

# Trend Analysis of GHG Emissions in CHANDIGARH

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\***



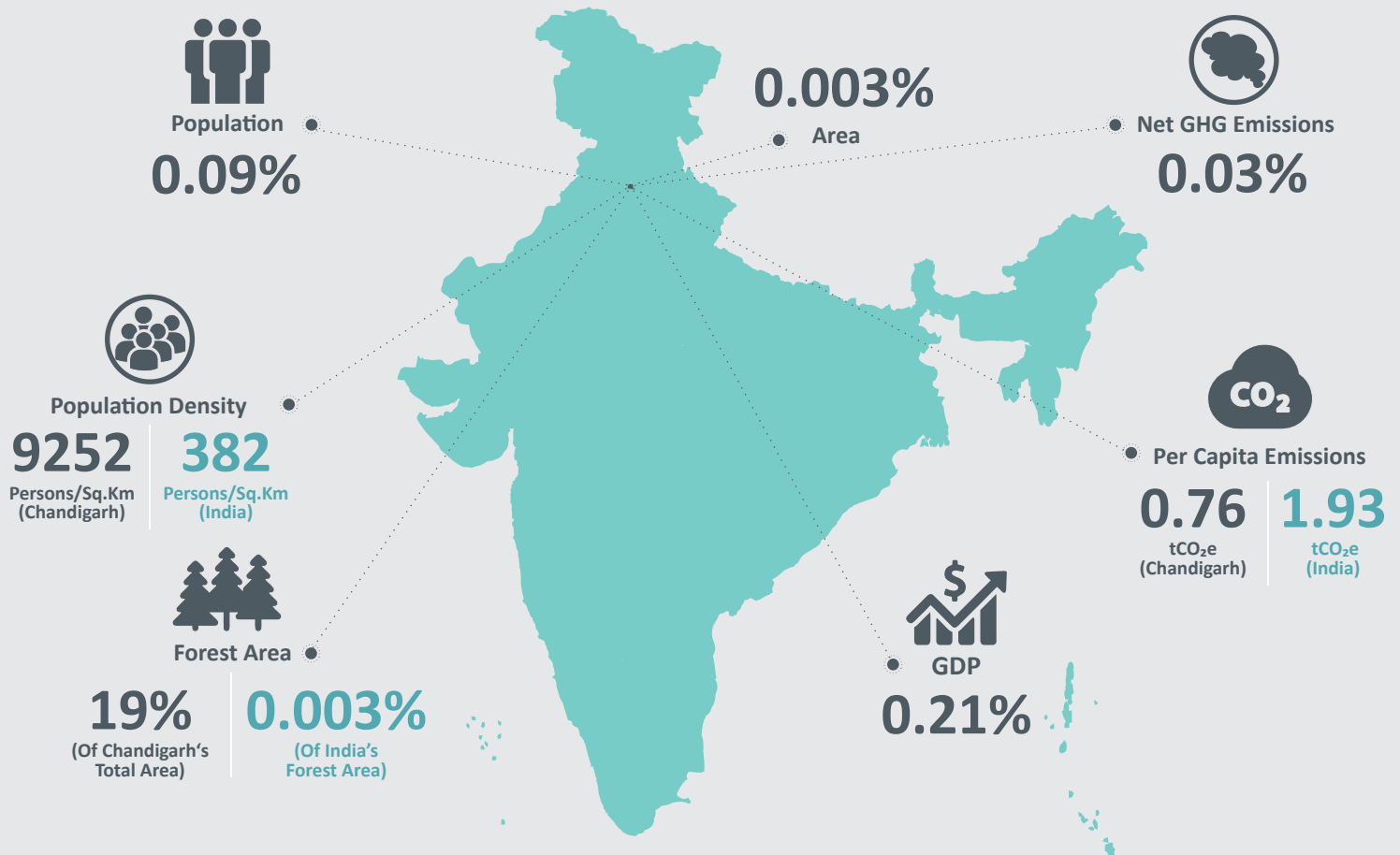
**AFOLU**



**WASTE**

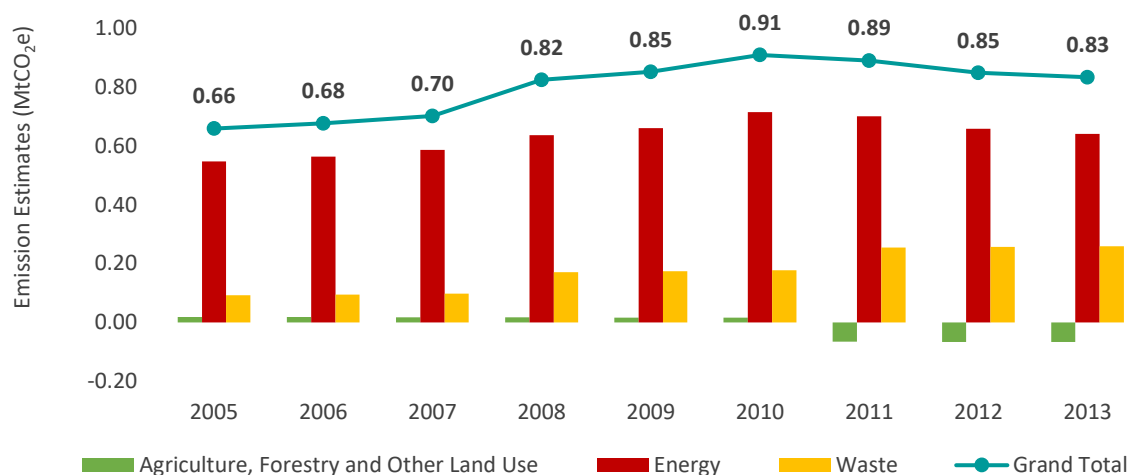
\*Fuel combusted for Captive Electricity Generation (Auto-Producers) has been reported under Energy sector.

## Chandigarh at a glance (2013)



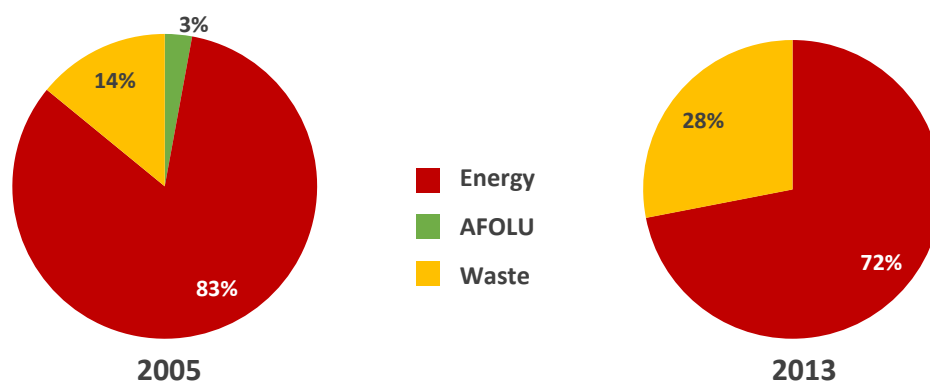
## Economy-wide Emission Estimates

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



Emissions of Chandigarh grew at a CAGR<sup>1</sup> of 2.98% from 0.66 MtCO<sub>2</sub>e in 2005 to 0.83 MtCO<sub>2</sub>e in 2013<sup>2</sup> with a peak in 2010 and a decline thereafter as depicted in Figure 1. Energy sector remained the major contributor of the emissions throughout 2005 to 2013. No emissions were registered from the IPPU sector of Chandigarh across all the reference years. Notably, the AFOLU sector was an emitter of GHG emissions from 2005 to 2010, however, from 2011 onwards it became a net sink of GHG. This transition of the AFOLU sector from a net emitter to a net sink was responsible for the slight decline in overall emissions of Chandigarh after 2010. In 2005, Energy sector had the major share of ~83% in the total GHG emissions of Chandigarh followed by the Waste (~14%) and the AFOLU sector (~3%) respectively. If emissions were considered excluding the removals from the AFOLU sector, ~72% of the total GHG emissions were registered from the Energy sector and ~28% from the Waste sector in Chandigarh in 2013 (Figure 2).

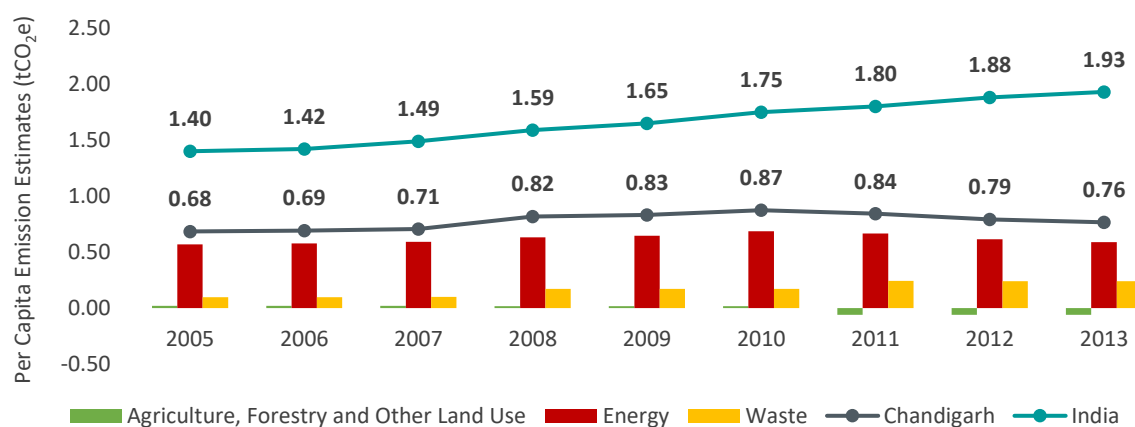
**Figure 2: Sector-wise Contribution to Economy-wide GHG Emissions of Chandigarh**



<sup>1</sup> Compound Annual Growth Rate

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

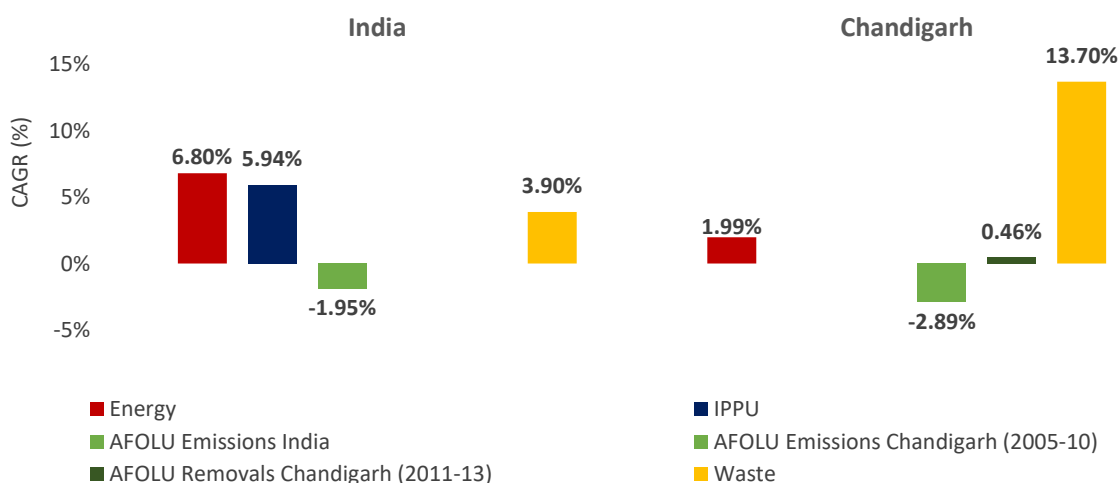
**Figure 3: Per capita GHG Emissions for Chandigarh and India (2005 to 2013)**



The per capita emissions of Chandigarh increased from 0.68 tCO<sub>2</sub>e in 2005 to 0.76 tCO<sub>2</sub>e in 2013, resulting in an almost flat growth curve. The observed CAGR of Chandigarh and India from 2005 to 2013 was 1.41% and 4.07% respectively. When compared to per capita emissions of India, Chandigarh had very low per capita emissions across all the reference years as illustrated in Figure 3 above.

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

*These growth rates have been compounded annually.*



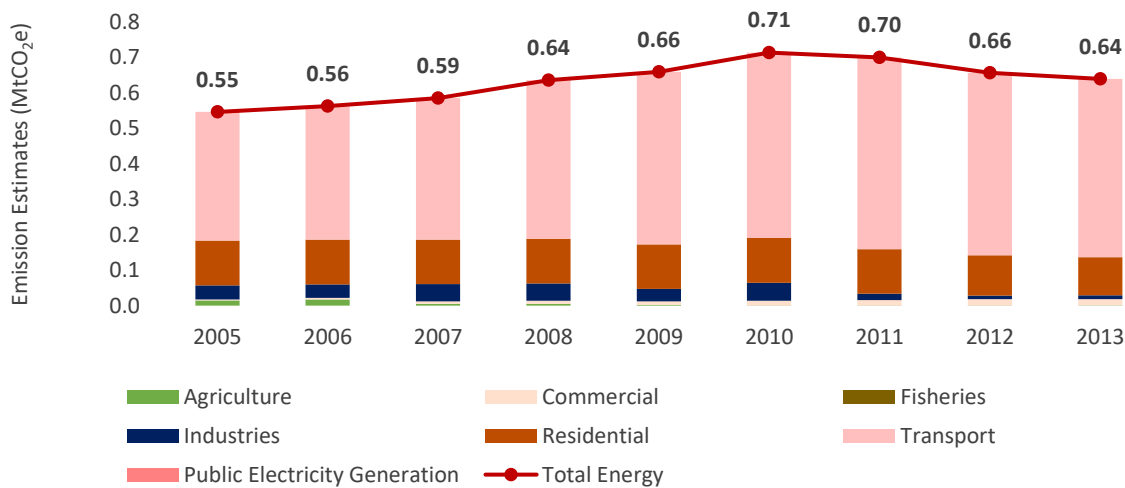
GHG emissions from the Waste sector of Chandigarh registered the highest CAGR of 13.70% from 2005 to 2013 amongst all other sectors (Figure 4). This was followed by the Energy sector which recorded a much lower growth rate of 1.99% for the same period. The emissions from the AFOLU sector declined at a rate of 2.89% (compounded annually) from 2005 to 2010 whereas the removals grew at a CAGR of 0.46% from 2011 to 2013. When compared to India's sectoral growth rates, all the sectors registered lower growth rates except the Waste sector of Chandigarh which recorded a higher growth rate when compared to India's Waste sector CAGR (3.90%). However, the AFOLU sector transformed itself from a net emitter to a net sink in 2011 and hence could not be compared to India's AFOLU sector emissions which declined at a negative rate of 1.95% during the reference period.



## Energy Sector

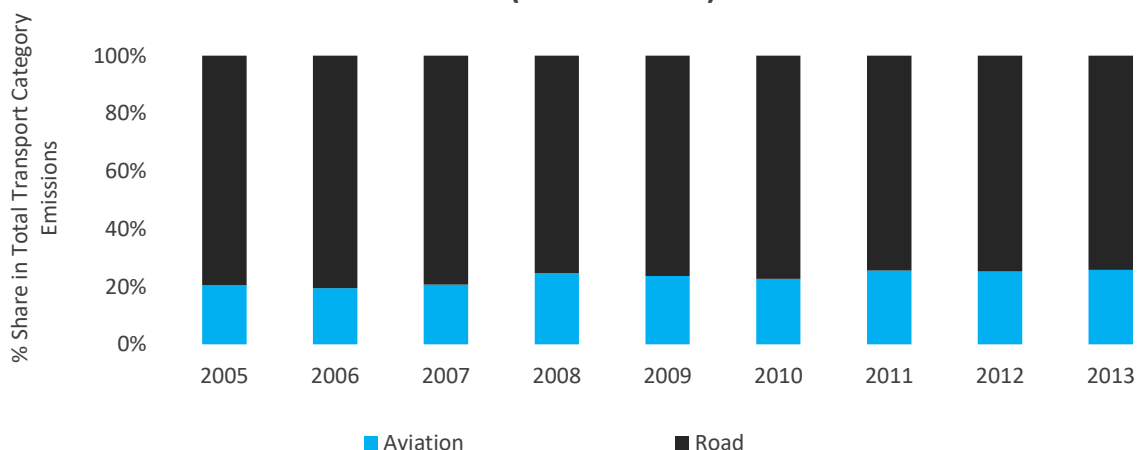
Energy sector represented ~72% of the total emissions of Chandigarh (if values are considered excluding the AFOLU sector) in the year 2013. In general, emissions from Energy sector arise from two main sub-sectors – Fuel Combustion (Public Electricity Generation, Transport, Industries and Agriculture, Commercial and Residential categories) and Fugitive. In Chandigarh, emissions were only due to Fuel Combustion and no Fugitive emissions were observed during the years in consideration. Emissions from the Energy sector grew at a CAGR of 1.99% from 0.55 MtCO<sub>2</sub>e in 2005 to 0.64 MtCO<sub>2</sub>e in 2013. Since 2010, a sudden drop in the reporting of Petroleum Coke consumption by the industries resulted in decline of emissions from the Industries category. This could be due to imposition of stringent environmental norms within the jurisdiction. However, it is yet to be verified, whether that has resulted into proportionately decline in the Industrial activity.

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



Transport was the major contributor of emissions in 2013 with a share of ~79% in the total Energy sector emissions. Emissions from the Transport category grew at an estimated CAGR of 4.2% from 0.36 MtCO<sub>2</sub>e in 2005 to 0.5 MtCO<sub>2</sub>e in 2013. Road Transport remained the major contributor of emissions with an average share of ~77% in the total emissions from this category across all the reference years as depicted in Figure 6 below.

**Figure 6: Share of GHG Emissions for Transport Category (2005 to 2013)**

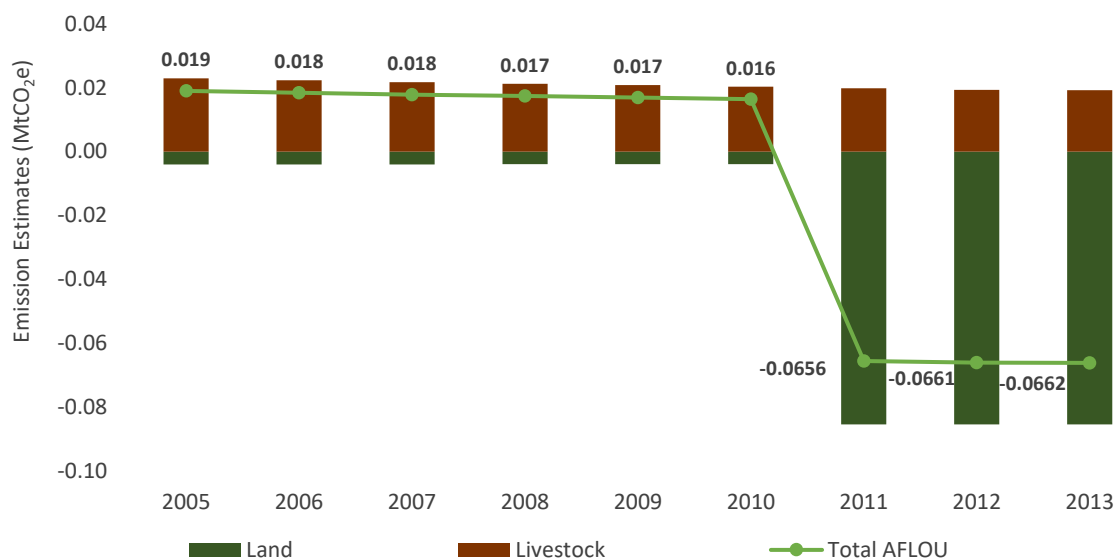




## AFOLU Sector

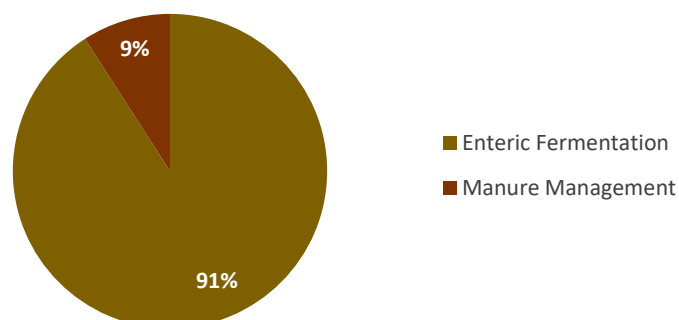
The AFOLU sector absorbed 0.0662 MtCO<sub>2</sub>e of GHG emissions from Chandigarh as the UT was a net sink in the year 2013. Emissions from the AFOLU sector arise from three main sub-sectors namely Livestock, Land and Aggregate Sources and Non-CO<sub>2</sub> Emissions Sources on Land. No emissions under Aggregate Sources and Non-CO<sub>2</sub> Sources on Land were observed for Chandigarh across the reference period. Till the year 2010, AFOLU sector acted as a net emitter. However, from 2011 onwards, the UT acted as a net sink due to increased CO<sub>2</sub> removals from the Land sub-sector. The overall AFOLU emissions declined at a rate of 2.89% from 0.019 MtCO<sub>2</sub>e in 2005 to 0.016 MtCO<sub>2</sub>e in 2010. However, removals from the AFOLU sector grew at a marginal CAGR of 0.46% from 0.0656 MtCO<sub>2</sub>e in 2011 to 0.0662 MtCO<sub>2</sub>e in 2013.

**Figure 7: GHG Emission Estimates for AFOLU Sector in Chandigarh (2005 to 2013)**



As illustrated in the Figure 7 above, the removals from the Land sub-sector grew at an enormous CAGR of 46.6% from 0.004 MtCO<sub>2</sub>e in 2005 to 0.09 MtCO<sub>2</sub>e in 2013. The only positive emissions in this sector were from the Livestock sub-sector. Within Livestock, it was found that ~91% emissions of the total AFOLU emissions were due to Enteric Fermentation while the remaining 9% emissions were a result of Manure Management in 2013 as depicted in Figure 8 below.

**Figure 8: Share of Emissions for the AFOLU Sub-sectors (2013)**

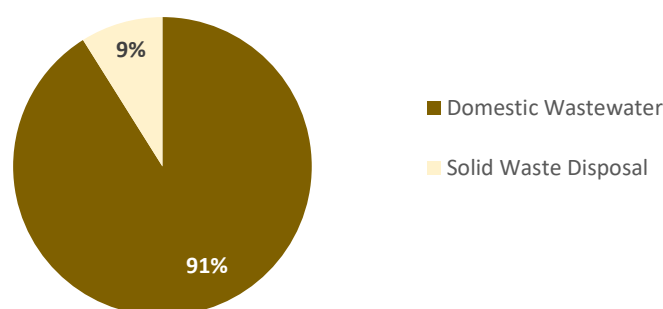




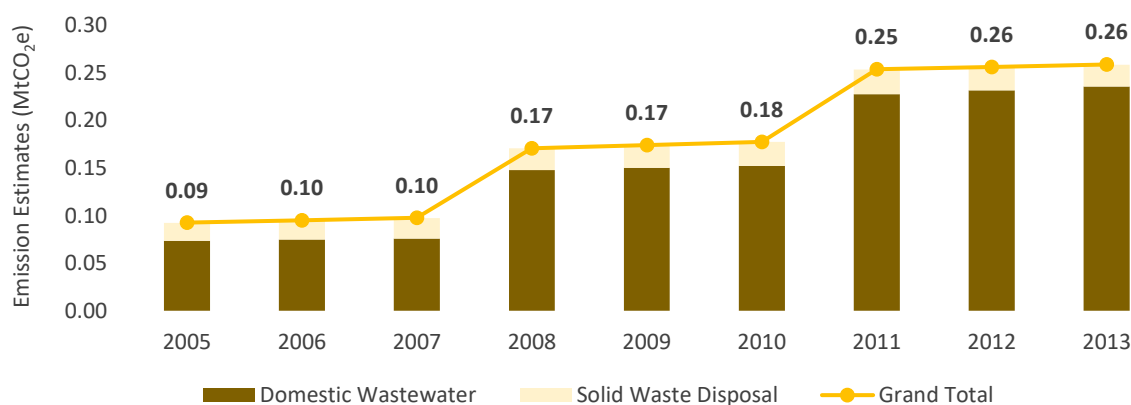
## Waste Sector

The Waste sector contributed to almost 28% of total emissions (if values are considered excluding AFOLU sector) of Chandigarh in 2013. Municipal Solid Waste<sup>3</sup>, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. In Chandigarh, no emissions were observed from the Industrial Wastewater sub-sector. GHG emissions from Waste grew at an estimated CAGR of 13.7% from 0.09 MtCO<sub>2</sub>e in 2005 to 0.26 MtCO<sub>2</sub>e in 2013. An interim rise in the emissions of the Waste sector was observed in the year 2011 owing to increased emissions from the Domestic Wastewater which reflects changing trends in use of various treatment systems as reported in Census of India 2011 as depicted in Figure 10 below.

**Figure 9: Category-wise Share of GHG Emissions for Waste Sector (in 2013)**



**Figure 10: Emission Estimates for Waste Sector in Chandigarh (2005 to 2013)**



Domestic Wastewater had the maximum share of ~91% in the total emissions from the Waste sector in 2013. In Chandigarh, emissions from Domestic Wastewater increased at CAGR of 15.7% from 0.07 MtCO<sub>2</sub>e in 2005 to 0.24 MtCO<sub>2</sub>e in 2013. Notably, ~100% emissions arising from Domestic Wastewater emanated from the urban areas of Chandigarh across all the reference years. Notably, discharge of untreated wastewater and use of septic tanks are key drivers of emissions in this sub-sector.

Municipal Solid Waste Disposal had an approximate share of ~9% in the total emissions of the Waste sector in the year 2013. The emissions from this sub-sector grew at an estimated CAGR of 2.5% from 0.019MtCO<sub>2</sub>e in 2005 to 0.023 MtCO<sub>2</sub>e in 2013. No emissions were observed from Industrial Wastewater category in the UT across all the reference year

<sup>3</sup> 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 CH<sub>4</sub> emissions'



## IPPU Sector

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Due to insignificant industrial activity within Chandigarh, no IPPU emissions were observed across the reporting period.



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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**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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