

Trend Analysis of GHG Emissions in SIKKIM

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*



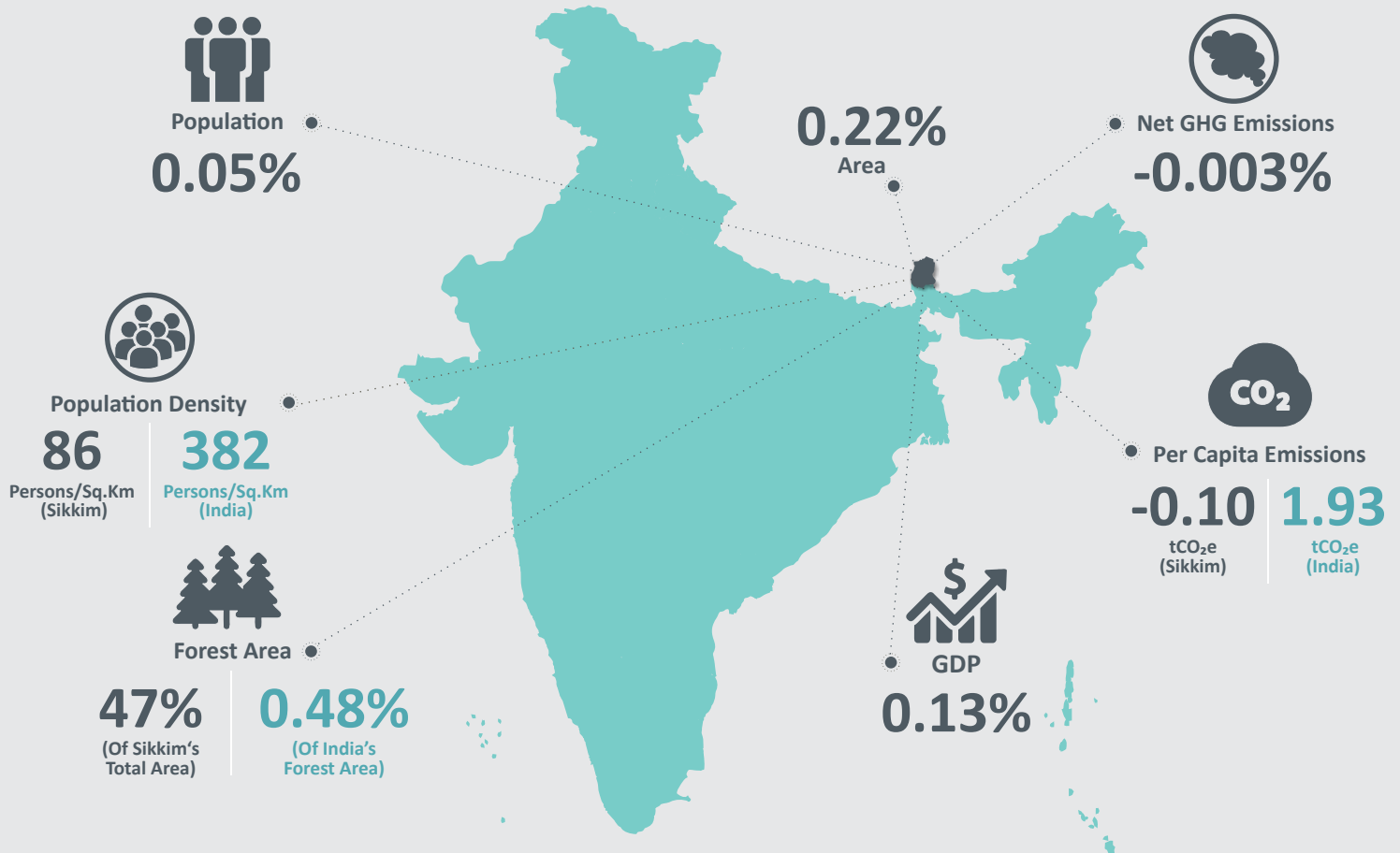
AFOLU



WASTE

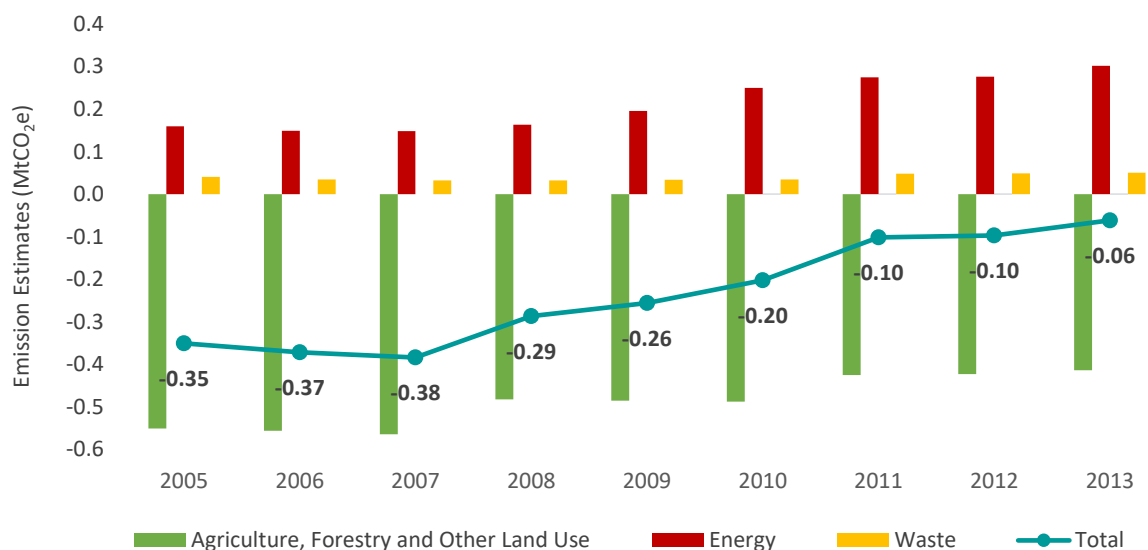
*Fuel combusted for Captive Electricity Generation (Auto-Producers) has been reported under Energy sector.

Sikkim at a glance (2013)



Economy-wide Emission Estimates

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



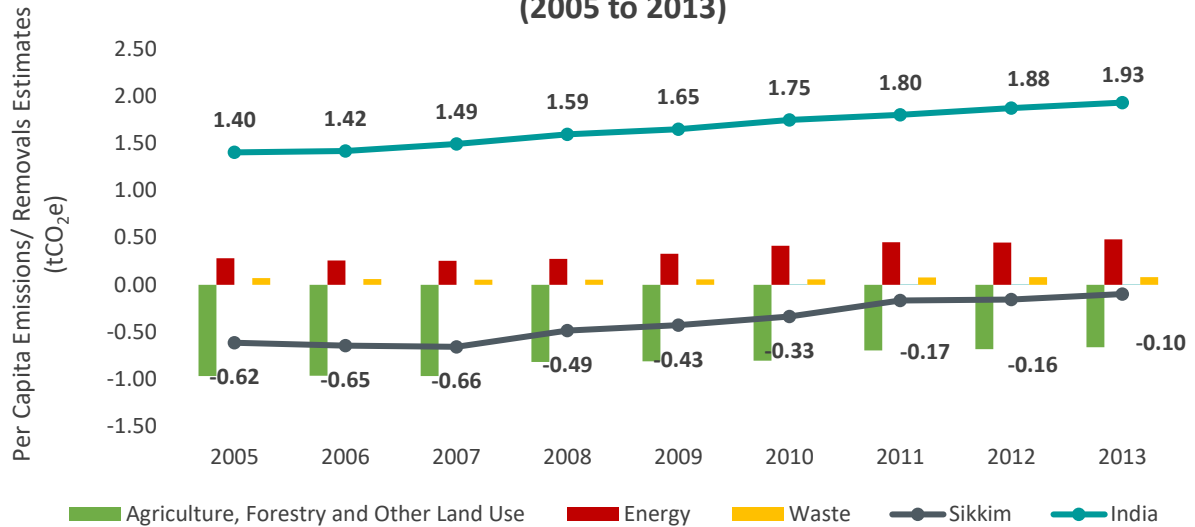
Sikkim was a net sink (remover of GHG emissions) from 2005 to 2013¹. Removals from the state of Sikkim declined from -0.35 MtCO₂e to -0.06 MtCO₂e at an estimated rate of - 19.6% (compounded annually) from 2005 to 2013 as depicted in Figure 1 above. While the Energy and Waste sectors were emitters of GHG's in Sikkim, the AFOLU sector was a net sink of emissions from 2005 to 2013. The removals from the AFOLU sector were higher than the positive emissions from other sectors, which is why Sikkim was a net sink of GHG emissions. Notably, there were no significant IPPU emissions in Sikkim throughout the reference period. Excluding the AFOLU sector, the share of positive emissions from the Energy sector were ~86% and those emanating from the Waste sector were ~14% of the total positive emissions of Sikkim in 2013. The share of emissions from the Energy sector had increased by ~6% from 2005, while the share of the Waste sector had declined in exactly the same proportion in 2013 as depicted in Figure 2 below.

Figure 2: Sector-wise Contribution to Economy-wide GHG Emissions (Excluding AFOLU) of Sikkim



¹ Calendar year values have been considered for this analysis. For Global Warming Potential (GWP) calculations IPCC-ARII values have been considered

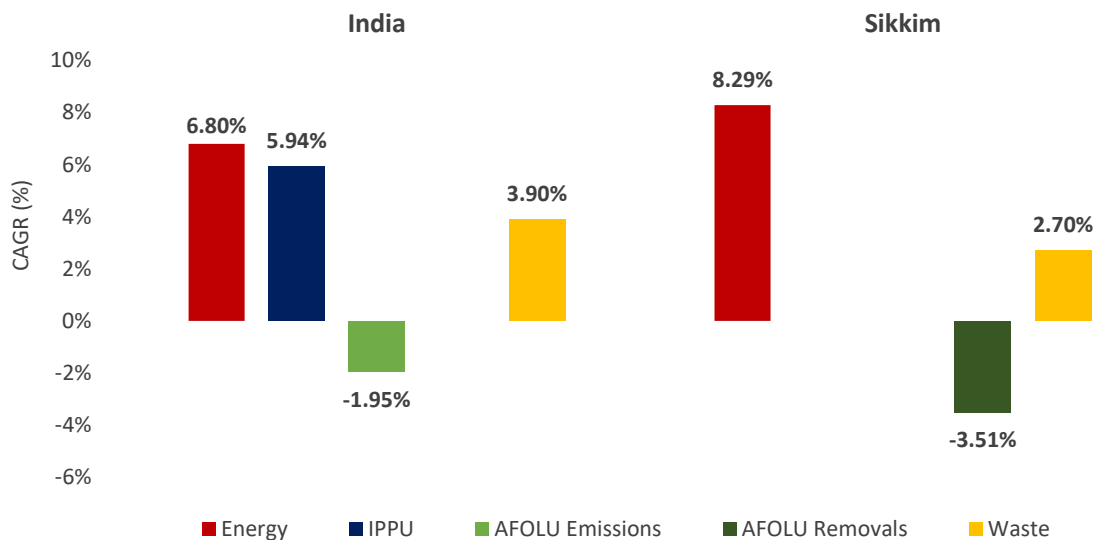
Figure 3: Per Capita GHG Emissions/Removals for Sikkim and India (2005 to 2013)



Per capita removals of Sikkim declined from -0.62 tCO₂e in 2005 to -0.1 tCO₂e in 2013 as depicted in Figure 3 above. India's per capita emissions grew from 1.4 tCO₂e in 2005 to 1.93 tCO₂e in 2013. Per capita removals from Sikkim declined at a rate of 20.52% (compounded annually) while that of India increased at a CAGR² of 4.07%. Thus, while Sikkim continued to be a per capita remover of GHG emissions between 2005 to 2013, the removals were declining rapidly.

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

These growth rates have been compounded annually.



The Energy sector in Sikkim recorded a CAGR of 8.29% from 2005 to 2013 as shown in Figure 4 above, while the Waste sector grew at a CAGR of 2.70%. The AFOLU sector removals declined by 3.51% from 2005 to 2013. When compared to India, the Energy sector of Sikkim recorded higher growth rates than India, while the Waste sector GHG emission growth rate was slightly lower than that of the country. The AFOLU sector of Sikkim was a net sink of GHGs, albeit a shrinking sink, unlike India's AFOLU sector, which was a net emitter.

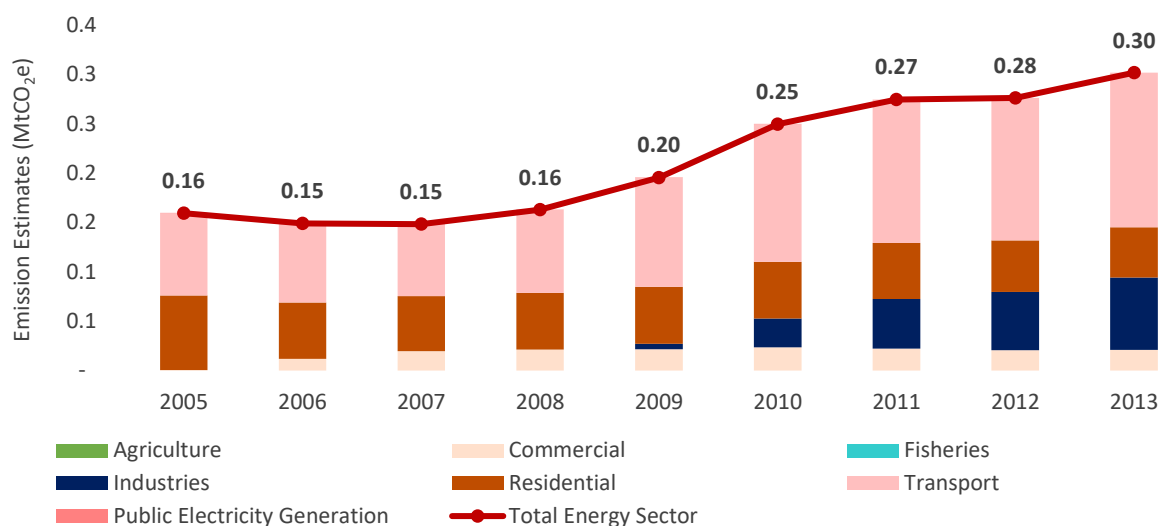
² Compound Annual Growth Rate



Energy Sector

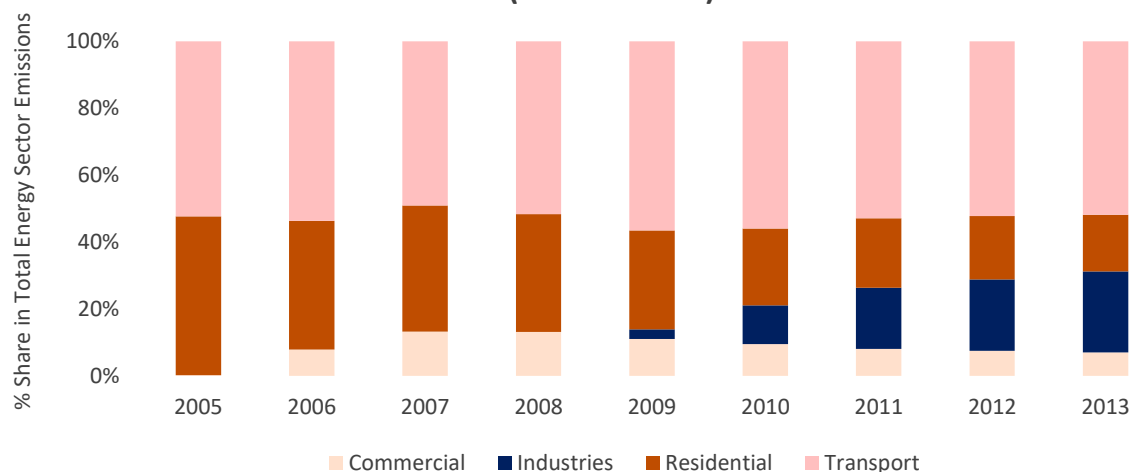
The Energy sector contributed the most to the total emissions (~86% if only positive emissions are considered) of Sikkim in 2013. In general, emissions from the Energy sector arise from two main sub-sectors – Fuel Combustion (Public Electricity Generation, Transport, Industries and Agriculture, Commercial and Residential categories) and Fugitive. In Sikkim, all the Energy sector emissions arose from Fuel Combustion. The emissions from this sector increased at a CAGR of 8.3% from 0.16 MtCO₂e in 2005 to 0.3 MtCO₂e in 2013 as depicted in Figure 5 below.

Figure 5: GHG Emission Estimates For Energy Sector in Sikkim (2005 to 2013)



Transport was a major category under the Fuel Combustion sub-sector with ~52% contribution in Sikkim's Energy emissions portfolio. Under the Transport category, most of the emissions arose from Road Transport. Residential category was the second highest GHG emitting category from 2005 to 2010. However due to unavailability of activity data, emissions from Industries were only estimated since 2009 and by 2013 had replaced the Residential category as the second most significant emitter in the Energy sector as illustrated in Figure 6 below.

Figure 6: Share of GHG Emissions For Energy Sub-sectors (2005 to 2013)

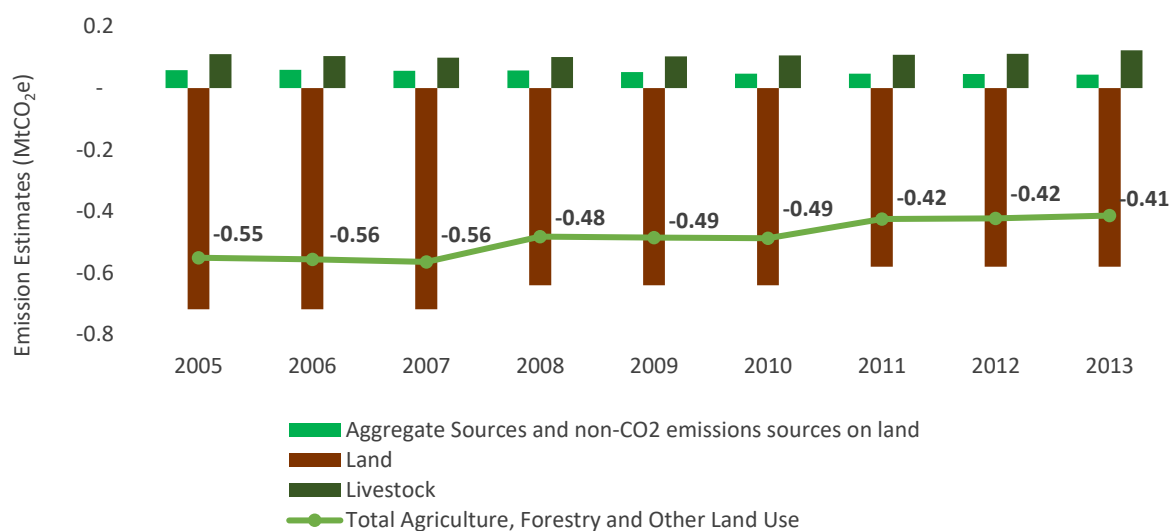




AFOLU Sector

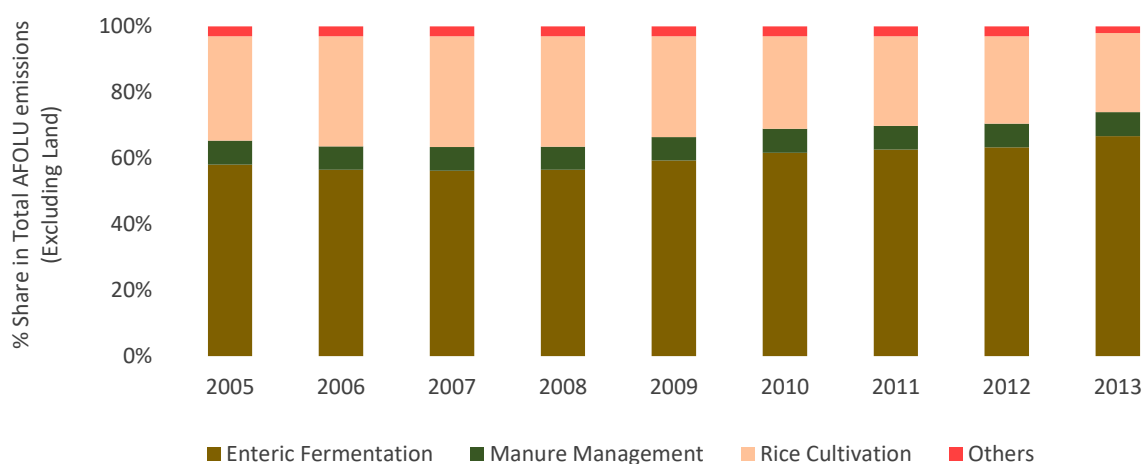
The AFOLU sector absorbed 0.41 MtCO₂e of GHG emissions in Sikkim in 2013. Removals/Emissions from the AFOLU sector arise mainly from three main sub-sectors namely Livestock, Land and Aggregate sources and Non-CO₂ Emissions Sources on Land. The AFOLU removals decreased from 0.55 MtCO₂e in 2005 to 0.41 MtCO₂e in 2013 at a rate of 3.5% (compounded annually) as depicted in Figure 7 below. Notably, the Land sub-sector was a major sink from year 2005 to 2013 in the state of Sikkim while Livestock and Aggregate Sources & Non-CO₂ Emission Sources on Land were emitters of GHGs. As removals from Land were higher than the combined emissions of all other sub-sectors, Sikkim's AFOLU sector was a net sink of GHGs from 2005 to 2013.

Figure 7: GHG Emission Estimates For AFOLU Sector in Sikkim (2005 to 2013)



Out of the two positive GHG emitting sub-sectors, approximately 73% of emissions in 2013 were from the Livestock sub-sector (Enteric Fermentation & Manure Management). Emissions from Livestock increased from 0.11 MtCO₂e in 2005 to 0.12 MtCO₂e in 2013 at a CAGR of 1.4% while those from Aggregate Sources and Non-CO₂ Emission Sources on Land decreased from 0.06 MtCO₂e in 2005 to 0.04 MtCO₂e in 2013 at a rate of 3.5% (compounded annually), as illustrated in Figure 8.

Figure 8: Share of GHG Emissions from AFOLU Categories (Excluding Land)





Waste Sector

Share of the Waste sector in total emissions of Sikkim was ~14% in 2013 (if only positive emissions are considered). Municipal Solid Waste³, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. The Waste sector emitted 0.05 MtCO₂e in the year 2013 up from 0.04 MtCO₂e in 2005 as illustrated in Figure 10 below. GHG emissions from Waste sector grew at a CAGR of 2.7% 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 9: Category-wise Share of GHG Emissions for Waste Sector (in 2013)

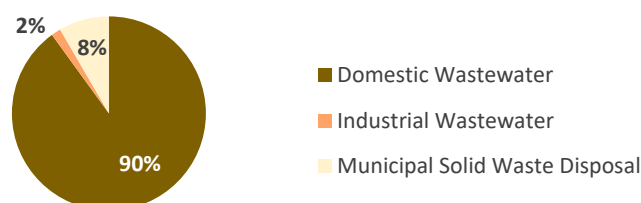
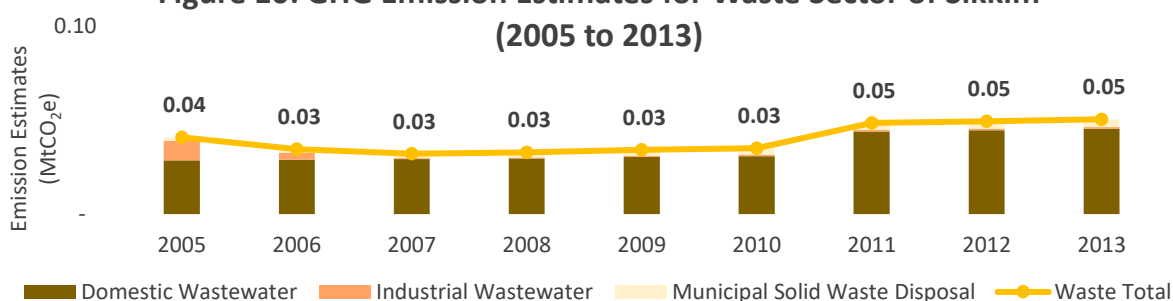
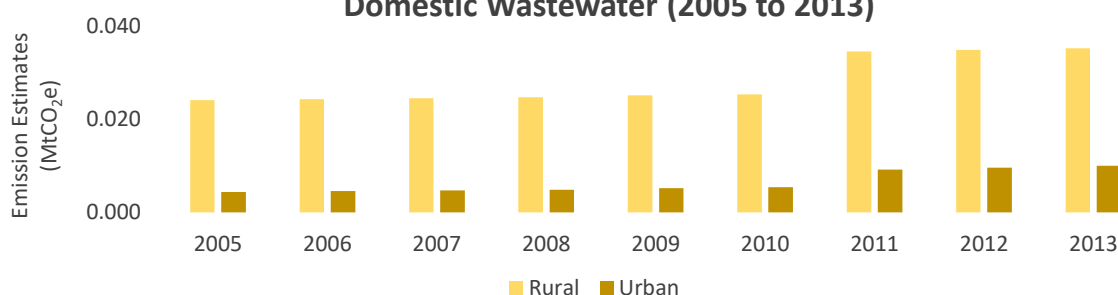


Figure 10: GHG Emission Estimates for Waste Sector of Sikkim (2005 to 2013)



Maximum Waste sector emissions (~90%) were from Domestic Wastewater in Sikkim and grew at a CAGR of 5.9% from 0.03 MtCO₂e in 2005 to 0.05 MtCO₂e in 2013. Almost 78% of Domestic Wastewater emissions resulted from rural areas of Sikkim in 2013. Notably, Domestic Wastewater emissions from the rural areas of Sikkim grew at a CAGR of 4.9% from 0.02 MtCO₂e in 2005 to 0.04 MtCO₂e in 2013, while those from the urban areas rose at CAGR of 10.8% from 0.004 MtCO₂e in 2005 to 0.01 MtCO₂e in 2013 as depicted in Figure 11 below. Thus, Domestic Wastewater emissions of the urban areas of Sikkim grew much more sharply than the rural areas. Discharge of untreated wastewater and use of septic tanks are key drivers of emissions in this sub-sector.

Figure 11: Areawise Emission Estimates for Domestic Wastewater (2005 to 2013)



Municipal Solid Waste contributed to ~8% of total Waste sector emissions of Sikkim in 2013. Changing Solid Waste composition resulted in an increase in the GHG emissions generated from every tonne of Solid Waste disposed of over the years in Sikkim and emissions from this category grew at a CAGR of 11.9% from 0.002 in 2005 to 0.004 in 2013. Industrial Wastewater represented ~2% of the Waste sector emissions in the year 2013. Nearly 75% of the Industrial Wastewater emissions in 2013 were due to Meat Industries while the remaining ~25% resulted due to Dairy waste.

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'



IPPU Sector

Due to insignificant industrial activity within Sikkim, no significant IPPU emissions were registered in Sikkim throughout the reference 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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