

Trend Analysis of GHG Emissions in KERALA

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*



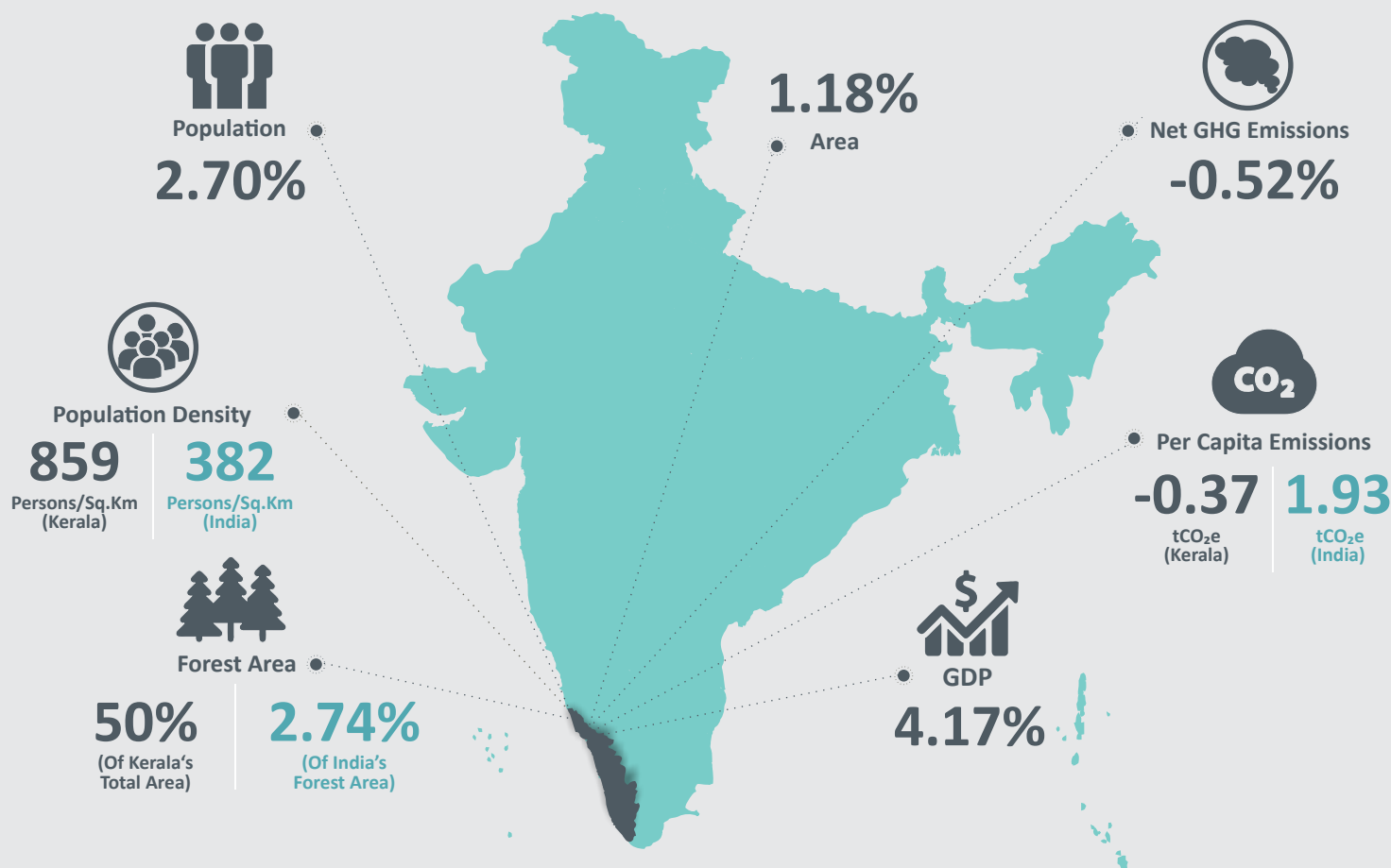
AFOLU



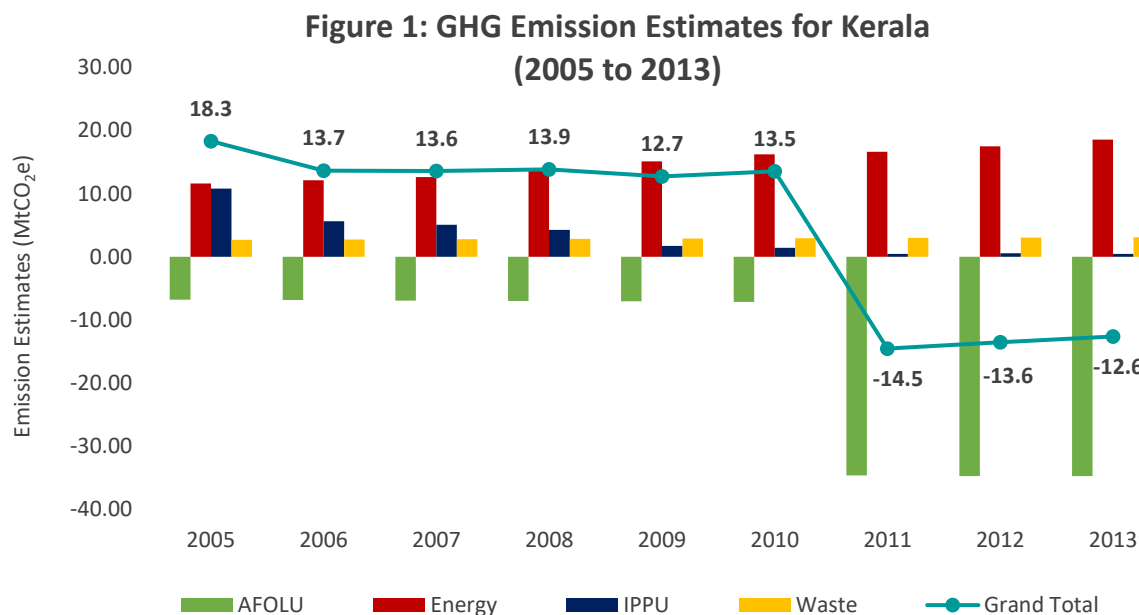
WASTE

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

Kerala at a glance (2013)

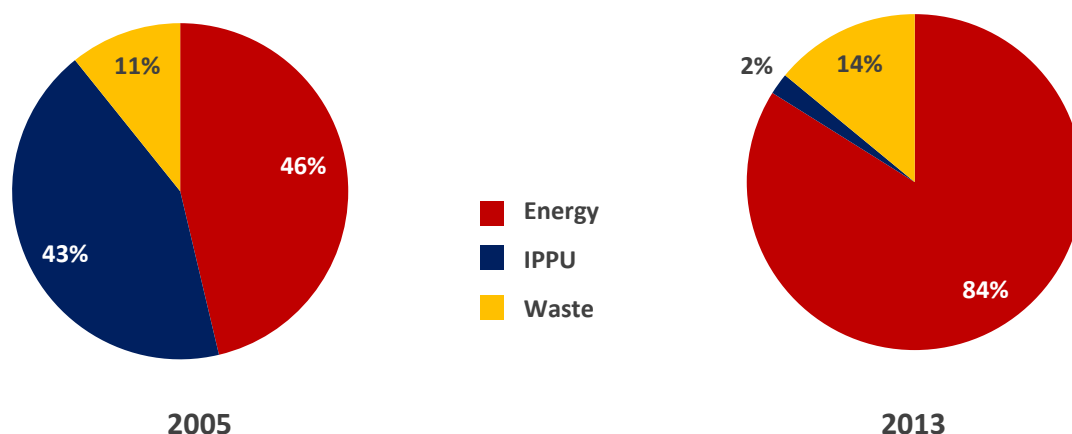


Economy-wide Emission Estimates



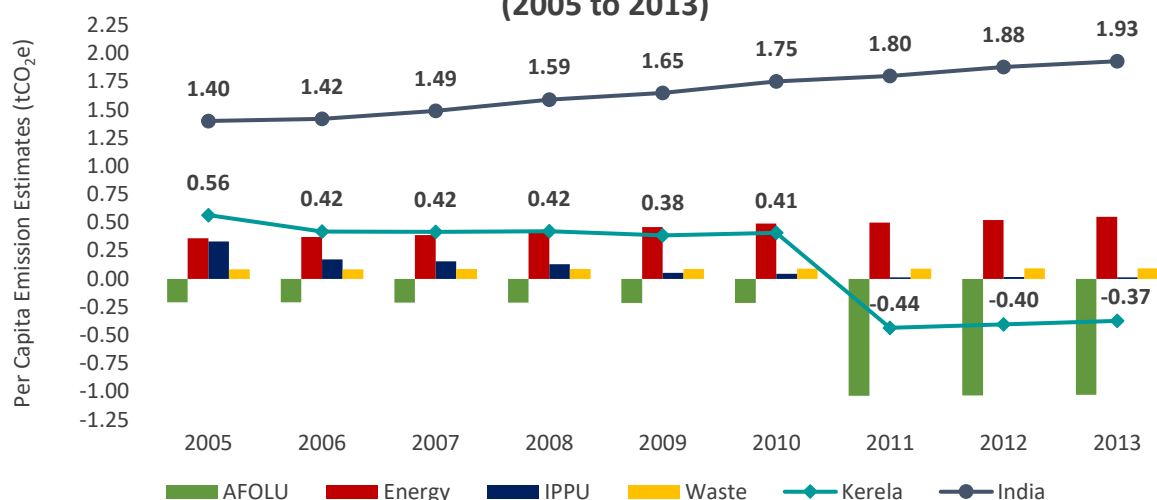
Kerala absorbed nearly 12.6 MtCO₂e of GHG emissions in 2013¹. Notably, Kerala was a net emitter till 2010 with emissions declining at a rate of ~5.91% (compounded annually) from 18.3 MtCO₂e in 2005 to 13.5 MtCO₂e in 2010. From 2011 onwards, it became a net sink of GHG emissions. However, the removals declined at a rate of 6.77% (compounded annually) from 14.5 MtCO₂e in 2005 to 12.6 MtCO₂e in 2013 as shown in Figure 1 above. If emissions were considered excluding the AFOLU sector, the share of emissions from the Energy sector in the total emissions was ~46% whereas the IPPU and Waste sectors represented ~43% and ~11% respectively in 2005. As inferred from Figure 2 below, in 2013, the share of the Energy sector increased enormously to ~84% while that of the IPPU sector declined to a meagre ~2%. Notably, the share of the Waste sector in Kerala's emissions increased relatively sedately to ~14% in 2013 when compared with 2005 levels.

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



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

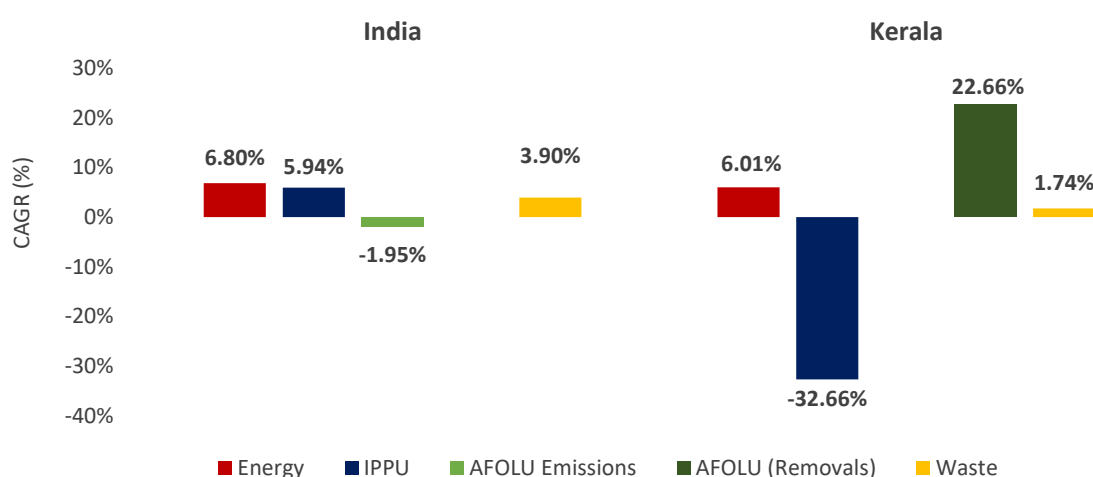
Figure 3: Per capita GHG Emissions for Kerala and India (2005 to 2013)



The per capita emissions of Kerala declined at a compounded rate of 6.35% from 0.56 tCO₂e in 2005 to 0.41 tCO₂e in 2010. This decline was exaggerated further in 2011 due to increased CO₂ removals from the AFOLU sector, and a secular decline in the IPPU emissions throughout the reference period. The per capita removals declined at a rate of 7.22% from 0.44 tCO₂e in 2011 to 0.37 tCO₂e in 2013. When compared to India, the per capita emissions of Kerala were much lower than that of the country as illustrated in the Figure 3 above, throughout the reference period. The observed CAGR² of the per capita emissions of India was 4.07% from 2005 to 2013, contrary to the decline of per capita emissions of Kerala.

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

These growth rates have been compounded annually



The CO₂ removals from the AFOLU sector in Kerala observed the highest growth rate of 22.66% from 2005 to 2013. On the contrary, the IPPU sector of Kerala registered a very high decline rate of 32.66% for the same reference period as illustrated in Figure 4 above. The Energy and Waste sectors recorded growth rates of 6.01% and 1.74% respectively from 2005 to 2013. When compared to India, the Energy and Waste sectors of Kerala recorded lower growth rates while the AFOLU sector registered removals of GHGs unlike in the case of India where AFOLU emissions were positive, albeit declining. The trend for the IPPU sector was also at variance with the national trend with a negative growth rate when compared to India's IPPU emissions growth of 5.94%.

² Compound Annual Growth Rate



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

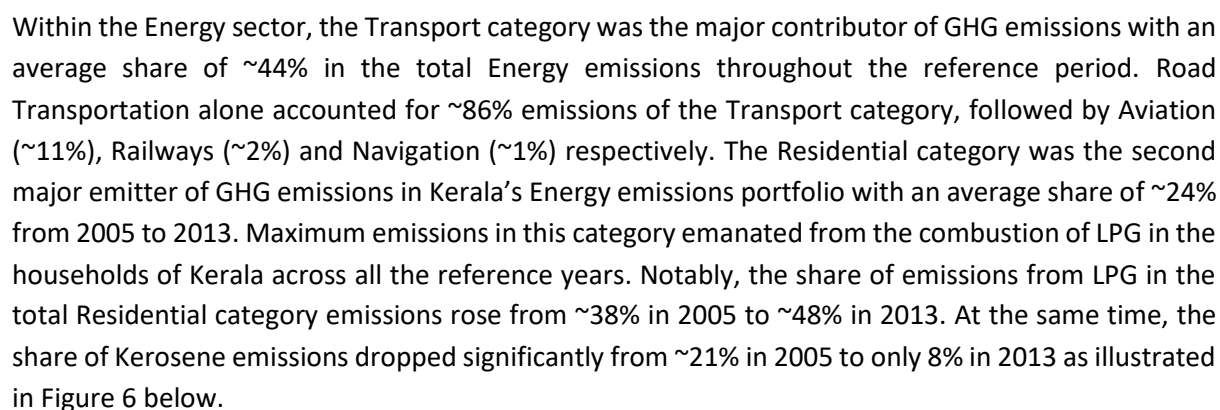
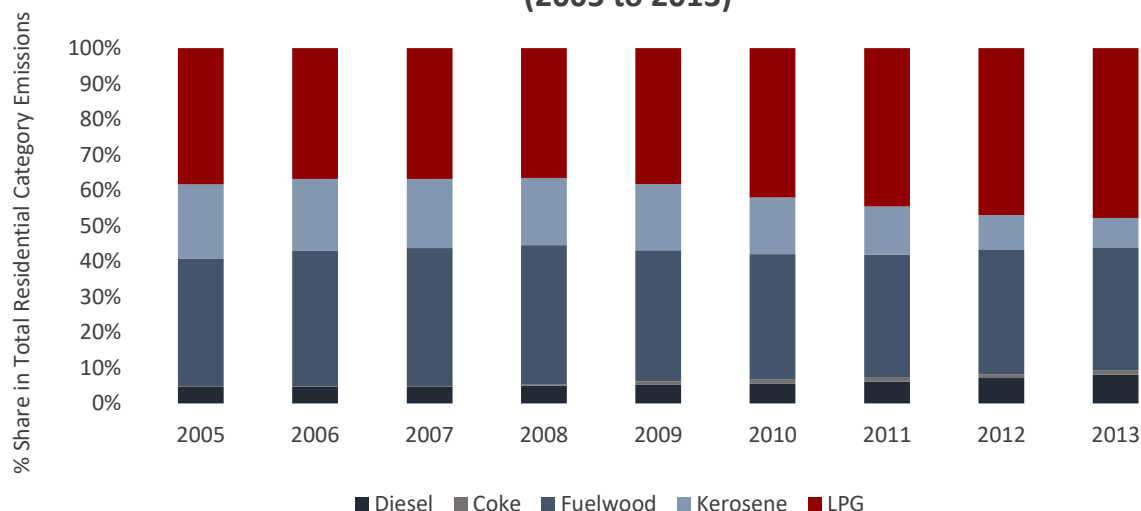


Figure 6: Share of GHG Emissions from Residential Categories (2005 to 2013)

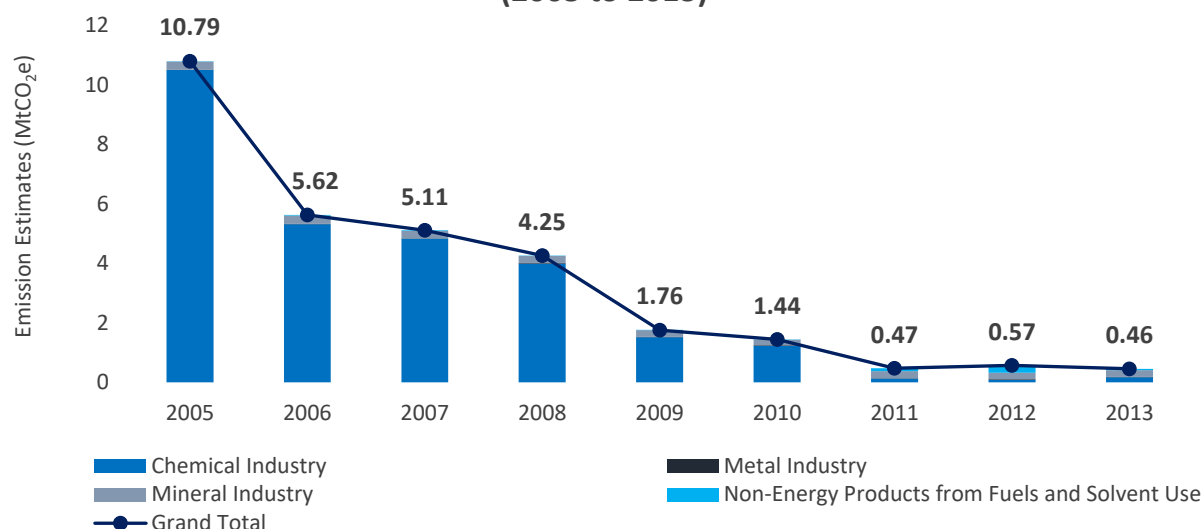




IPPU Sector

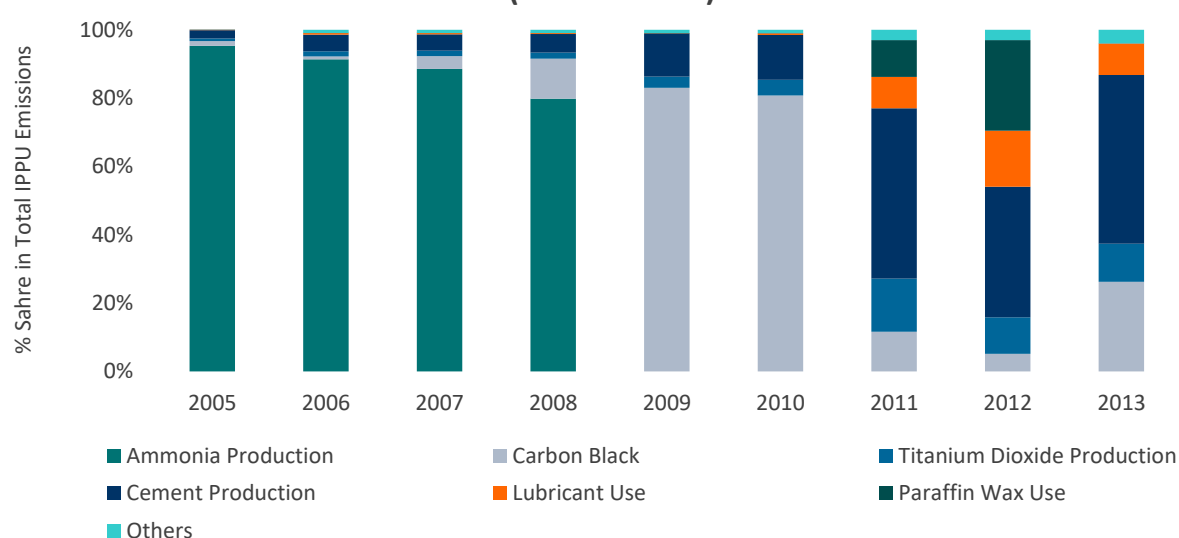
The IPPU sector represented ~2% of the total GHG emissions (if values were considered excluding AFOLU sector) of Kerala in 2013. Emissions from the IPPU sector are largely driven by Chemical, Metal, Mineral Industries and Non-Energy Products from Fuels and Solvent Use. Between 2005 and 2013, the overall IPPU emissions declined drastically at a compounded rate of 32.66% from 10.79 MtCO₂e in 2005 to 0.46 MtCO₂e in 2013 owing to a significant decline in the Chemical Industry emissions during the reference period (Figure 7).

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



A detailed trend of the GHG emissions by various IPPU categories is depicted in Figure 8 below. The IPPU sector followed a very uneven trend throughout the reference period. Ammonia Production, observed as a key contributor to the IPPU emissions during the initial years saw inadequate reporting of the activity data in the recent years. Hence, the overall trend registered a sudden drop in IPPU emissions.

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

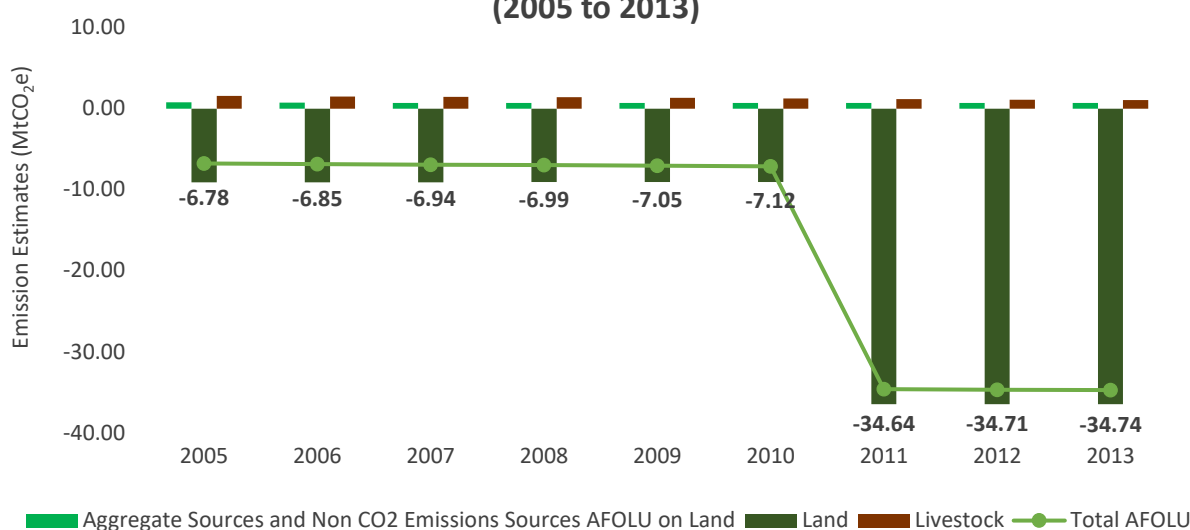




AFOLU Sector

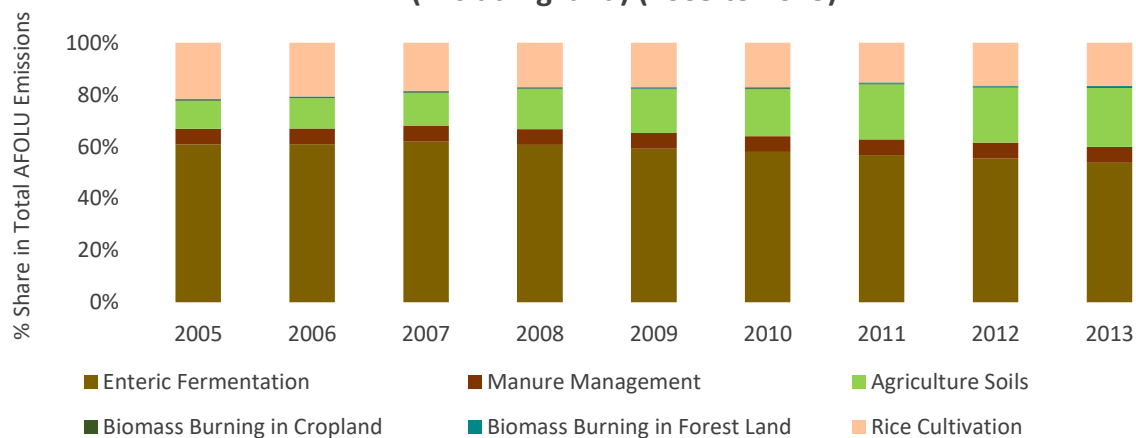
The AFOLU sector absorbed 36.5 MtCO₂e of GHG emissions from Kerala in 2013. Emissions from the AFOLU sector arise from three main sub-sectors namely Livestock, Land and Aggregate sources and non-CO₂ emissions sources on land. While the Livestock sub-sector and Aggregate Sources and Non-CO₂ Emissions Sources on Land were net GHG emitters, the Land sub-sector acted as sink of GHGs across all the reference years. Notably, the AFOLU sector on the whole remained a net sink of emission across all the reference years because removals from Land were much higher than the emissions from the other subsectors of the AFOLU sector. Removals by the AFOLU sector grew at a fast clip with a CAGR of 22.66% from 6.78 MtCO₂e in 2005 to 34.74 MtCO₂e in 2013 as illustrated in Figure 9 below. A significant rise in the overall removals was observed in 2011 owing to increased removals from the Land sub-sector which played a major role in making Kerala a carbon negative state from then onwards.

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



Deep diving into the AFOLU sub-sectors, Livestock was the maximum emitter of GHG emissions during the reference period with an average share of ~65% (if values are considered excluding Land). Under the Livestock sub-sector, Enteric Fermentation was the major contributor of emission across the reference period with an average share of ~59% from 2005 to 2013. However, the contribution of emissions from this category of emissions declined at a rate of 4.86% (compounded annually) from 1.40 MtCO₂e in 2005 to 0.95 MtCO₂e in 2013. Under Aggregate Sources and Non-CO₂ Emissions Sources on Land, Rice Cultivation and Agricultural Soils were the top GHG emitters with an average share of ~18% and ~17% respectively during the reference period as illustrated in Figure 10 below.

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





Waste Sector

The Waste sector contributed to almost 14% of the total emissions (if values were considered excluding the AFOLU sector) of Kerala in 2013. Municipal Solid Waste³, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. GHG emissions from the Waste sector of Kerala grew linearly at a CAGR of 1.74% from 2.70 MtCO₂e in 2005 to 3.10 MtCO₂e in 2013.

Figure 11: GHG Emission Estimates for Waste Sector in Kerala (2005 to 2013)

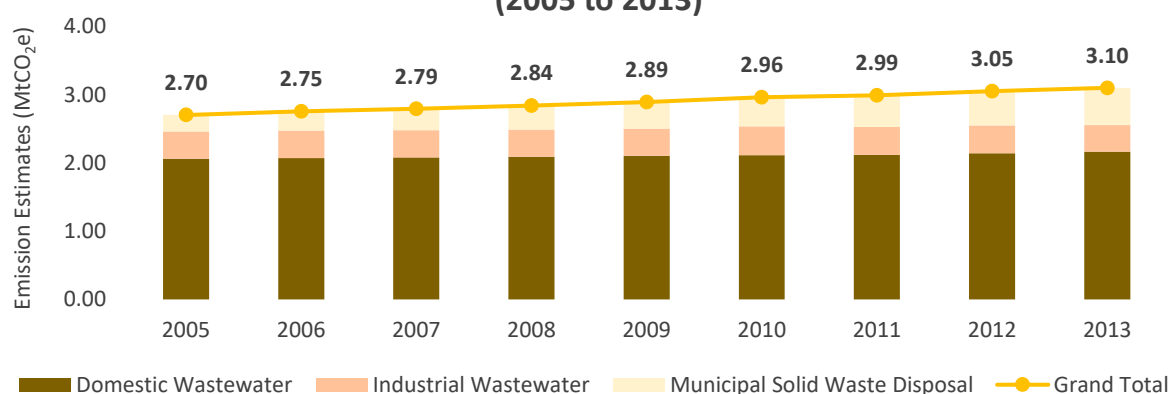
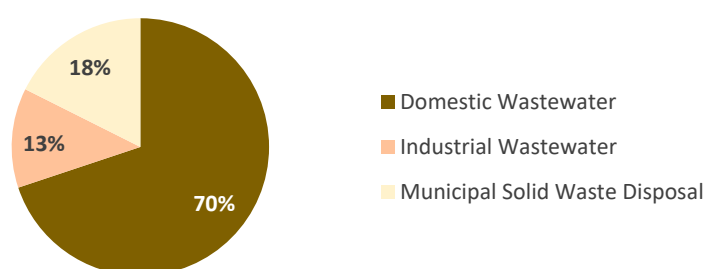


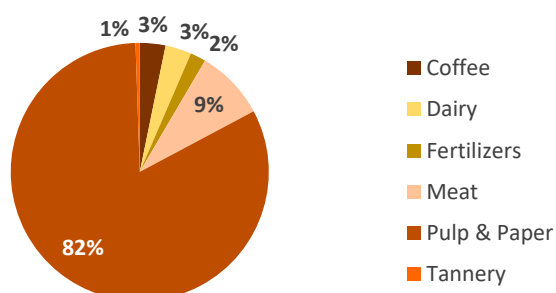
Figure 12: Category-wise Share of GHG Emissions for Waste Sector (in 2013)



Domestic Wastewater had a share of ~70% in the total Waste sector emissions of Kerala in 2013. Emissions from Domestic wastewater of the rural and urban areas grew at a low CAGR of 0.63% from 2.06 MtCO₂e in 2005 to 2.17 MtCO₂e in 2013. Almost 52% of Domestic wastewater emissions were from the urban areas of Kerala in 2013. Discharge of untreated wastewater and use of septic tanks are key drivers of emissions in this sub-sector.

Approximately 18% of the Waste sector emissions were from Municipal Solid Waste Disposal in 2013. Emissions from this subsector grew at an estimated CAGR of 10.71% from 0.24 MtCO₂e in 2005 to 0.55 MtCO₂e in 2013. Industrial Wastewater represented nearly 13% of Waste sector emissions in 2013. Emissions from this sector declined at a rate of 0.37% (compounded annually) from 0.40 MtCO₂e in 2005 to 0.39 MtCO₂e in 2013. Deep diving into Industrial Wastewater categories, maximum emissions were registered from the Pulp and Paper Industries with a share of ~82% in 2013 as illustrated in Figure 13 below.

Figure 13: Share of Emissions from Industrial Wastewater Categories (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 CH₄ emissions'



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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