

Trend Analysis of GHG Emissions of UTTAR PRADESH

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

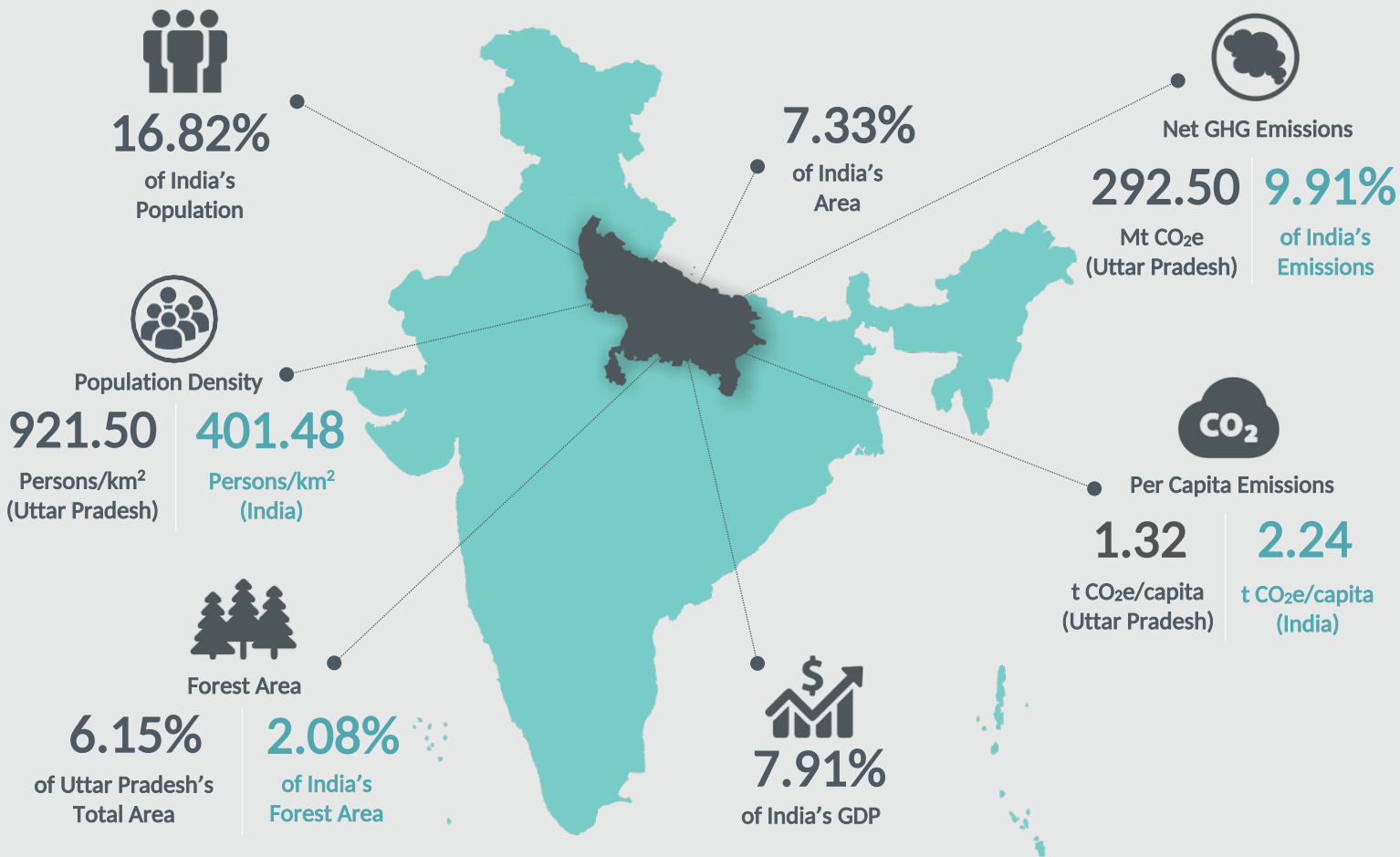
The Platform aims to add value to the various ongoing GHG emissions estimation efforts by addressing existing data gaps and data accessibility issues, broadening the scope of national inventories to include state inventories, and increasing the volume of analytics and policy dialogue on India's GHG emissions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

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



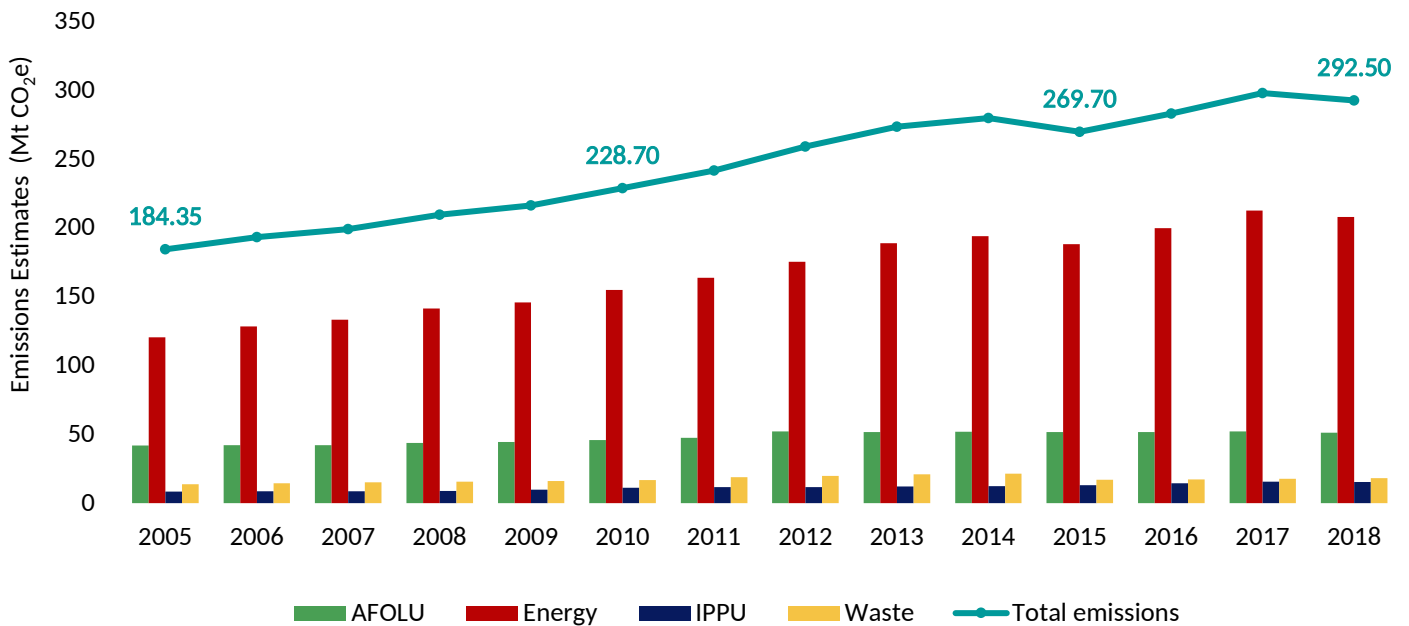
* Fuel combusted for captive electricity generation (auto-producers) and direct fuel combustion (industrial energy) has been reported under Energy sector.

Uttar Pradesh at a Glance (2018)



Economy-wide Emissions Estimates

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



Emissions of Uttar Pradesh increased at a CAGR of 3.61% from 184.35 Mt CO₂e in 2005 to 292.50 Mt CO₂e in 2018 (see Figure 1). In 2018, ~71% of emissions emanated from the Energy sector, up from ~65% in 2005. Whereas, the Agriculture, Forestry, and Other Land-Use (AFOLU) sector's share of the economy-wide emissions decreased from ~23% in 2005 to ~18% in 2018. The share of emissions from the Industrial Processes and Product Use (IPPU) sector decreased from ~7% in 2005 to 6% in 2018, while the contribution from the Waste sector emissions declined from 7% in 2005 and to 6% in 2018 (see Figure 2).

Figure 2: Sector-wise Contribution (Mt CO₂e) and Percentage Share in Total Economy-wide GHG Emissions of Uttar Pradesh

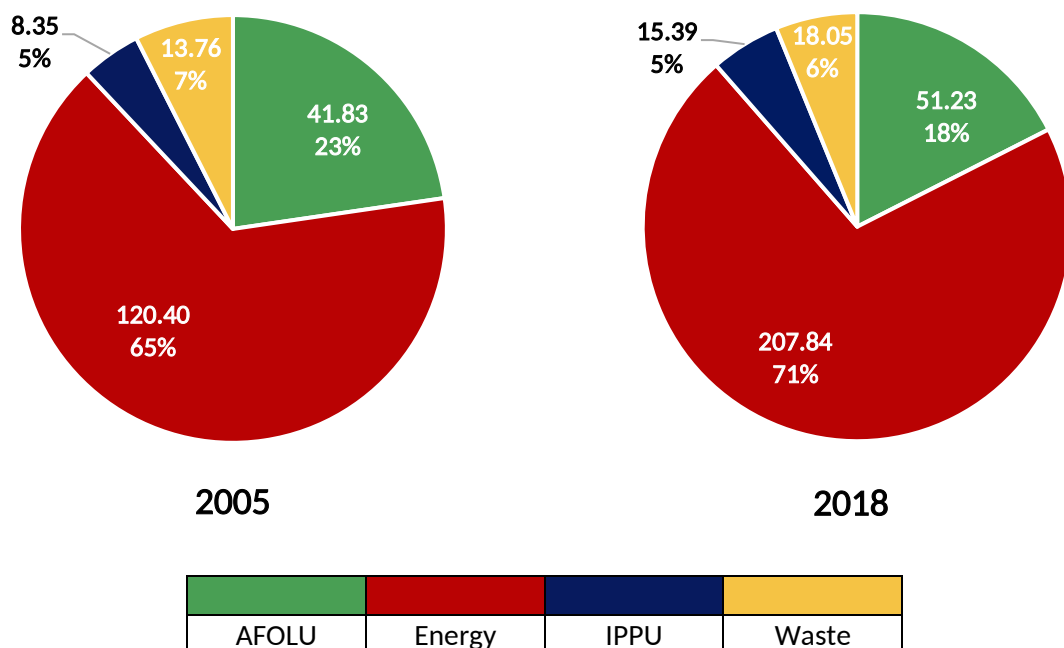
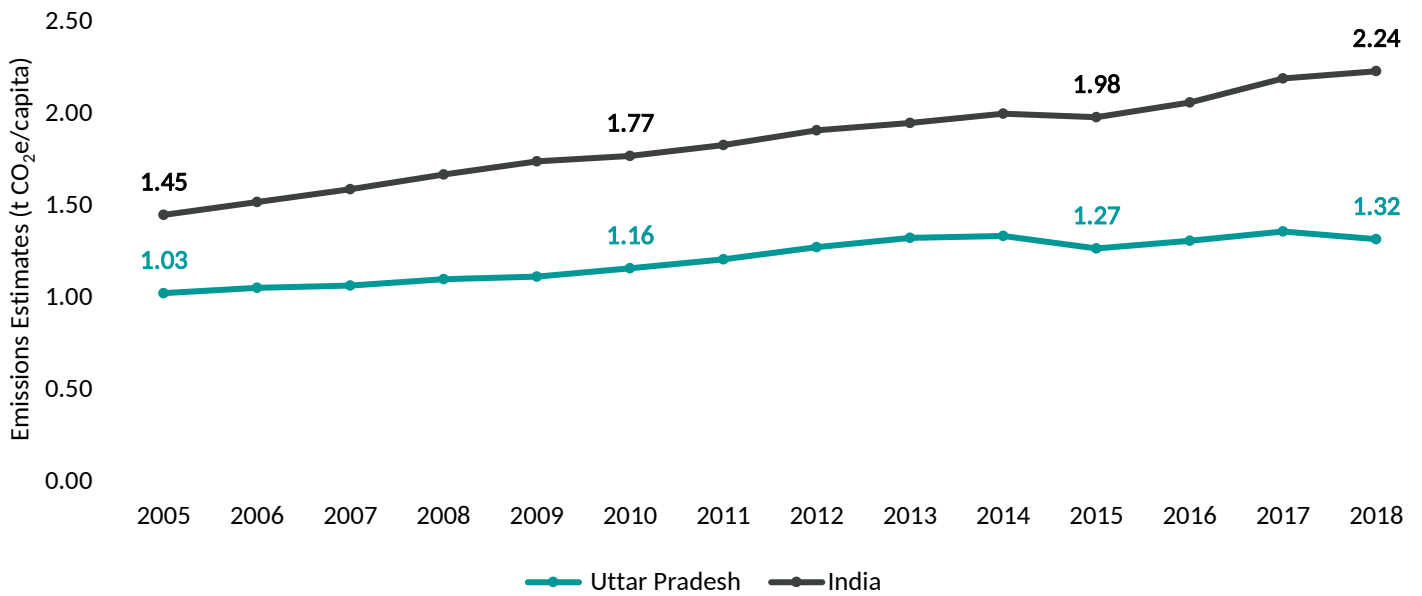


Figure 3: Per Capita GHG Emissions of Uttar Pradesh and India (2005 to 2018)



The per capita emissions of Uttar Pradesh were lower than the per capita emissions of India throughout the reference years (see Figure 3). Further, the per capita emissions of Uttar Pradesh grew at an estimated CAGR of 1.94% from 1.03 t CO₂e/capita in 2005 to 1.32 t CO₂e/capita in 2018, which was much lower than that of India (~3.41%).

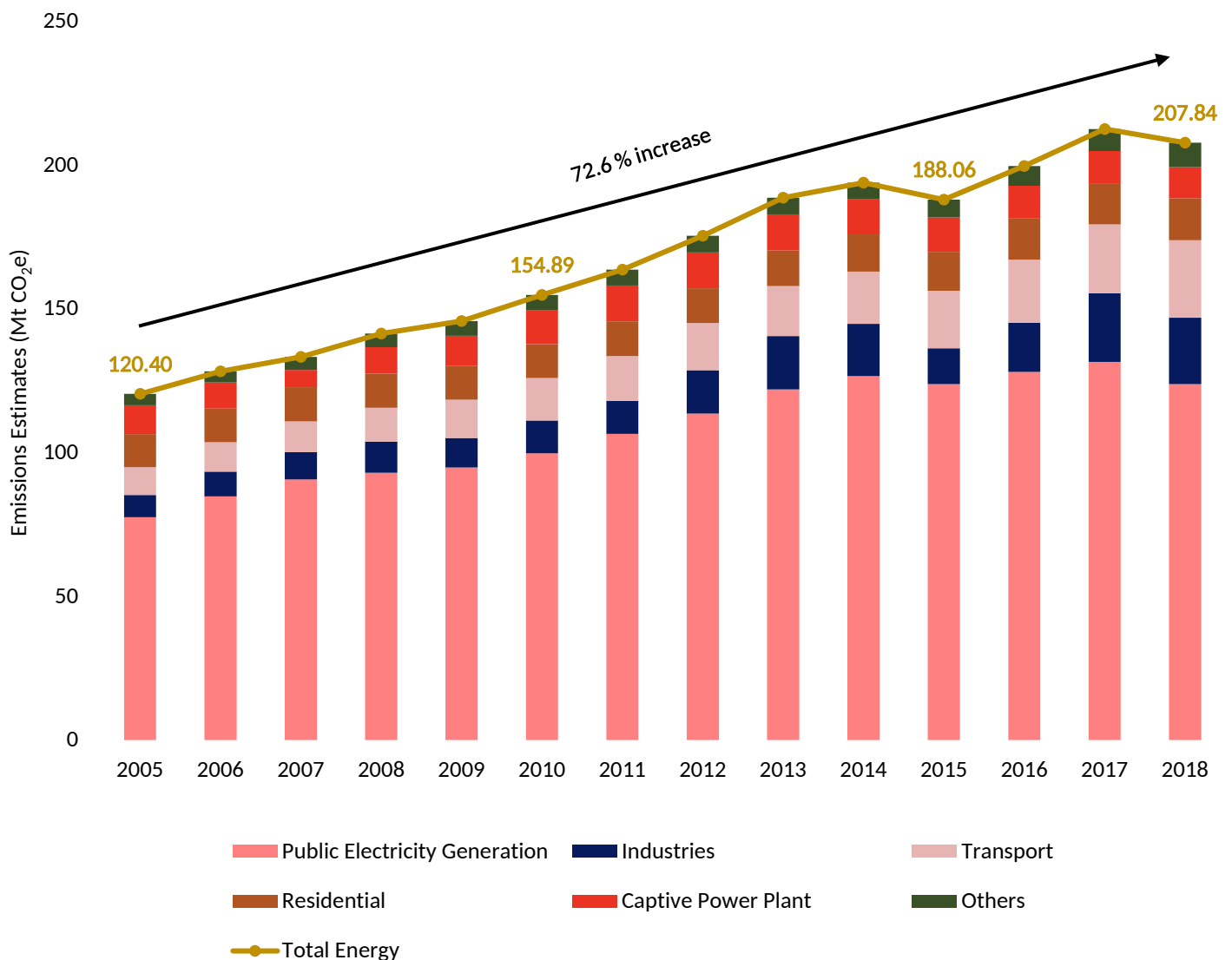
Energy Sector



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

The Energy sector of Uttar Pradesh accounted for ~71% of the total economy-wide emissions of the state in 2018. Emissions from the Energy sector increased by 72.6% from 120.40 Mt CO₂e in 2005 to 207.84 Mt CO₂e in 2018 (see Figure 4).

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



Within the Energy Sector, Public Electricity Generation category was the major contributor, with a share of ~60% of the total Energy emissions in 2018. This was followed by Transport category with a share of ~13% and Industrial Energy with a share of ~11% (see Figure 5).

Within the Fuel Combustion sub-sector, emissions from Coal had the highest share of ~71% between 2005 and 2018 (see Figure 6). This was followed by emissions from combustion of Liquid Petroleum Fuels, with their average share at ~18%, during the reference years. The Gaseous Petroleum Fuels had an average share of ~9%, while Other Fuels contributed ~2% to the Fuel Combustion emissions throughout the reference period.

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

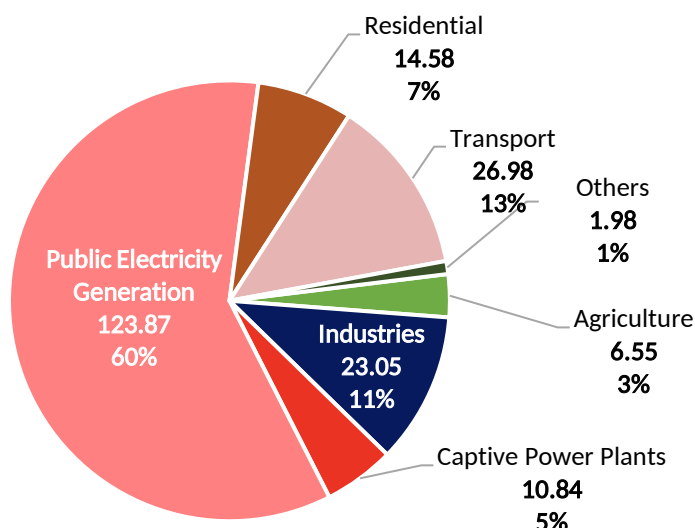
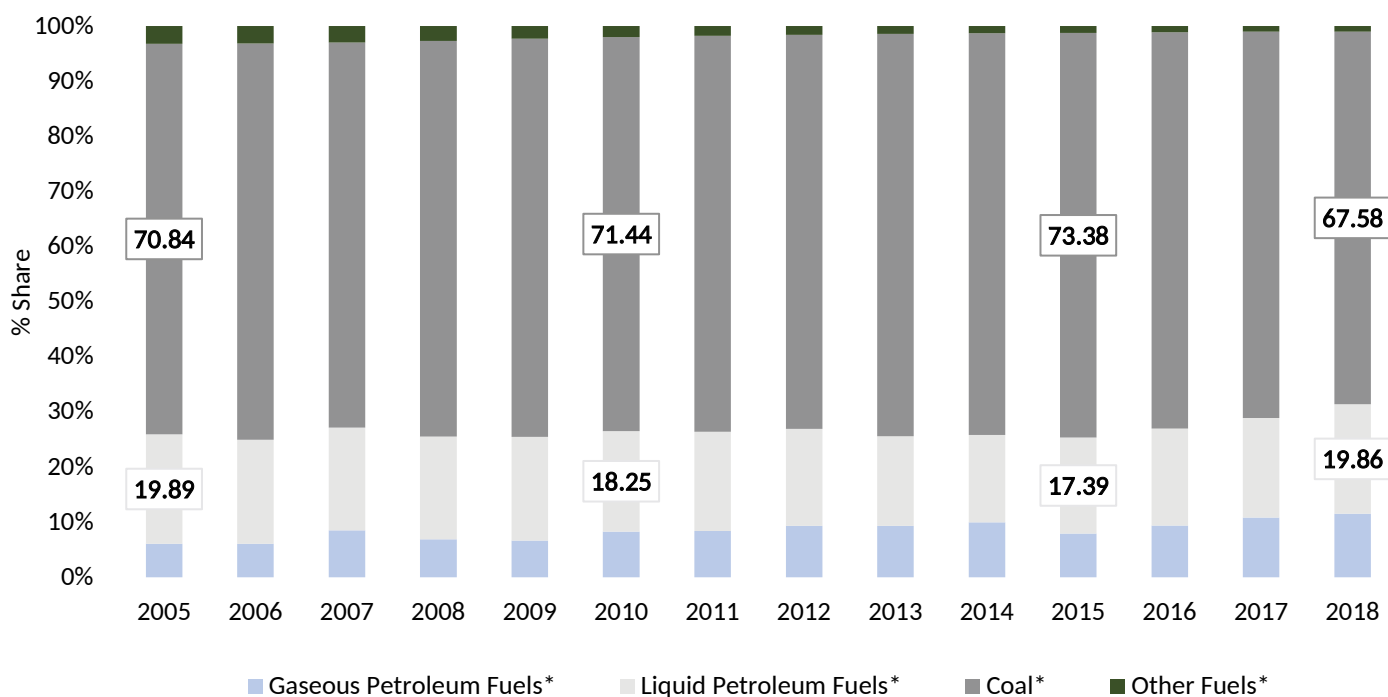


Figure 6: Percentage Share of GHG Emissions by Fuel Type due to Fuel Combustion in Energy Sector (2005 to 2018)



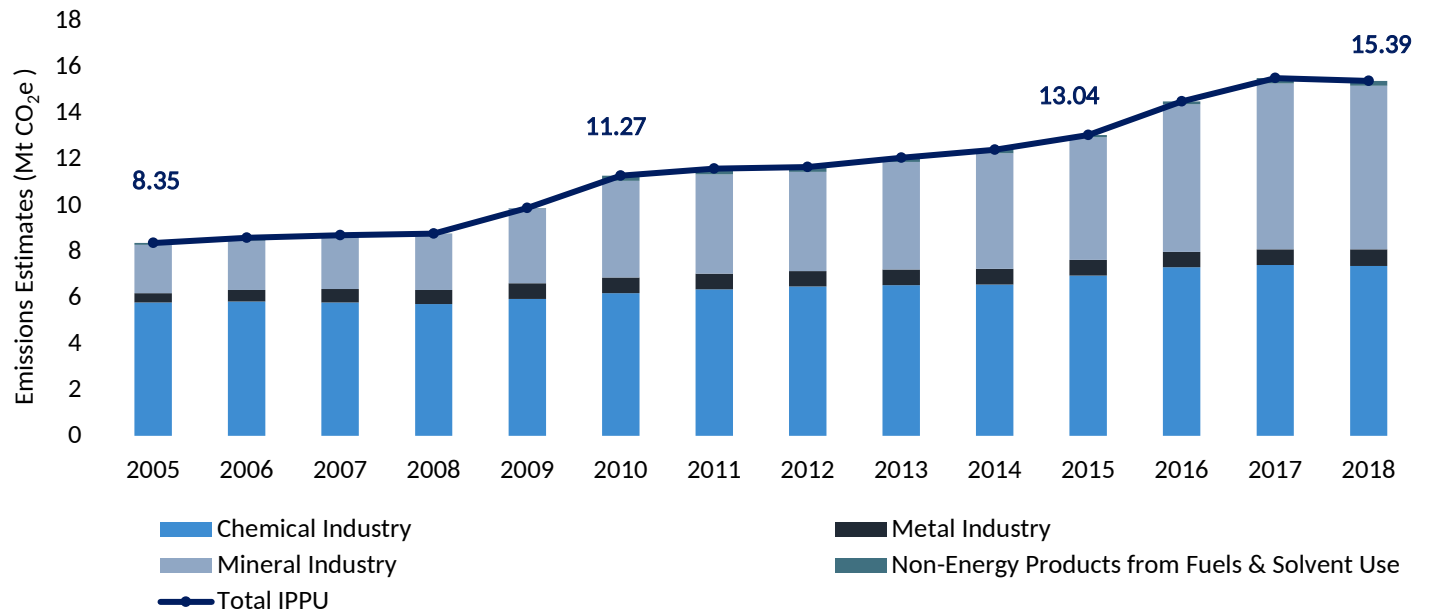
***Notes:**

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



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 Uttar Pradesh, the IPPU sector represented ~5.2% of the total economy-wide emissions, in 2018. Between 2005 and 2018, the overall IPPU emissions increased from 8.35 Mt CO₂e to 15.39 Mt CO₂e at a CAGR of 4.81% as illustrated in Figure 7. A rise in the IPPU sector emissions was observed from 2010 onwards, owing to increase in emissions from Chemical Industry sub-sector (primarily from Ammonia Production) and Mineral Industry sub-sector (primarily from Cement Production).

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



Chemical Industry sub-sector was a major contributor to total IPPU emissions with a share of 48% in 2018, followed by the Mineral Industry sub-sector with a share of 46%. Emissions from Ammonia Production were the leading contributor to IPPU sector emissions with an average share of ~50% between 2005 and 2018. Emissions from Cement Production and Aluminium Production came in second and third, respectively, with average shares of 35% and 6% during the reference years (see Figures 8 and 9).

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

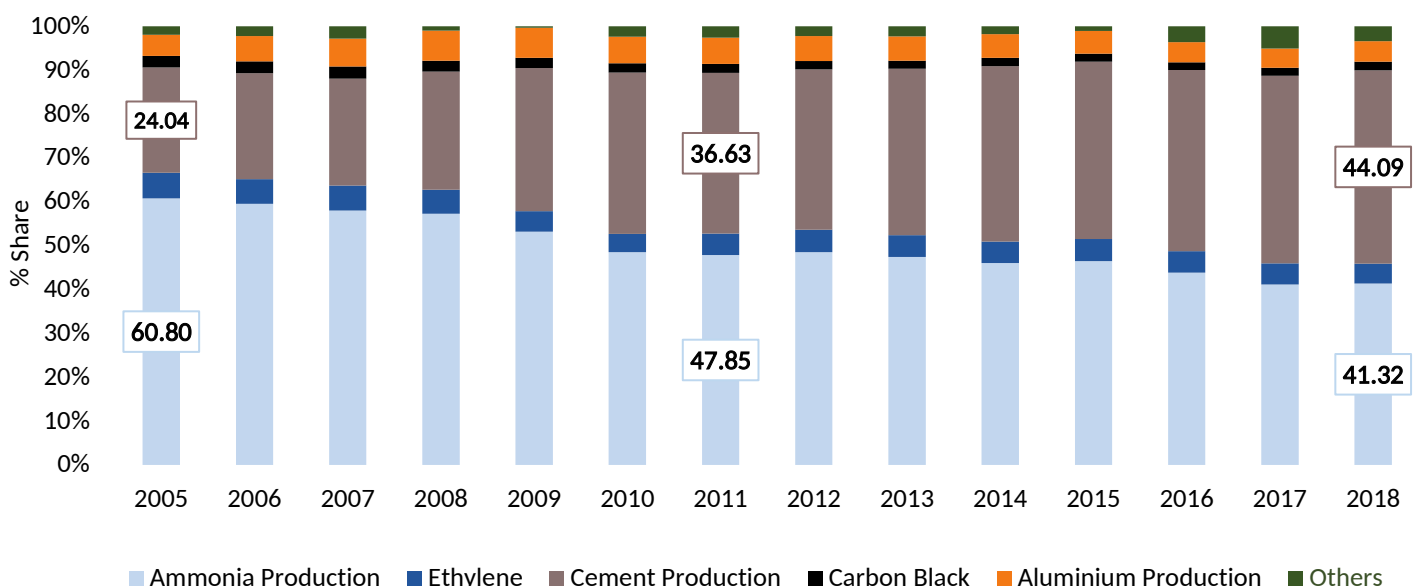
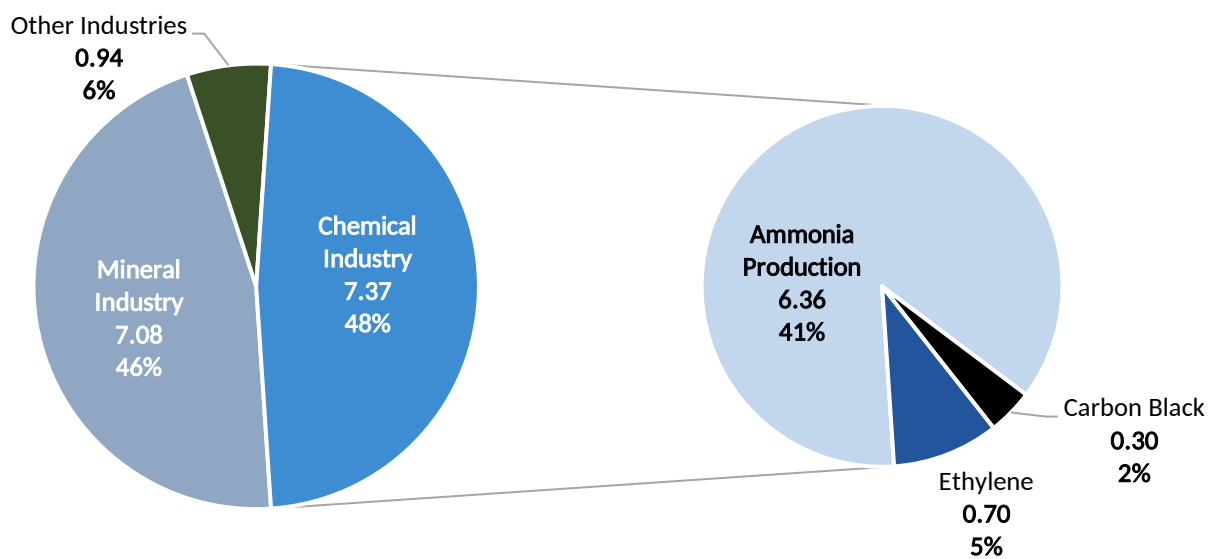


Figure 9: Sub-sector Emissions (Mt CO₂e) and Percentage Share in Total IPPU Emissions (2018)

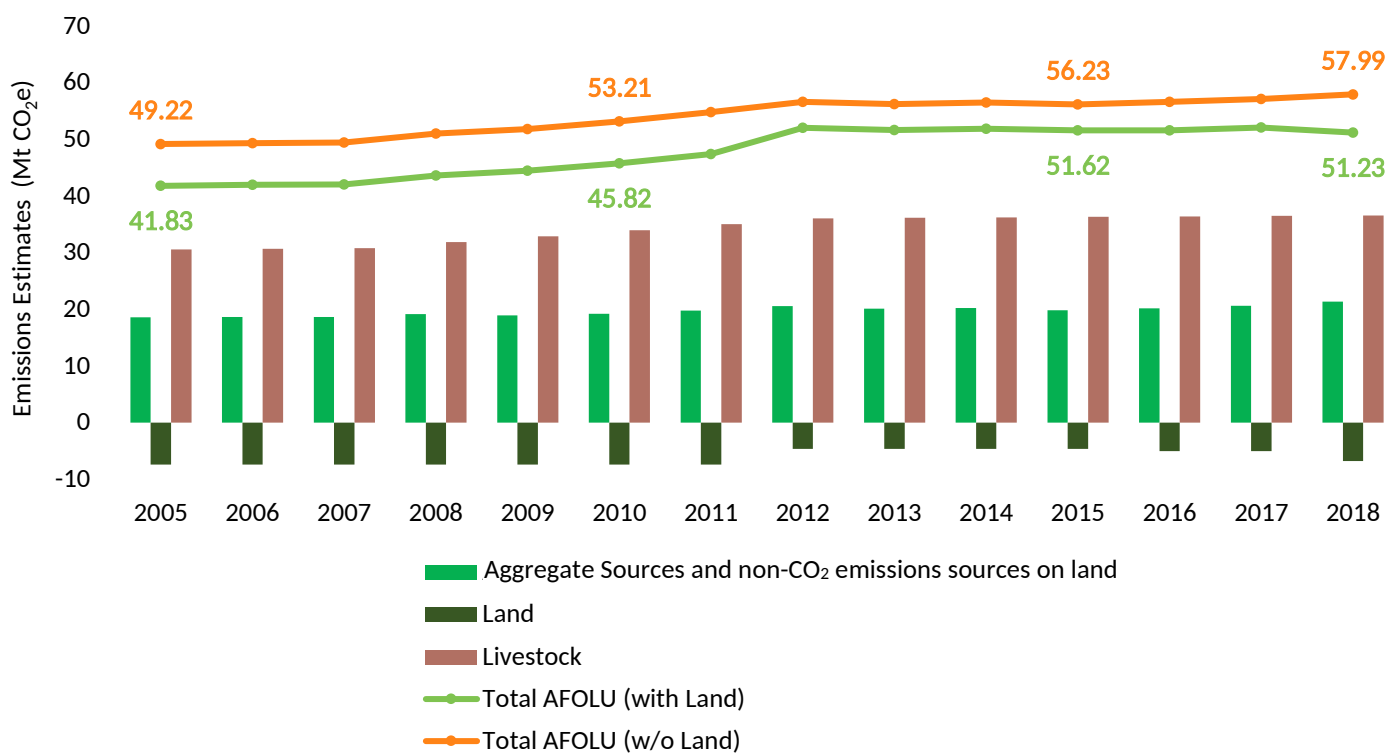




Emissions from the Agriculture, Forestry and Other Land Use (AFOLU) sector arise from three main sub-sectors, namely Livestock, Land and Aggregate Sources and Non-CO₂ Emissions Sources on Land*. In Uttar Pradesh, AFOLU sector represented ~17.5% of the total economy-wide emissions in 2018. The total AFOLU emissions increased at a CAGR of ~1.57% from 41.83 Mt CO₂e in 2005 to 51.23 Mt CO₂e in 2018.

The Land sub-sector was a sink between 2005 and 2018. A reduction in the sink was observed between 2012 and 2017 as a result of a relatively lower rate of increase in forest area during those years. In 2018, the removals from Land sub-sector increased due to increase in forest area as well as carbon stock density of state's forest as reported by Forest Survey of India (2021)**. The average annual removals from the Land sub-sector in Uttar Pradesh during the reference period were 6.22 Mt CO₂e, around ~11.51% of the average annual gross AFOLU emissions (excluding Land sub-sector) (see Figure 10).

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



The Livestock sub-sector had the maximum share of ~63% of gross AFOLU emissions (excluding Land sub-sector) of Uttar Pradesh during the reference period. Within the Livestock sub-sector, Enteric Fermentation was the major contributor to gross AFOLU emissions, with an average share of ~57% across the reference period. Emissions from the Livestock sub-sector increased at a rate of 1.38% (compounded annually) from 30.62 Mt CO₂e in 2005 to 36.62 Mt CO₂e in 2018.

From the Aggregate Sources sub-sector, the categories of Agriculture Soils and Rice Cultivation were the top contributors to gross AFOLU emissions, with shares of about ~18% and ~15%, respectively, in 2018. In the gross AFOLU emissions, the share of emissions from Agriculture Soils increased from ~17% in 2005 to ~18% in 2018, whereas, the share of emissions from Rice Cultivation decreased from ~18% in 2005 to ~15% in 2018 (see Figures 11 and 12).

* The sub-sector called 'Aggregate Sources and Non-CO₂ Emissions 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)

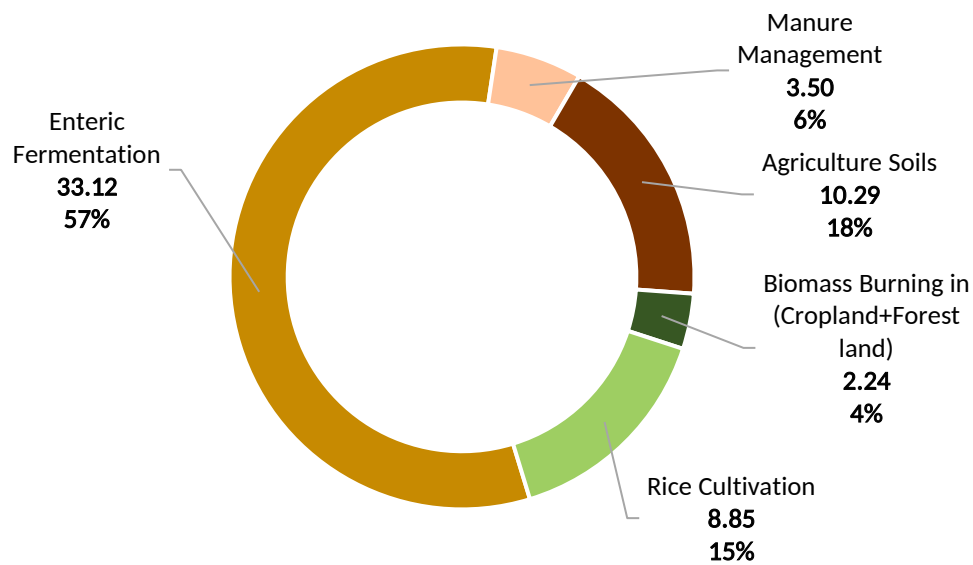
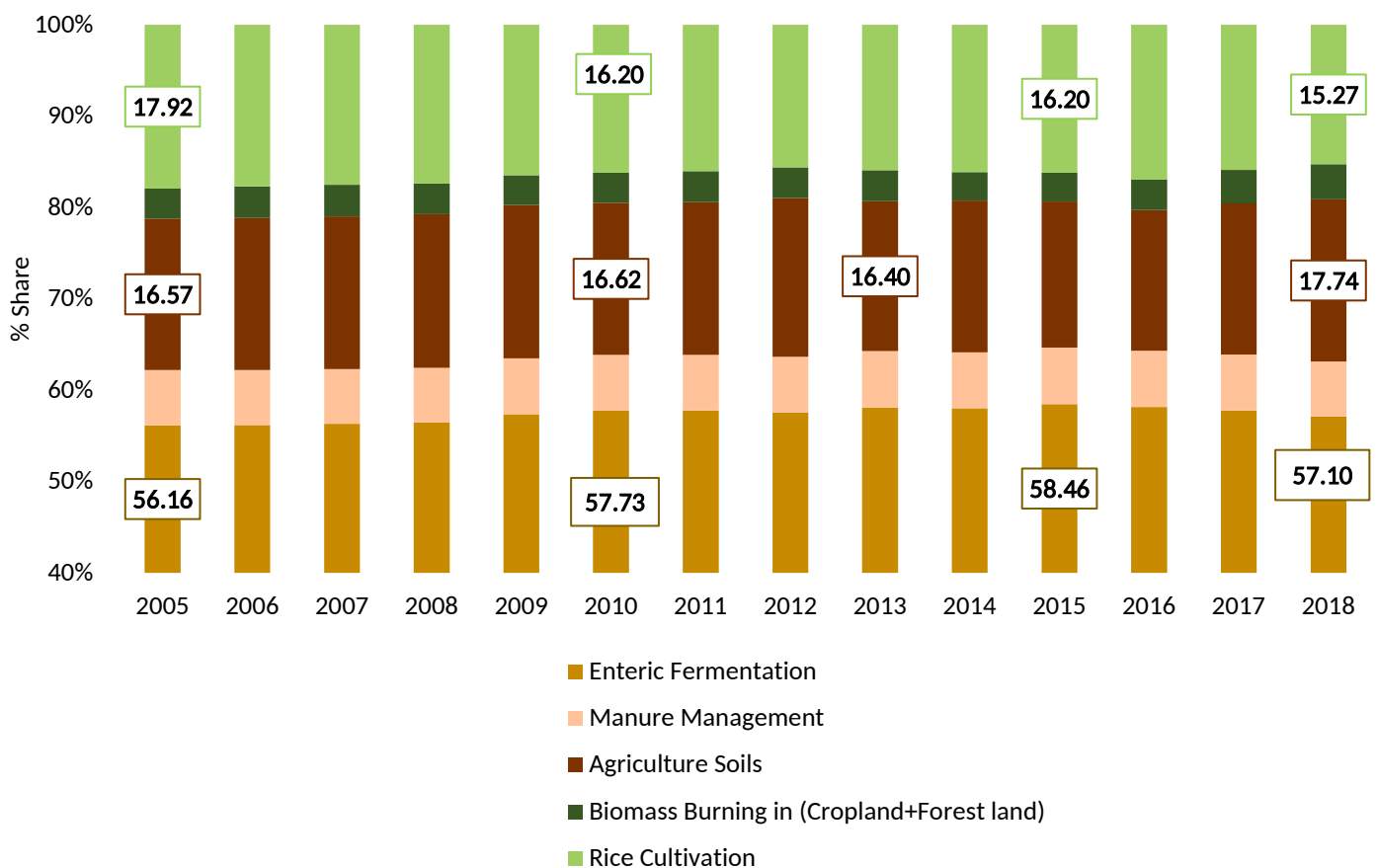


Figure 12: Category-wise share of Gross AFOLU Emissions (excluding Land sub-sector) (2005-2018)





Waste Sector

Solid Waste Disposal, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. Waste sector accounted for 6% of the total economy-wide emissions of Uttar Pradesh in 2018. GHG emissions from the Waste sector increased at an estimated CAGR of 2.11% from 13.76 Mt CO₂e in 2005 to 18.05 Mt CO₂e in 2018. As can be seen in Figure 13 below, a sudden dip in the overall emissions of the Waste sector was observed in 2015. This can be attributed to the decrease in emissions from the Industrial Wastewater sub-sector of Uttar Pradesh.

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

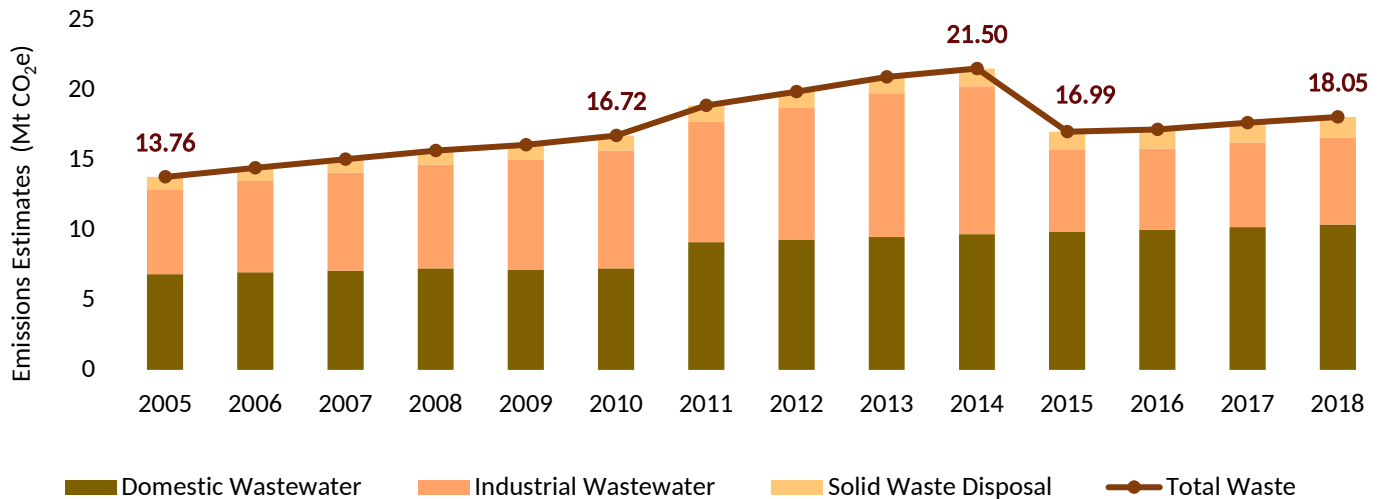
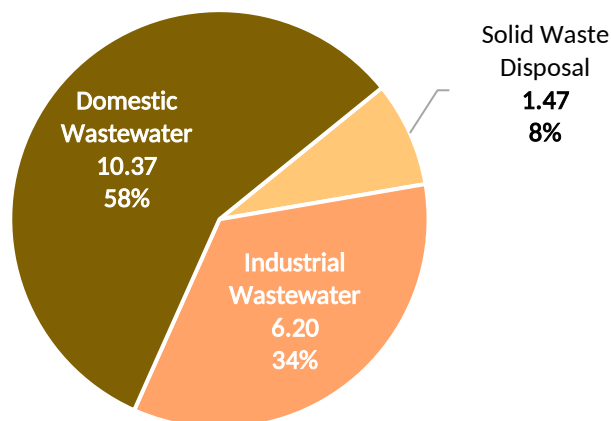


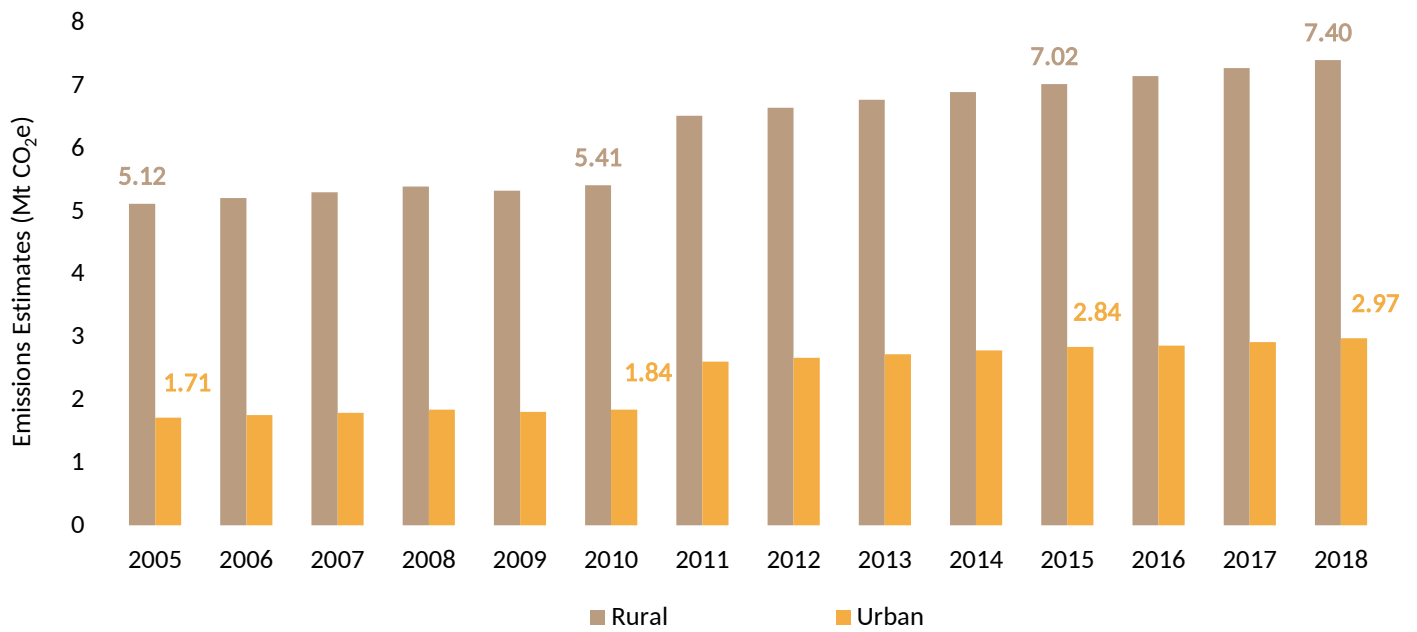
Figure 14: Sub-sector Emissions (Mt CO₂e) and Percentage Share in Total Waste Sector Emissions (2018)



Discharge of untreated wastewater and use of septic tanks are key drivers of emissions in this sub-sector. Domestic Wastewater had a share of ~58% in the total Waste sector emissions of Uttar Pradesh in 2018. Approximately ~8% of the Waste sector emissions were from Solid Waste Disposal, which grew at an estimated CAGR of 3.97% from 0.89 Mt CO₂e in 2005 to 1.49 Mt CO₂e in 2018. Industrial Wastewater accounted for nearly 34% of Waste sector emissions in 2018 and grew at a CAGR of 0.24% from 6.05 Mt CO₂e in 2005 to 6.20 Mt CO₂e in 2018 (see Figure 14).

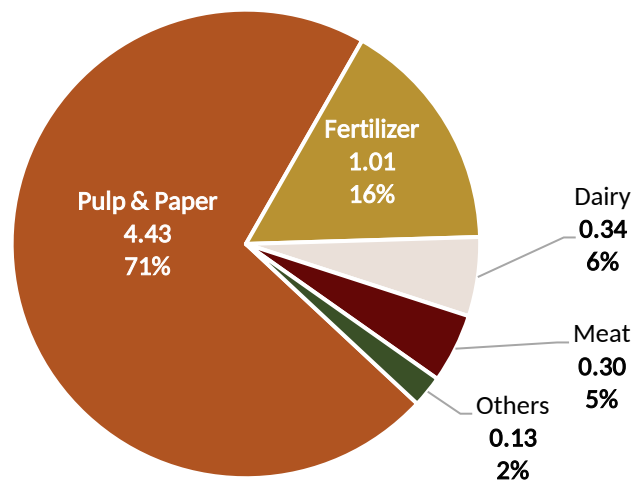
Emissions from Domestic Wastewater of Uttar Pradesh from both rural and urban areas grew at a CAGR of 3.27% from 6.83 Mt CO₂e in 2005 to 10.37 Mt CO₂e in 2018. As shown in Figure 15, the majority of the Domestic Wastewater emissions originated from the rural areas of Uttar Pradesh with a share of ~71% in 2018 (see Figure 15).

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



Pulp and Paper Industry was the major contributor to Industrial Wastewater emissions with a share of 71% in 2018, followed by Fertilizer Industry (16%), Dairy (6%), Meat (5%) and other industries (8%) as shown 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.

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