GHG Platform INDIA

Trend Analysis of GHG Emissions in GOA

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.

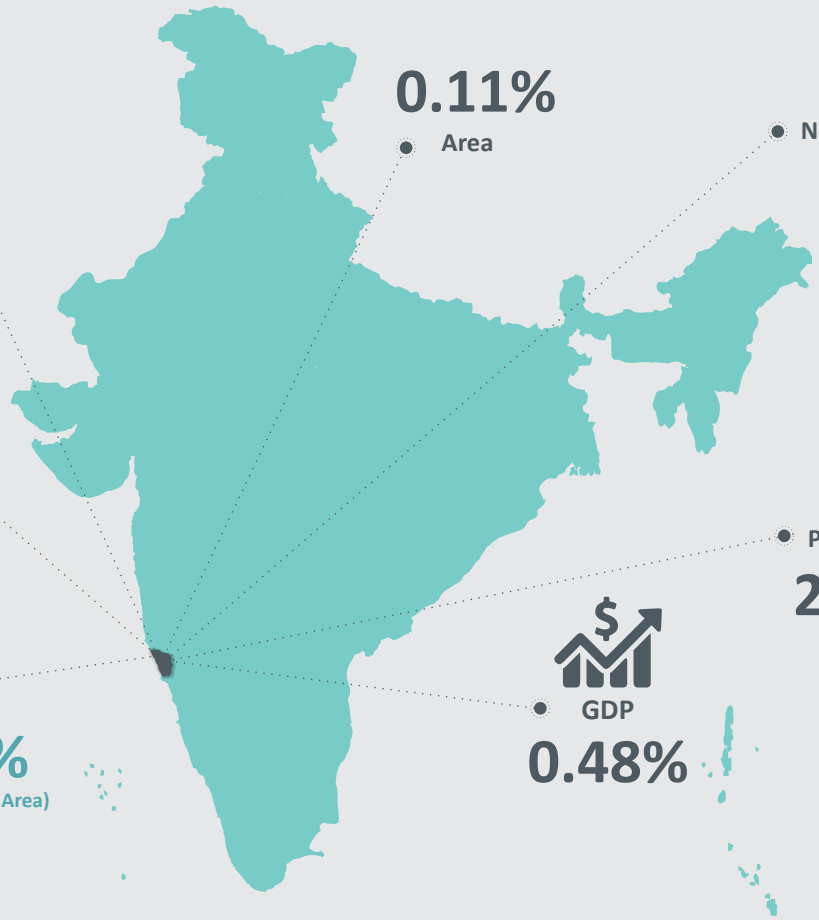
The Platform seeks to add value to the various ongoing GHG emission estimation efforts by helping address existing data gaps and data accessibility issues, extending beyond the scope of national inventories to state inventories, and by increasing the volume of analytics and policy dialogue on India's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

Goa at a glance (2013)



Population
0.12%

0.11%
Area

Net GHG Emissions
0.13%

Population Density
394 Persons/Sq.Km (Goa)
382 Persons/Sq.Km (India)

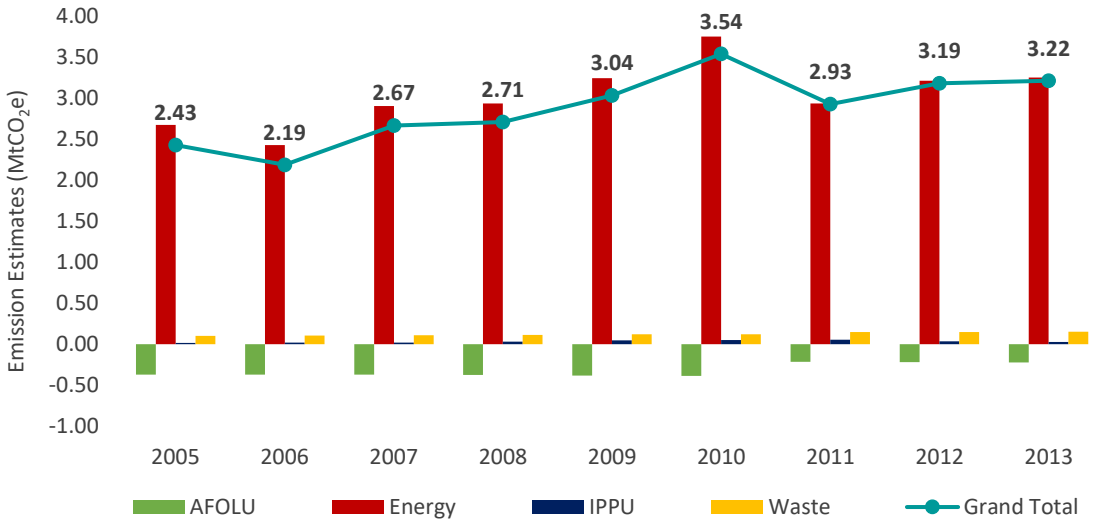
Per Capita Emissions
2.17 tCO_2e (Goa)
1.93 tCO_2e (India)

Forest Area
60% (Of Goa's Total Area)
0.32% (Of India's Forest Area)

GDP
0.48%

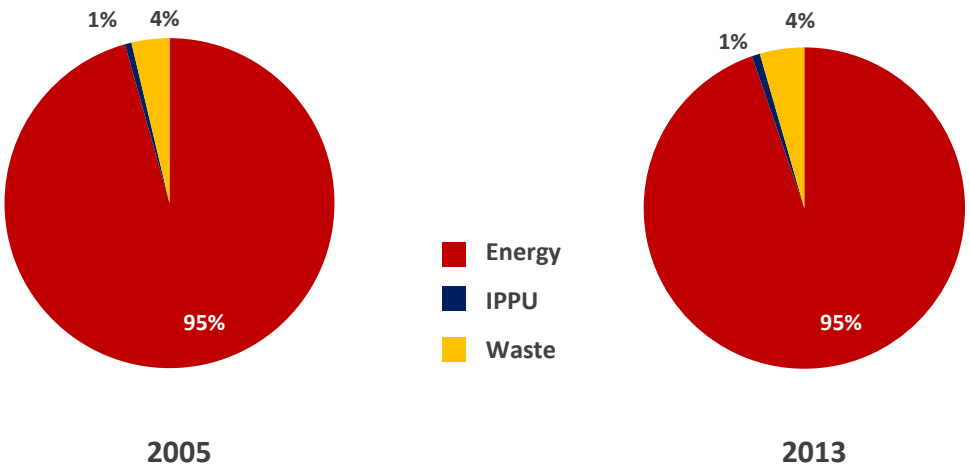
Economy-wide Emission Estimates

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



Emissions of Goa grew from 2.43 $MtCO_2e$ in 2005 to 3.22 $MtCO_2e$ in 2013[1] at an estimated CAGR[2] of 3.56% as illustrated in Figure 1 above. The AFOLU sector was a net sink of GHGs during the reference period with removals decreasing from 0.37 $MtCO_2e$ in 2005 to 0.22 $MtCO_2e$ in 2013 at a rate of 6.22% (compounded annually). In 2010, an interim peak in the total emissions was observed due to a significant jump in the Energy sector emissions. If the values were considered excluding the AFOLU sector, Energy sector remained the major emitter of GHGs across all the reference years. In 2013, Energy sector represented ~95% of the total emissions (if values were considered excluding AFOLU) while the remaining ~5% emissions were a result of the Waste (~4%) and IPPU sectors (~1%). Notably, the contribution of each sector in the total emissions remained unchanged in 2013 when compared to 2005 values as shown in Figure 2 below.

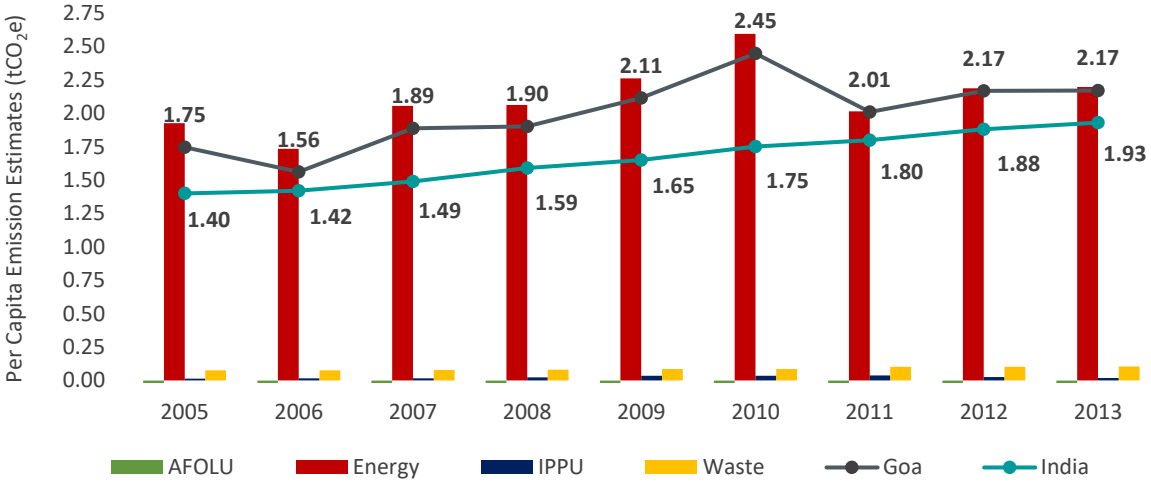
Figure 2: Sector-wise Contribution to Economy-wide GHG Emissions (Excluding AFOLU) of Goa



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

[2] Compound Annual Growth Rate

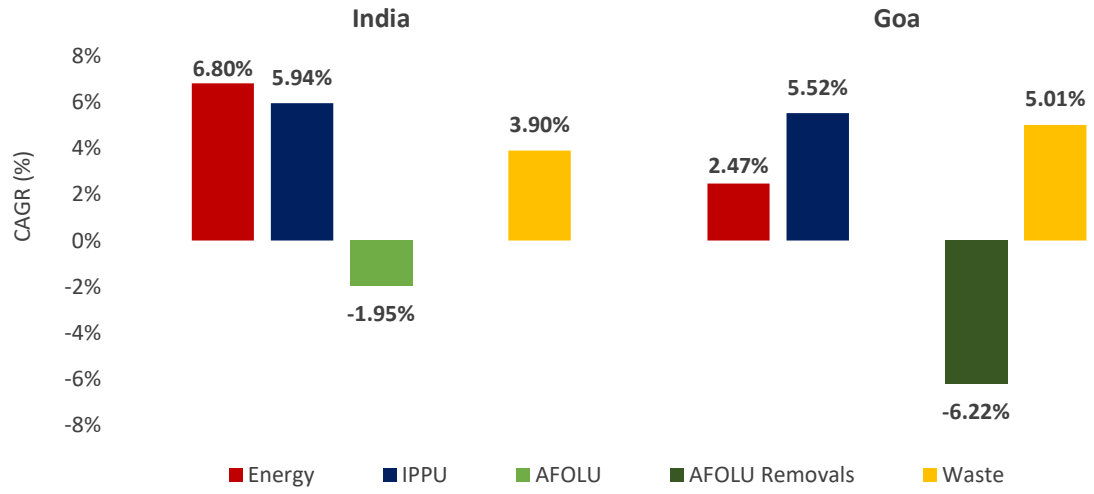
Figure 3: Per capita GHG Emissions for Goa and India (2005 to 2013)



The per capita emissions of Goa grew from 1.75 tCO_2e in 2005 to 2.17 tCO_2e in 2013 as illustrated in Figure 3 above. When compared to India, per capita emissions of Goa were higher than that of the country across all the reference years. The observed CAGR of the per capita emissions of Goa and India were 2.75% and 4.07% respectively from 2005 to 2013.

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

These growth rates have been compounded annually.

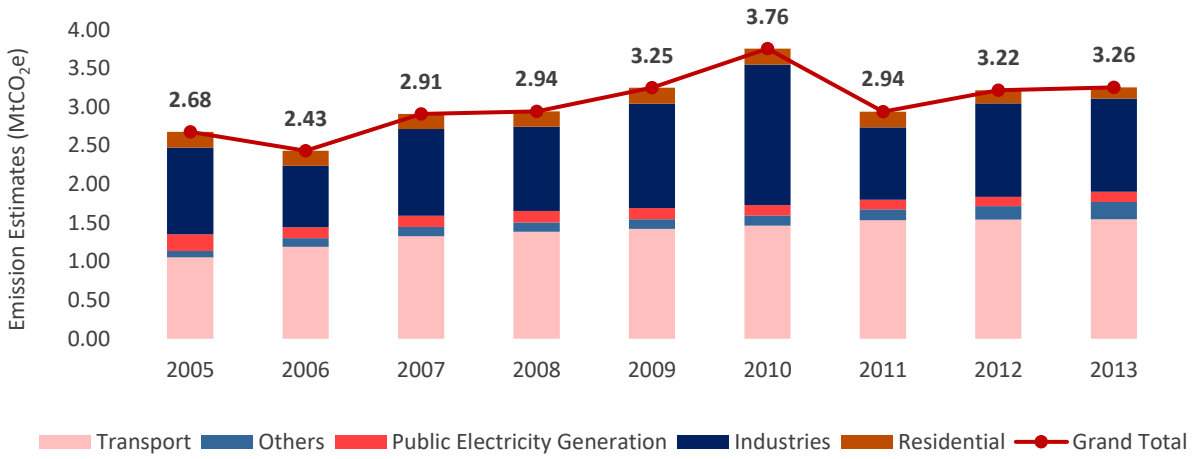


The IPPU sector in Goa registered the highest observed CAGR of 5.52% from 2005 to 2013. This was followed by the Waste sector, which had a slightly lower CAGR of 5.01% for the same period. The Energy sector registered the lowest CAGR of 2.47% from 2005 to 2013. Notably, the AFOLU sector was a net sink of GHGs, removals from which declined at a rate of 6.22% during the reference period as shown in Figure 4 when compared to India's AFOLU sector which was a net emitter, emissions from which declined at a rate of 1.95%. When compared to India's sectoral emission growth or decline rates, the Waste sector emissions increased at a rate that was faster, the Energy Sector emissions grew at a rate that was significantly lower. The growth in IPPU sector for Goa during the period was comparable to that of the country.

Energy Sector

The Energy sector represented ~95% of the total emissions (if values were considered excluding AFOLU sector) of Goa 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. However, in Goa no Fugitive emissions were registered across all the reference years. Emissions from the Energy sector grew at a CAGR of 2.47% from 2.68 $MtCO_2e$ in 2005 to 3.26 $MtCO_2e$ in 2013. An interim peak in the total Energy emissions was registered in 2010 owing to the variation in emissions emanating from the Fuels combusted in the Industries.

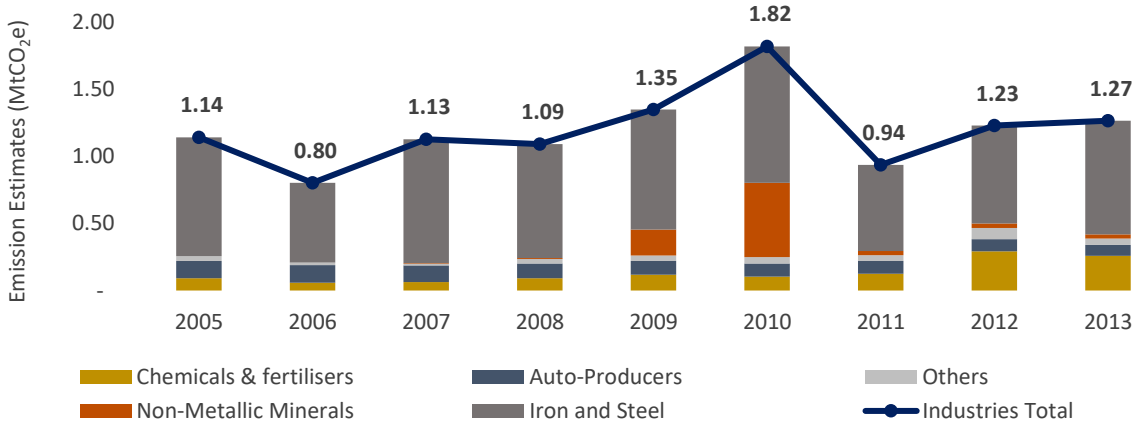
Figure 5: GHG Emission Estimates for Energy Sector in Goa (2005 to 2013)



Under the Energy sector, Transport category was the major emitter of GHG emissions in 2013 with a share of ~48% in the total Energy emissions followed by the Industries category (~37%). Nearly 70% of the Transport emissions were due to Road Transportation alone followed by emissions from Aviation (~23%) and Railways (~7%) respectively in 2013.

Deep diving into the Industry category emissions, Iron and Steel Industries were found to be the key driver of GHG emissions throughout the period (Figure 6). Notably, emissions from Iron and Steel Industries increased till the year 2010, post which it witnessed a decline. One plausible explanation can be attributed to the crackdown of illegal mining or iron ore during the period. However, emissions from the other industries in this category were found to inconsistent across years. Notably, the contribution of emissions from the Non-Metallic Minerals led to a significant jump in the overall emissions of Energy as well as the total emissions of Goa in 2010.

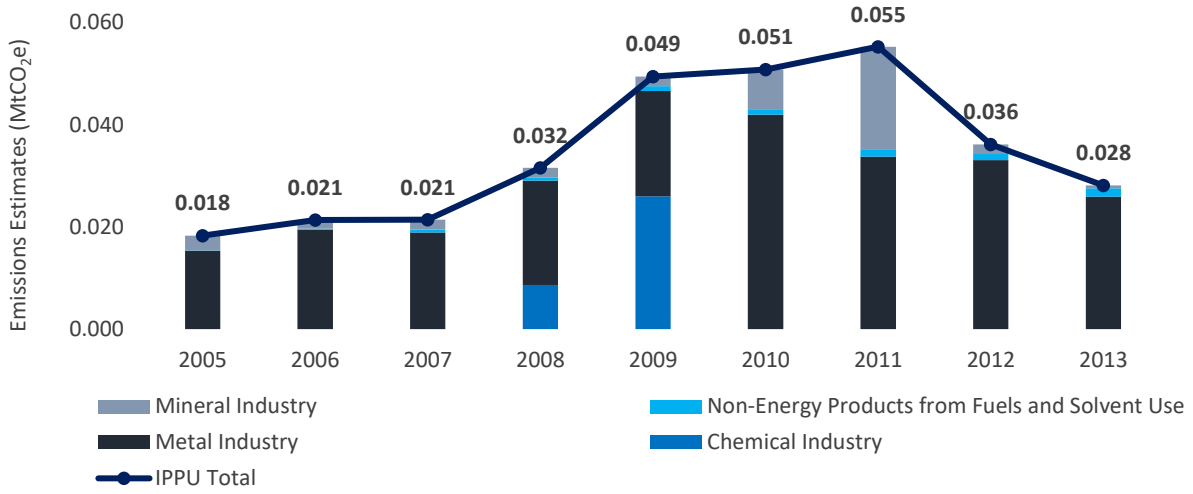
Figure 6: GHG Emission Estimates from Industries Category (2005 to 2013)



IPPU Sector

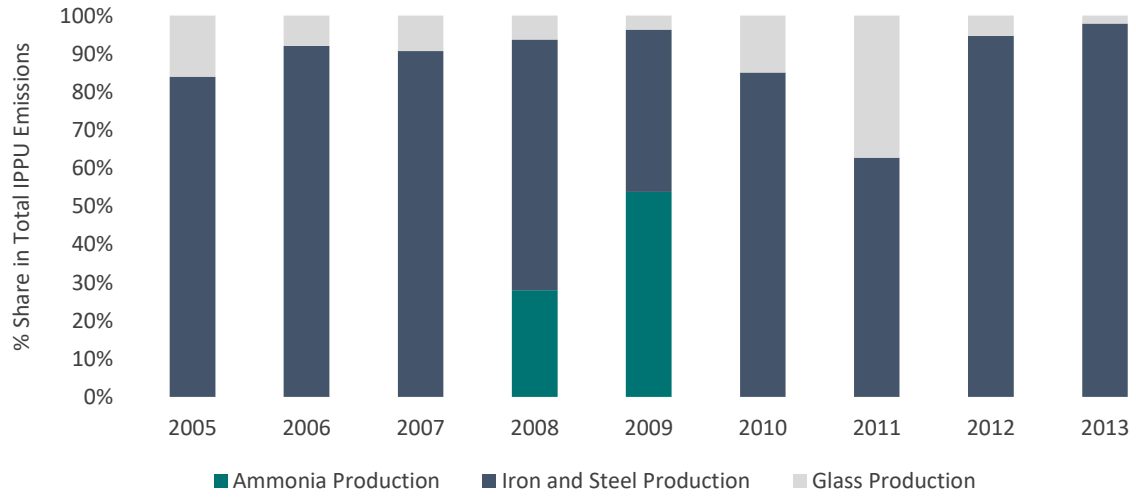
The IPPU sector represented a minor share of ~1 in the total GHG emissions (if values were considered excluding AFOLU sector) of Goa in 2013. Emissions from the IPPU sector are largely driven by Chemical, Metal, Mineral Industries and Non-Energy Products from Fuels and Solvent Use. Notably, emissions from the Chemical Industries in Goa were registered only in 2008 and 2009 as illustrated in Figure 7 below. Between 2005 and 2013, the overall IPPU emissions grew at a CAGR of 5.52% from 0.018 $MtCO_2e$ in 2005 to 0.028 $MtCO_2e$ in 2013. In 2009, a significant jump in the total IPPU emissions occurred. Subsequently, this increase sustained itself till 2011 owing to increased GHG emissions from Metal and Mineral Industries for 2010 and 2011.

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



A detailed trend of GHG emissions from various IPPU categories is depicted in Figure 8 below. Similar to the Energy use emissions, IPPU emissions estimated from the Industries are inconsistent during the reference years. While, Iron and Steel Industries were the major contributor to emissions during the period, activity data of Ammonia Production in the state was reported only in 2008 and 2009. A sudden increase in production output of the Glass industries was also registered in the year 2011.

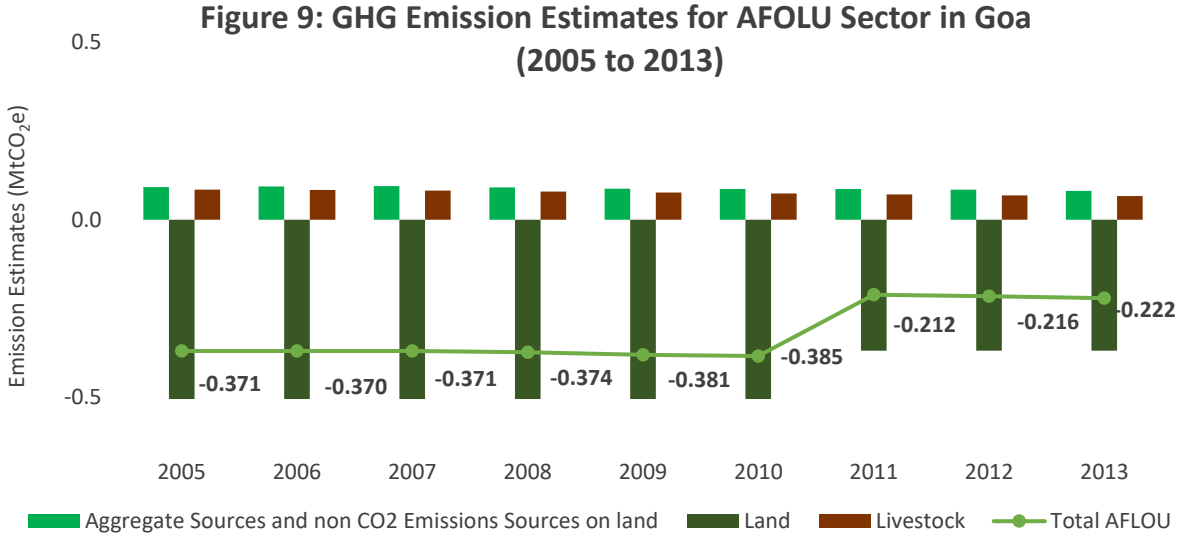
Figure 8: Share of GHG Emissions from IPPU Categories (2005 to 2013)



AFOLU Sector

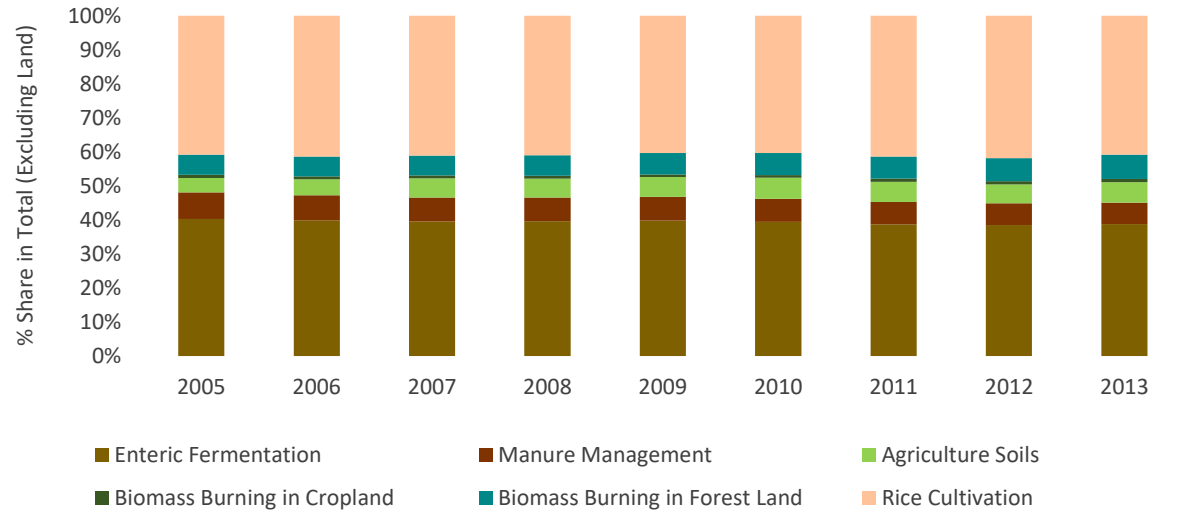
The AFOLU sector absorbed nearly 0.22 $MtCO_2e$ of GHG emissions in 2013. Emissions from the AFOLU sector arise from three main sub-sectors namely Livestock, Land and Aggregate Sources and Non-CO_2 Emissions Sources on Land. While Livestock sub-sector and Aggregate Sources and Non-CO_2 Emissions Sources on Land were net GHG emitters, the Land sub-sector was a net sink of GHGs. Notably, the AFOLU scetor was a net sink across all the reference years because the removals from the Land sub-sector were much higher than the emissions from the other sub-sectors. Removals from the AFOLU sector declined at a rate of 6.22% from 0.371 $MtCO_2e$ in 2005 to 0.222 $MtCO_2e$ in 2013 as shown in Figure 9 below. The removals from the AFOLU sector remained almost stagnant till 2010, however, in 2011 a sudden decline in the removals was recorded owing to the decreased green cover of the state.

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



If emissions were considered without taking into account the removals from the Land sub-sector, under Aggregate Sources and Non-CO_2 Emissions Sources on Land maximum emissions were registered due to Rice Cultivation with an average share of ~41% in across all the reference years. Under Livestock, Enteric Fermentation was the majpr emitter of GHGs from 2005 to 2013 with an average share of ~39% as illsutrated in Figure 10 below.

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



Waste Sector

The Waste sector in Goa contributed to almost 5% of the total emissions (if values were considered excluding the AFOLU sector) in 2013. Municipal Solid Waste[3], Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. GHG emissions from the Waste sector grew at a CAGR of 5.01% from 0.104 $MtCO_2e$ in 2005 to 0.154 $MtCO_2e$ in 2013 as illustrated in Figure 11. A 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 11: GHG Emission Estimates for Waste Sector in Goa (2005 to 2013)

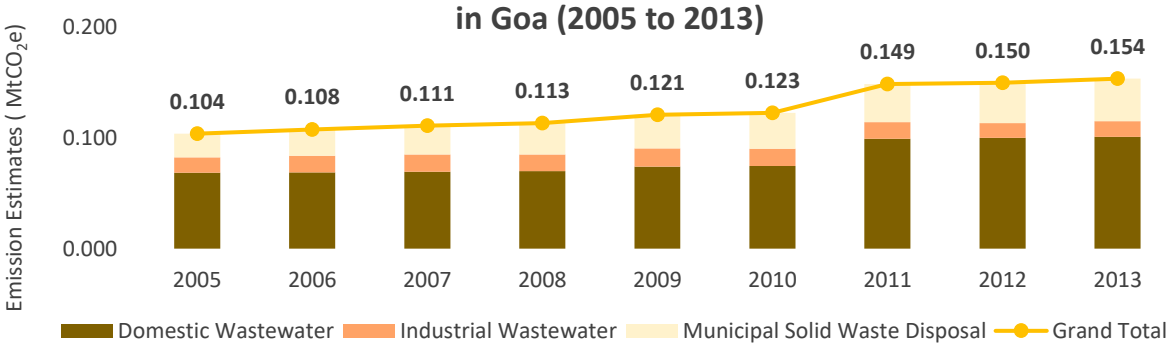
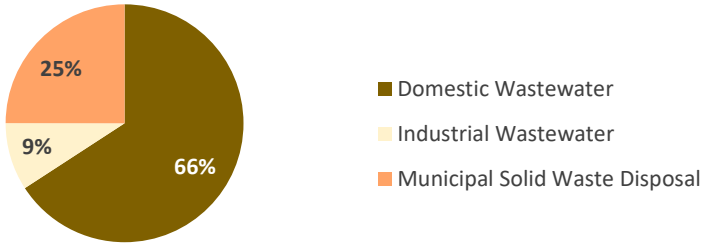


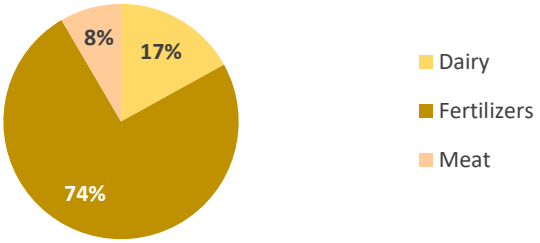
Figure 12: Category-wise Share of GHG Emissions for Waste Sector (in 2013)



Domestic Wastewater had a share of ~66% in the total emissions of the waste sector in 2013. Emissions from Domestic Wastewater from the rural and urban areas of Goa grew at a CAGR of 4.99% from 0.069 $MtCO_2e$ in 2005 to 0.101 $MtCO_2e$ in 2013. Nearly 63% of the Domestic Wastewater emissions emanated from the urban areas of Goa. Discharge of untreated wastewater and use of septic tanks are key drivers of emissions in this sub-sector.

Approximately 25% emissions of the Waste sector were due to Municipal Solid Waste Disposal in 2013 which grew at an estimated CAGR of 7.65% from 0.021 $MtCO_2e$ in 2005 to 0.038 $MtCO_2e$ in 2013. Industrial Wastewater represented nearly 9% of the Waste sector emissions. In 2013, ~74% of the emissions of this sub-sector were due to Fertilizers followed by Dairy (~17%) and Meat Waste (~8%) respectively.

Figure 13: Share of GHG Emissions from Industrial Wastewater (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 CH_4 emissions'

GHG Platform INDIA

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

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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.

The International Maize and Wheat Improvement Center (CIMMYT) is the global leader in agricultural research for development in wheat and maize-based farming systems.

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