

Trend Analysis of GHG Emissions in ARUNACHAL PRADESH

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.

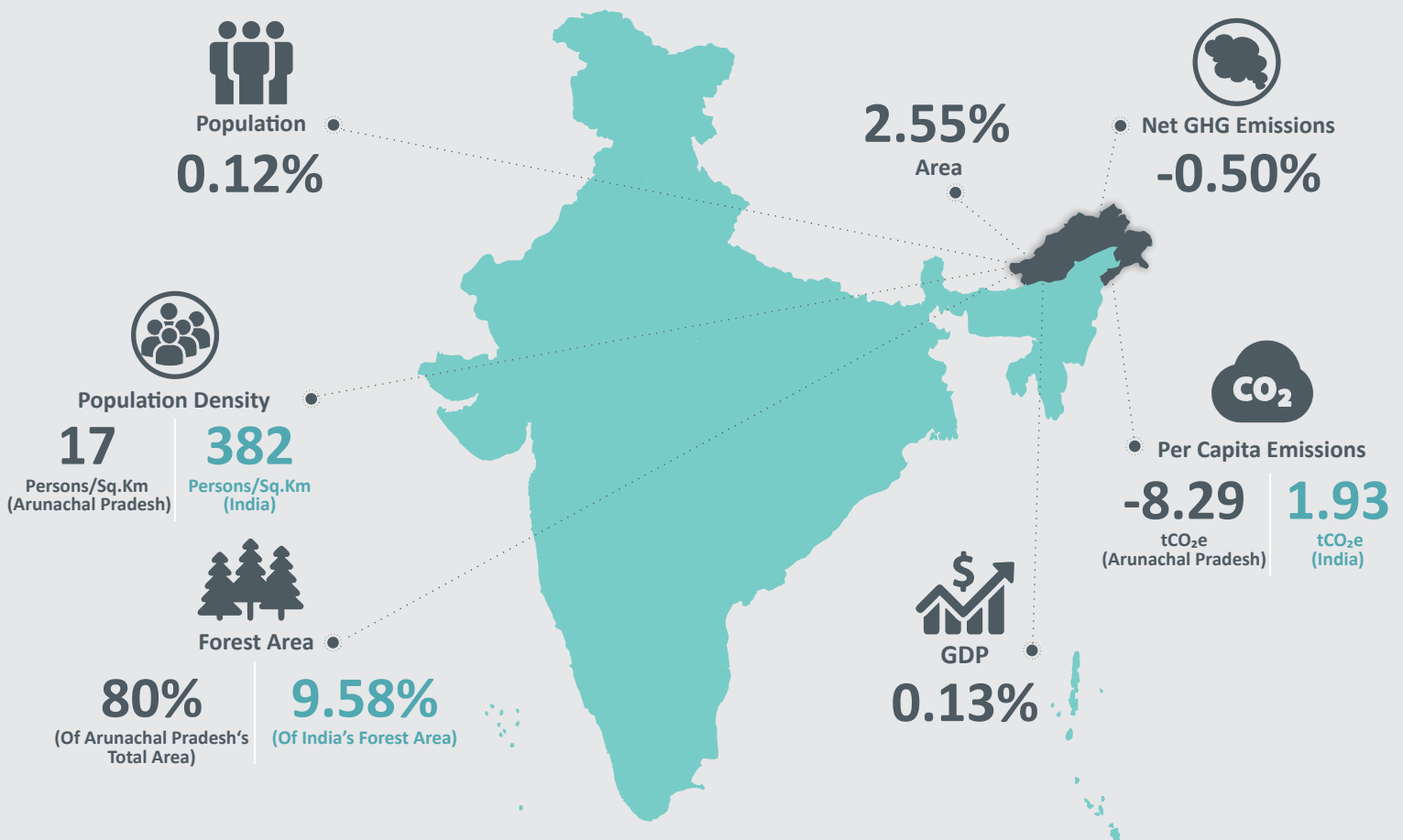
The Platform seeks to add value to the various ongoing GHG emission estimation efforts by helping address existing data gaps and data accessibility issues, extending beyond the scope of national inventories to state inventories, and by increasing the volume of analytics and policy dialogue on India's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

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



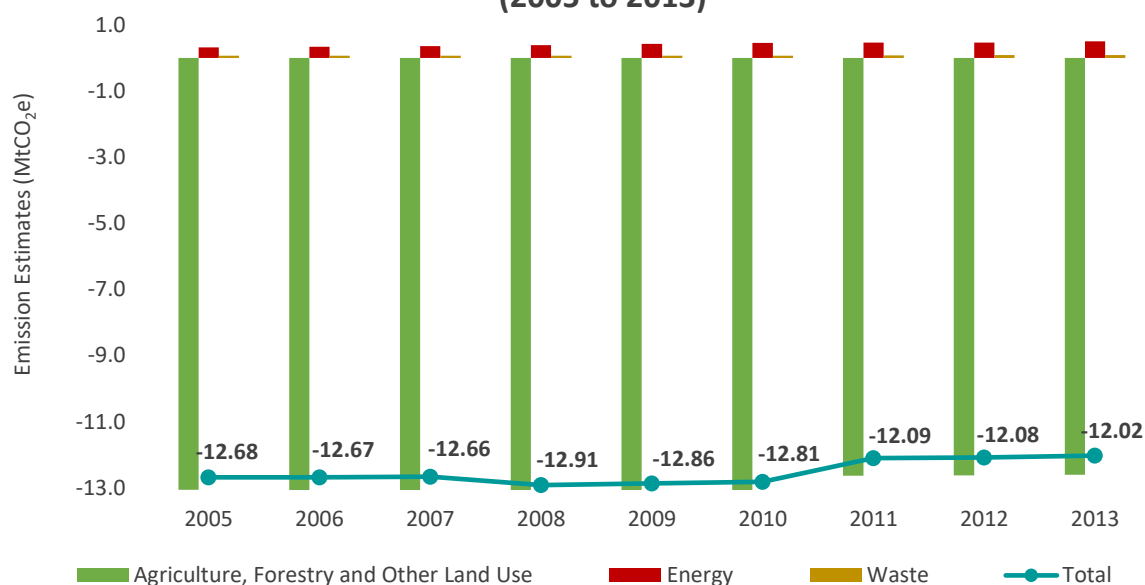
*Fuel combusted for Captive Electricity Generation (Auto-Producers) has been reported under Energy sector.

Arunachal Pradesh at a glance (2013)



Economy-wide Emission Estimates

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

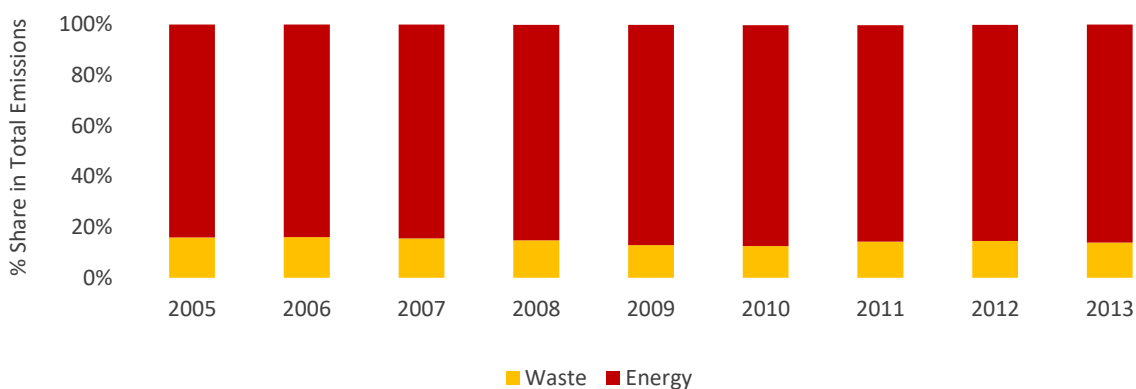


The state of Arunachal Pradesh was a net sink of GHGs from 2005 to 2013¹. Removals from this state declined marginally from 12.68 MtCO₂e to 12.02 MtCO₂e at a negative rate of 0.66% from 2005 to 2013 (compounded annually). While the AFOLU sector was a net remover of GHGs, the other sectors namely Energy and Waste were emitters as depicted in Figure 1 above.

The state registered very low positive emissions from the Energy and Waste sectors and no emissions from the IPPU sector due to low infrastructure development, absence of industrial activities and low carbon intensity levels of economic activity. However, the state removed high amounts of GHG emissions from the atmosphere as 80%² of the state’s area in 2013 was covered with dense and rich forests.

If net positive emissions were to be considered (i.e. without the AFOLU sector), ~86% emissions arose from the Energy sector and the remaining 14% from the Waste sector in 2013 (Figure 2).

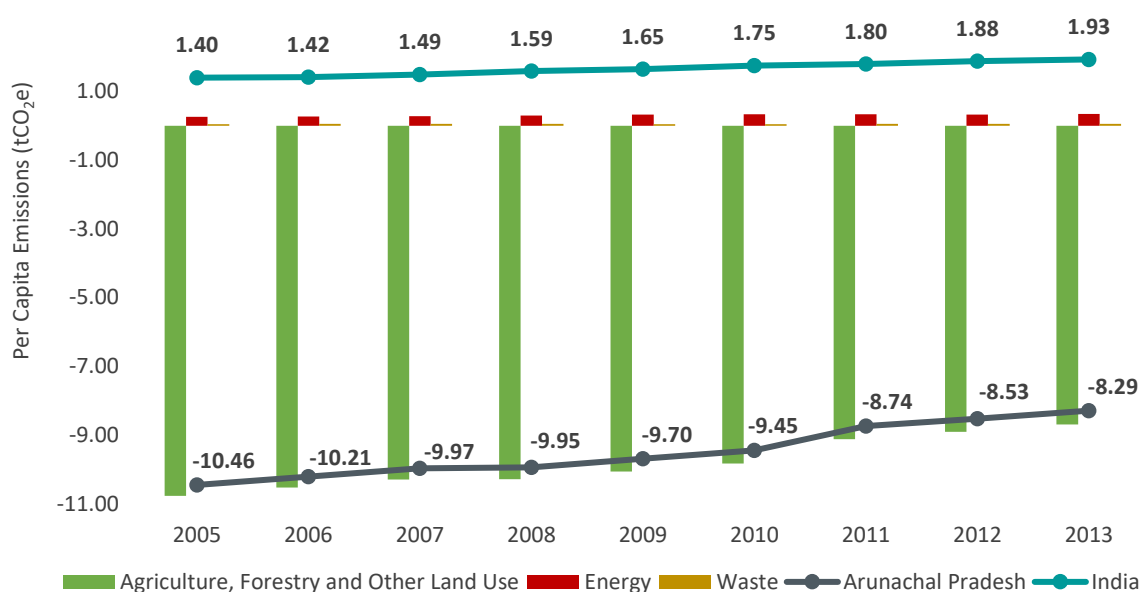
Figure 2: Sectoral Share of GHG Emissions for Arunachal Pradesh (Excluding AFOLU) (2005 to 2013)



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

² State of Forest Report 2015 accessed from www.fsi.nic.in

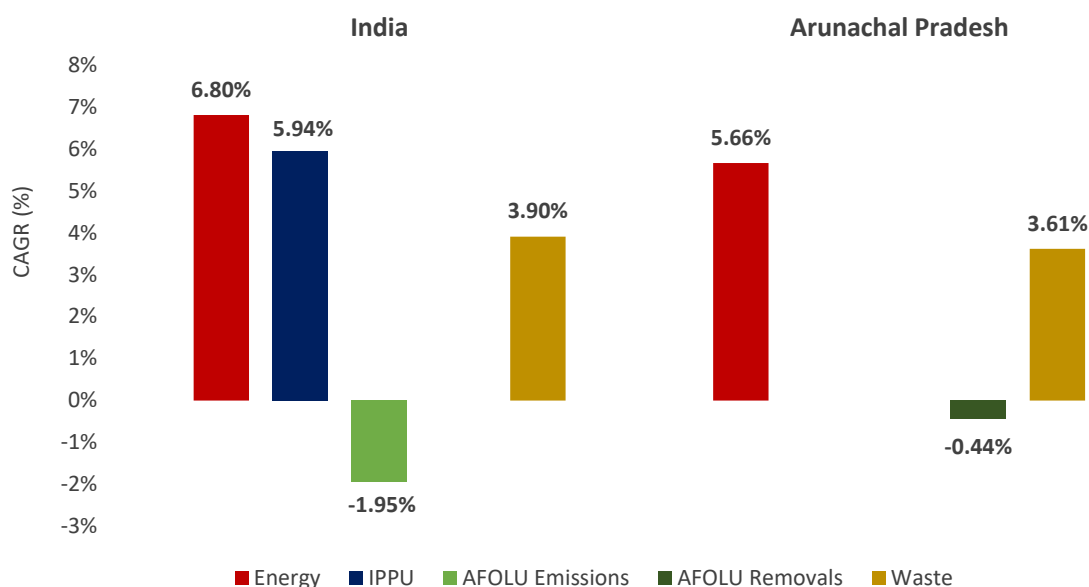
Figure 3: Per Capita GHG Emissions for Arunachal Pradesh and India (2005 to 2013)



Per capita removals from Arunachal Pradesh declined from 10.46 tCO₂e in 2005 to 8.29 tCO₂e in 2013. When compared to per capita emissions of India, Arunachal Pradesh recorded negative per capita emissions i.e. removals. The growth/decline rates (CAGR³) for India and Arunachal Pradesh from 2005 to 2013 were 4.07% (growth) and -2.85% (decline of removals) respectively (Figure 3).

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

These growth rates have been compounded annually.



GHG emissions from the Energy sector of Arunachal Pradesh recorded the highest growth rate of 5.66% from 2005 to 2013 amongst all other sectors (Figure 4). This was followed by the Waste sector which recorded a slightly lower growth rate of 3.61%. The AFOLU sector reported a negative trend and the removals declined by 0.44%. When compared to India, the Energy and Waste sectors recorded almost similar growth rates - 5.66% and 3.61% respectively.

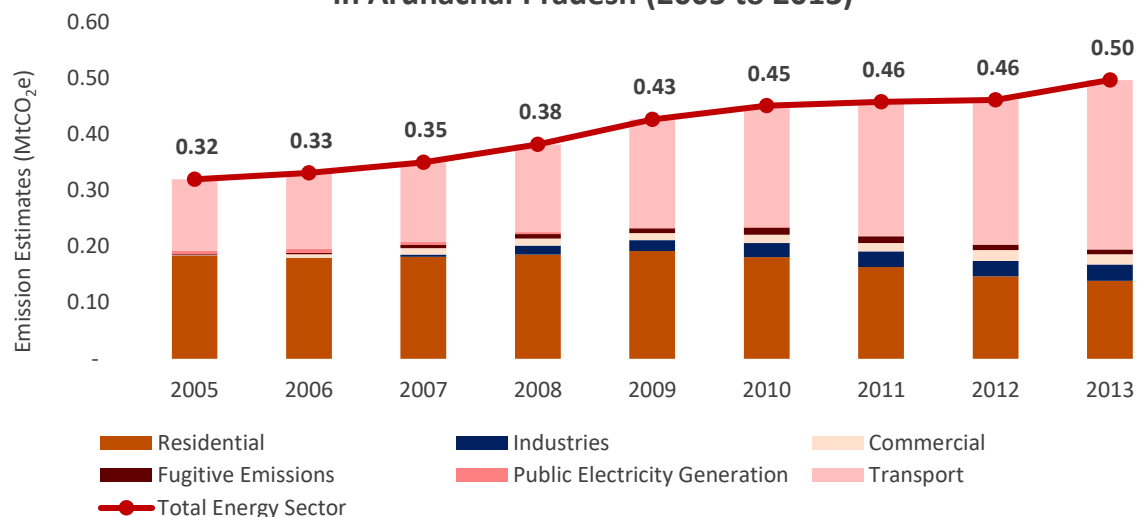
³ Compound Annual Growth Rate



Energy Sector

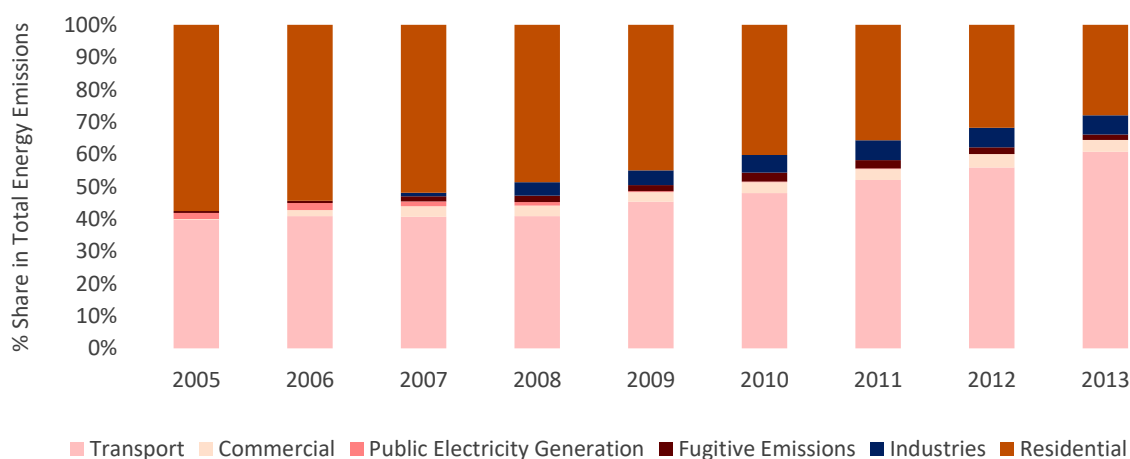
The Energy sector represented nearly 86% of total emissions in the state of Arunachal Pradesh in 2013 (excluding the AFOLU sector). In general, emissions from the Energy sector arise from two main sub-sectors – Fuel Combustion (Public Electricity Generation, Transport, Industries and Agriculture, Commercial and Residential categories) and Fugitive. In 2013, ~98% emissions were from Fuel Combustion and remaining 2% emissions from Fugitive sub-sector. The Energy sector emissions increased at an observed CAGR of 5.66% from 0.32 MtCO₂e in 2005 to 0.50 MtCO₂e in 2013 (Figure 5).

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



Transport was a major category under the Fuel Combustion sub-sector with ~61% contribution in Arunachal Pradesh's Energy emissions portfolio followed by ~28% contribution from the Residential category in 2013. From the Transport category, ~98% emissions were from Road Transport alone. The total emissions of the Transport category increased at an estimated CAGR of 11.39% with its emissions increasing from 0.13 MtCO₂e in 2005 to 0.30 MtCO₂e in 2013 (Figure 6). Low emissions were reported from Public Electricity Generation category as the state of Arunachal Pradesh is less dependent on Fossil Fuels but it relies on Hydroelectricity and Renewable Energy for Electricity Production. Further, the state is dependent on biomass as primary source of Energy for cooking, heating etc., leading to low GHG emissions from this sector. However due to unavailability of activity data, emissions from Industries were only estimated since 2007 and increased from 4000 tCO₂e in 2007 to 29000 tCO₂e in 2013.

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

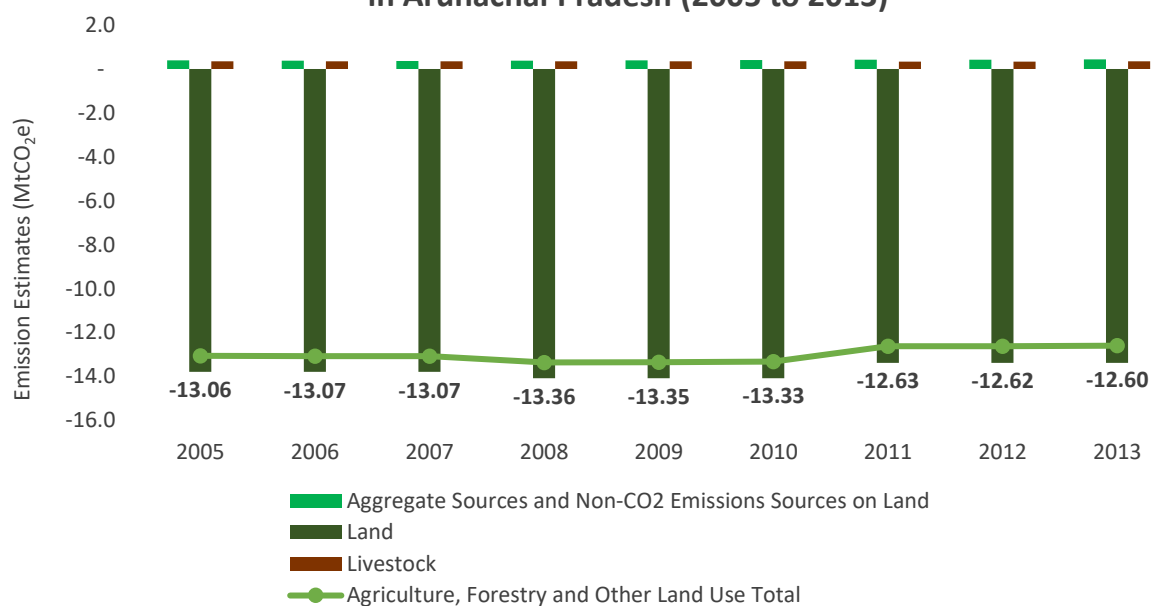




AFOLU Sector

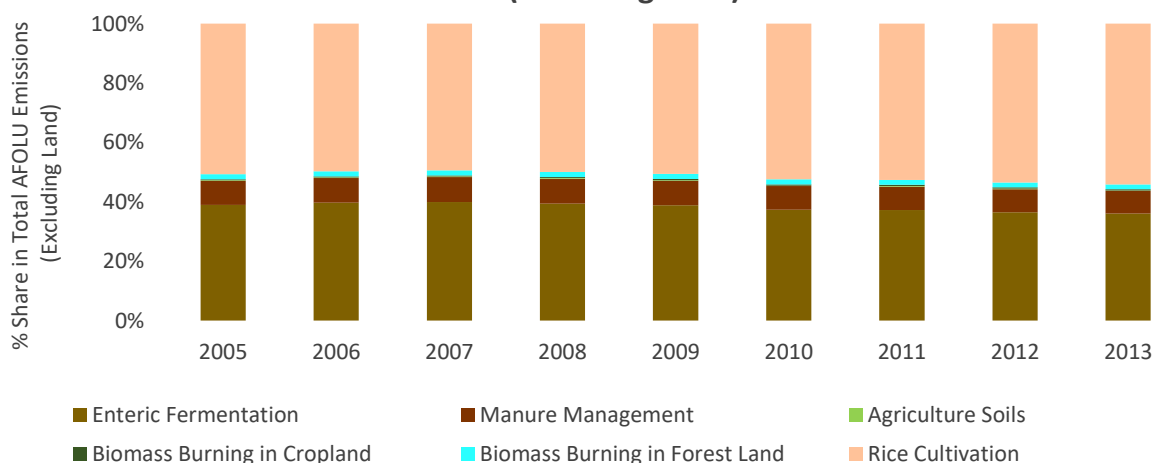
The AFOLU sector of Arunachal Pradesh was a net sink of GHGs in India from 2005 to 2013. Emissions/Removals from this sector arise from three main sub-sectors namely Livestock, Land and Aggregate Sources and Non-CO₂ Emissions Sources on Land. The removals decreased at an observed rate of 0.44% (CAGR) from 13.06 MtCO₂e in 2005 to 12.60 MtCO₂e in 2013 in the state. Notably, Land sub-sector was a sink across all years from 2005 to 2013. The reason for the slight decrease in removals from AFOLU sector can be attributed to the decrease in absorption/removals from the Land sector due to some losses in forest area/deforestation and a simultaneous increase in emissions from Aggregate Sources and Non-CO₂ Emissions Sources on Land in Arunachal Pradesh.

Figure 7: GHG Emission Estimates for AFOLU Sector in Arunachal Pradesh (2005 to 2013)



Out of the three sub-sectors, maximum positive emissions in year 2013 were from Aggregate Sources and Non-CO₂ Emissions Sources on Land. Amongst this sub-sector, Rice Cultivation was the major contributor of emissions across all the reference years. Emissions from Rice Cultivation increased from 51% in 2005 to 54% in 2013 under this sub-sector. Emissions from Enteric Fermentation had shown a decline from 39% in 2005 to 36% in 2013 in the state which was perhaps a reflection of decreased dairy and other associated activities in the animal husbandry sector.

Figure 8: Share of GHG Emissions for AFOLU Sub-sectors (Excluding Land)

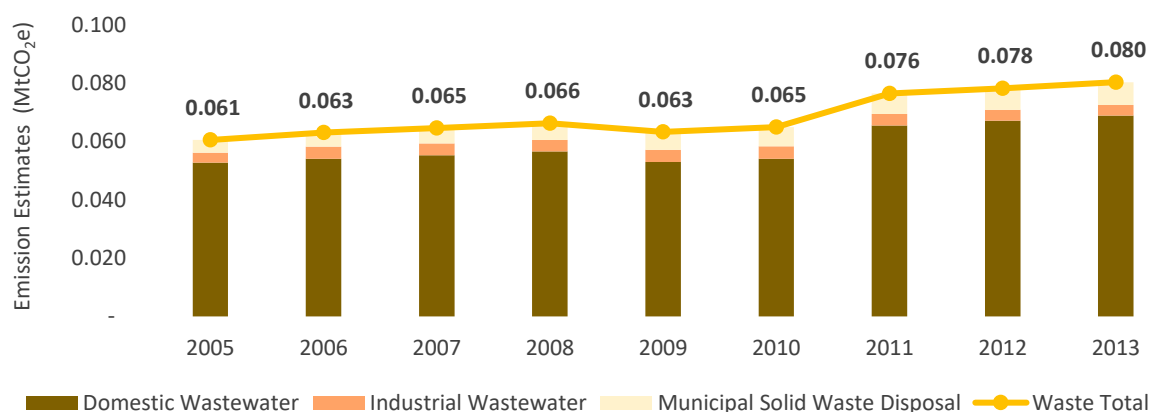




Waste Sector

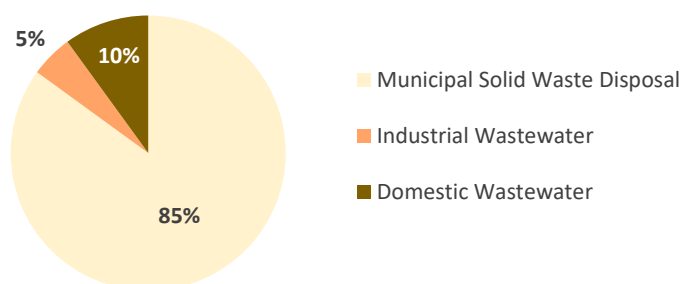
The Waste sector contributed ~14% of total emissions of Arunachal Pradesh in 2013 (excluding the AFOLU sector). Municipal Solid Waste⁴, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. The Waste sector emitted 0.061 MtCO₂e in 2005 which increased to 0.080 MtCO₂e in 2013. GHG emissions from Waste grew at a CAGR of 3.61% from 2005 to 2013 (Figure 9). The emissions from the Waste sector in Arunachal Pradesh followed an almost linear trend until 2011. The spike in emissions in 2011 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: GHG Emission Estimates for Waste Sector in Arunachal Pradesh (2005 to 2013)



In Arunachal Pradesh, maximum emissions (~85%) arose from Domestic Wastewater from rural and urban areas and had increased at a CAGR of 3.39% from 0.05 MtCO₂e in 2005 to 0.07 MtCO₂e in 2013. Almost 67% Domestic Wastewater emissions emanated from the rural areas of Arunachal Pradesh in 2013. Discharge of untreated wastewater and use of septic tanks are key drivers of emissions in this sub-sector. Municipal Solid Waste Disposal contributed 10% of 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 Arunachal Pradesh and emissions from this category had increased at 7.74% (CAGR) from 2005 to 2013. Industrial Wastewater also contributed to almost 5% of emissions in 2013 from Arunachal Pradesh's Waste sector (Figure 10).

Figure 10: Category-wise Share of GHG Emissions for Waste Sector (in 2013)



⁴ 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

No IPPU emissions were recorded for Arunachal Pradesh from 2005 to 2013.



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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