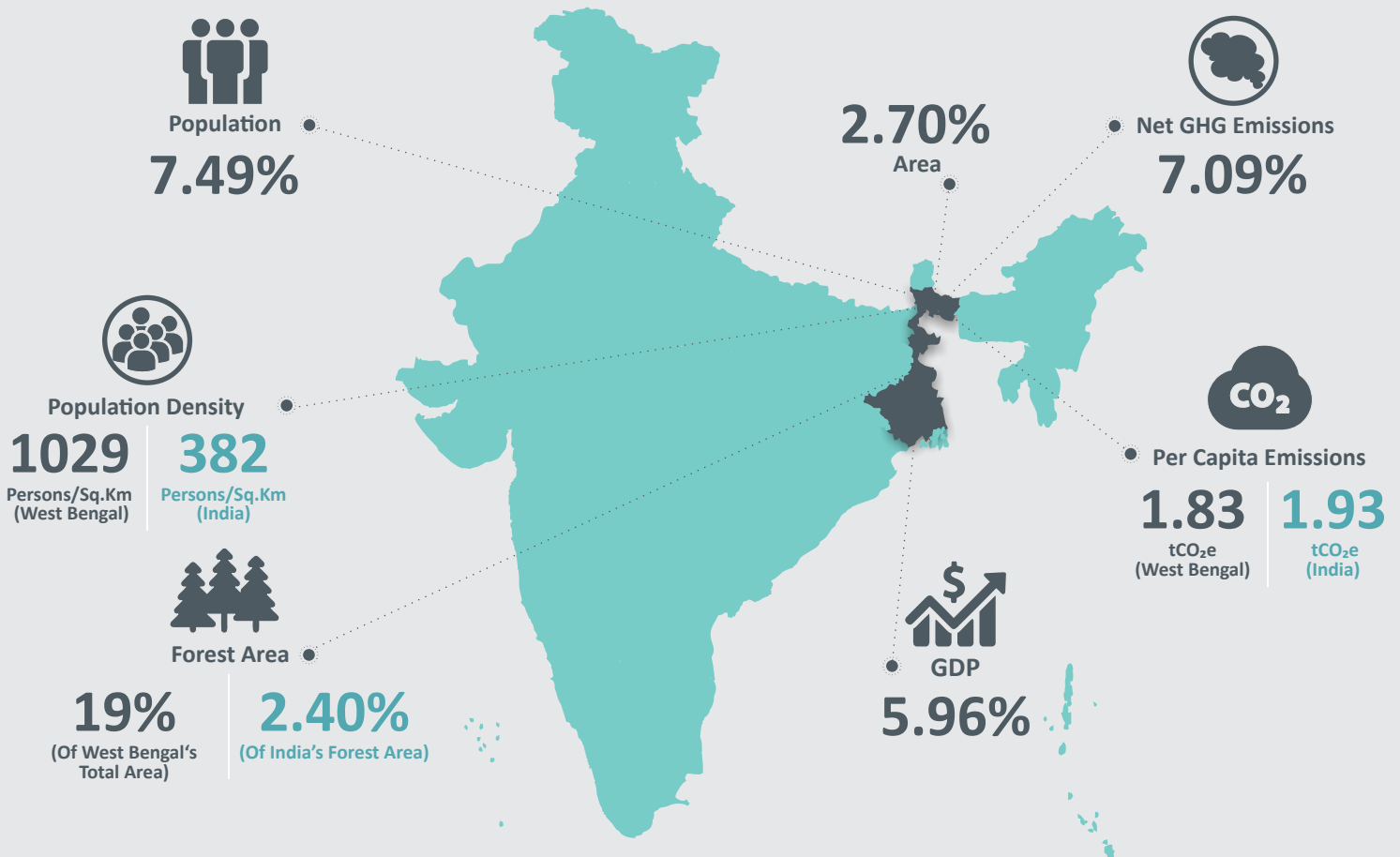
AFOLU



WASTE

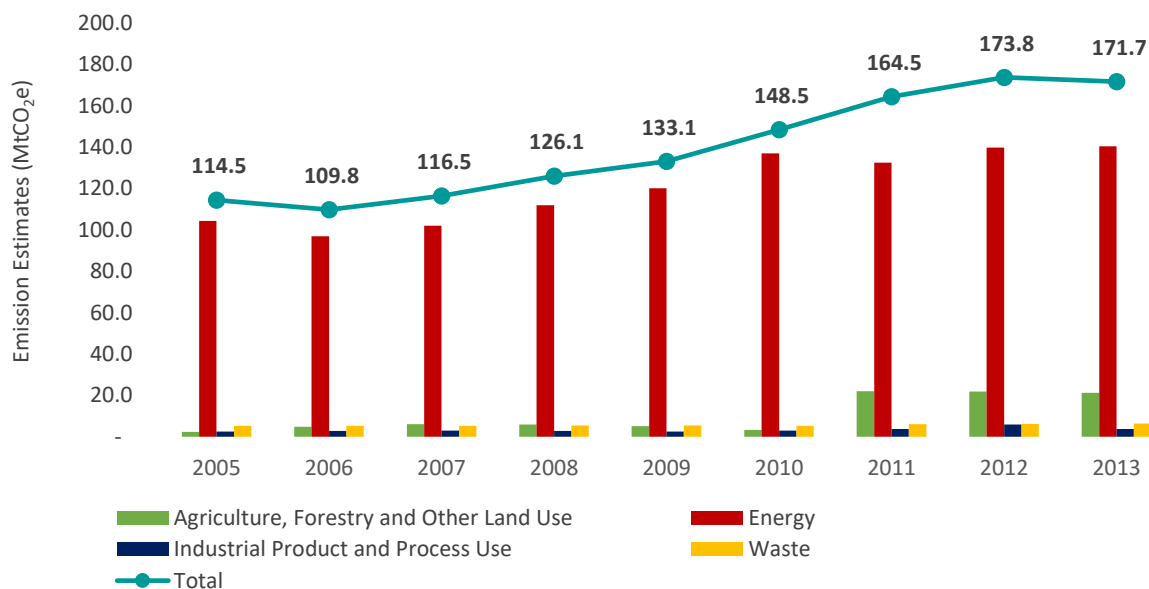
*Fuel combusted for Captive Electricity Generation (Auto-Producers) has been reported under Energy sector.

West Bengal at a glance (2013)



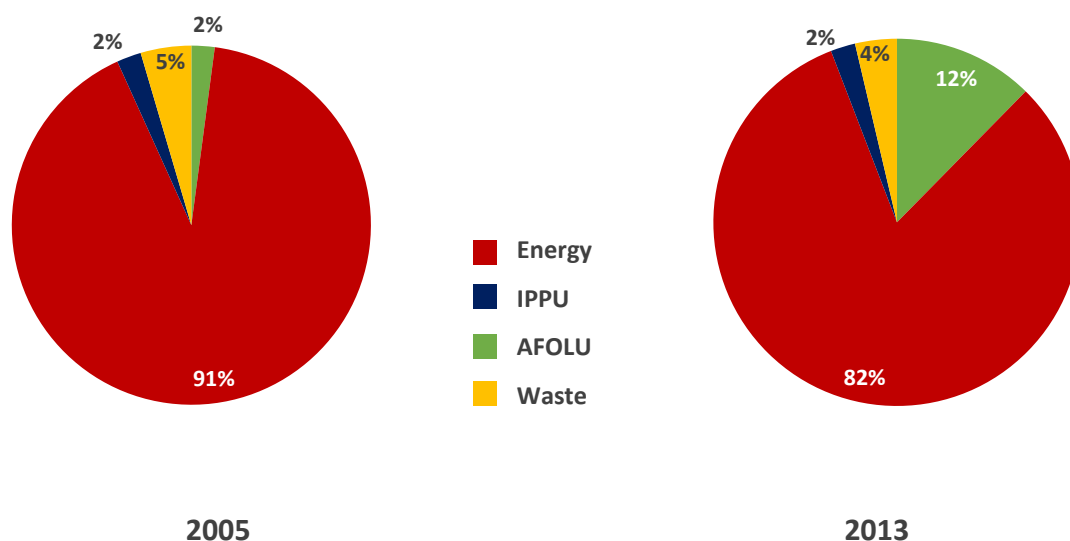
Economy-wide Emission Estimates

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



Emissions from the state of West Bengal grew from 114.5 MtCO₂e to 171.7 MtCO₂e at an estimated CAGR¹ of 5.19% from 2005 to 2013² as depicted in Figure 1 above. The Energy sector was the major contributor in West Bengal’s total emissions across all the reference years. However, the share of emissions from the Energy sector declined from ~91% in 2005 to ~82% in 2013, while the share of emissions from the AFOLU sector increased from merely ~2% in 2005 to ~12% in 2013. The share of emissions from the Waste and IPPU sectors remained almost unchanged when compared to 2005 levels as illustrated in Figure 2 below.

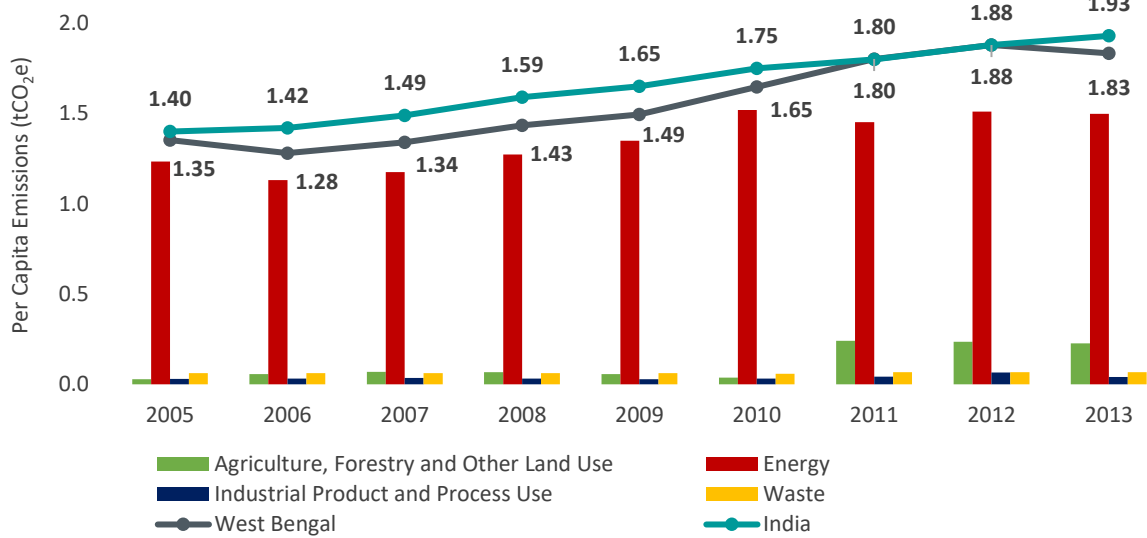
Figure 2: Sector-wise Contribution to Economy-wide GHG Emissions of West Bengal



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.

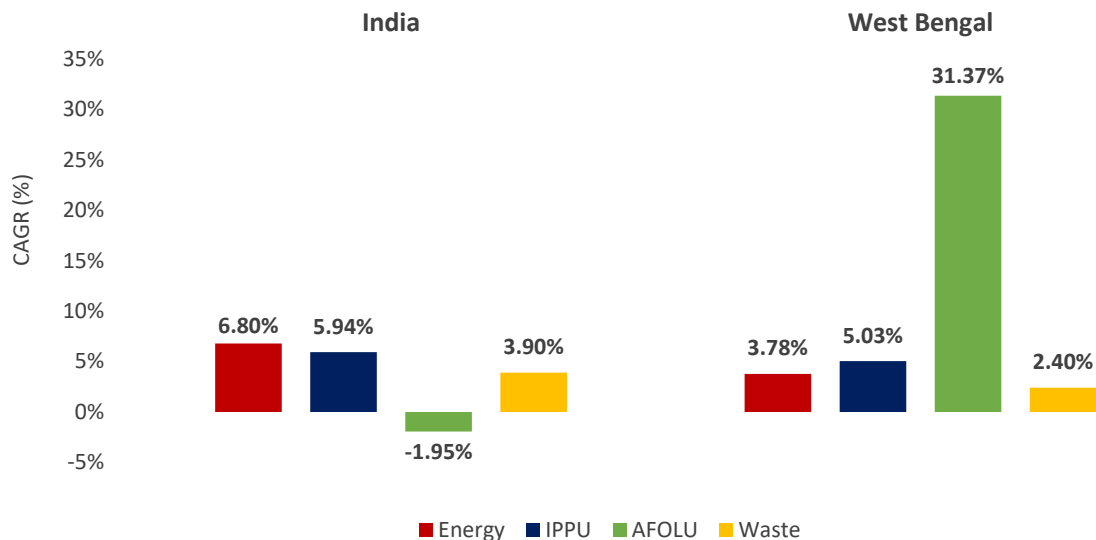
Figure 3: Per Capita GHG Emissions for West Bengal and India (2005 to 2013)



The per capita emissions of West Bengal grew from 1.35 tCO₂e in 2005 to 1.83 tCO₂e in 2013. The CAGR of the per capita emissions in West Bengal and India from 2005 to 2013 was 3.87% and 4.07% respectively. When compared to per capita emissions of India, West Bengal recorded slightly lower per capita emissions to begin with, but had caught up by 2011 and again dipped slightly in 2013 as depicted in Figure 3 above.

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

These growth rates have been compounded annually.



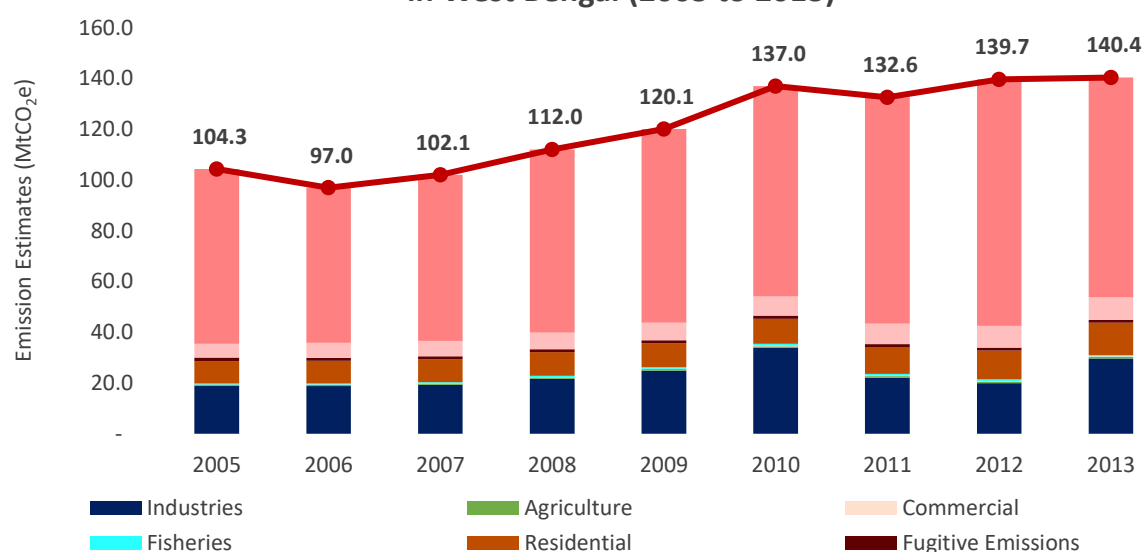
GHG emissions from the AFOLU sector of West Bengal recorded the highest growth rate of 31.37% from 2005 to 2013 amongst all other sectors (Figure 4). This was followed by the IPPU sector which recorded a growth rate of 5.03% followed by the Energy and Waste sectors with a CAGR of 3.78% and 2.4% respectively from 2005 to 2013.



Energy Sector

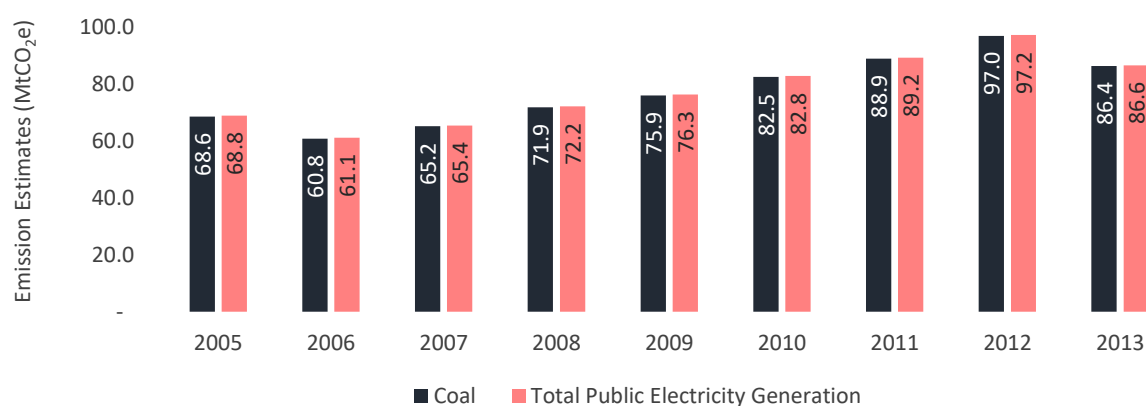
The Energy sector represented nearly 82% of the total emissions of West Bengal in 2013. In general, emissions from the Energy sector arise from two main sub-sectors – Fuel Combustion (Public Electricity Generation, Transport, Industries and Agriculture, Commercial and Residential categories) and Fugitive. In 2013, ~99% emissions of the Energy sector were from Fuel Combustion and the remaining ~1% emissions were Fugitive. The Energy sector emissions increased at an estimated CAGR of 3.78% from 104.3 MtCO₂e in 2005 to 140.4 MtCO₂e in 2013 as depicted in Figure 5 below. A significant dip and subsequent peak in the total Energy emissions was observed in the year 2006 and 2010 respectively owing to variations in the emissions of the Public Electricity Generation category.

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



On further investigation of the Energy sub-sectors, it was observed that Public Electricity Generation was a major category under the Fuel Combustion sub-sector across all the reference years with its share being ~62% in the Energy emissions portfolio of West Bengal in 2013. Emissions from this category grew at a CAGR of 2.91% from 68.8 MtCO₂e in 2005 to 86.6 MtCO₂e in 2013. Nearly 99.7% emissions of this category were found to be emanating from the Coal-based Power Plants of West Bengal in the year 2013 as depicted in Figure 6. The total emissions from Coal-based Power Plants increased at an estimated CAGR of 2.93% from 68.6 MtCO₂e in 2005 to 86.4 MtCO₂e in 2013 with an average share of ~99.6% in the total Public Electricity Generation emissions during the reference years.

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

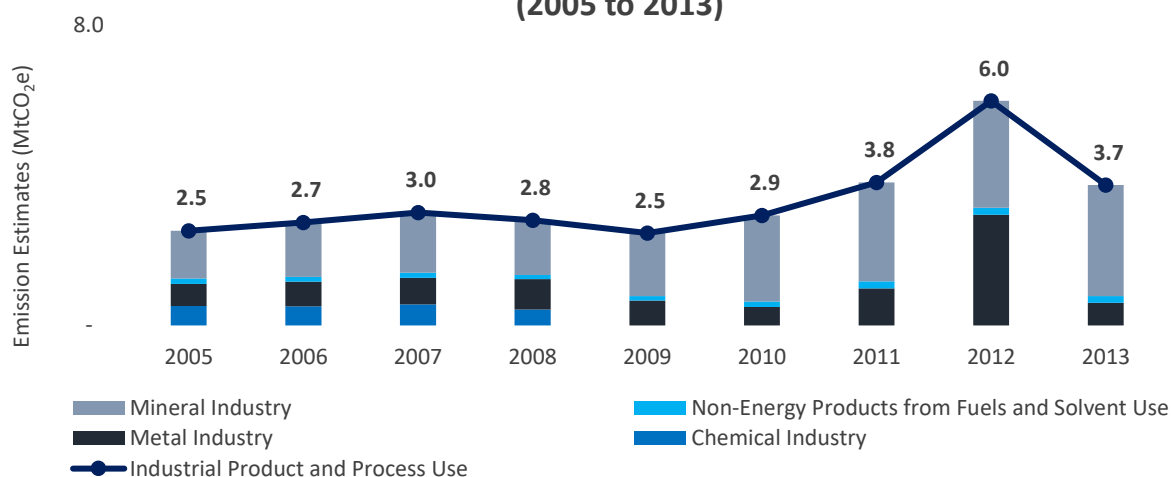




IPPU Sector

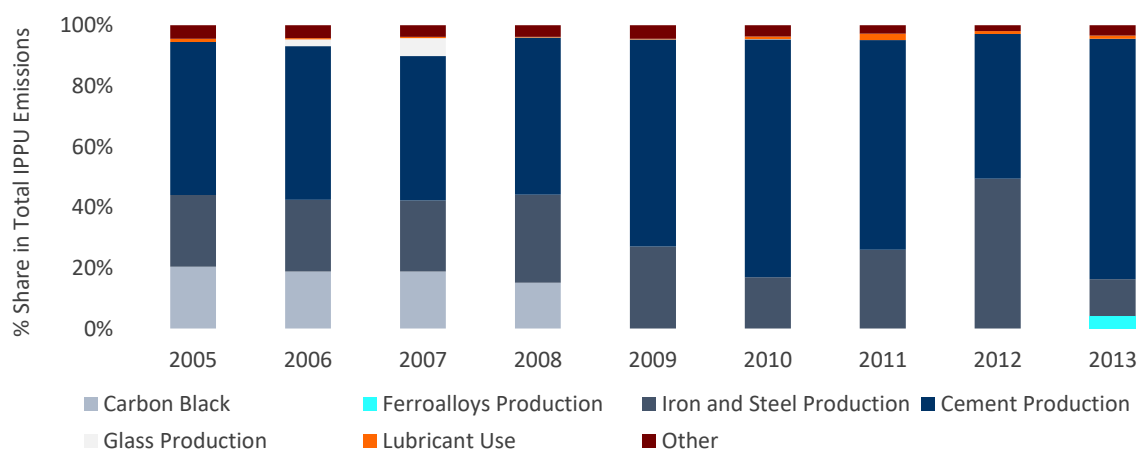
The IPPU sector represented ~2% of the total GHG emissions in West Bengal in 2013. Emissions from the IPPU sector are largely driven by Chemical, Metal, Mineral Industries and Non-Energy Products from Fuels and Solvent Use. Between 2005 to 2013, overall IPPU emissions in West Bengal rose at a CAGR of 5.03% from 2.5 MtCO₂e in 2005 to 3.7 MtCO₂e. Maximum emissions were observed from the Mineral Industries across all the reference years except in 2012 where emissions from the Metal Industries became dominant indicating an interim rise in the overall IPPU emissions for the said year. Notably, emissions from the Chemical Industry were observed only from year 2005 to 2008 as illustrated in Figure 7 below.

Figure 7: Emission Estimates for IPPU Sector in West Bengal (2005 to 2013)



Cement Production was a key driver of IPPU emissions throughout 2005 to 2013 as shown in Figure 8 below. In the year 2013, the combined share of Cement Production (~79%) and Iron & Steel Production (~12%) roughly represented ~91% in the overall IPPU emissions of West Bengal. Notably, the share of emissions from Cement Production increased from ~50% in 2005 to ~79% in 2013 while the share of Iron and Steel Production in the total IPPU emissions declined from ~24% in 2005 to ~12% in 2013. An interim peak in Iron and Steel Production emissions was observed in the year 2012, wherein the share of emissions (~49%) from this category was the highest amongst all other categories. Emissions from Carbon Black were observed only from the year 2005 to 2008 and thereafter no emissions were recorded from this category.

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

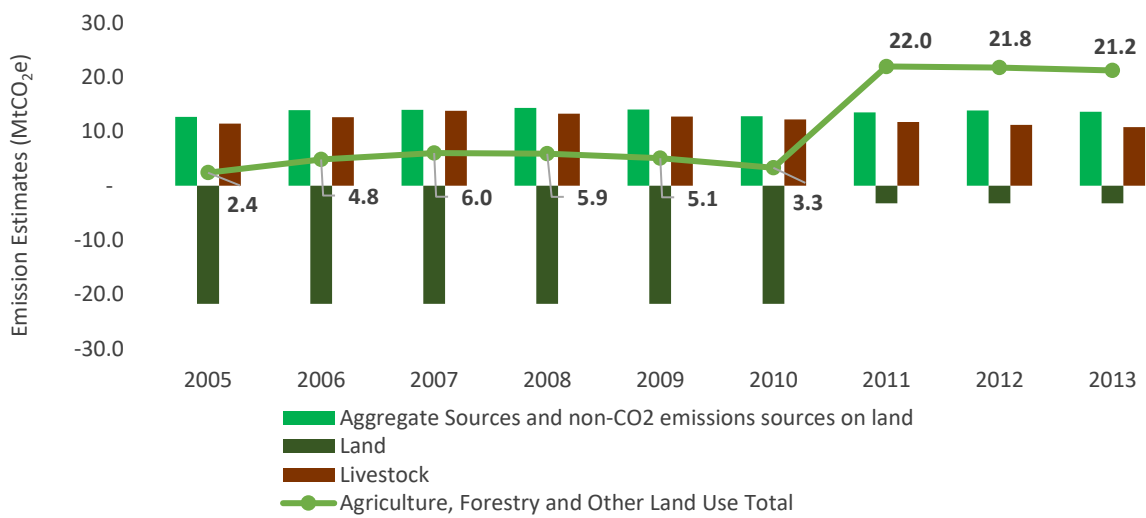




AFOLU Sector

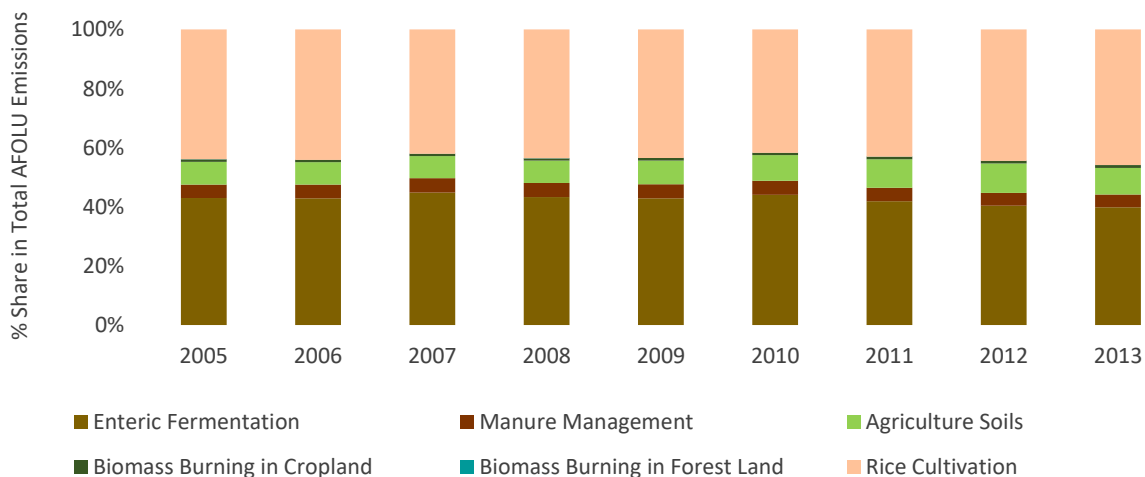
Emissions from the AFOLU sector represented ~12% of the total emissions in West Bengal in 2013. Emissions from this sector arise from three main sub-sectors namely Livestock, Land and Aggregate Sources and Non-CO₂ Emissions sources on Land. Emissions from the AFOLU sector grew at a CAGR of 31.37% from 2.4 MtCO₂e in 2005 to 21.2 MtCO₂e in 2013. Notably, the Land sub-sector was a sink throughout from 2005 to 2013 in West Bengal. Removals from Land followed an almost flat growth curve until the year 2011 when a significant decline in the removals was observed, which was also evident in the overall emissions of the AFOLU sector in West Bengal as depicted in Figure 9 below.

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



Deep diving into AFOLU sub-sectors, it was observed that Rice Cultivation and Enteric Fermentation were the top two major emitters of GHGs in the AFOLU sector throughout the years in consideration as illustrated in Figure 10 below. If emissions from the AFOLU sector in West Bengal were considered without taking the removals from the Land sub-sector into account, maximum emissions arose from Rice Cultivation (~46%) followed by Enteric Fermentation (~40%), Agricultural Soils (~9%) and Manure Management (~4%) in 2013. Notably, emissions from Rice Cultivation grew at a CAGR of 0.72% from 10.6 MtCO₂e in 2005 to 11.2 MtCO₂e in 2013. Whereas, emissions from Enteric Fermentation declined at a rate of 0.75% (compounded annually) from 10.4 MtCO₂e in 2005 to 9.8 MtCO₂e in 2013.

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





Waste Sector

The Waste sector contributed to ~4% of the total emissions in West Bengal 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 6.3 MtCO₂e of GHG's in 2013 up from 5.2 MtCO₂e in 2005. GHG emissions from Waste grew at a CAGR of 2.4% from 2005 to 2013. A spike in emissions in 2011 was observed 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 11: Category-wise Share of GHG Emissions for Waste Sector (in 2013)

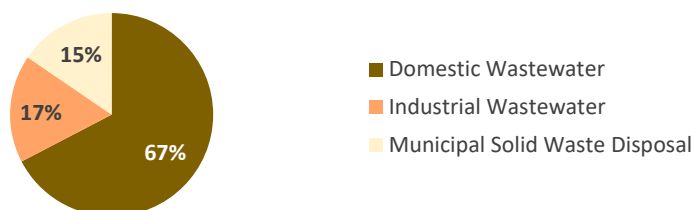
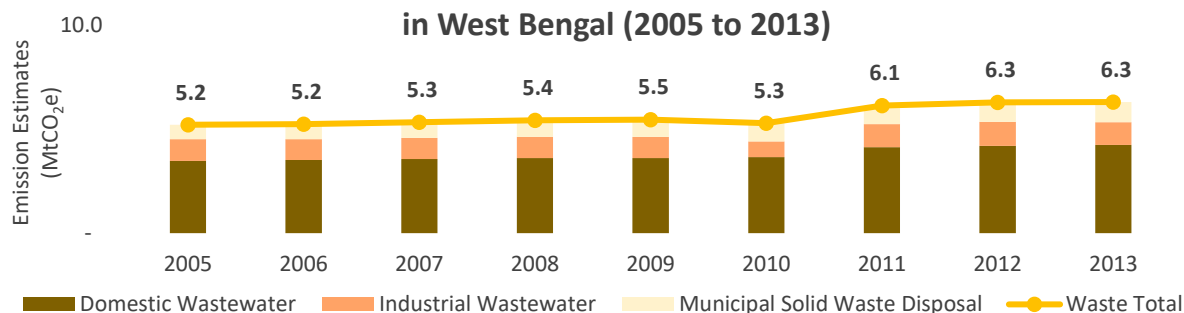


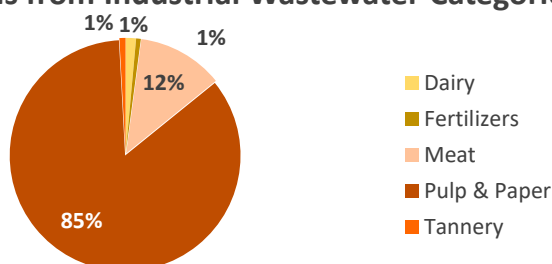
Figure 12: GHG Emission Estimates for Waste Sector in West Bengal (2005 to 2013)



Domestic Wastewater comprised ~67% of the Waste sector emissions in West Bengal in 2013. Emissions from the Domestic Wastewater of the rural and urban areas in West Bengal grew at a CAGR of 2.54% from 3.5 MtCO₂e in 2005 to 4.2 MtCO₂e in 2013. Domestic Wastewater originating from the rural areas of the state was the major contributor of emissions in this sub-sector throughout the reference period. In 2013, almost 58% of the Domestic Wastewater emissions emanated from the rural areas of West Bengal.

Industrial Wastewater contributed to almost 17% of the total emissions of West Bengal's Waste sector. Under this sub-sector, maximum emissions were found to be originating from Pulp and Paper Industries (~85%) followed by Meat Industries (~12%) in 2013 as illustrated in Figure 13 below. The remaining ~3% emissions were observed from Dairy, Fertilizers and Tannery Industries each contributing ~1% of GHG emissions.

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



Municipal Solid Waste contributed ~15% of the total Waste emissions in the year 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 West Bengal and emissions from this sub-sector grew at a CAGR of 4.39% from 0.7 MtCO₂e in 2005 to 1 MtCO₂e in 2013.

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



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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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