GHG Platform INDIA

Trend Analysis of GHG Emissions of CHANDIGARH

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

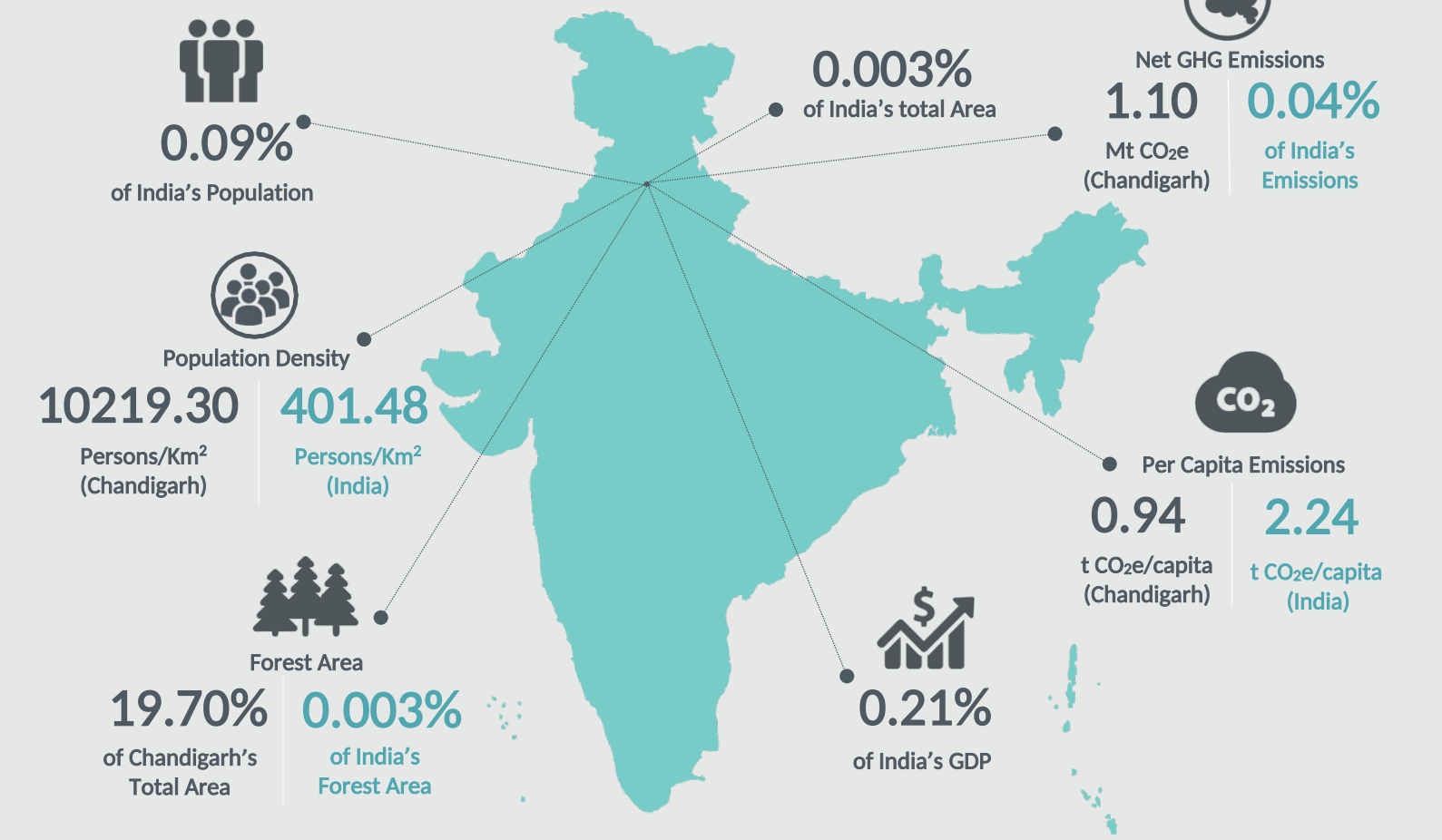
The Platform seeks to add value to the various ongoing GHG emissions estimation efforts by helping address existing data gaps and data accessibility issues, extending beyond the scope of national inventories to state inventories, and by increasing the volume of analytics and policy dialogue on India's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

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

ENERGY | IPPU* | AFOLU | WASTE

* Fuel combusted for Captive Electricity Generation (Auto-Producers) and direct fuel combustion (industrial energy) has been reported under Energy sector.

Chandigarh at a Glance (2018)

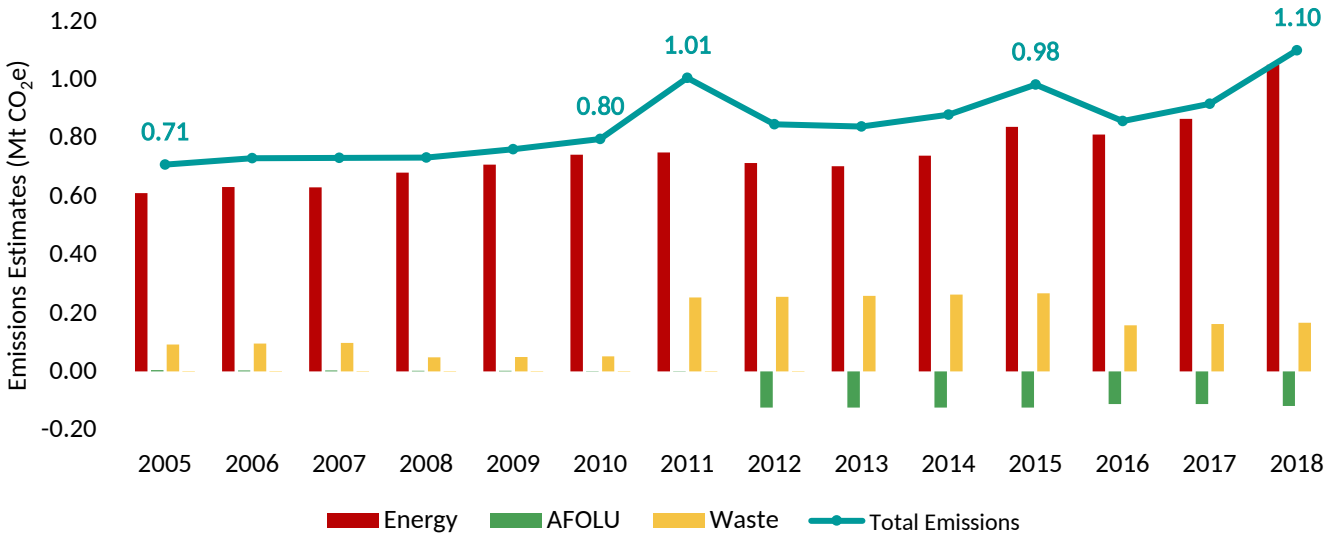


*Mt CO_2e – Million Tonnes of Carbon Dioxide Equivalent | CAGR – Compound Annual Growth Rate

*The map represents the data for 2018

Economy-wide Emissions Estimates

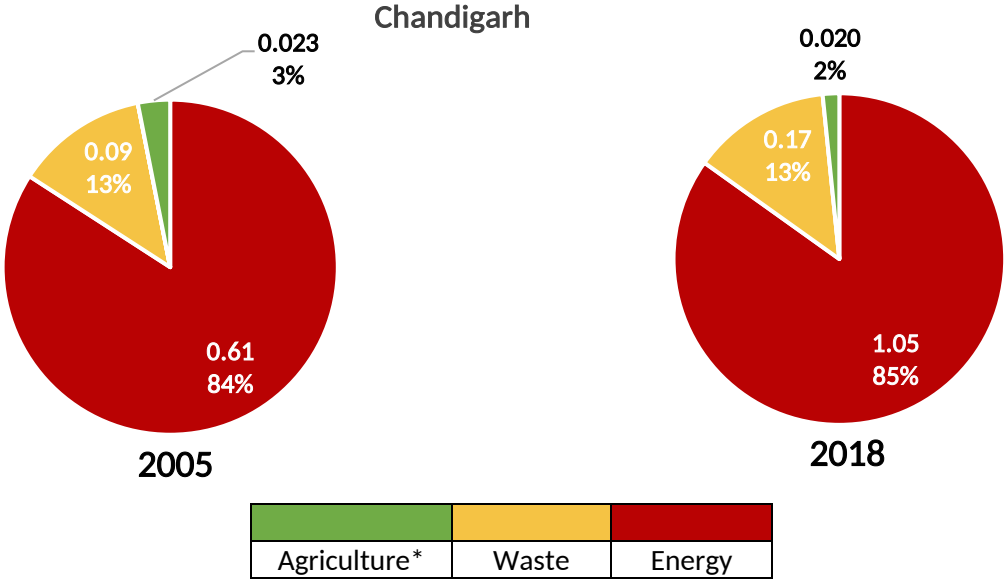
Figure 1: GHG Emissions Estimates of Chandigarh (2005 to 2018)



Emissions of Chandigarh increased at an estimated CAGR of 3.44% from 0.71 Mt CO_2e in 2005 to 1.10 Mt CO_2e in 2018. As illustrated in Figure 1, Energy sector is the major contributor to Chandigarh's total economy-wide emissions, throughout the reference period. A peak was observed in 2011 at 1.01 Mt CO_2e due to increase in emissions from the Waste sector. In 2012 and 2013, the total economy-wide emissions dipped due to reduction in Energy sector emissions and enhancement of removal from Agriculture Forestry and Other Land Use (AFOLU) sector, despite being moderated by high emissions from the Waste Sector. However, sustained increases in Energy sector emissions in the subsequent years, despite some moderation in 2016 and 2017, led to continued growth in total economy-wide emissions.

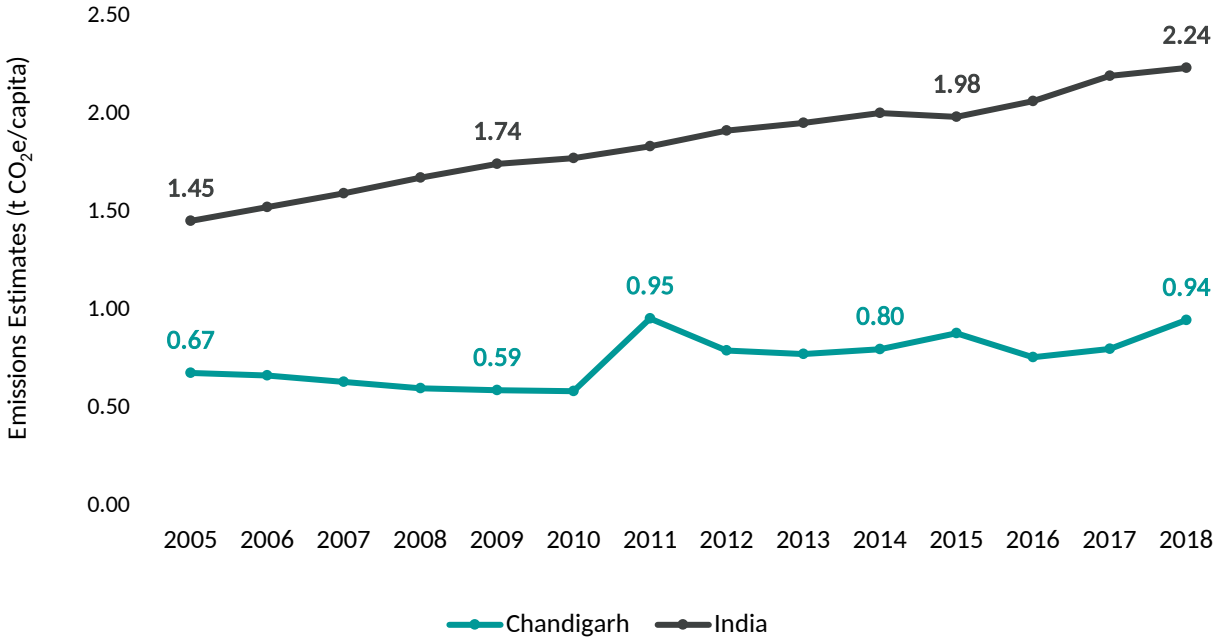
It is important to note that the entire AFOLU sector was a net emitter till 2011 and became a net sink from 2012. In 2005, the share of Energy sector in gross economy-wide emissions (excluding Land sub-sector within AFOLU) was ~84%. This was followed by Waste (~13%), and Agriculture (~3%). In 2018, the share of Energy sector emissions increased marginally to ~85% of the gross economy-wide emissions (excluding Land sub-sector within AFOLU). Whereas, the share of Agriculture declined to ~2% in 2018 and that of Waste sector remained the same i.e., 13% (see Figure 2).

Figure 2: Sector-wise Contribution (Mt CO_2e) and Percentage Share in Gross Economy-wide Emissions of (excluding Land sub-sector within AFOLU) of Chandigarh



**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 Chandigarh and India (2005 to 2018)



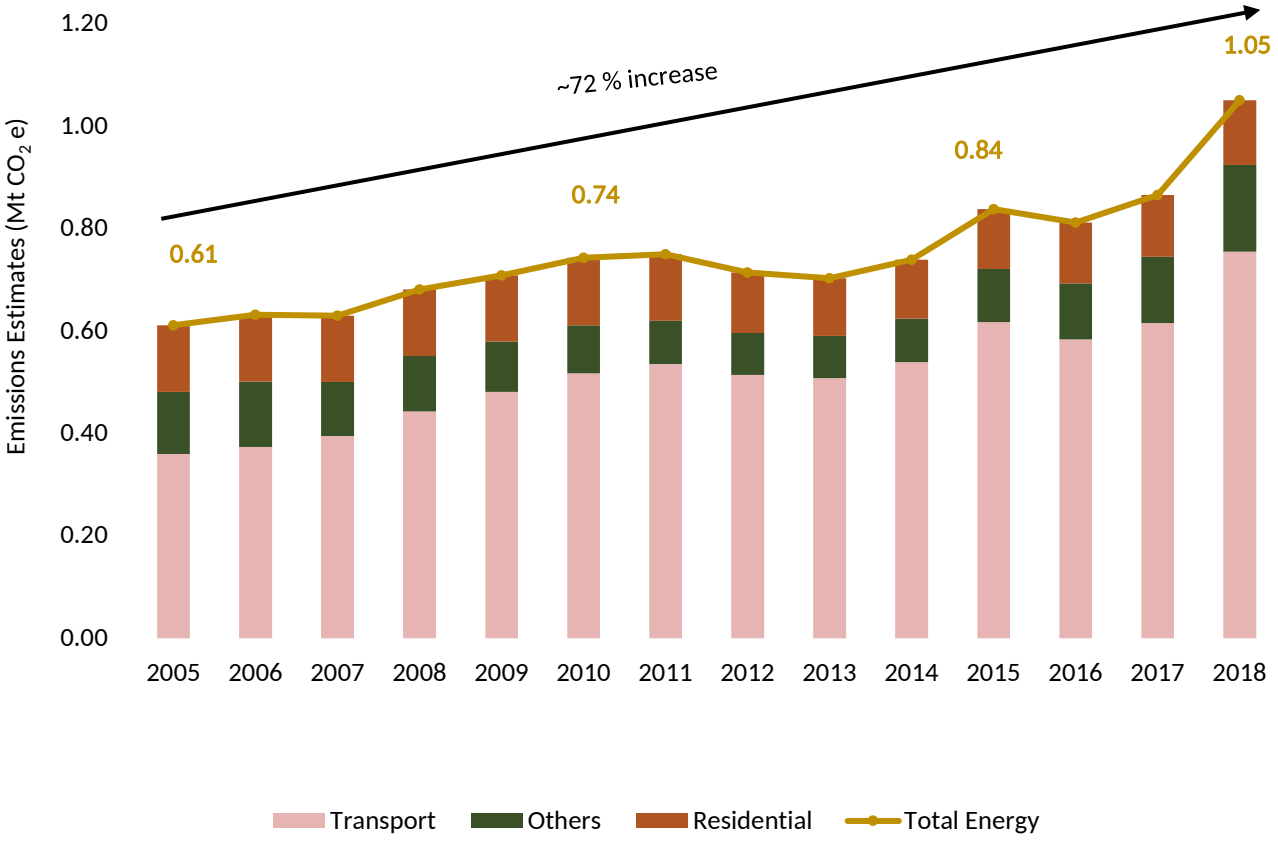
The per capita emissions of Chandigarh remained very low throughout the reference period. They increased at a compounded rate of 2.60% from 0.67 t CO_2e/capita in 2005 to 0.94 t CO_2e/capita in 2018, which was lower than that of India (~3.41%).

Energy Sector

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

The Energy sector of Chandigarh accounted for ~85% of the gross economy-wide emissions (excluding Land sub-sector in AFOLU) in the year 2018. In Chandigarh, emissions were only due to Fuel Combustion, and no Fugitive Emissions were observed during the reference period. Emissions from the Energy sector grew at a CAGR of 4.3% from 0.61 Mt CO_2e in 2005 to 1.05 Mt CO_2e in 2018.

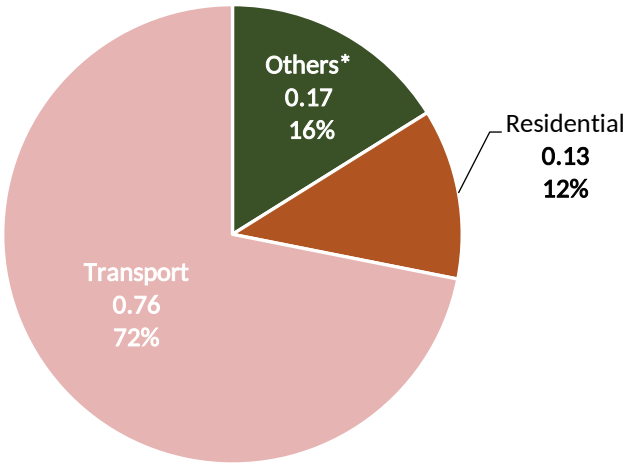
Figure 4: GHG Emissions Estimates of Energy Sector - Chandigarh (2005 to 2018)



Within the Energy sector, Transport category was the major contributor of GHG emissions with a share of ~72% of the total Energy emissions in 2018. This was followed by Residential category (12%). Whereas, the Other categories, together held a share of 16% (see Figure 5).

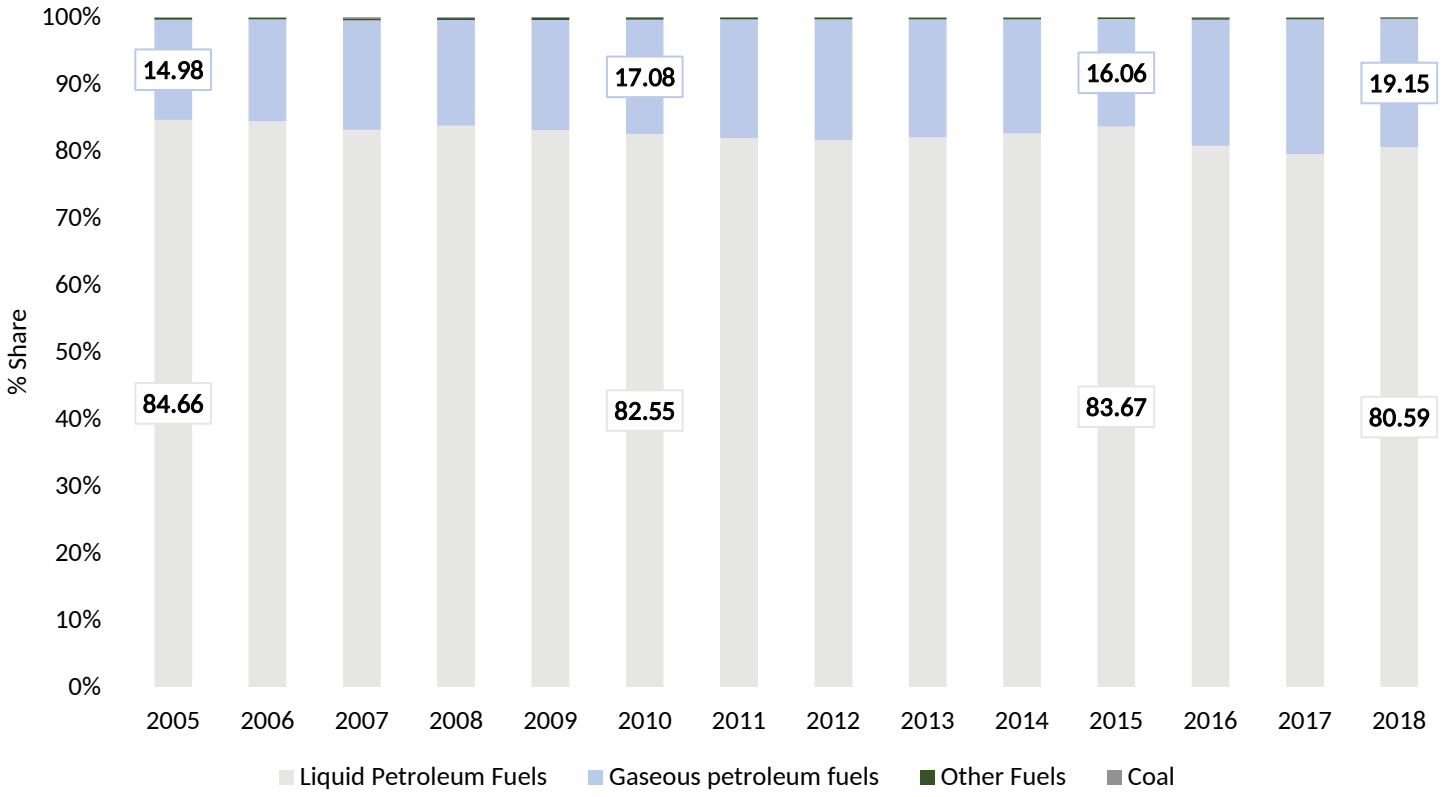
Within the Fuel Combustion sub-sector, emissions from Liquid Petroleum Fuels were the major contributor to GHG emissions, with an average share of ~82.50%, across the reference period (see Figure 6). This was followed by emissions from combustion of Gaseous Petroleum Fuels, with an average share of ~17.16% between 2005 and 2018. Coal had an average share of ~0.09%, while Other Fuels contributed ~0.26% to the Fuel Combustion emissions throughout the reference period.

Figure 5: Category-wise Emissions (Mt CO_2e) and Percentage Share in Total Energy Sector Emissions (2018)



Others include Agriculture, Commercial, Industries and Captive Power Plant.

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

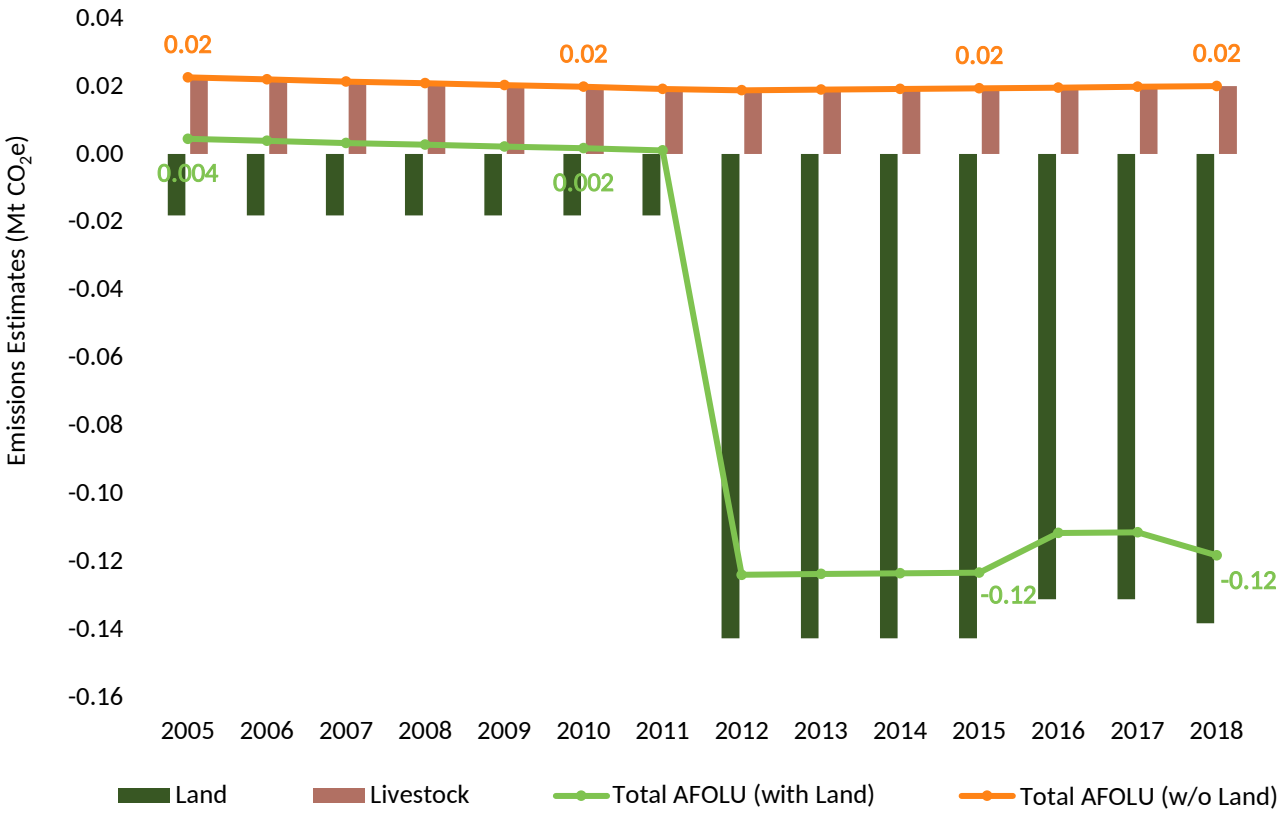
Emissions from the Industrial Processes and Product Use (IPPU) sector are largely driven by Chemical, Metal, Mineral Industries and Non-Energy Products from Fuels and Solvent Use. Industrial activities as listed by IPCC to be responsible for GHG emissions from IPPU were nominally present in the Union Territory of Chandigarh. The only emitting category was Other Uses of Soda Ash (from Mineral Industry). However, its emissions were negligible across the reference period. Therefore, trend analysis for the IPPU sector could not be done for the Union Territory of Chandigarh.

AFOLU Sector

Emissions from the Agriculture Forestry and Other Land Use (AFOLU) sector comprise of three main sub-sectors namely Livestock, Land and Aggregate Sources and Non-CO_2 Emissions Sources on Land*. In Chandigarh, while the Livestock sub-sector was a net GHG emitter, the Land sub-sector was a sink throughout the reference period. Chandigarh registered negligible (less than 3 tonnes CO_2e) emissions from the Aggregate Sources sub-sector only from 2016 onwards.

The AFOLU sector became a net sink of emissions from 2012 onwards. This can be attributed to significant increase in removals from Agricultural Land category (see Figure 7). The average annual emissions from Livestock and Aggregate sources during the reference period were 0.02 Mt CO_2e and were neutralised by CO_2 removals from the Land sub-sector which was, on an average, removing 0.08 Mt CO_2e between 2005 and 2018.

Figure 7: GHG Emissions Estimates of AFLOU Sector - Chandigarh (2005 to 2018)

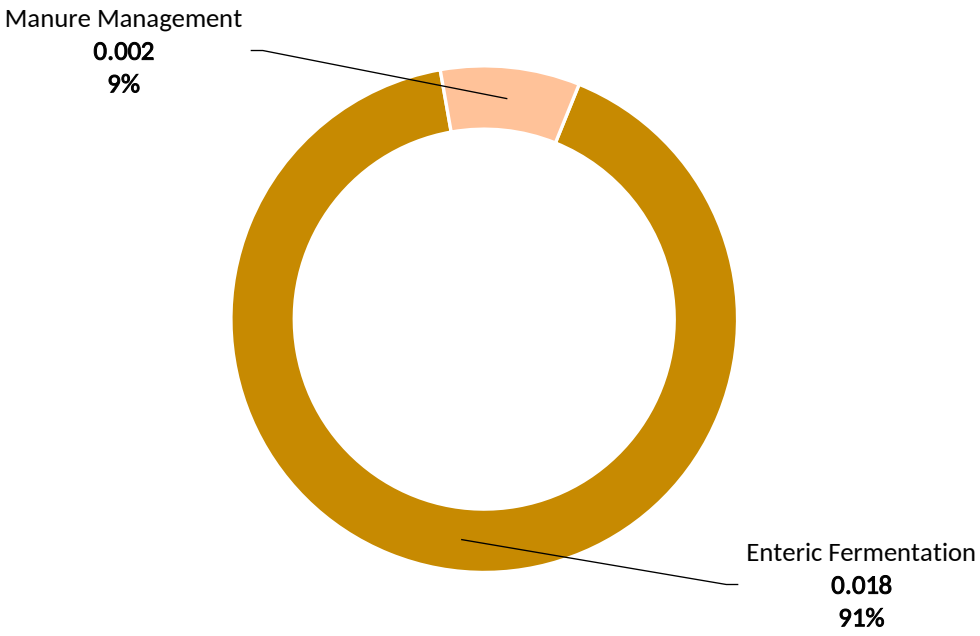


Livestock sub-sector was the major contributor to positive AFOLU emissions (excluding Land sub-sector) of the UT across all the reference years. Within the Livestock sub-sector, the contribution of Enteric Fermentation and Manure Management to positive AFOLU emissions was 91% and 9% respectively in 2018 as depicted in Figure 8. However, the emissions from these categories declined at CAGRs of 0.90% and 1.27% respectively, from 0.02 Mt CO_2e in 2005 to 0.01 Mt CO_2e 2018 for Enteric Fermentation, and 0.0021 Mt CO_2e in 2005 to 0.0018 Mt CO_2e in 2018 for Manure Management.

Within the Aggregate Sources sub-sector, the contribution to positive AFOLU emissions was negligible, the only category from this sub-sector that led to emissions was Biomass Burning in Cropland with a share of ~ 0.014% in positive AFOLU emissions.

**The sub-sector called 'Aggregate Sources and Non-CO_2 Emission Sources on Land' includes emissions from Rice Cultivation, Agriculture Soils and Biomass Burning in Cropland and Forestland.*

Figure 8: Category-wise Emissions (Mt CO_2e) and Percentage Share in Positive AFOLU Emissions (excluding Land sub-sector) (2018)



Waste Sector

Solid Waste Disposal, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. The Waste sector contributed to almost 13% of gross economy-wide emissions (excluding Land sub-sector within AFOLU) of Chandigarh in 2018. GHG emissions from Waste grew at an estimated CAGR of 4.7% from 0.09 Mt CO_2e in 2005 to 0.17 Mt CO_2e in 2018. Between 2011 and 2015, emissions of the Waste sector rose substantially, primarily due to increased emissions from the Domestic Wastewater as depicted in Figure 9.

Figure 9: GHG Emissions Estimates of Waste Sector- Chandigarh (2005 to 2018)

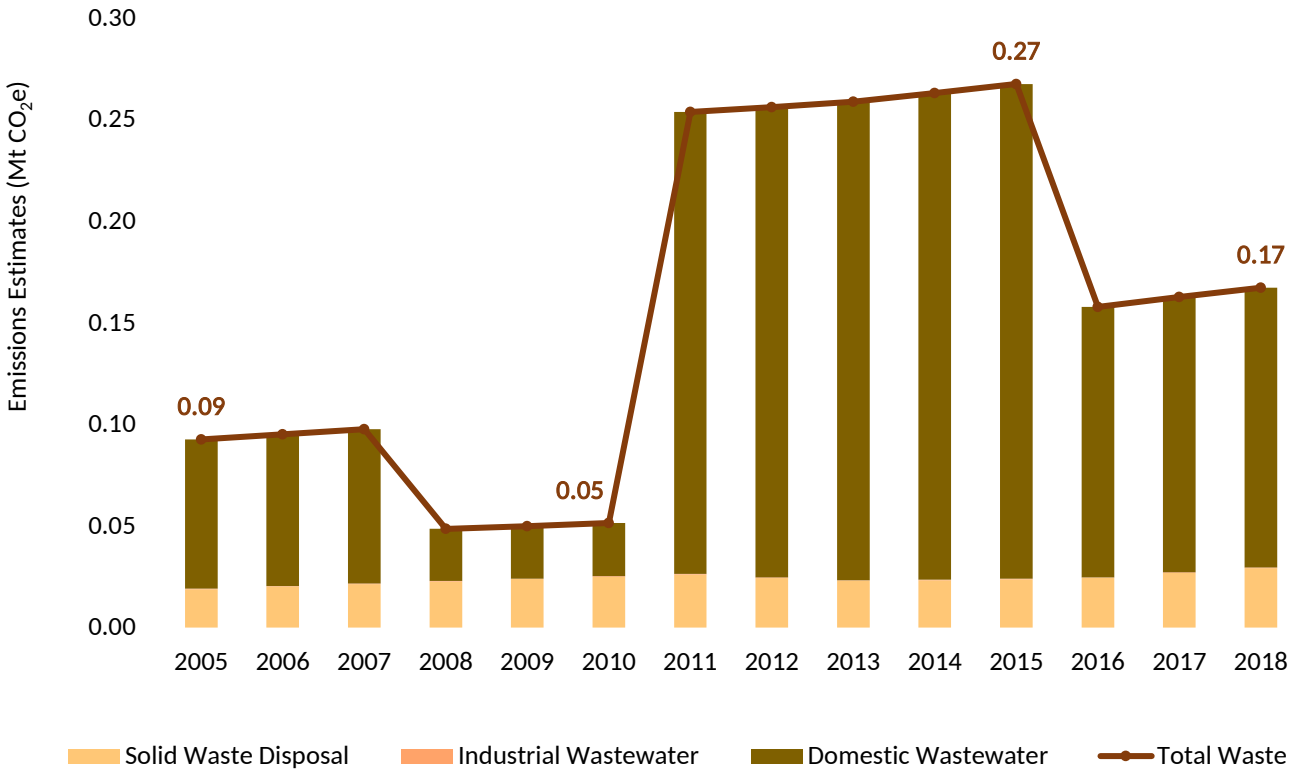
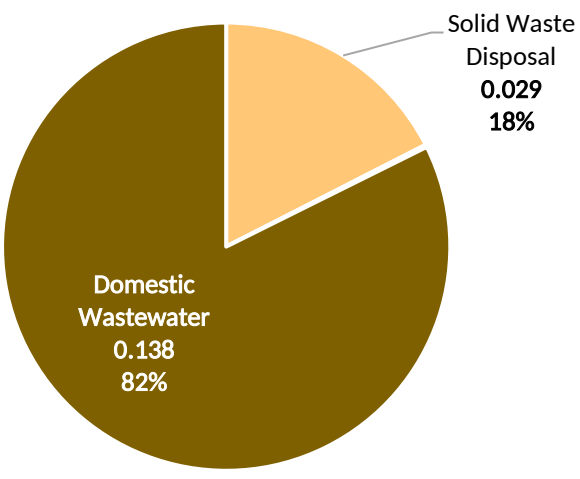


Figure 10: Sub-sector Emissions (Mt CO_2e) and Percentage Share in Total Waste Sector Emissions (2018)



Discharge of untreated wastewater and use of septic tanks are the key drivers of emissions due to Domestic Wastewater sub-sector. In Chandigarh, Domestic Wastewater had the maximum share of ~82% of the total Waste emission. Approximately, 18% of the Waste sector emissions were due to Solid Waste Disposal in 2018 (see Figure 10). The emissions from Solid Waste Disposal grew at an estimated CAGR of 3.41% from 0.02 Mt CO_2e in 2005 to 0.03 Mt CO_2e in 2018. The Industrial Wastewater sub-sector had negligible emissions across the reference years.

Emissions from Domestic Wastewater increased at CAGR of 4.95% from 0.07 Mt CO_2e in 2005 to 0.14 Mt CO_2e in 2018. Almost ~100% of the emissions arising from Domestic Wastewater emanated from the urban areas of Chandigarh across all the reference years (see Figure 11).

Figure 11: Area-wise GHG Emissions Estimates of Domestic Wastewater (2005 to 2018)

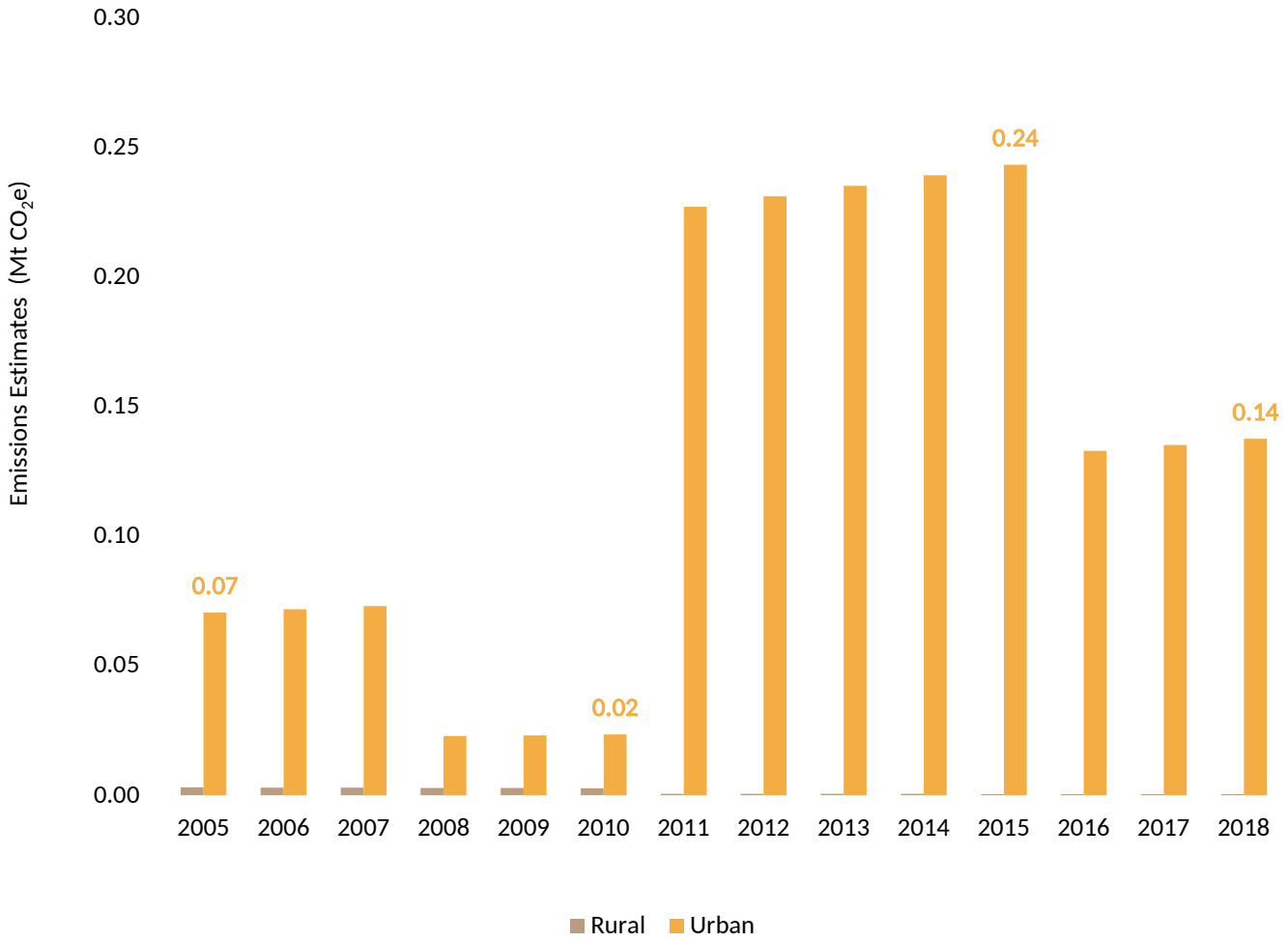
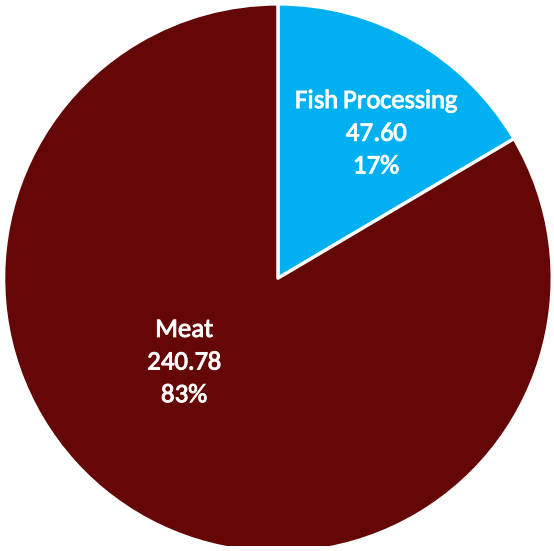


Figure 12 shows that the Meat Industry was the major contributor to the Industrial wastewater emissions with a share of ~83% in 2018, this was followed by Fish Processing category (17%).

Figure 12: Category-wise Emissions (t CO_2e)* and Percentage Share in Total Industrial Wastewater Emissions (2018)



**Please note that emissions of Industrial Wastewater categories given in Figure 12 are in tonnes of CO2e and not in million tonnes (unlike all other graphs) because the total emissions values of these categories were very small*

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:

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.

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