

# Trend Analysis of GHG Emissions in DAMAN & DIU

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\***



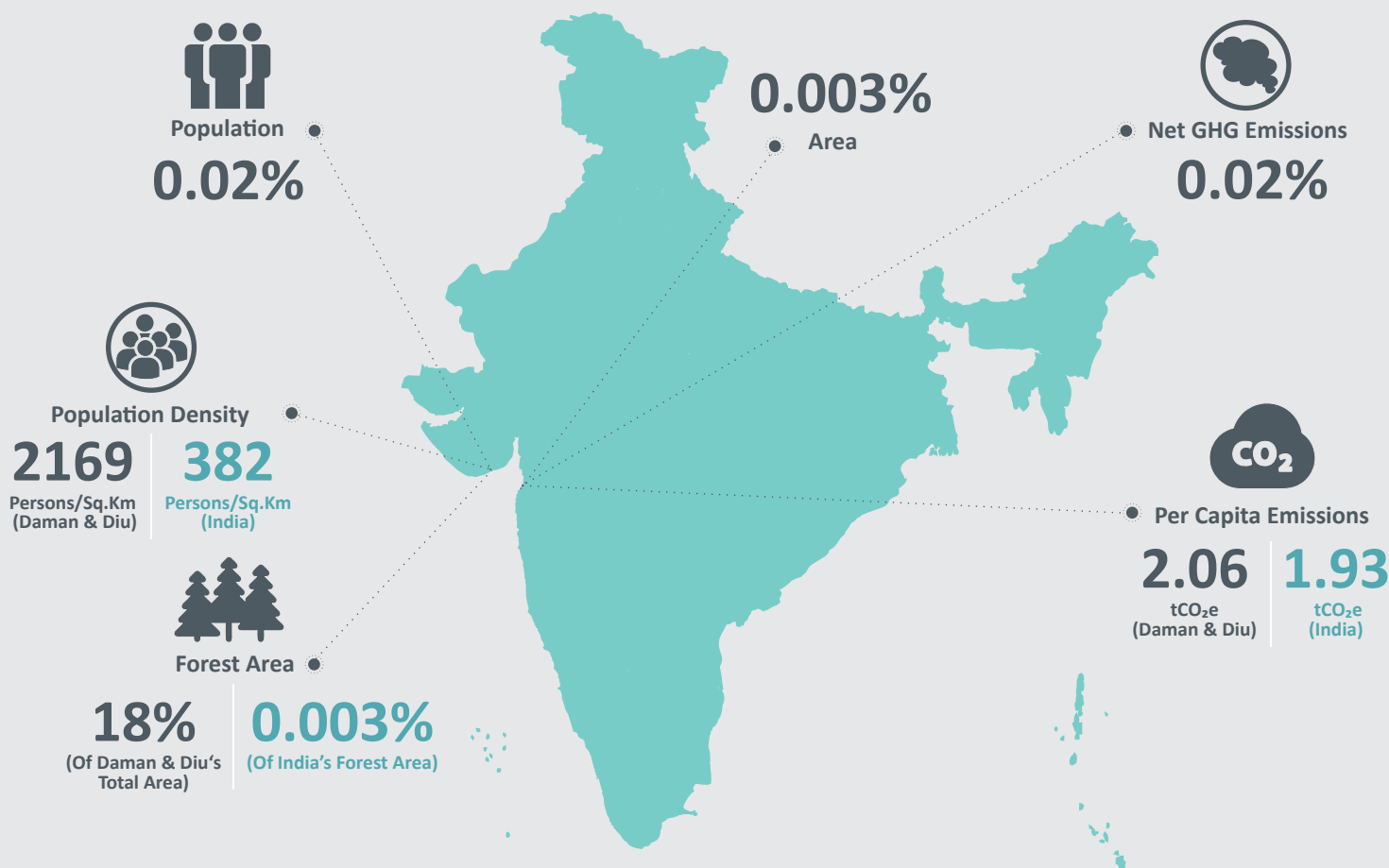
**AFOLU**



**WASTE**

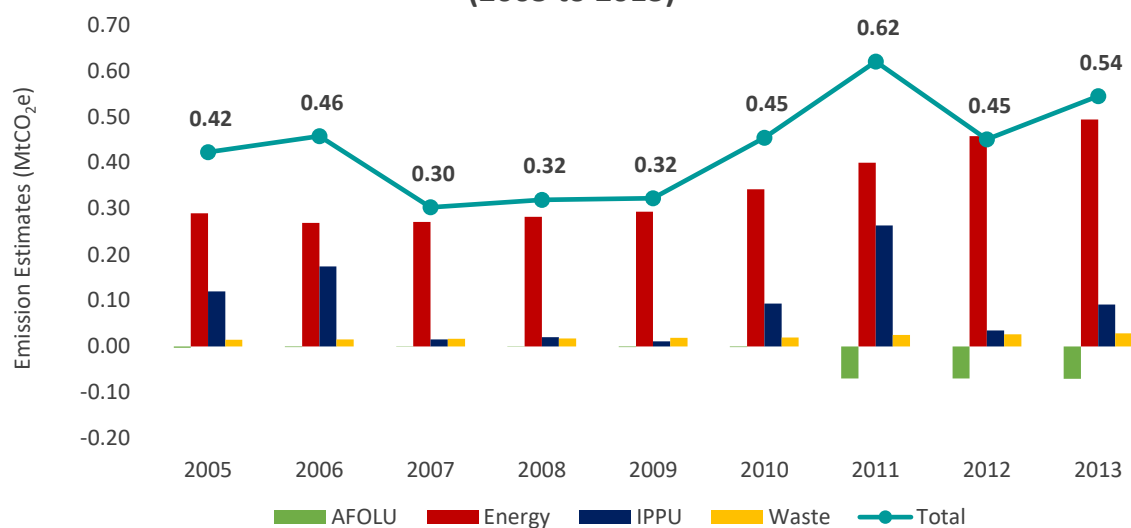
\*Fuel combusted for Captive Electricity Generation (Auto-Producers) has been reported under Energy sector.

## Daman & Diu at a glance (2013)



## Economy-wide Emission Estimates

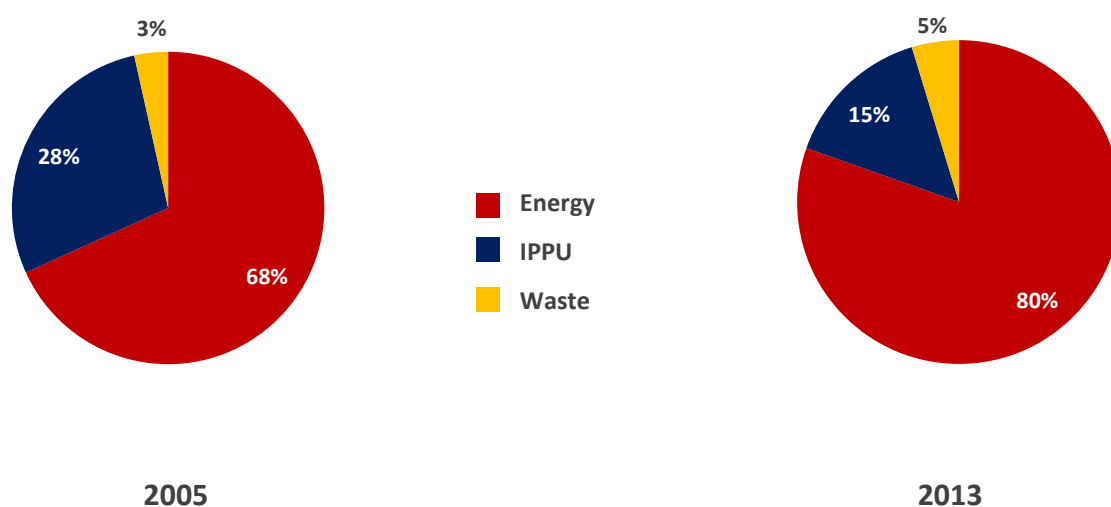
**Figure 1: GHG Emission Estimates for Daman & Diu (2005 to 2013)**



Emissions from the UT of Daman & Diu increased marginally from 0.42 MtCO<sub>2</sub>e to 0.54 MtCO<sub>2</sub>e at a CAGR<sup>1</sup> of 3.20% from 2005 to 2013<sup>2</sup>. While the AFOLU sector was a net remover of GHGs, the other sectors namely the Energy, IPPU, and Waste sectors were positive emitters as depicted in Figure 1 above. However, the IPPU sector emissions were highly variable during the reference period. Further, the AFOLU sector removals were almost negligible except from 2011 onwards until 2013.

If net positive emissions were considered (i.e. without the AFOLU sector), ~80% emissions emanated from the Energy sector, ~15% from the IPPU sector and the remaining ~5% from the Waste sector in 2013 (Figure 2). If compared to 2005 values, the Energy sector's contribution to GHG emissions of Daman & Diu increased in almost the same proportion as the decline in the contribution of the IPPU sector.

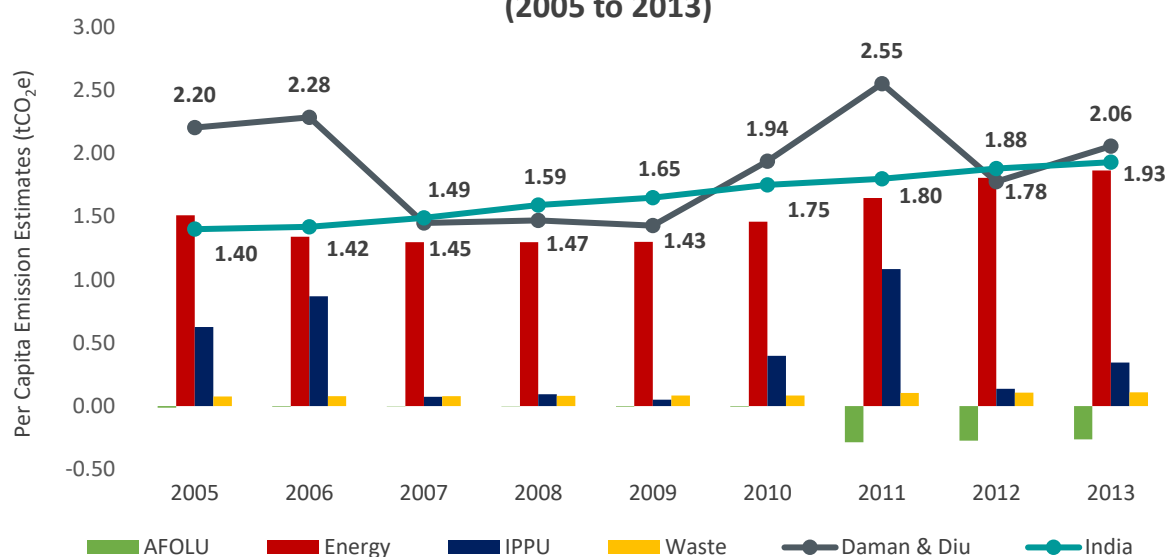
**Figure 2: Sector-wise Contribution to Economy-wide GHG Emissions (Excluding AFOLU) of Daman & Diu**



<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.

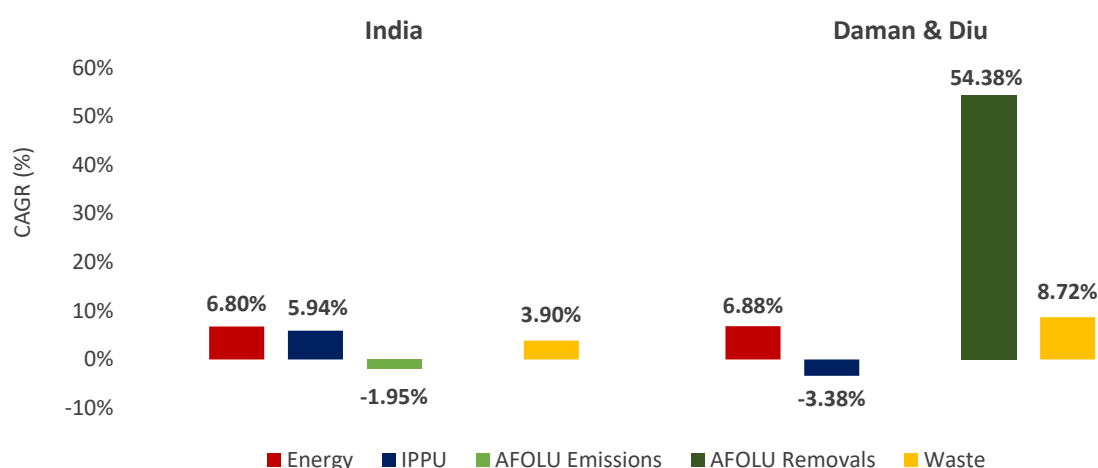
**Figure 3: Per Capita GHG Emissions for Daman & Diu and India (2005 to 2013)**



Per capita GHG emissions from Daman & Diu followed a non-linear trend and declined from 2.20 tCO<sub>2</sub>e in 2005 to 2.06 tCO<sub>2</sub>e in 2013. Per capita emissions peaked and declined during the reference period mainly due to the peaks and troughs exhibited by the IPPU sector. When compared to per capita emissions of India, Daman & Diu recorded higher per capita emissions in 2013. However, the overall trend was highly uneven and between 2007 and 2009, per capita emissions of Daman & Diu were below India's per capita emissions. The compounded annual growth/decline rates of per capita emissions for India and Daman & Diu from 2005 to 2013 were 4.07% (growth) and -0.86% (decline) respectively (Figure 3).

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

*These growth rates have been compounded annually.*



GHG emission removals from the AFOLU sector of Daman & Diu recorded the highest rate of increase of 54.38%<sup>3</sup> from 2005 to 2013 amongst all other sectors (Figure 4). The Waste sector recorded a growth rate of 8.72%, while the IPPU sector recorded a decline and the emissions decreased by 3.38%. When compared to India, the Energy sector of Daman & Diu recorded comparable growth rates i.e. 6.80% for India and 6.88% for Daman & Diu. The AFOLU sector of India was a net emitter of GHGs while the AFOLU sector of Daman & Diu was a net and growing sink of GHGs from 2005 to 2013.

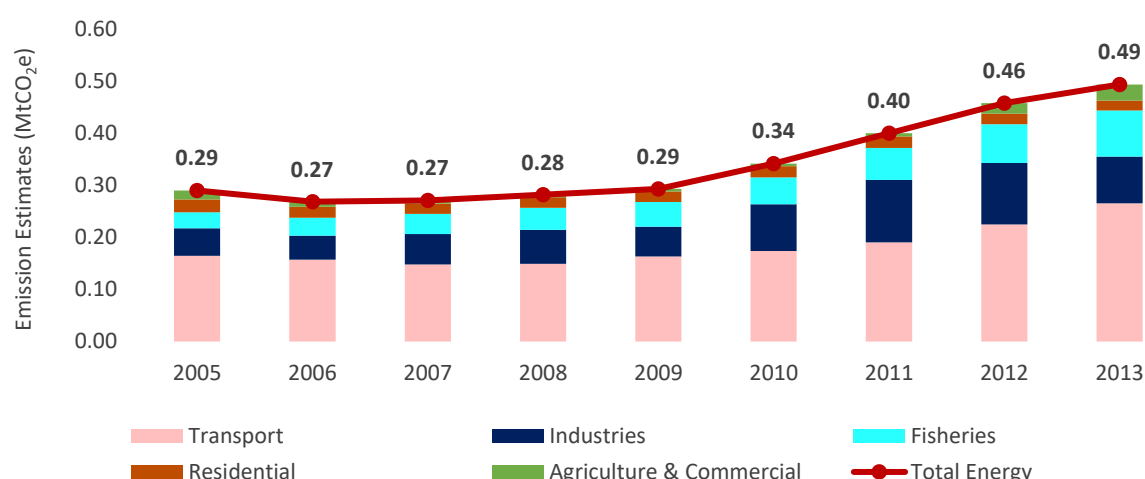
<sup>3</sup> The CAGR value is very high but the corresponding change in absolute emissions was only of the order of 0.067 MtCO<sub>2</sub>e from 2005 to 2013



## Energy Sector

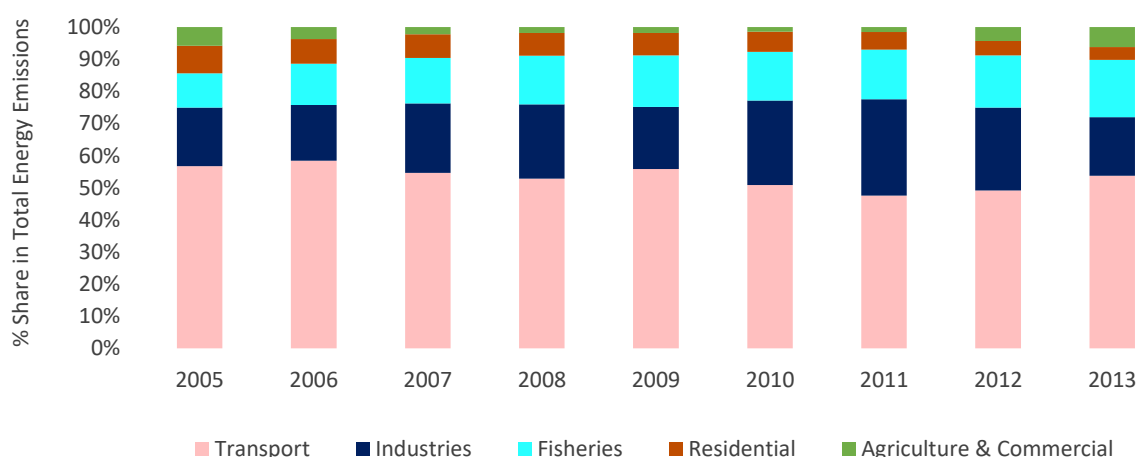
The Energy sector represented nearly 80% of the total emissions of Daman & Diu in 2013 (excluding the AFOLU sector). In general, emissions from the Energy sector arise from two main sub-sectors – Fuel Combustion (Public Electricity Generation, Transport, Industries and Agriculture, Commercial and Residential categories) and Fugitive. In Daman & Diu, emissions were only from Fuel Combustion sub-sector. The Energy sector emissions increased at an observed CAGR of 6.88% from 0.29 MtCO<sub>2</sub>e in 2005 to 0.49 MtCO<sub>2</sub>e in 2013 (Figure 5).

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



Transport was a major category under the Fuel Combustion sub-sector with ~54% contribution in Daman & Diu's Energy emissions portfolio followed by ~18% contribution from the Industries and Fisheries category each in 2013 (Figure 6). Under the Transport category, ~99% emissions were from Road Transport alone. The total emissions from the Transport category increased at an estimated CAGR of 6.17% with its emissions increasing from 0.16 MtCO<sub>2</sub>e in 2005 to 0.27 MtCO<sub>2</sub>e in 2013. No emissions were reported from the Public Electricity Generation category throughout the reference period.

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

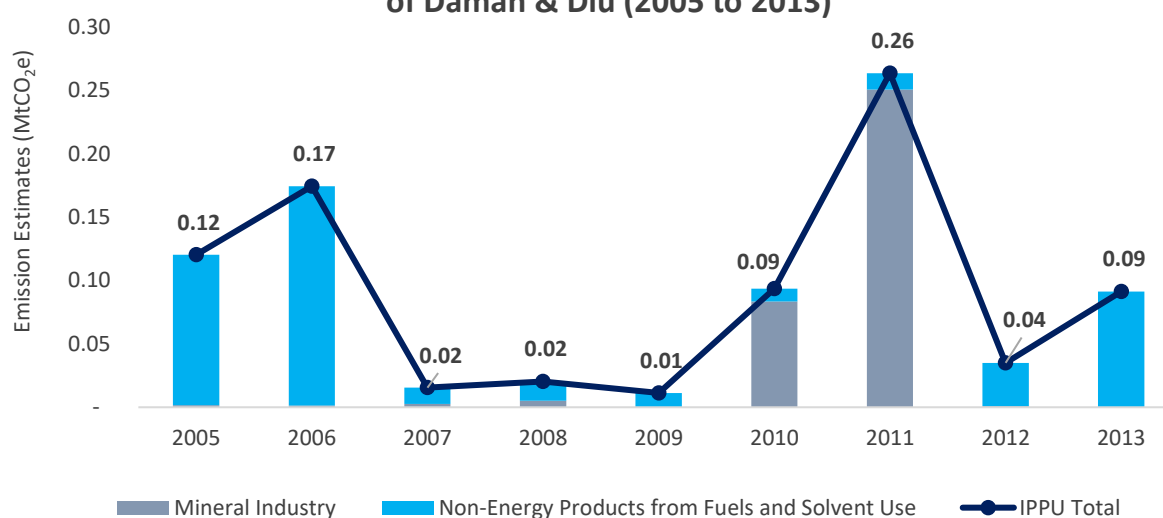




## IPPU Sector

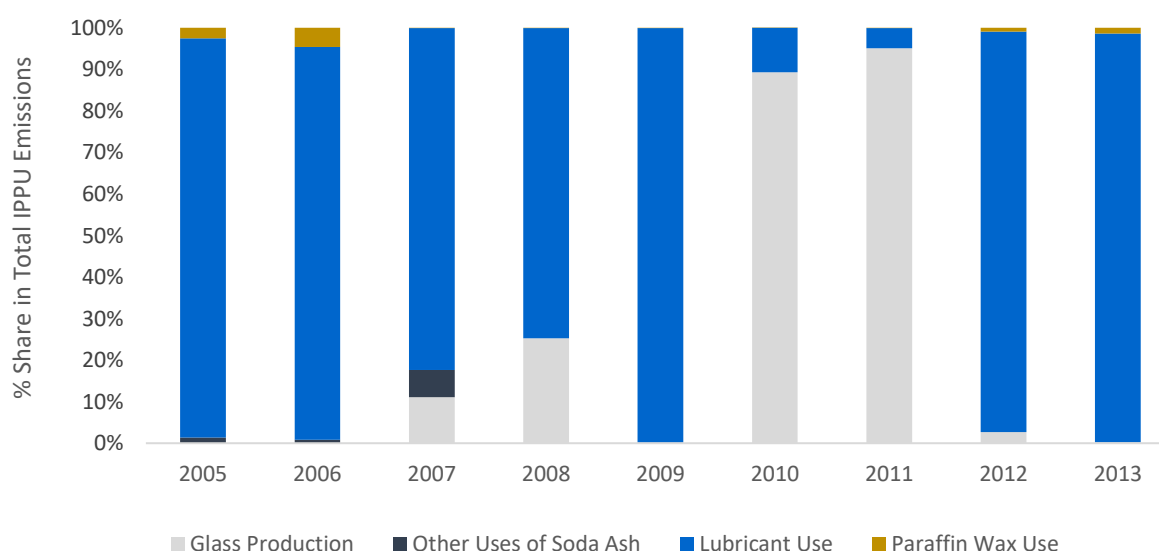
The IPPU sector represented ~15% of the total emissions (if values were considered excluding the AFOLU sector) of Daman & Diu in 2013. Emissions from the IPPU sector are largely driven by Chemical, Metal, Mineral Industries and Non-Energy Products from Fuels and Solvent Use. In Daman & Diu, IPPU emissions showed a non-linear trend. Between 2005 and 2013, the overall IPPU emissions declined at a rate of 3.38% (compounded annually) from 0.12 MtCO<sub>2</sub>e in 2005 to 0.09 MtCO<sub>2</sub>e in 2013. Majority of the emissions from 2005 to 2013 arose from Non-Energy Products from Fuels and Solvent Use except in 2010 and 2011 where an interim peak was observed as major emissions emanated from the Mineral Industries (Figure 7). No emissions were observed from Chemical & Metal Industries over the years in reference.

**Figure 7: GHG Emission Estimates for IPPU Sector of Daman & Diu (2005 to 2013)**



A detailed trend of GHG emissions by various IPPU categories is depicted in Figure 8 below. Lubricant Use was a key driver of the IPPU emissions across all the reference years except 2010 and 2011 where Glass Production was the major contributor of emissions. Significant emissions from Glass Production were also observed in 2007 and 2008.

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

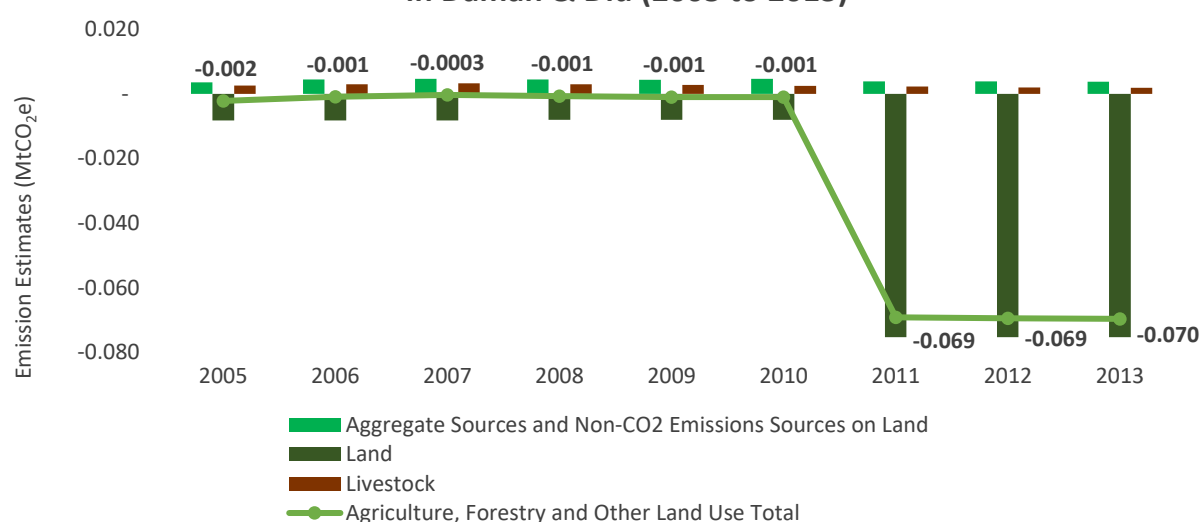




## AFOLU Sector

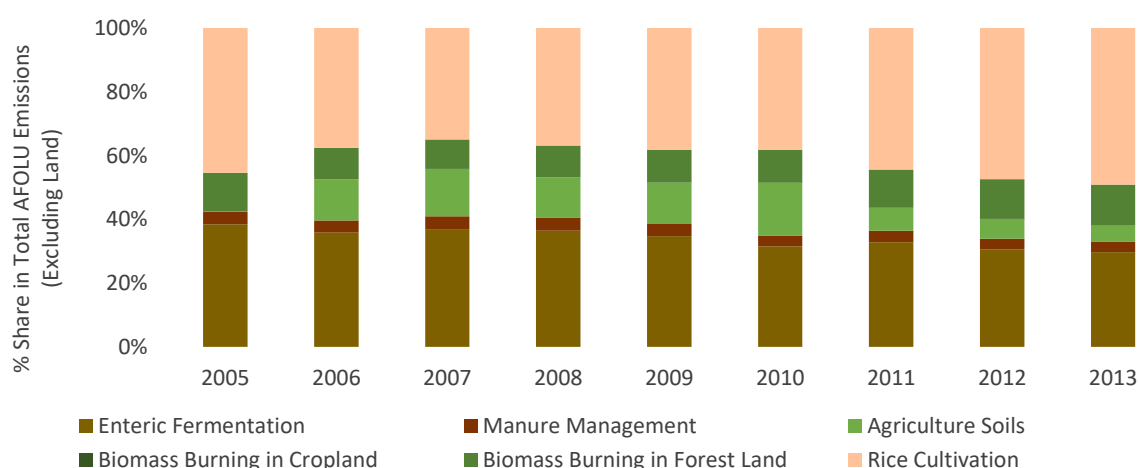
The AFOLU sector of Daman & Diu was a net sink of GHGs from 2005 to 2013. Emissions/removals from this sector arise from three main sub-sectors namely Livestock, Land and Aggregate Sources and Non-CO<sub>2</sub> Emissions Sources on Land. The removals increased at an observed CAGR of 54.38%<sup>4</sup> from 0.002 MtCO<sub>2</sub>e in 2005 to 0.07 MtCO<sub>2</sub>e in 2013 in the UT. Notably, Land sub-sector was a sink across all years from 2005 to 2013. The reason for the high increase in removals from AFOLU sector can be attributed to the increase in absorption/removals from Land due to some gain in forest area and a simultaneous decrease in emissions from Aggregate Sources and Non-CO<sub>2</sub> Emissions Sources on Land and Livestock sector in Daman & Diu.

**Figure 9: GHG Emission Estimates for AFOLU Sector in Daman & Diu (2005 to 2013)**



If only positive emissions were considered, maximum emissions in the year 2013 were from Aggregate Sources and Non-CO<sub>2</sub> Emissions Sources on Land. Under this sub-sector, Rice Cultivation was the major contributor of emissions. The share of emissions from this category rose from ~45% in 2005 to ~49% in 2013. (Figure 10). Enteric Fermentation (~30%) was the second major contributor of GHG in 2013. Emissions from Enteric Fermentation had shown a decline from 2005 to 2013 in the UT which was perhaps a reflection of decreased dairy and other associated activities in the animal husbandry sector.

**Figure 10: Share of GHG Emissions from AFOLU Categories (Excluding Land)**



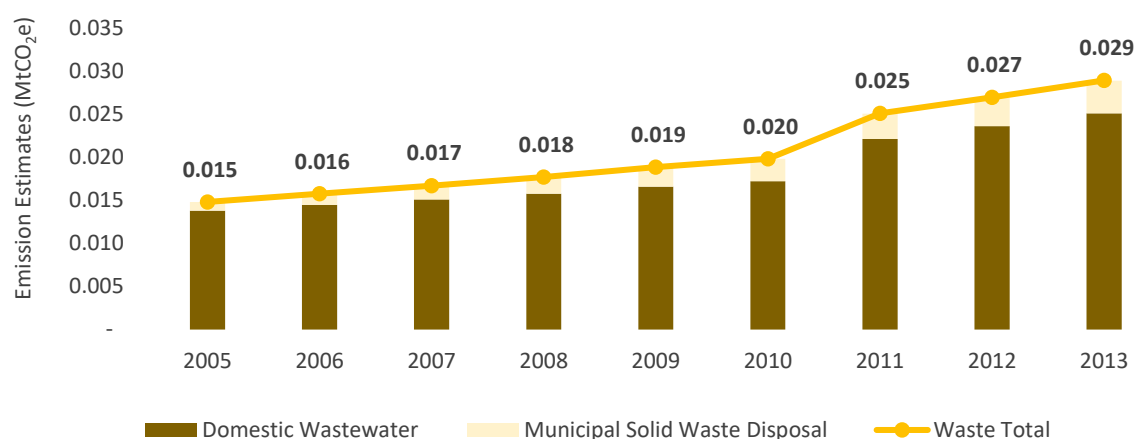
<sup>4</sup> The CAGR value is very high but the corresponding change in absolute emissions was only of the order of 0.067 MtCO<sub>2</sub>e from 2005 to 2013



## Waste Sector

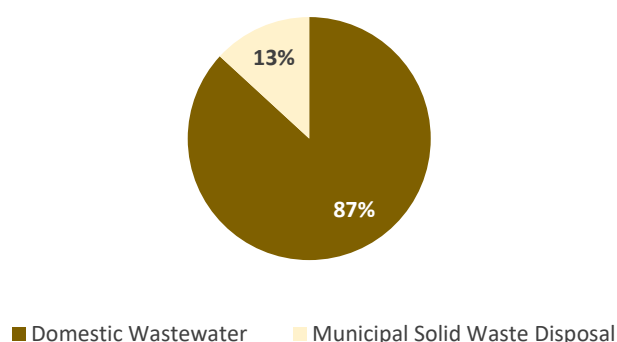
The Waste sector contributed ~5% of total emissions of Daman & Diu in 2013 (excluding the AFOLU sector). Municipal Solid Waste<sup>5</sup>, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. The Waste sector emitted 0.015 MtCO<sub>2</sub>e in 2005 which increased to 0.029 MtCO<sub>2</sub>e in 2013. GHG emissions from Waste grew at a CAGR of 8.72% from 2005 to 2013 (Figure 11). The emissions from the Waste sector in Arunachal Pradesh followed an almost linear trend until 2011. Notably, a spike in the overall emissions was observed in 2011 which can be attributable 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 Daman & Diu (2005 to 2013)**



In Daman & Diu, maximum Waste sector emissions (~87%) arose from Domestic Wastewater from rural and urban areas and had increased at a CAGR of 7.75% from 0.014 MtCO<sub>2</sub>e in 2005 to 0.025 MtCO<sub>2</sub>e in 2013. Almost 62% Domestic Wastewater emissions emanated from the urban areas of Daman & Diu 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 to the remaining 13% of the Waste sector 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 Daman & Diu and emissions from this category had increased at 18.07% (CAGR) from 0.001 MtCO<sub>2</sub>e in 2005 to 0.004 MtCO<sub>2</sub>e in 2013. No emissions were recorded from Industrial Wastewater sector in Daman & Diu (Figure 12).

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



<sup>5</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'



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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.

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

**Center for Study of Science, Technology and Policy (CSTEP)** is a not for profit research organisation incorporated in 2005 u/s 25 of The Companies Act, 1956.

**ICLEI - Local Governments for Sustainability** is a leading global network of over 1,500 cities, towns and regions committed to building a sustainable future.

**Shakti Sustainable Energy Foundation** works to strengthen the energy security of the country by aiding the design and implementation of policies that encourage energy efficiency, renewable energy and sustainable transport solutions.

**Vasudha Foundation**, set up in 2010, is a not for profit organisation, working in the clean energy and climate policy space.

**WRI-India** is a research organization that turns big ideas into action at the nexus of environment, economic opportunity and human well-being.

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