

Trend Analysis of GHG Emissions of PUDUCHERRY

GHG Platform India is a civil society initiative providing an independent estimation and analysis of India's Greenhouse Gas (GHG) emissions across key sectors.

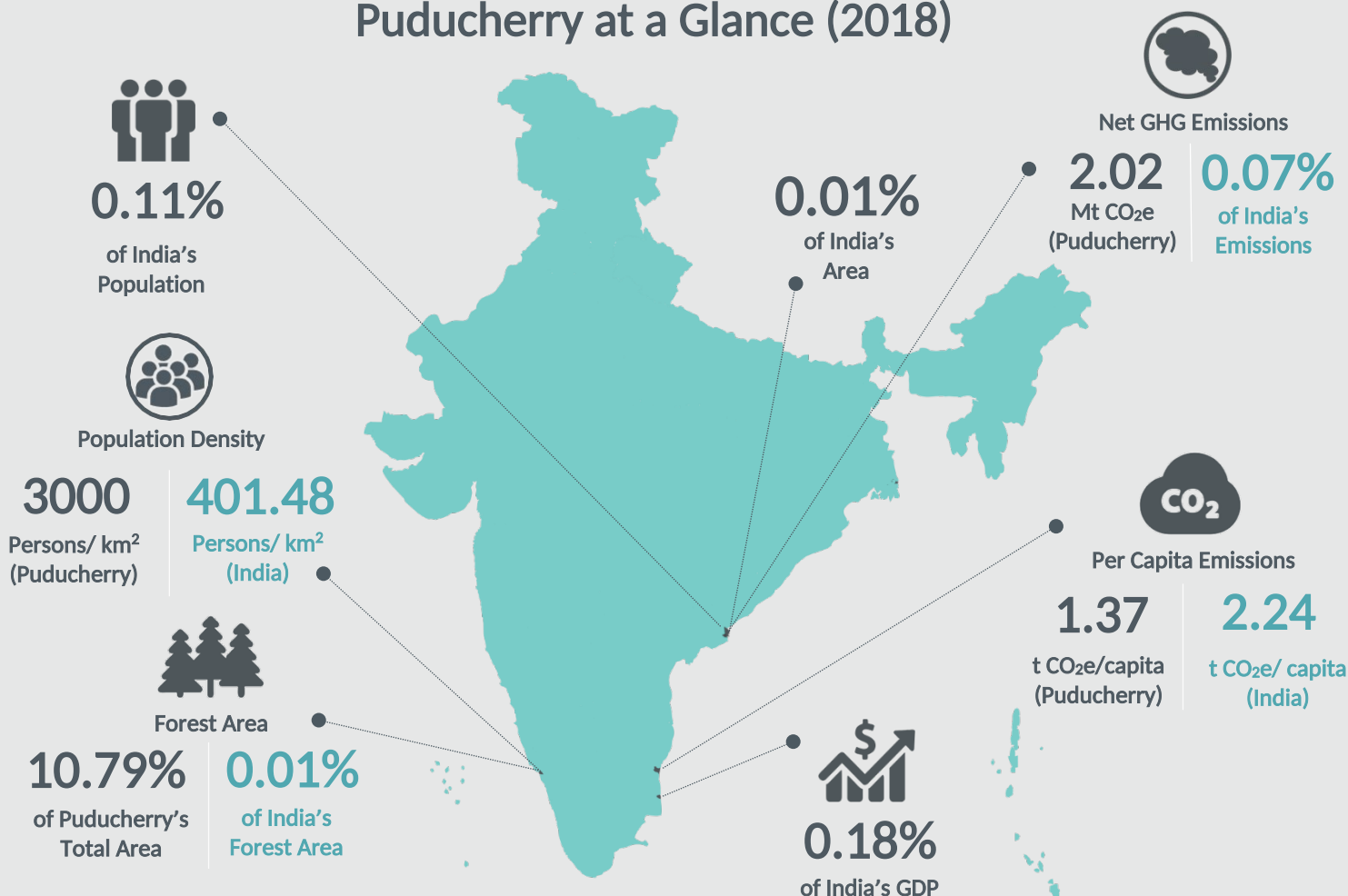
The Platform seeks to add value to the various ongoing GHG emissions estimation efforts by helping address existing data gaps and data accessibility issues, extending beyond the scope of national inventories to state inventories, and by increasing the volume of analytics and policy dialogue on India's 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) and direct fuel combustion (industrial energy) has been reported under energy sector.

Puducherry at a Glance (2018)

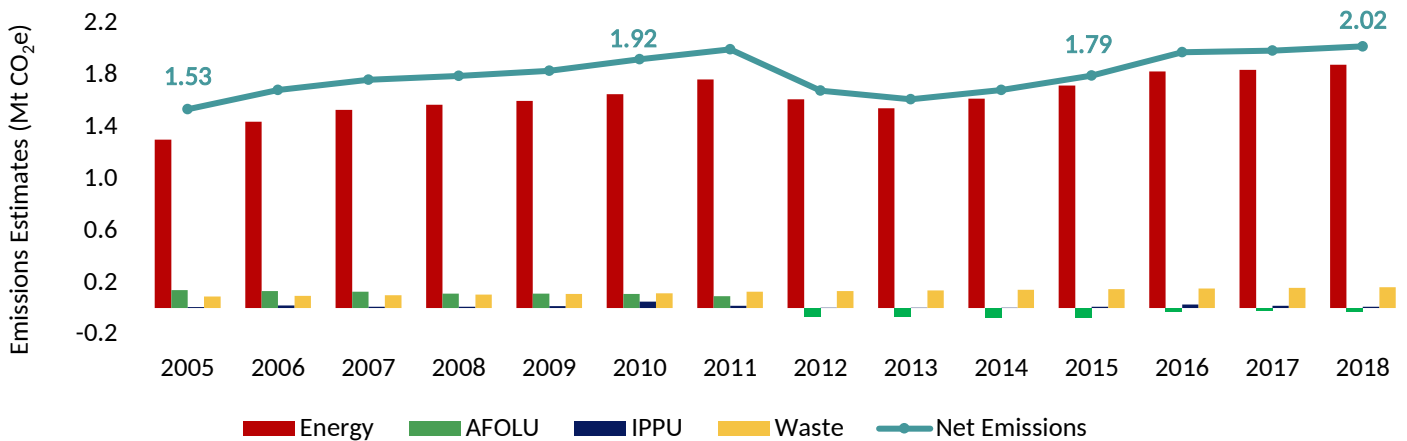


*Mt CO₂e – Million Tonnes of Carbon Dioxide Equivalent | CAGR – Compound Annual Growth Rate

**The map represents the data for 2018. The four regions of Puducherry UT are at different geographical locations as shown in the map above. It may be noted that all the information given above (and in this document) is for the entire UT and not for a particular region of Puducherry.

Economy-wide Emissions Estimates

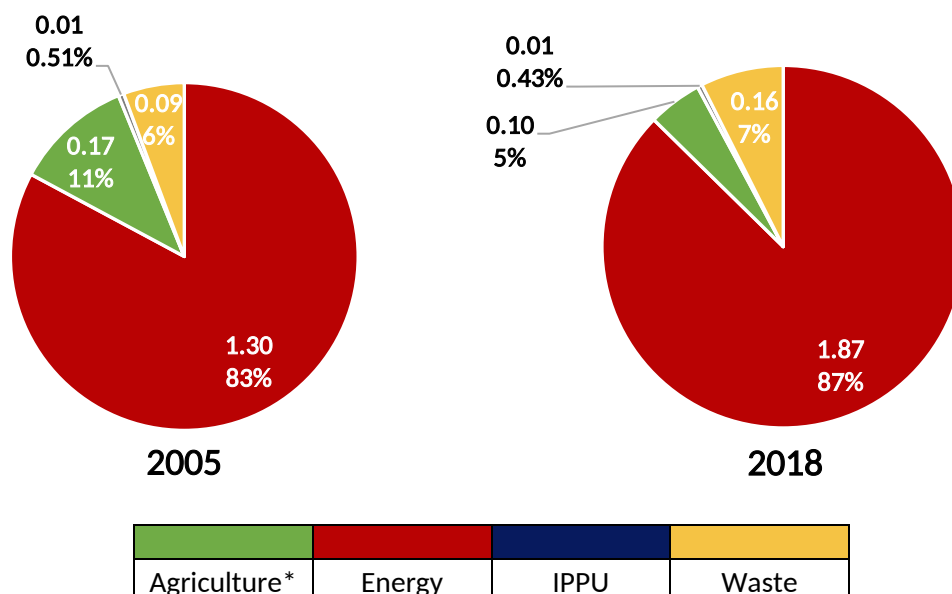
Figure 1: GHG Emissions Estimates of Puducherry (2005 to 2018)



Emissions of Puducherry increased at an estimated CAGR of 2.14%, from 1.53 Mt CO₂e in 2005 to 2.02 Mt CO₂e in 2018. Energy sector was the major contributor to Puducherry’s GHG emissions, throughout the reference period (see Figure 1). The economy-wide emissions peaked in 2011 at 1.99 Mt CO₂e. This was followed by a slight dip in total GHG emissions from 2012 to 2014 which was due to decline in emissions from Energy sector, coupled with increase in removals from Agriculture, Forestry and Other Land Use (AFOLU) sector. Puducherry’s net emissions began to grow again from 2014 onwards owing to the increased emissions from Energy sector. The AFOLU sector was a net emitter till 2011 and became a net sink from 2012 onwards.

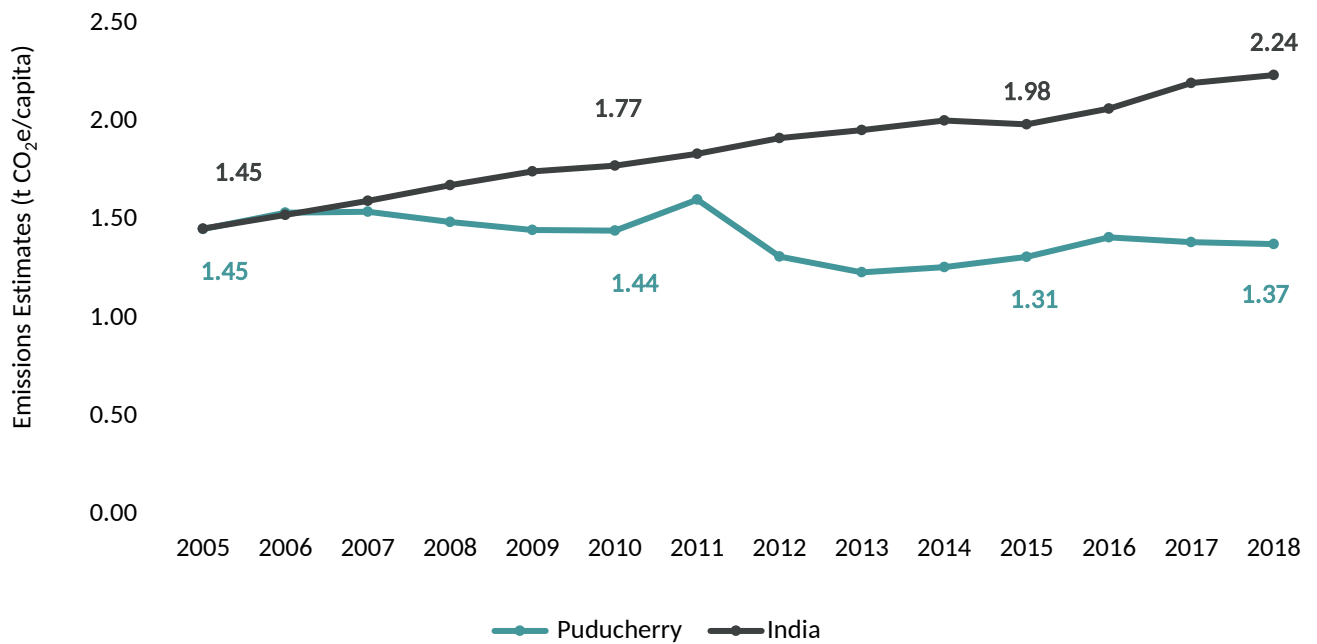
In 2005, the share of Energy sector in gross economy-wide emissions (excluding Land sub-sector within AFOLU) was ~83%. This was followed by Agriculture sector, Waste sector and Industrial Processes and Product Use (IPPU) sectors with shares of ~11%, ~6% and ~0.51%, respectively. In 2018, the share of Energy sector emissions increased to ~87% of the gross economy-wide emissions (excluding Land sub-sector within AFOLU). Similarly, share of Waste sector increased to ~7%, whereas share of emissions from Agriculture (excluding the Land sub-sector in AFOLU) declined to ~5% in 2018. In the same year, IPPU sector’s share reduced nominally to ~0.43%.

Figure 2: Sector-wise Contribution (Mt CO₂e) and Percentage Share in Gross Economy-wide GHG Emissions (without Land sub-sector within AFOLU) of Puducherry



* For the purpose of this comparison, agriculture emissions do not include removals from lands and forests. For further details, please see the section on AFOLU emissions below.

Figure 3: Per Capita Net GHG Emissions of Puducherry and India (2005 to 2018)



Per capita emissions of Puducherry were lower as compared to India's per capita emissions across the reference years (see Figure 3). The per capita emissions of Puducherry declined at the rate of 0.42% (compounded annually) from 1.45 tCO₂e/capita in 2005 to 1.37 tCO₂e/capita in 2018, which was lower than India's CAGR (~3.41%).

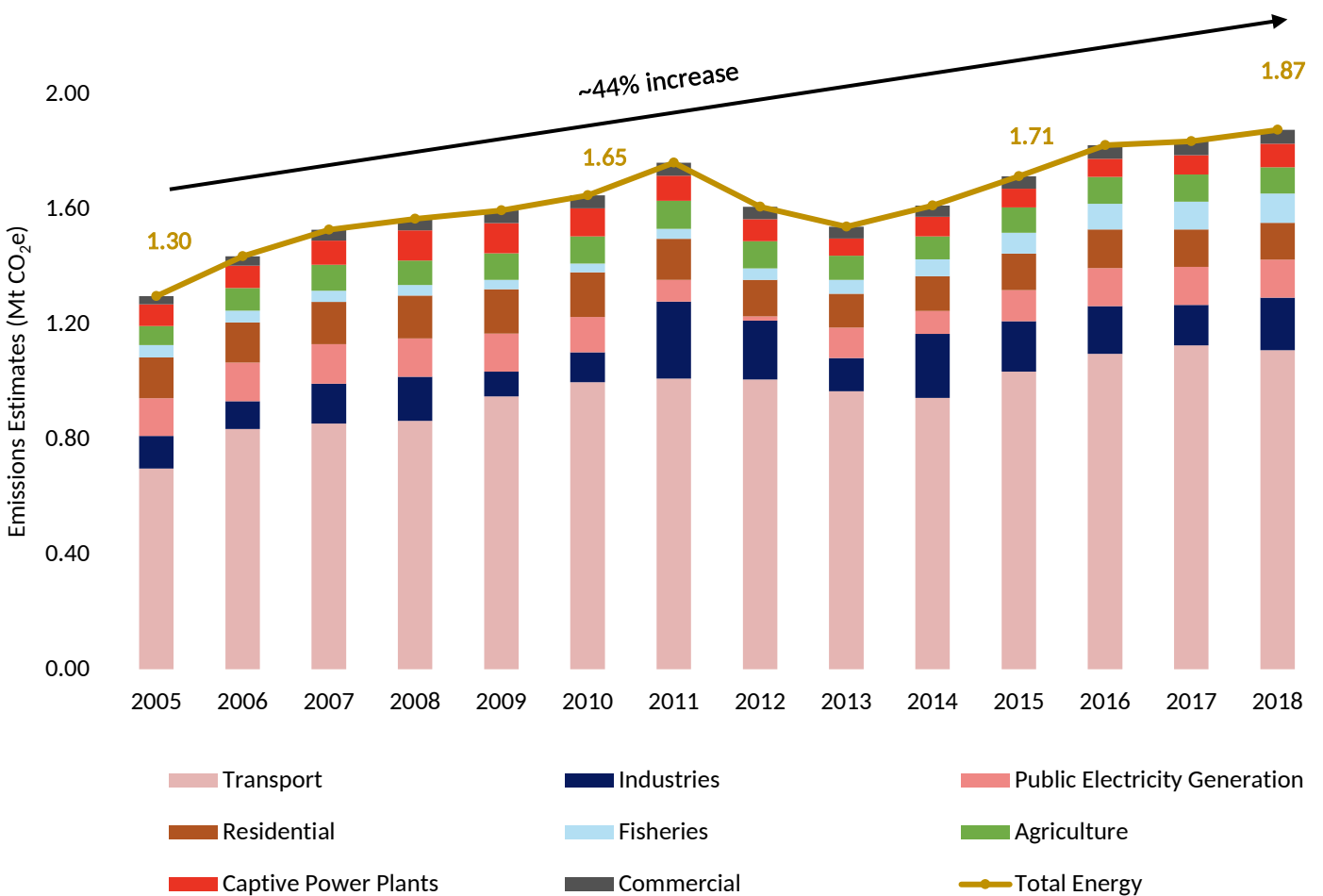
Energy Sector



The Energy sector emissions comprise of emissions from Fuel Combustion and Fugitive Emissions. Fuel Combustion includes emissions from Public Electricity Generation, Transport, Captive Power Plants, Industries, Agriculture, Commercial, and Residential categories. Fugitive Emissions are due to Fuel Production.

The Energy sector of Puducherry represented nearly ~87% of gross economy-wide emissions (excluding Land sub-sector within AFOLU) in 2018. Energy sector emissions in the state increased at a CAGR of 2.88%, from 1.30 Mt CO₂e in 2005 to 1.87 Mt CO₂e in 2018 (see Figure 4). However, the emissions from the Energy sector decreased between 2012 and 2014, owing to the reduction in emissions from the Transport category, but they began to rise again after 2013.

Figure 4: GHG Emissions Estimates of Energy Sector - Puducherry (2005 to 2018)



Within the Energy sector, Transport category was the major contributor to the GHG emissions with a share of ~59% in 2018. This was followed by Industrial Energy (~10%) category, Residential and Public Electricity Generation categories both with shares of ~7% each, in 2018 (see Figure 5).

Within the Fuel Combustion sub-sector, Liquid Petroleum Fuels were the major contributor to the GHG emissions across the reference years, with an average share of ~79%. This was followed by Gaseous Petroleum Fuels with an average share of ~19% between 2005 and 2018. Coal and Other Fuels contributed an average share of ~1% each to Fuel Combustion, during the reference years (see Figure 6).

Figure 5: Category-wise Emissions (Mt CO₂e) and Percentage Share in Total Energy Sector Emissions (2018)

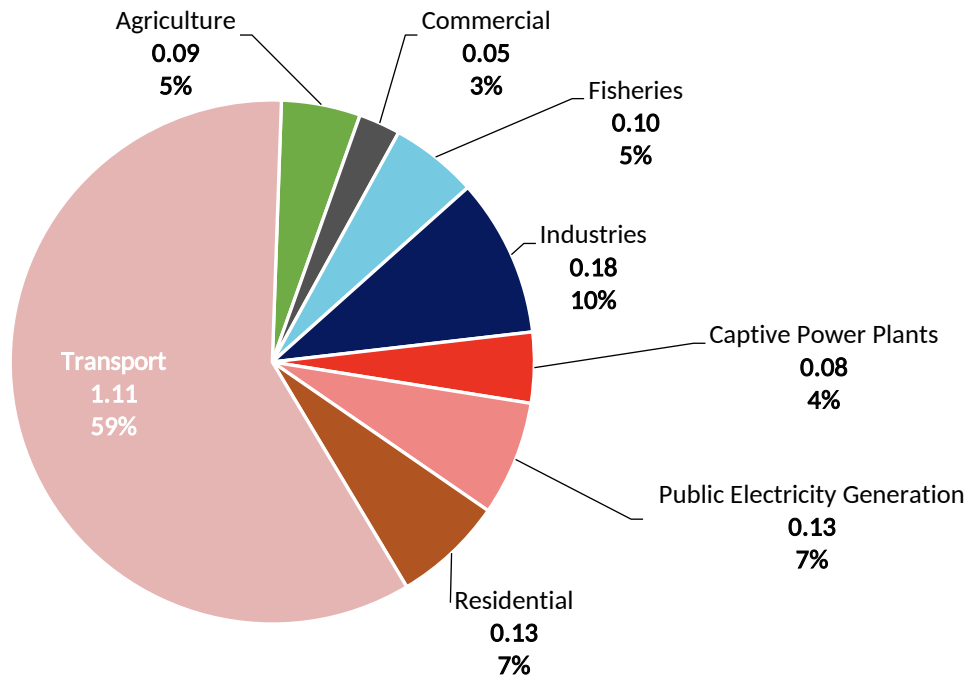
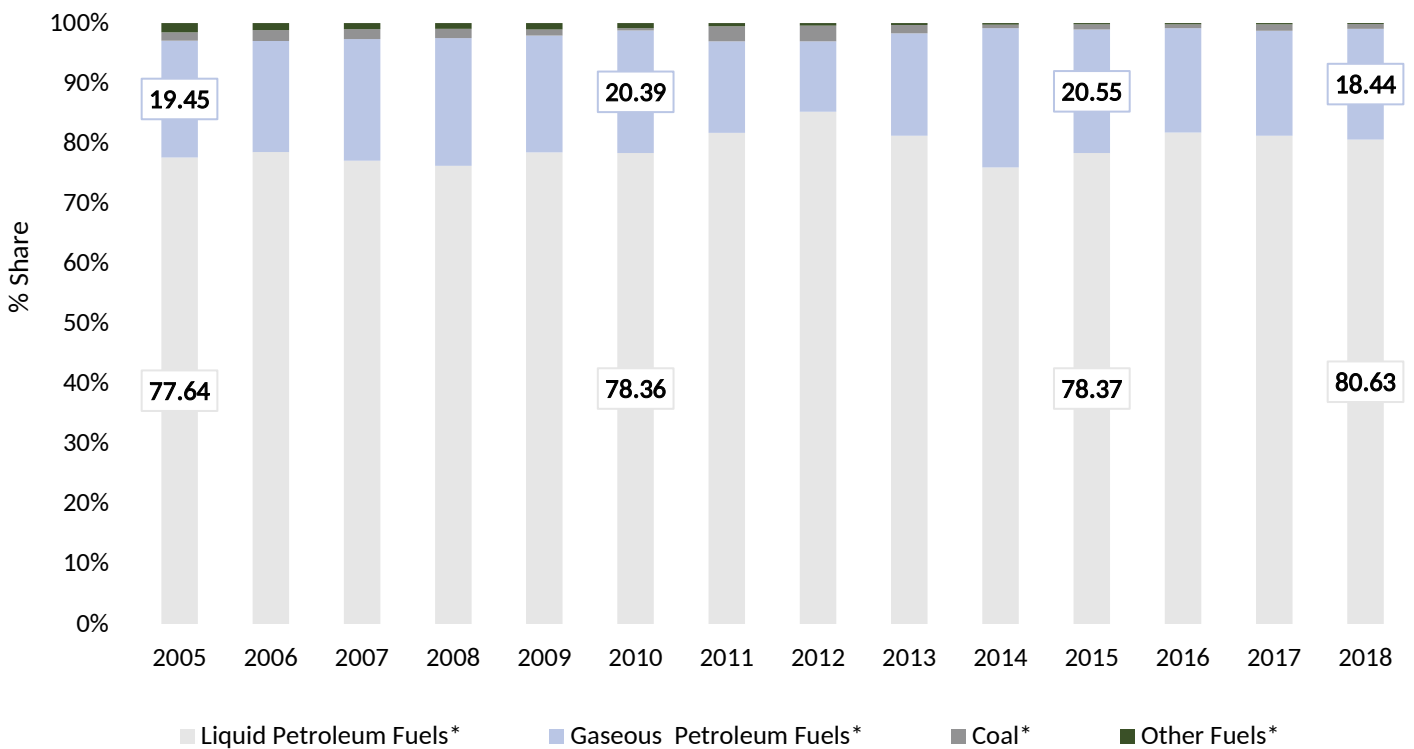


Figure 6: Percentage Share of GHG Emissions by Fuel Type due to Fuel Combustion in Energy Sector (2005 to 2018)



***Notes -**

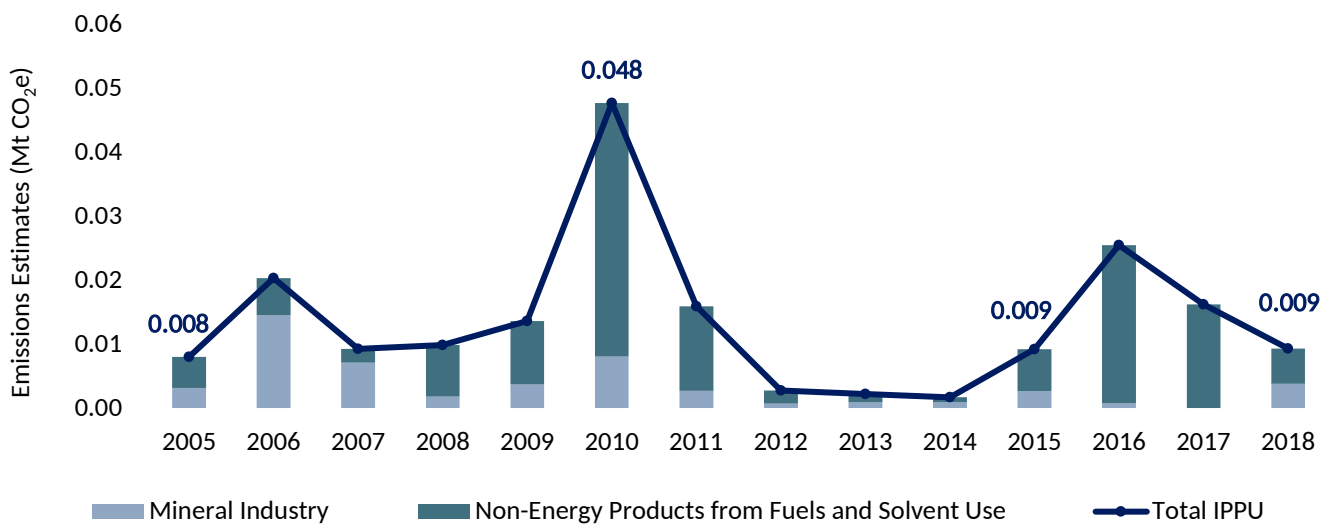
1. Coke is included in Coal because the bifurcation of pet-coke and coke was not available
2. Liquid Petroleum Fuels - ATF, diesel, kerosene, motor spirit and other liquid fuels.
3. Gaseous Petroleum Fuels - natural gas, LPG and other gaseous fuels
4. Other Fuels comprises of firewood and charcoal



IPPU Sector

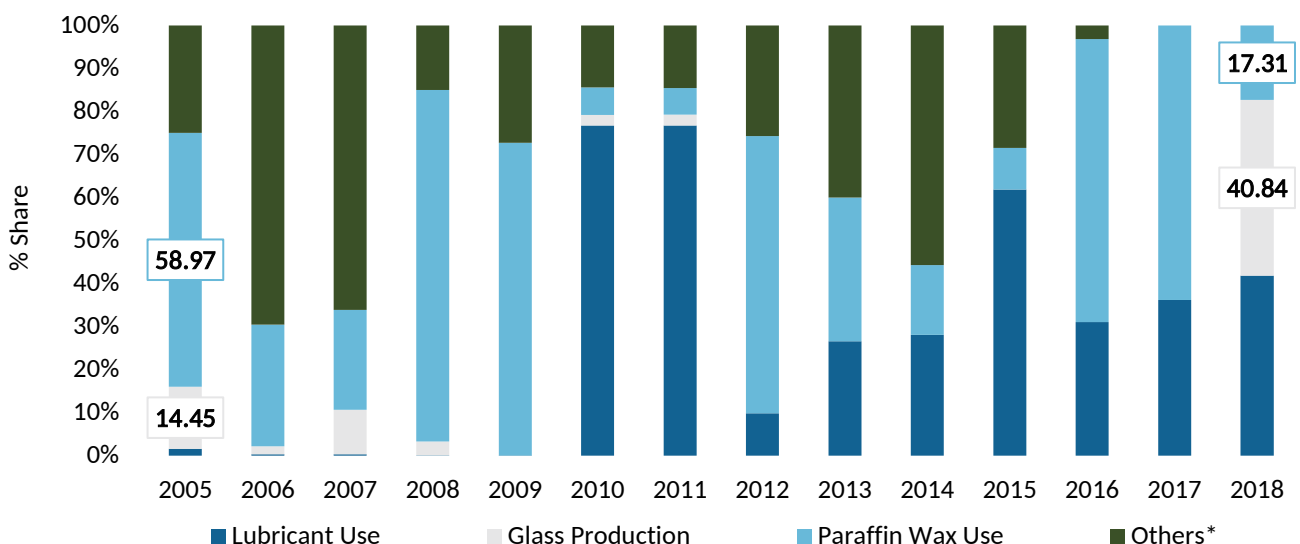
Emissions from the Industrial Processes and Product Use (IPPU) sector are largely driven by Chemical, Metal, Mineral Industries and Non-Energy Products from Fuels and Solvent Use. In Puducherry, the key contributing industrial sub-sectors were Mineral and Non-Energy Products from Fuels and Solvent Use. The IPPU sector represented ~1% of the gross economy-wide emissions (excluding Land sub-sector within AFOLU) in 2018. The emissions from the IPPU sector grew at a CAGR of 1.15% from 0.008 Mt CO₂e in 2005 to 0.009 Mt CO₂e in 2018 (see Figure 7). Significant emissions were also registered from Non-Energy Products from Fuels and Solvent Use sub-sector. Notably, a peak was observed in 2010 due to the increase in the emissions from the Lubricant Use from the Non-Energy Products from Fuels and Solvent Use sub-sector, which declined subsequently. Another peak was observed in 2016 due to increase in emissions from Paraffin Wax Use from the same sub-sector, which also declined subsequently.

Figure 7: GHG Emissions Estimates of IPPU Sector - Puducherry (2005 to 2018)



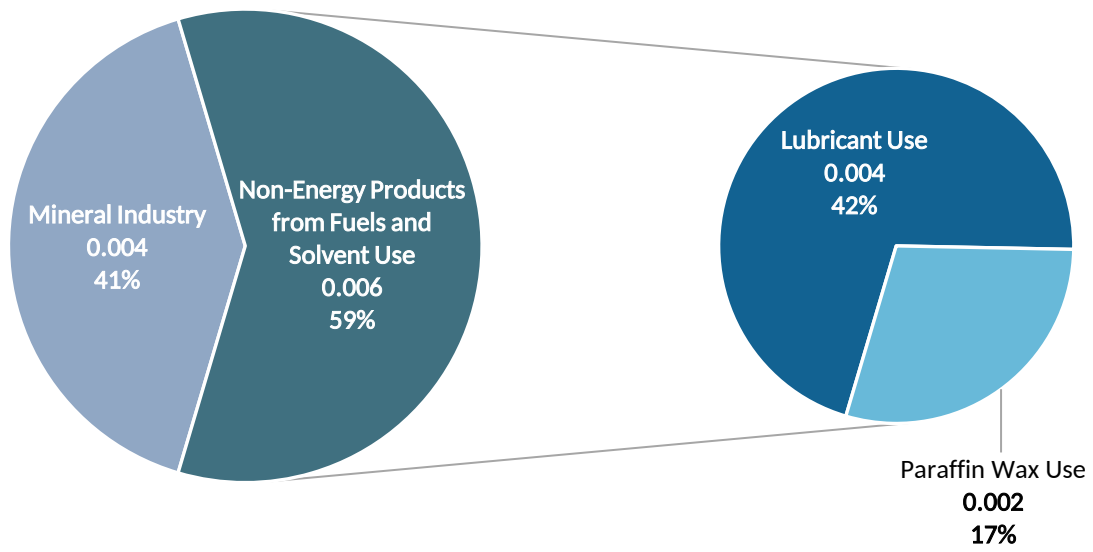
In 2018, Lubricant Use accounted for ~42% of overall IPPU sector emission, followed by Glass Production (~17%) and Paraffin Wax Use (~17%) categories. Share of emissions from Lubricant Use increased from ~2% in 2005 to ~42% and that of Glass Production increased from ~14% in 2005 to ~17%. Whereas, the share of emissions from Paraffin Wax Use declined from ~59% in 2005 to ~17% in 2018 (see Figures 8 and 9).

Figure 8: Percentage Share of GHG Emissions from IPPU Categories (2005 to 2018)



*Others category includes Ceramics and Other Uses of Soda Ash categories

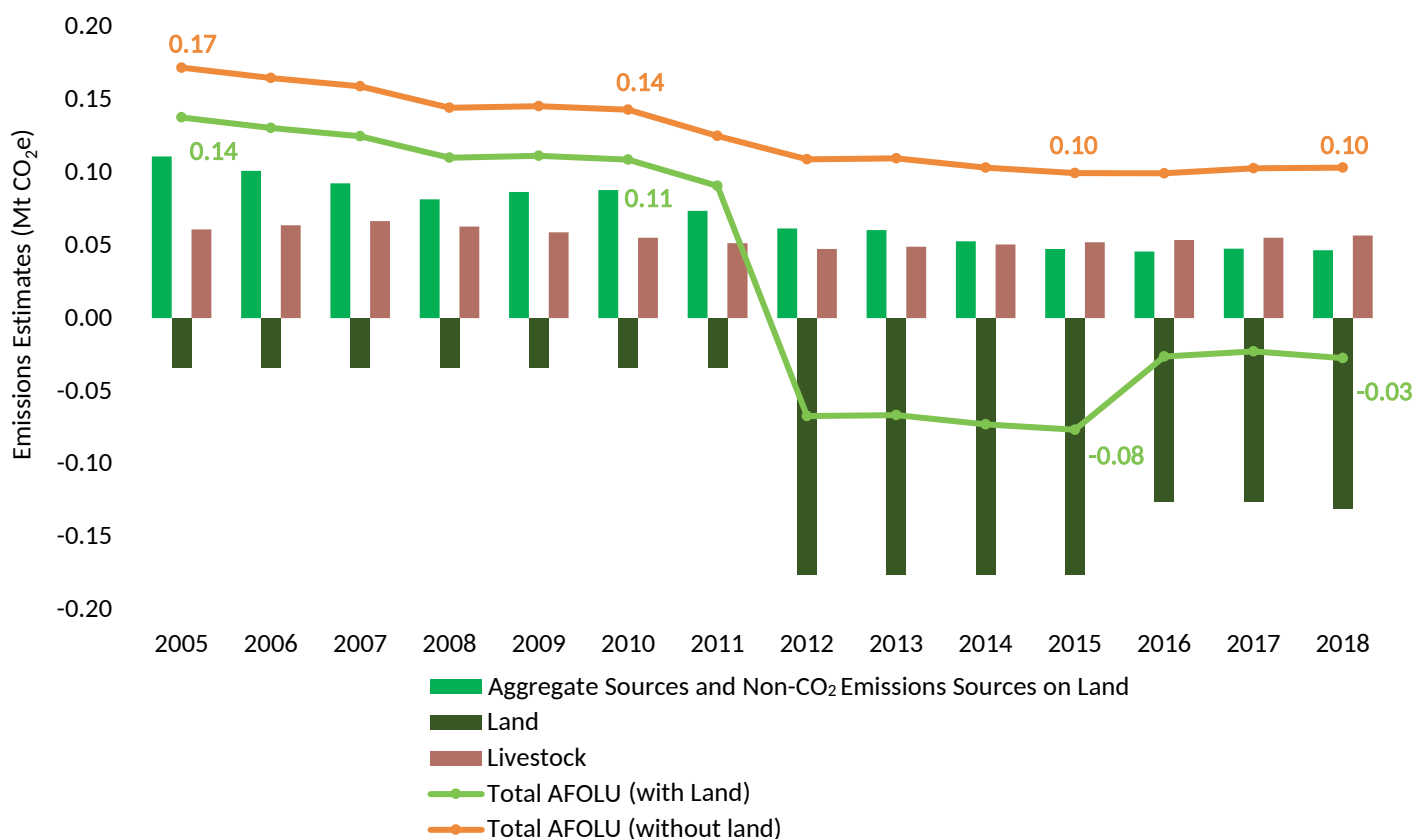
Figure 9: Sub-Sector Emissions (Mt CO₂e) and Percentage Share in Total IPPU Emissions (2018)





Emissions from the Agriculture, Forestry and Other Land Use (AFOLU) sector arise from three main sub-sectors, namely Livestock, Land and Aggregate Sources and Non-CO₂ Emissions Sources on Land*. In Puducherry, while the Livestock and Aggregate Sources and Non-CO₂ Emissions Sources on Land sub-sectors were net GHG emitters, the Land sub-sector was a sink throughout the reference period. Notably, net AFOLU emissions declined at a rate of 6.70% (compounded annually) from 0.14 Mt CO₂e in 2005 to 0.09 Mt CO₂e in 2011. Post 2011, the overall AFOLU sector became a net sink of emissions, which can be attributed to the increase in the removals from Agricultural Land and Other Land categories (see Figure 10). Further, there is a noticeable reduction in AFOLU sink between 2016 and 2018. This dip can be attributed to relatively smaller increase in forest area and overall decline in carbon stock density of the forests as reported by Forest Survey of India (2021)**. The average annual removals from the Land Sub-Sector in Puducherry during the reference period were 0.09 Mt CO₂e, around ~74.50% of the average annual gross AFOLU emissions (excluding Land sub-sector) (see Figure 10).

Figure 10: GHG Emissions Estimates of AFOLU Sector - Puducherry (2005 to 2018)



The Livestock sub-sector of Puducherry had the maximum share of ~55% in the gross AFOLU emissions (excluding Land sub-sector) in 2018. Within Livestock sub-sector, Enteric Fermentation category was the major contributor to gross AFOLU emissions, throughout the reference period, with an average share of ~41%. Emissions from this category declined at a rate of 0.52% from 0.06 Mt CO₂e in 2005 to 0.05 Mt CO₂e in 2018.

Within the Aggregate Sources sub-sector, Agriculture Soils and Rice Cultivation were major contributors to gross AFOLU emissions with average shares of ~33% and ~21%, respectively, during the reference period. The share of emissions from Agriculture Soils reduced from ~45% in 2005 to ~20% in 2018, whereas, the share of emissions from Rice Cultivation increased from ~19% in 2005 to ~24% in 2018 (see Figures 11 and 12).

* The sub-sector called 'Aggregate Sources and Non-CO₂ Emission Sources on Land' includes emissions from Rice Cultivation, Agriculture Soils and Biomass Burning in Cropland and Forestland.

** FSI Report 2021 reports data for 2019

Figure 11: Category-wise Emissions (Mt CO₂e) and Percentage Share in Gross AFOLU Emissions (excluding Land sub-sector) (2018)

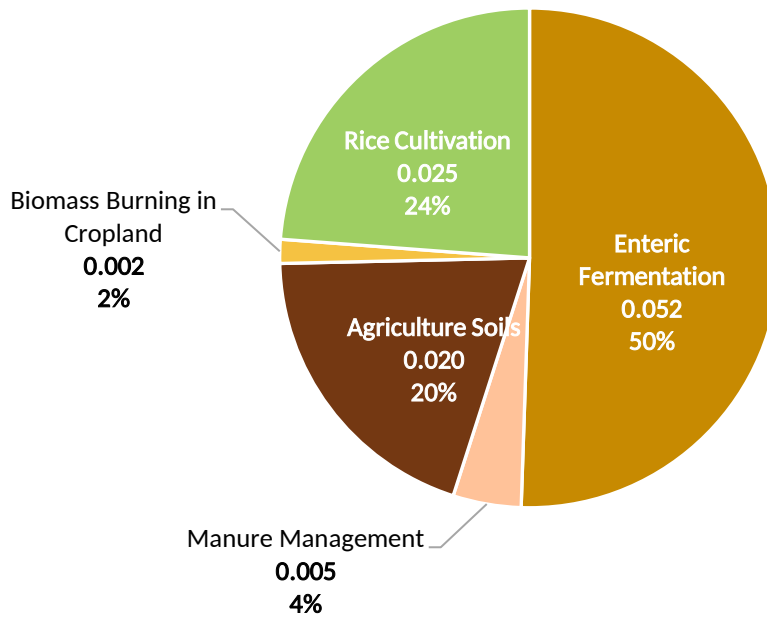
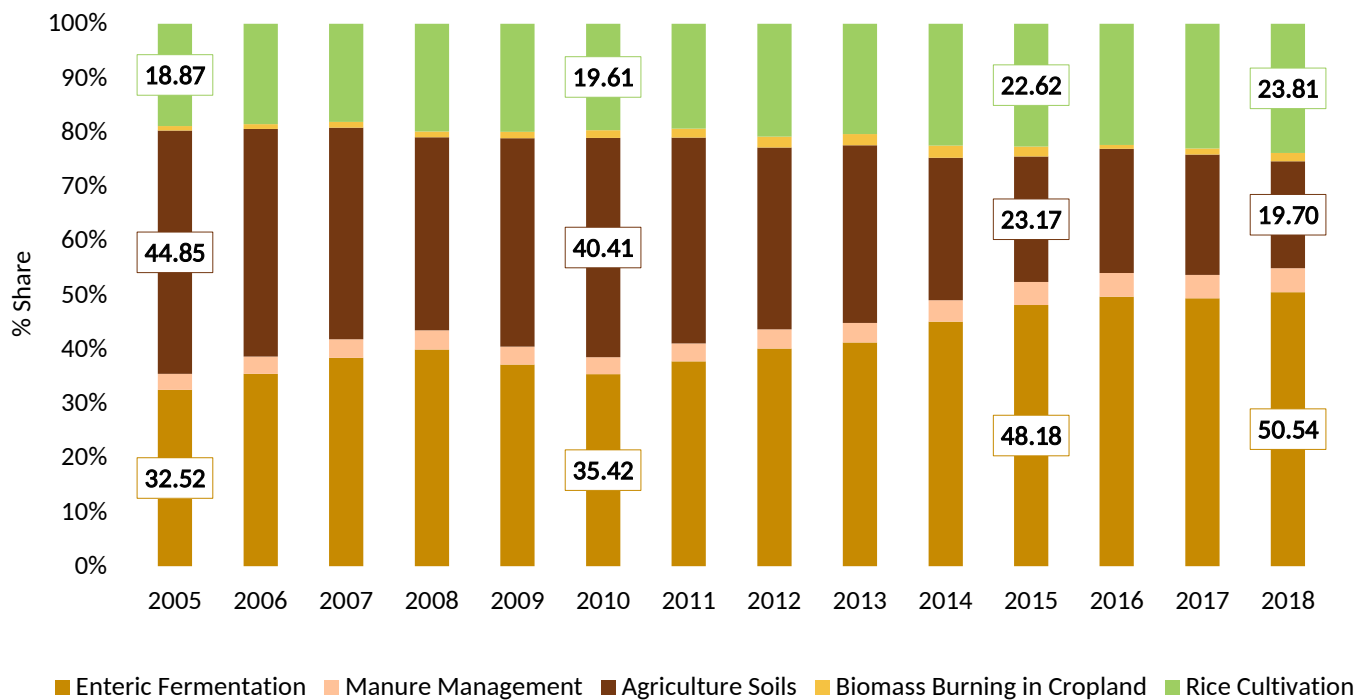


Figure 12: Category-wise Share of Gross AFOLU Emissions (excluding Land sub-sector) (2005 to 2018)

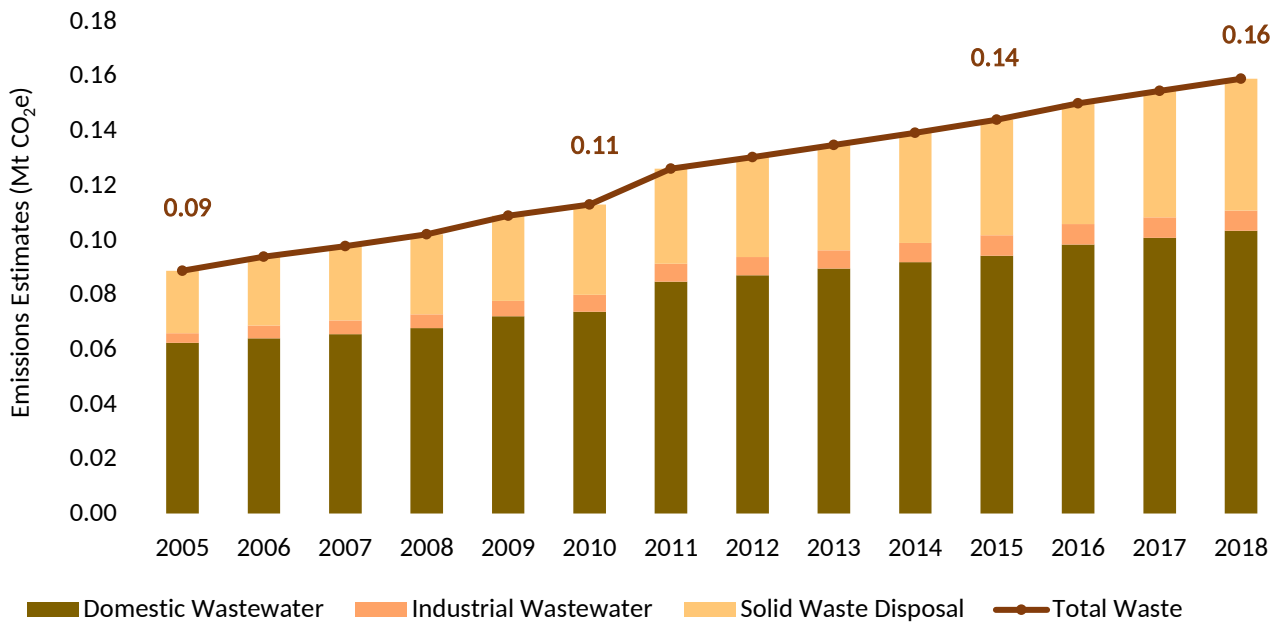




Waste Sector

Solid Waste Disposal, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. In Puducherry, the Waste sector contributed to almost ~7% of gross economy-wide emissions (excluding Land sub-sector within AFOLU), in 2018. Emissions from the Waste sector increased at a CAGR of 4.58% from 0.09 Mt CO₂e in 2005 to 0.16 Mt CO₂e in 2018 primarily due to rising emissions from Domestic Wastewater (see Figure 13).

Figure 13: GHG Emissions Estimates of Waste Sector - Puducherry (2005 to 2018)



Discharge of untreated wastewater and use of septic tanks are the key drivers of emissions due to Domestic Wastewater sub-sector. Domestic Wastewater had a share of ~65% in the total Waste sector emissions of Puducherry in 2018. Nearly, ~30% of the Waste sector emissions were from Solid Waste Disposal in 2018 and these emissions grew at an estimated CAGR of 5.91% from 0.02 Mt CO₂e in 2005 to 0.05 Mt CO₂e in 2018. Industrial Wastewater accounted for nearly ~5% of Waste sector emissions in 2018, which grew at a CAGR of 5.98% from 0.003 Mt CO₂e in 2005 to 0.007 Mt CO₂e in 2018 (see Figure 14).

The emissions from Domestic Wastewater of both rural and urban areas grew at a CAGR of 3.95% from 0.06 Mt CO₂e in 2005 to 0.10 Mt CO₂e in 2018. The majority of the Domestic Wastewater emissions were observed from the urban areas of Puducherry with a share of ~73% in 2018 (see Figure 15).

Figure 14: Sub-sector Emissions (Mt CO₂e) and Percentage Share in Total Waste Sector Emissions (2018)

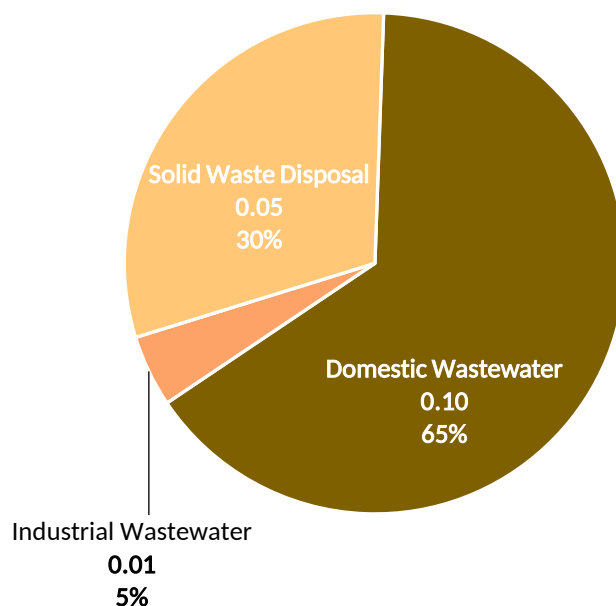
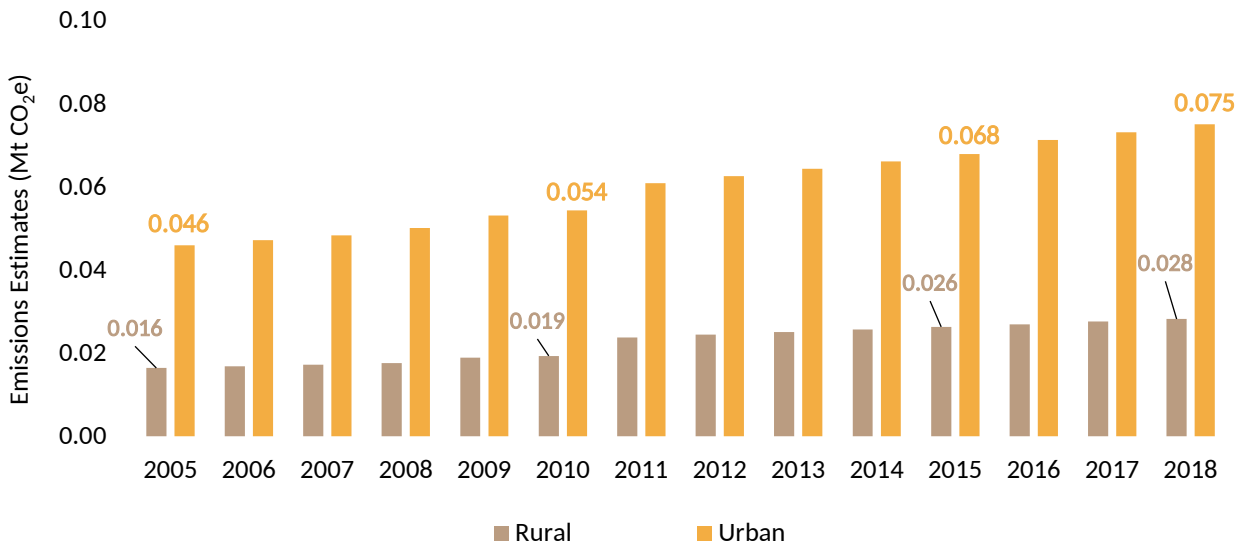
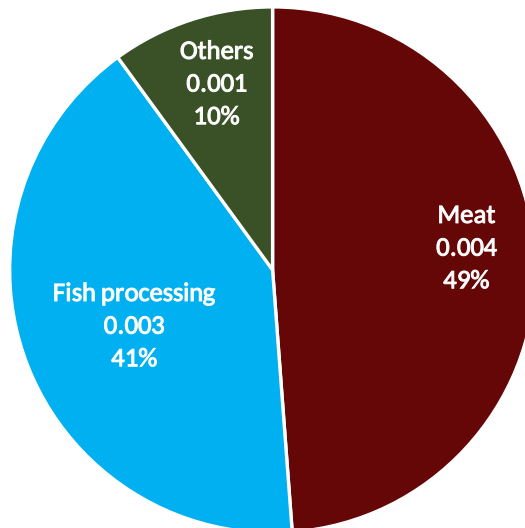


Figure 15: Area-wise GHG Emissions Estimates of Domestic Wastewater (2005 to 2018)



Meat Industry was the major contributor to the Industrial Wastewater emissions with a share of ~41% in 2018. This was followed by Fish Processing and Other industries, with shares of ~41% and ~10%, respectively, as illustrated in Figure 16.

Figure 16: Category-wise Emissions (Mt CO₂e) and Percentage Share in Industrial Wastewater Emissions (2018)





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:



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.

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

Secretariat Contact

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