GHG Platform INDIA

Trend Analysis of GHG Emissions of RAJASTHAN

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

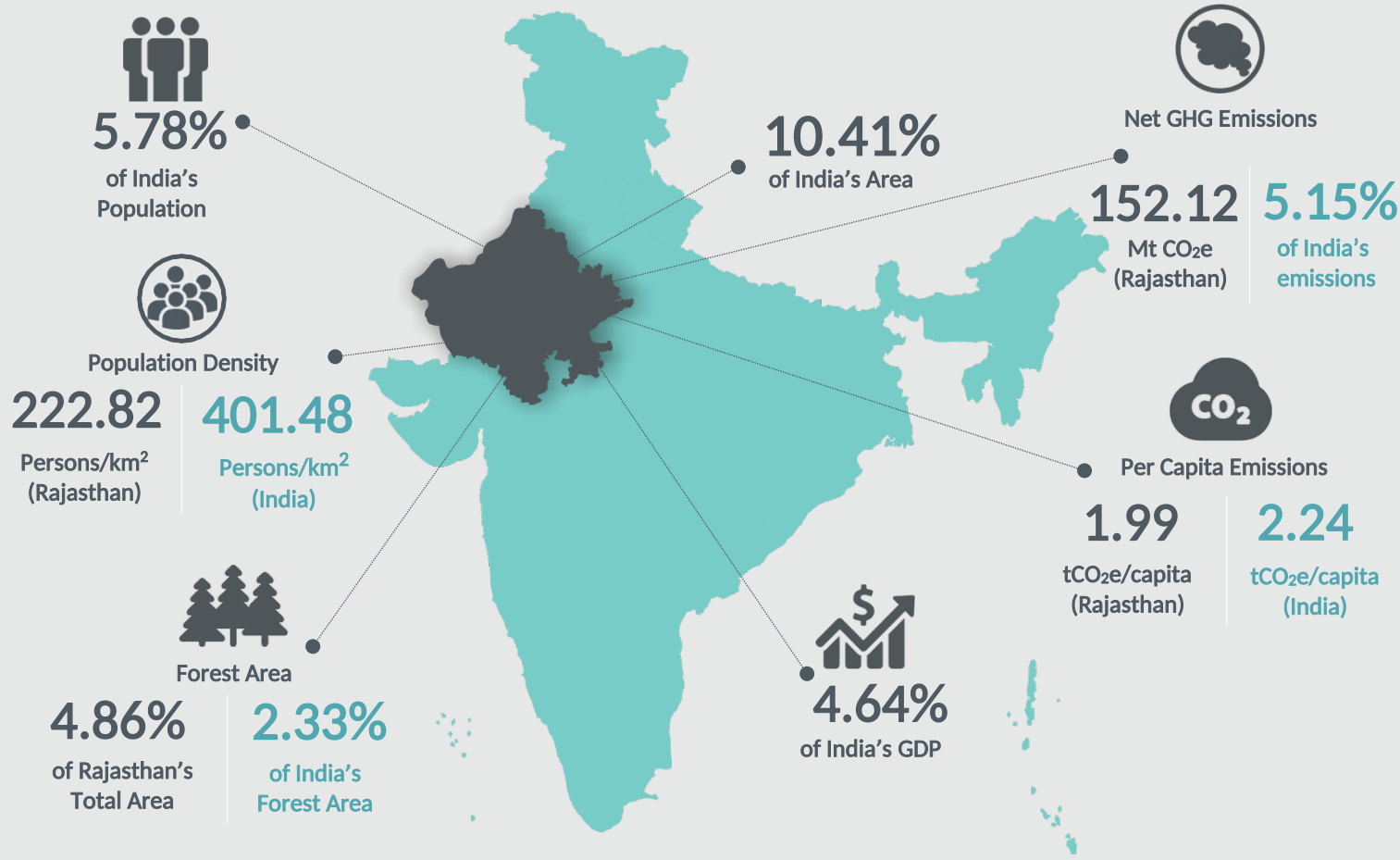
The Platform seeks to add value to the various ongoing GHG emissions estimation efforts by helping address existing data gaps and data accessibility issues, extending beyond the scope of national inventories to state inventories, and by increasing the volume of analytics and policy dialogue on India's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

Rajasthan at a Glance (2018)

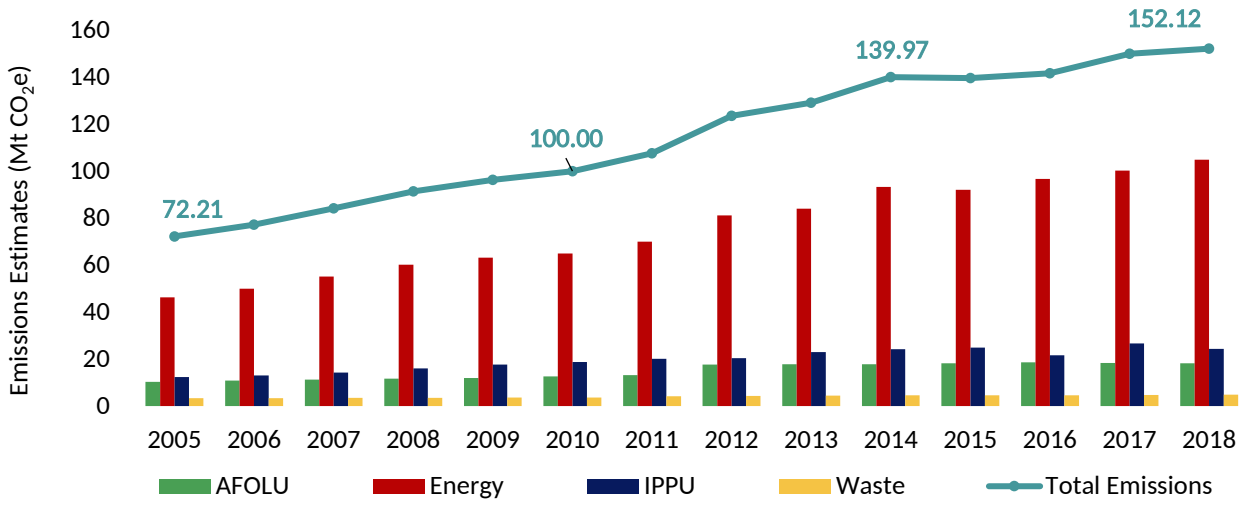


*The map represents the data for 2018

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

Economy-wide Emissions Estimates

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



Emissions of Rajasthan grew at a CAGR of 5.90%, from 72.21 Mt CO_2e in 2005 to 152.12 Mt CO_2e in 2018, as illustrated in Figure 1. The Energy sector was a major contributor of GHG emissions in Rajasthan's total emissions across all the reference years. The share of emissions from the Energy sector increased from ~64% in 2005 to ~69% in 2018. Whereas, contribution of Agriculture, Forestry and Other Land-Use (AFOLU) sector in economy-wide emissions reduced from ~14% in 2005 to ~12% in 2018. The Industrial Process and Product Use (IPPU) sector's share reduced from ~17% in 2005 to ~16% in 2018 and the share of Waste sector reduced from ~5% in 2005 to ~3% in 2018 (see Figure 2).

Figure 2: Sector-wise Contribution (Mt CO_2e) and Percentage Share in Economy-wide GHG Emissions of Rajasthan

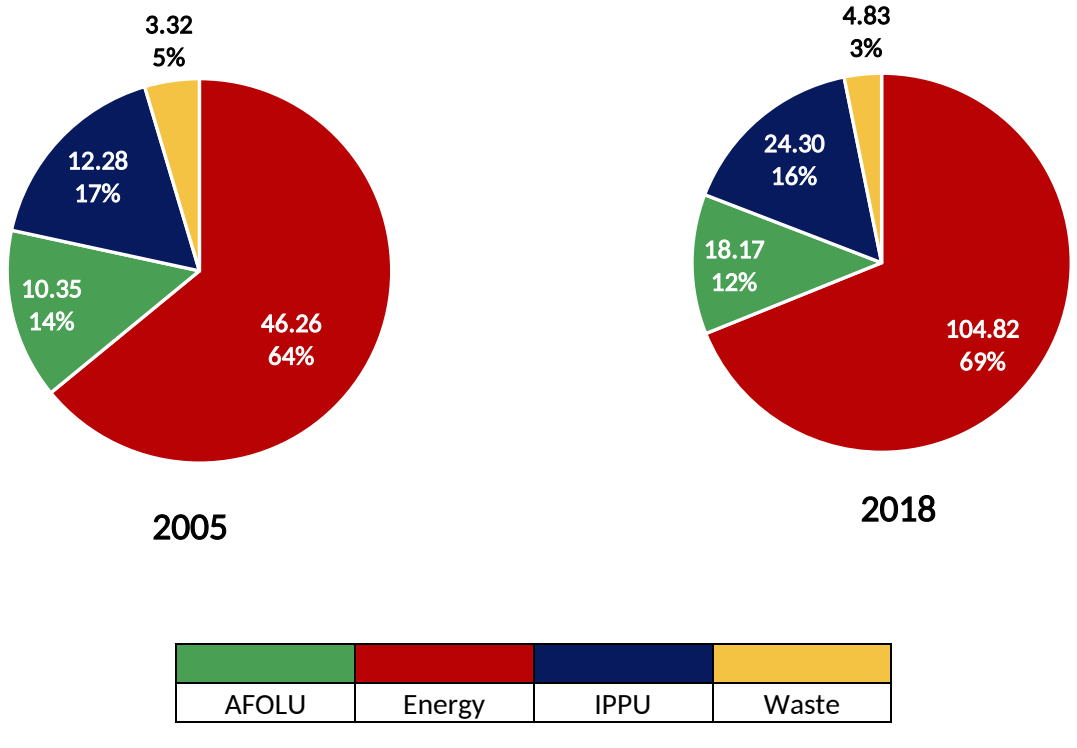
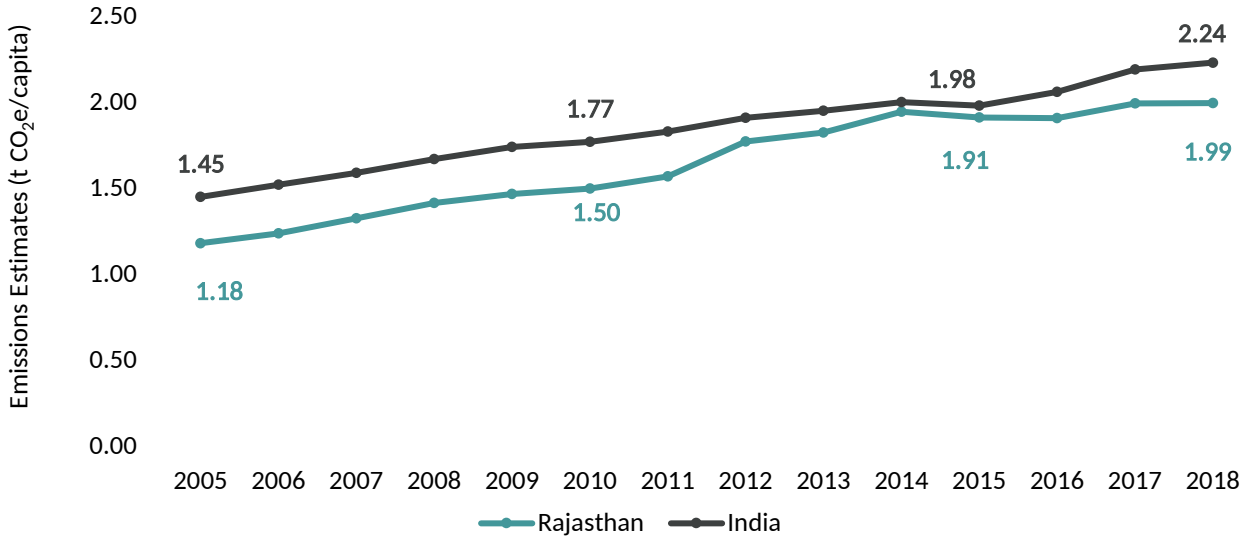


Figure 3: Per Capita GHG Emissions of Rajasthan and India (2005 to 2018)

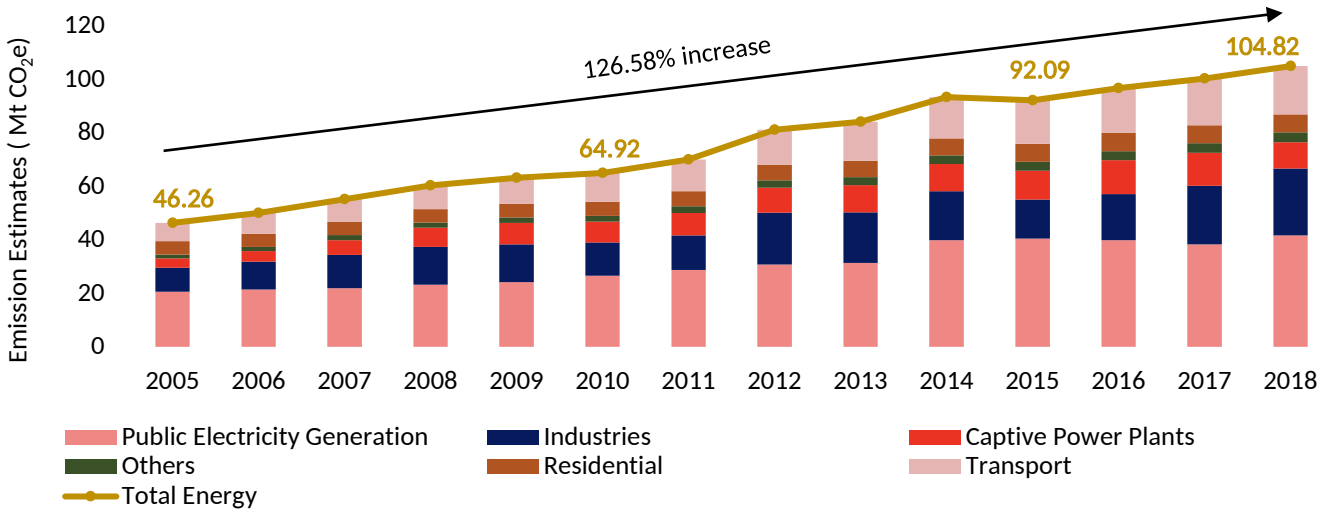


Per capita emissions of Rajasthan were slightly lower than the per capita emissions of India, throughout the reference period (see Figure 3). However, they increased at an estimated CAGR of 4.11% from 1.18 t CO_2e/ capita in 2005 to 1.99 t CO_2e/capita 2018, which was higher than India's CAGR (~3.41%).

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 Rajasthan accounted for ~69% of the total economy-wide emissions in 2018. Emissions from the Energy sector increased at a CAGR of 6.49% from 46.26 Mt CO_2e in 2005 to 104.82 Mt CO_2e in 2018 (see Figure 4).

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



Within the Energy Sector, Public Electricity Generation category was the major contributor of GHG emissions with a share of ~40% of the total Energy emissions in 2018. This was followed by Industrial Energy and Transport Categories with shares of ~24% and ~17%, respectively (see Figure 5).

Within the Fuel Combustion sub-sector, Coal was the major contributor of emissions with an average share of ~63%, across the reference period (see Figure 6). This was followed by emissions from combustion of Liquid Petroleum Fuels, with an average share of ~25% between 2005 and 2018. Gaseous Petroleum Fuels had an average share of ~9%, while Other Fuels contributed ~3% to the Fuel Combustion emissions during the reference period.

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

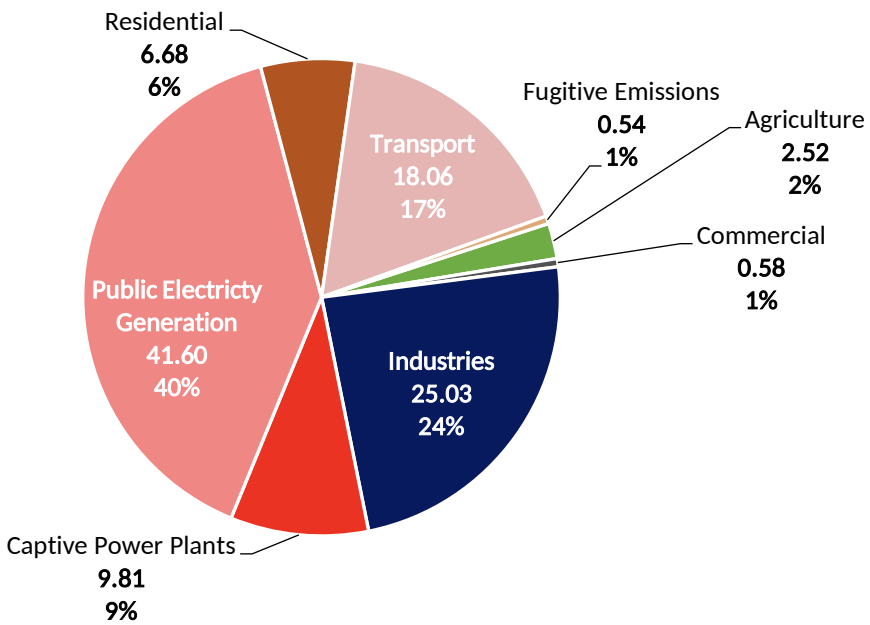
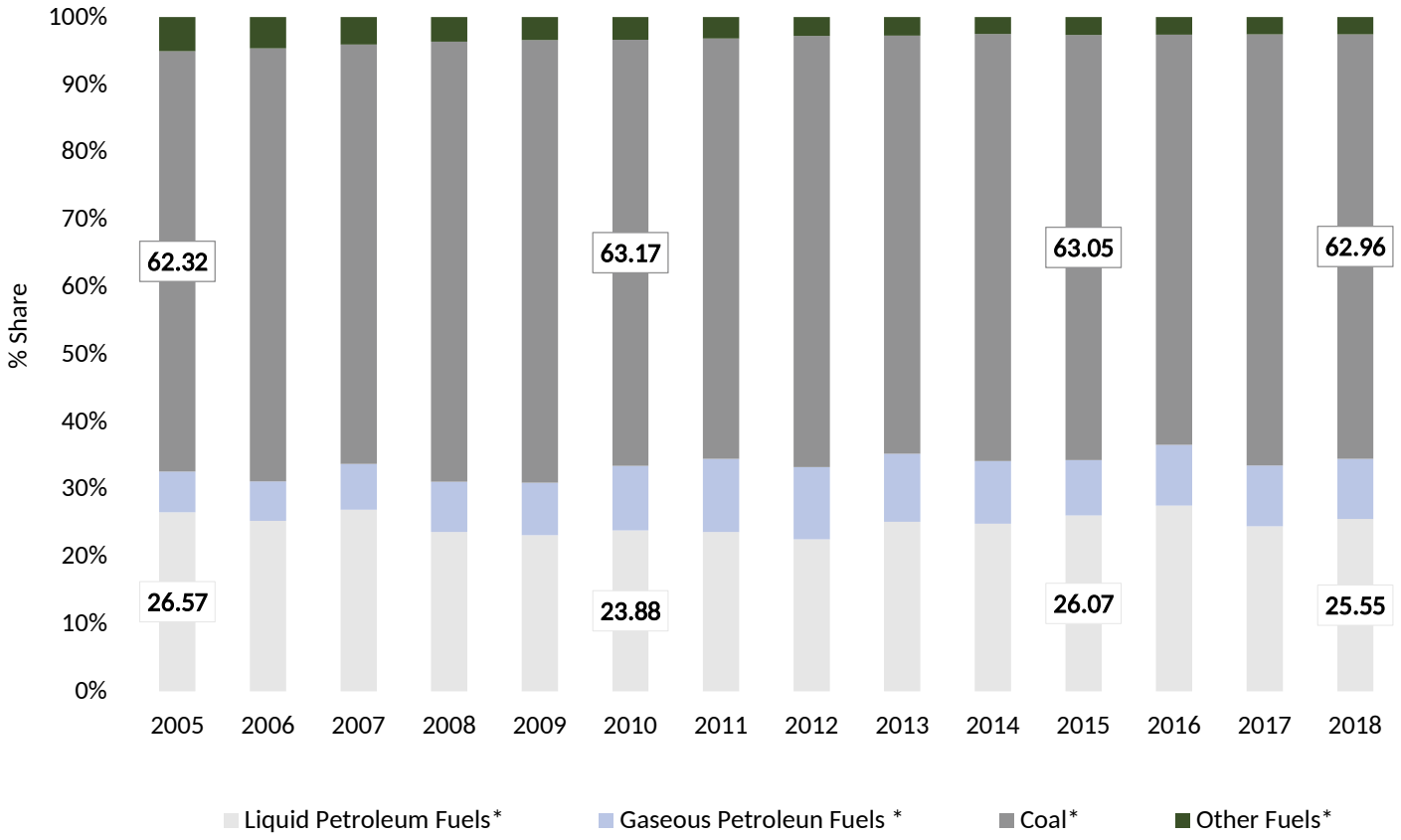


Figure 6: Percentage share of GHG Emissions by Fuel Type due to Fuel Combustion in Energy Sector (2005-2018)



**Notes:*

1. Liquid Petroleum Fuel - ATF, diesel, kerosene, motor spirit and other liquid fuels

2. Gaseous Petroleum Fuels - natural gas, LPG and other gaseous fuels

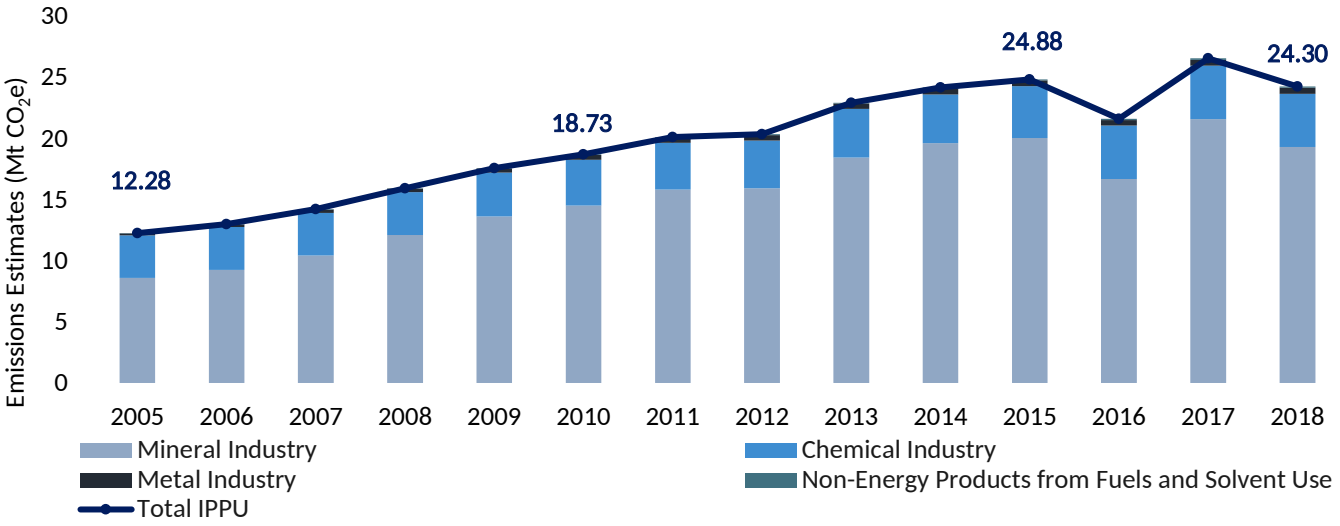
3. Coke is included in Coal because the bifurcation of pet-coke and coke was not available

4. Other Fuels comprises of firewood and charcoal

IPPU Sector

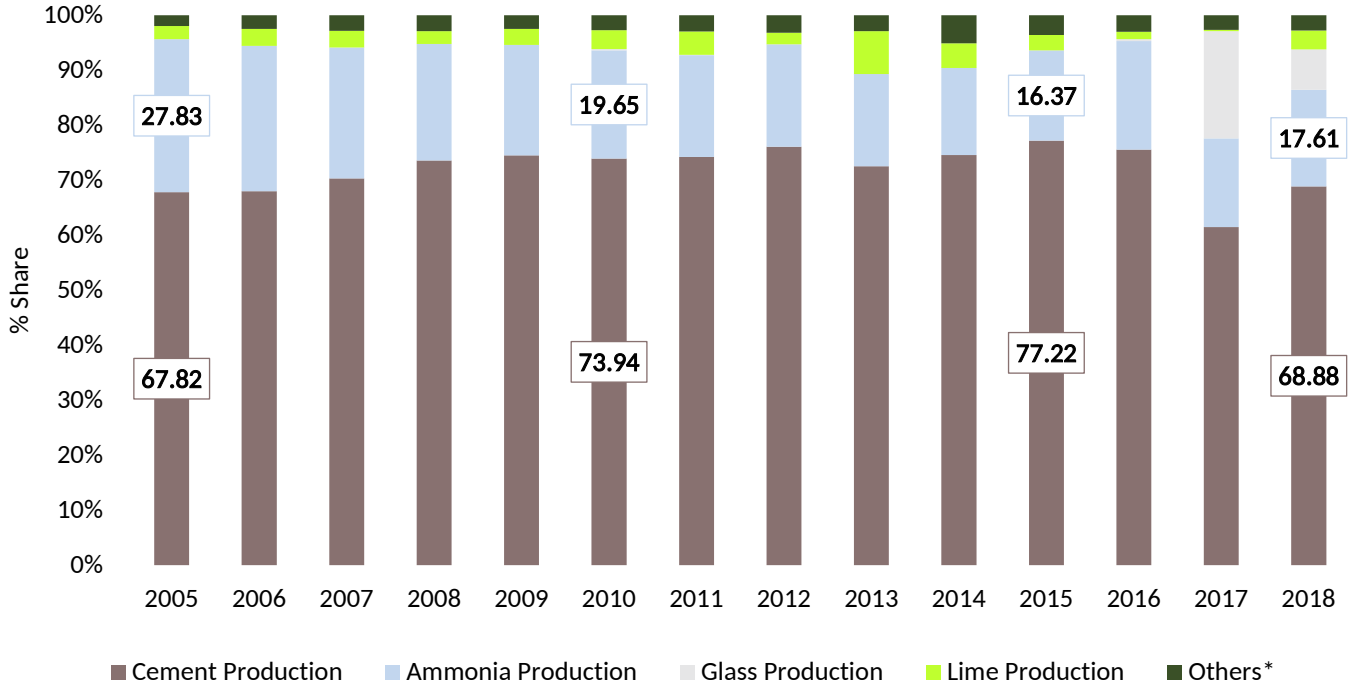
Emissions from the Industrial Processes and Product Use (IPPU) sector are largely driven by Chemical, Metal, Mineral Industries and Non-Energy Products from Fuels and Solvent Use. The IPPU sector represented ~16% of the total GHG emissions in Rajasthan, in 2018. Between 2005 to 2018, the overall IPPU emissions almost doubled, at a CAGR of 5.39% from 12.28 Mt CO_2e in 2005 to 24.30 Mt CO_2e in 2018 (see Figure 7). Emissions of the IPPU sector in Rajasthan were primarily driven by the Mineral Industry, largely due to Cement Production category.

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



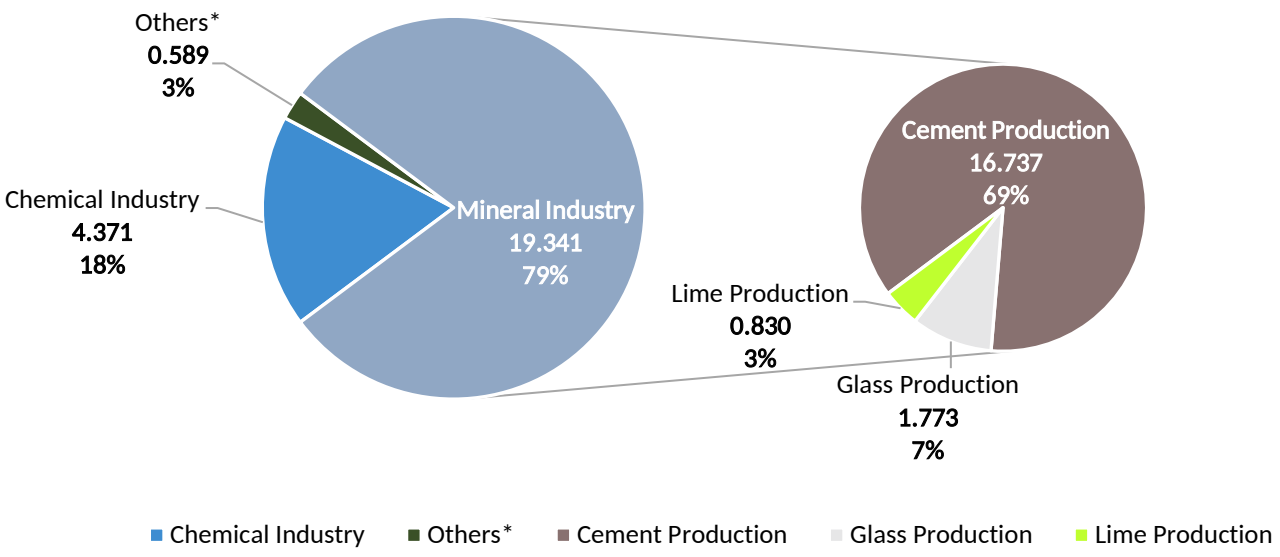
A detailed trend of GHG emissions by various IPPU categories is depicted in Figure 8. Cement Production was the key driver of GHG emissions in IPPU sector with an average share of ~72% between 2005 and 2018. Significant emissions were also registered from Ammonia, Glass and Lime Production categories, with average shares of ~20%, ~2% and ~3%, respectively, during the reference period (see Figures 8 and 9).

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



**Others includes Carbide Production, Iron and Steel Production, Lead Production, Zinc Production, Ceramics, Non-Metallurgical Magnesia Production, Other Process Uses of Carbonates, Other Uses of Soda Ash, Lubricant Use and Paraffin Wax Use categories.*

Figure 9: Sub-Sector Emissions (Mt CO_2e) and Percentage Share in Total IPPU Emissions (2018)



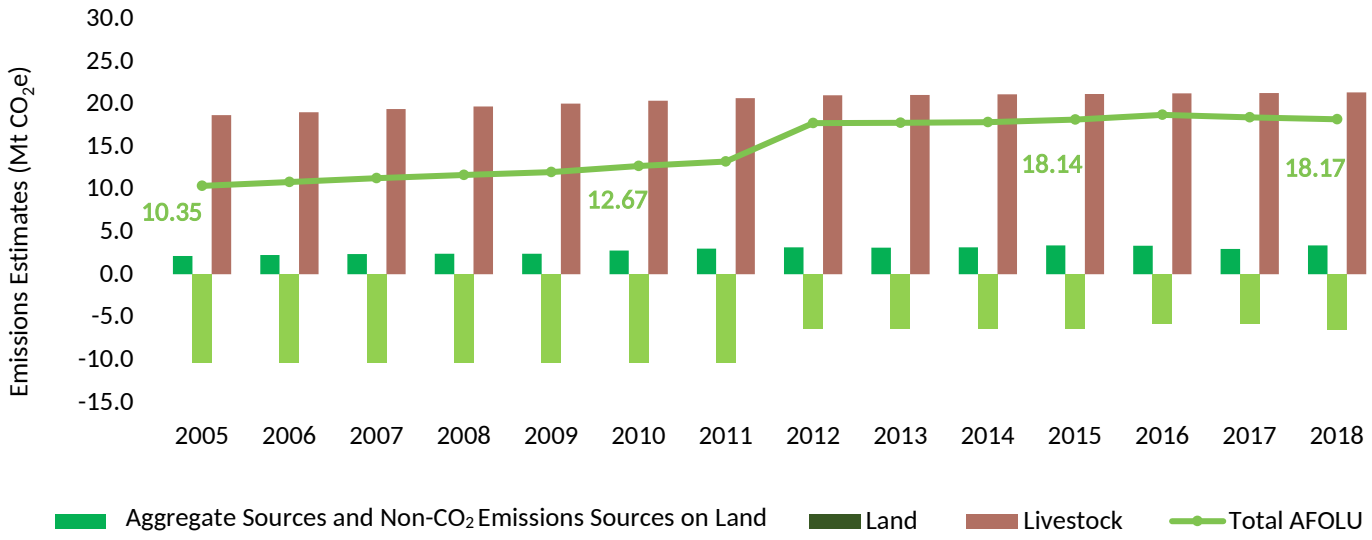
*Others category includes Metal Industry and Non-Energy Products from Fuels and Solvent Use sub-sector

AFOLU Sector

Emissions from the Agriculture, Forestry and Other Land Use (AFOLU) sector arise from three main sub-sectors: Livestock, Land and Aggregate Sources and Non-CO_2 Emissions Sources on Land*. AFOLU sector represented ~12% of the total economy-wide emissions of Rajasthan, in 2018.

While the Livestock and Aggregate Sources and Non-CO_2 Emissions Sources on Land sub-sectors were net GHG emitters, the Land sub-sector was a net sink throughout the reference period. Between 2005 and 2018, the total AFOLU emissions increased at a CAGR of 4.43% from 10.35 Mt CO_2e in 2005 to 18.17 Mt CO_2e in 2018. Post 2011, a decrease was registered in the Land sub-sector removals. This can be attributed to the decreasing sink of Agricultural Land and Other Land categories (see Figure 10). The average annual removals from the Land sub-sector in Rajasthan during the reference period were 8.33 Mt CO_2e, around ~35.87% of the average annual gross AFOLU emissions.

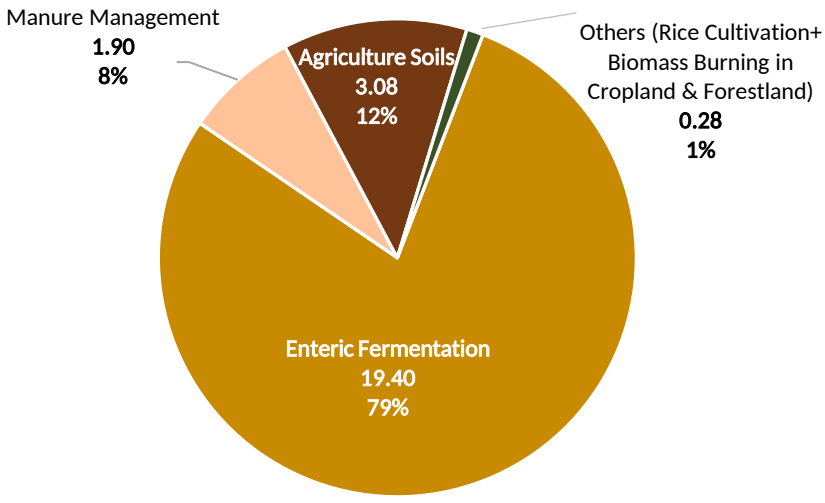
Figure 10: GHG Emissions Estimates of AFOLU Sector - Rajasthan (2005 to 2018)



In Rajasthan, the Livestock sub-sector was the major contributor to the gross AFOLU emissions (excluding Land sub-sector) of Rajasthan, with a share of ~86% in 2018. Within the Livestock sub-sector, Enteric Fermentation category was the major contributor to gross AFOLU emissions across the reference period with an average share of ~80%. Emissions from this category grew at a rate of 1.01% (compounded annually) from 17.02 Mt CO_2e in 2005 to 19.40 Mt CO_2e in 2018.

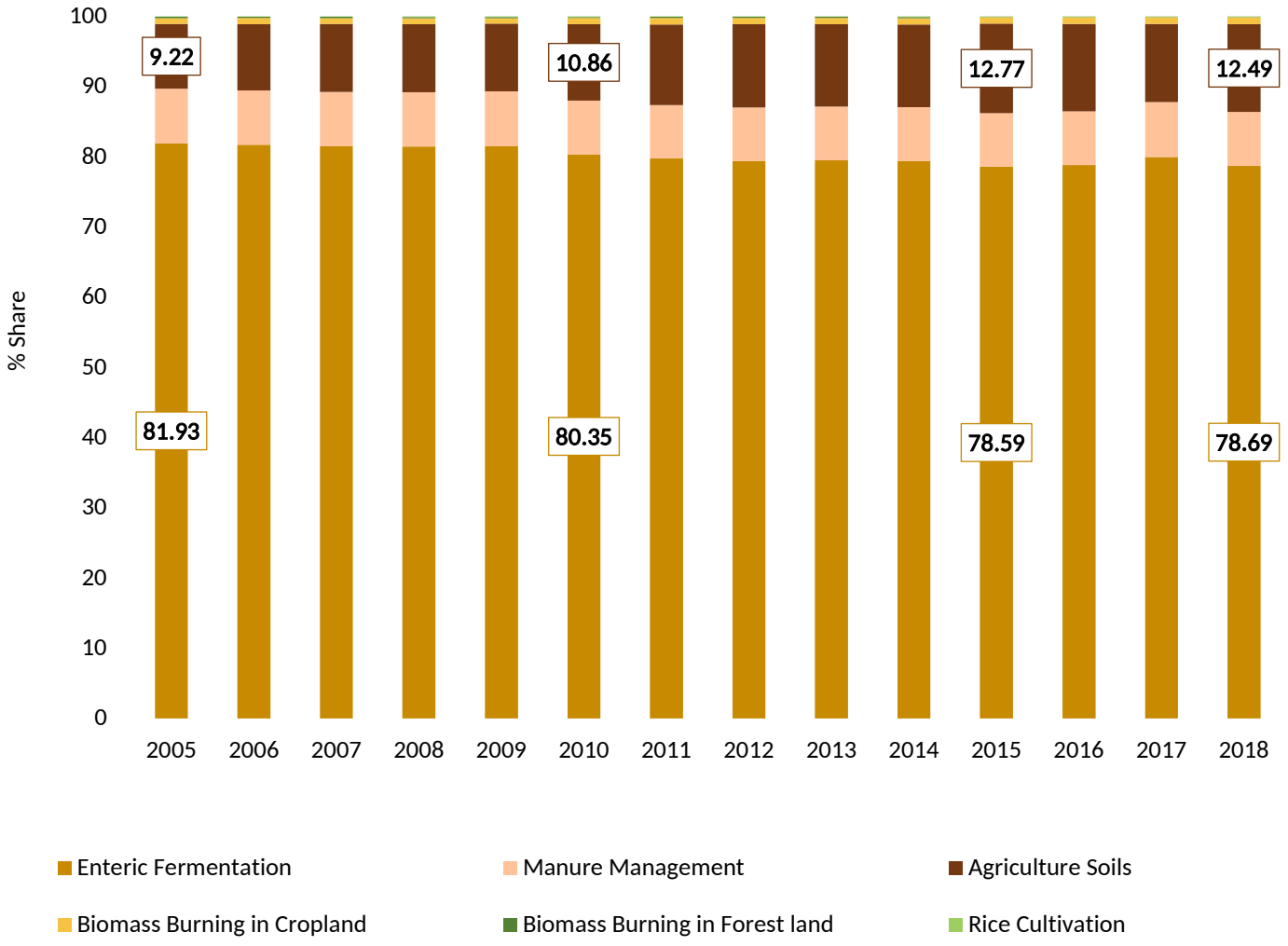
From the Aggregate Sources sub-sector, Agriculture Soils category was a major contributor to gross AFOLU emissions with an average share of ~11%, during the reference period. The share of Agriculture Soils in gross AFOLU emissions increased from ~9% in 2005 to ~12% in 2018 (see Figures 11 and 12).

Figure 11: Category-wise Emissions (Mt CO_2e) and Percentage Share in Gross AFOLU Emissions (excluding Land sub-sector) (2018)



** 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.*

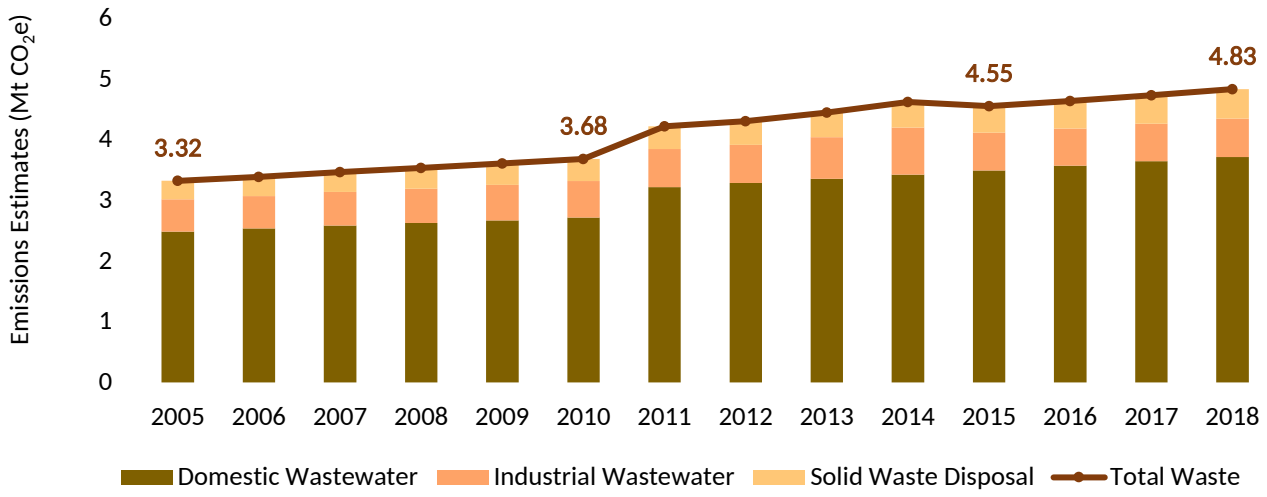
Figure 12: Category-wise Percentage Share in Gross AFOLU Emissions (excluding Land sub-sector) (2005 to 2018)



Waste Sector

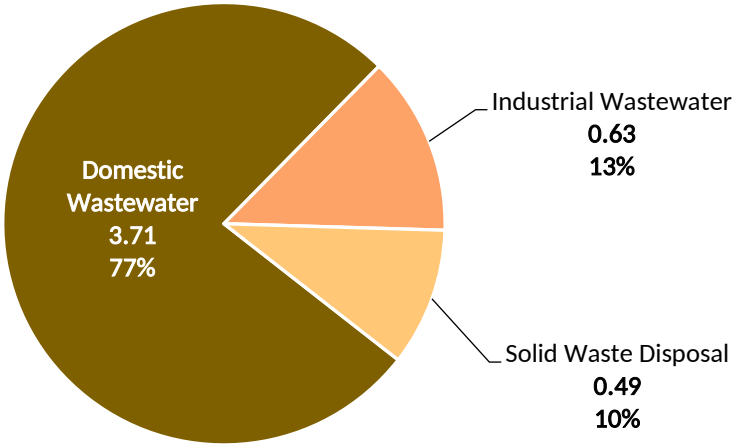
Solid Waste Disposal, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. In Rajasthan, the Waste sector contributed to almost ~3% of total economy-wide emissions in 2018. GHG emissions from the Waste sector increased at an estimated CAGR of 2.93% from 3.32 Mt CO_2e in 2005 to 4.83 Mt CO_2e in 2018. The overall Waste sector emissions increased in 2011 due to growth in Domestic Wastewater emissions of Rajasthan, as illustrated in Figure 13.

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



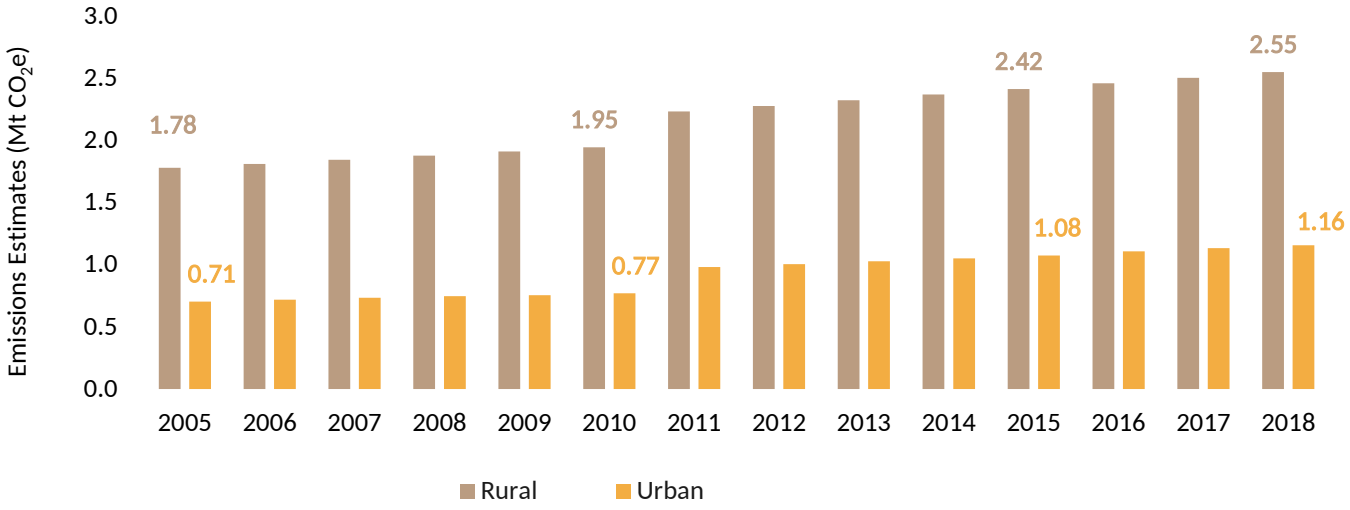
Discharge of untreated wastewater and use of septic tanks are the key drivers of emissions in the Domestic Wastewater sub-sector. Domestic Wastewater had a share of ~77% in the total Waste sector emissions of Rajasthan in 2018. Approximately 10% of the Waste sector emissions were from Solid Waste Disposal, which grew at an estimated CAGR of 3.65% from 0.31 Mt CO_2e in 2005 to 0.49 Mt CO_2e in 2018. Industrial Wastewater accounted for nearly ~13% of the Waste sector emissions in 2018. Emissions from this sub-sector grew at a CAGR of 1.39% from 0.53 Mt CO_2e in 2005 to 0.63 Mt CO_2e in 2018 (see Figure 14).

Figure 14: Sub-sector emissions (Mt CO_2e) and Percentage Share in Total Waste Sector Emissions (2018)



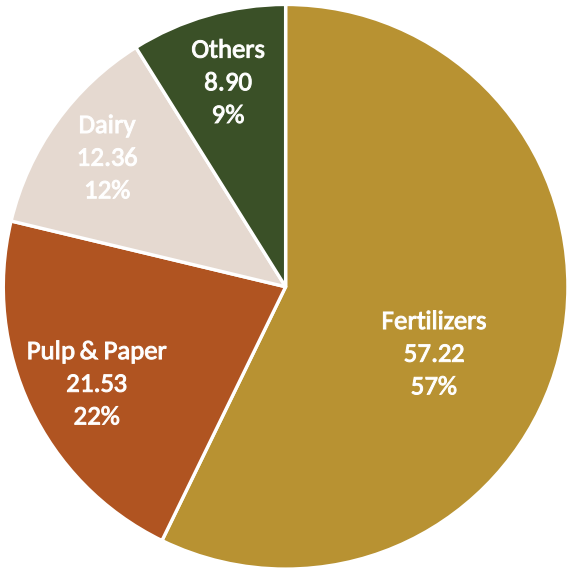
Emissions from Domestic Wastewater sub-sector in both rural and urban areas grew at a CAGR of 3.13% from 2.49 Mt CO_2e in 2005 to 3.71 Mt CO_2e in 2018. As shown in Figure 15, the majority of the Domestic Wastewater emissions originated from the rural areas of Rajasthan, with a share of ~69% in 2018.

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



As illustrated in Figure 16, Fertilizers Industry was the major contributor to the Industrial Wastewater emissions with a share of 57~% in 2018. This was followed by Pulp and Paper (~22%), Dairy Industry (~12%) and Other Industries (~9%).

Figure 16: Category-wise Emissions (Mt CO_2e) and Percentage Share in Total Industrial Wastewater Emissions (2018)



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.

Secretariat Contact
Vasudha Foundation, CISRS House, 14, Jangpura B,
Mathura Road, New Delhi - 110014, India
Phone No. - 011-24372680

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