GHG Platform INDIA

Trend Analysis of GHG Emissions of UTTARAKHAND

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

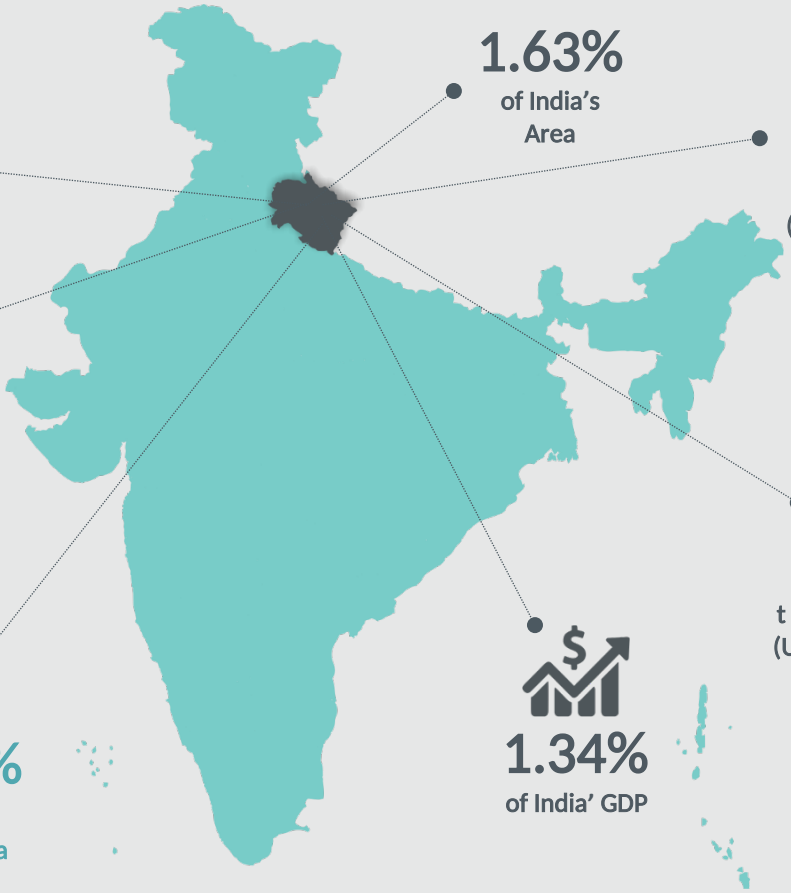
The Platform aims to add value to the various ongoing GHG emissions estimation efforts by addressing existing data gaps and data accessibility issues, broadening the scope of national inventories to include state inventories, and increasing the volume of analytics and policy dialogue on India's GHG emissions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

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

ENERGY | IPPU* | AFOLU | WASTE

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

Uttarakhand at a Glance (2018)



0.83% of India's Population

1.63% of India's Area

Net GHG Emissions
11.83 Mt CO_2e (Uttarakhand)
0.40% of India's Emissions

Population Density
205.92 Persons/km² (Uttarakhand)
401.48 Persons/km² (India)

Per Capita Emissions
1.07 t CO_2e/capita (Uttarakhand)
2.24 t CO_2e/capita (India)

Forest Area
45.44% of Uttarakhand's Total Area
3.41% of India's Forest Area

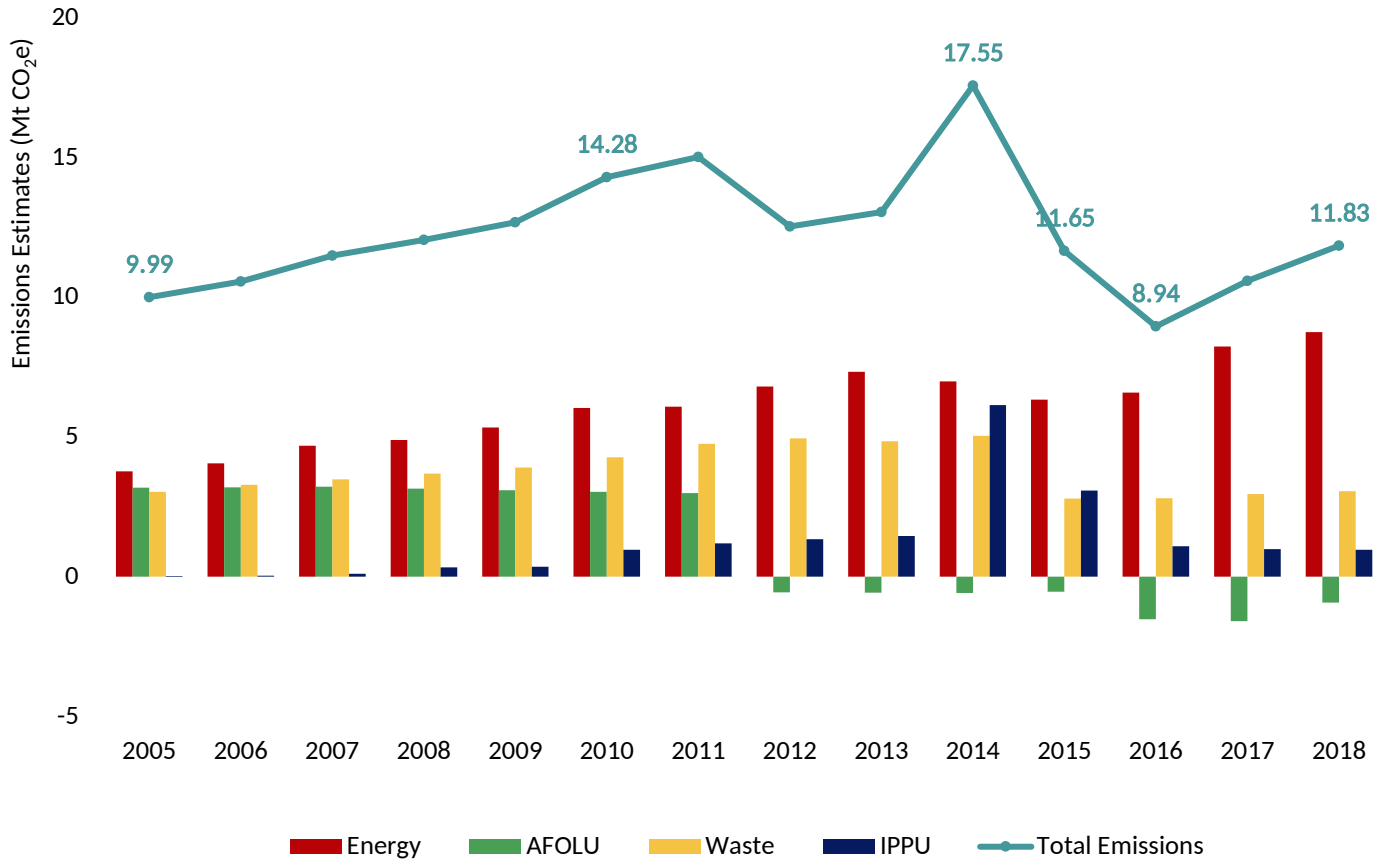
1.34% of India' GDP

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 Uttarakhand (2005 to 2018)



Emissions of Uttarakhand increased at an estimated CAGR of 1.30% from 9.99 Mt CO_2e in 2005 to 11.83 Mt CO_2e in 2018. As seen in Figure 1, Energy sector was the major contributor to Uttarakhand's GHG emissions, throughout the reference period. Notably, the economy-wide emissions peaked in 2014 at 17.55 Mt CO_2e. Between 2014 and 2016, there was a dip in net GHG emissions primarily due to a decline in emissions from Industrial Processes and Product Use (IPPU) sector coupled with increase in removals from Agriculture, Forestry and Other Land Use (AFOLU) sector. Although, an increase in economy-wide emissions was observed post 2016, as the emissions from Energy sector increased significantly, it was not enough to completely offset the decline in emissions between 2014 and 2016.

It is important to note that the entire AFOLU sector was a net emitter till 2011 and became a net sink from 2012 onwards.

In 2005, the share of Energy sector in the gross economy-wide emissions (excluding Land sub-sector within AFOLU) was ~39%. This was followed by Waste and Agriculture sectors with shares of 31% and 30%, respectively. The contribution of IPPU sector in 2005 was negligible. In 2018, the share of Energy sector emissions increased to ~57% of the gross economy-wide emissions (excluding Land sub-sector within AFOLU), while the share of IPPU sector increased to ~6%. However, the contribution of Agriculture and Waste sectors declined to ~17% and ~20% respectively in 2018 (see Figure 2).

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

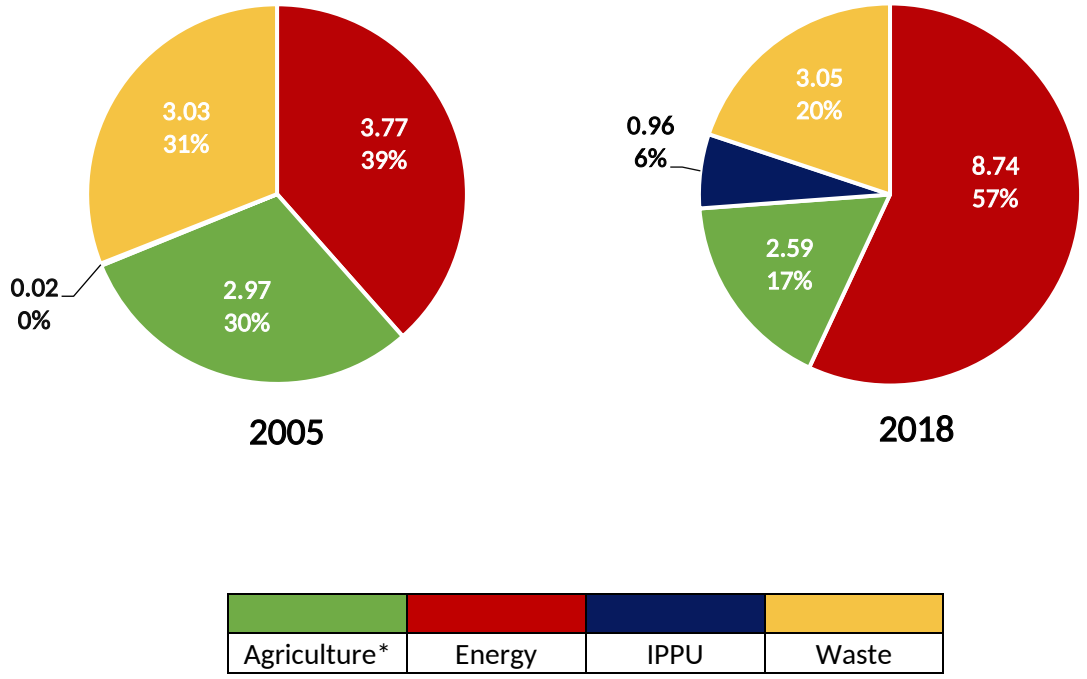
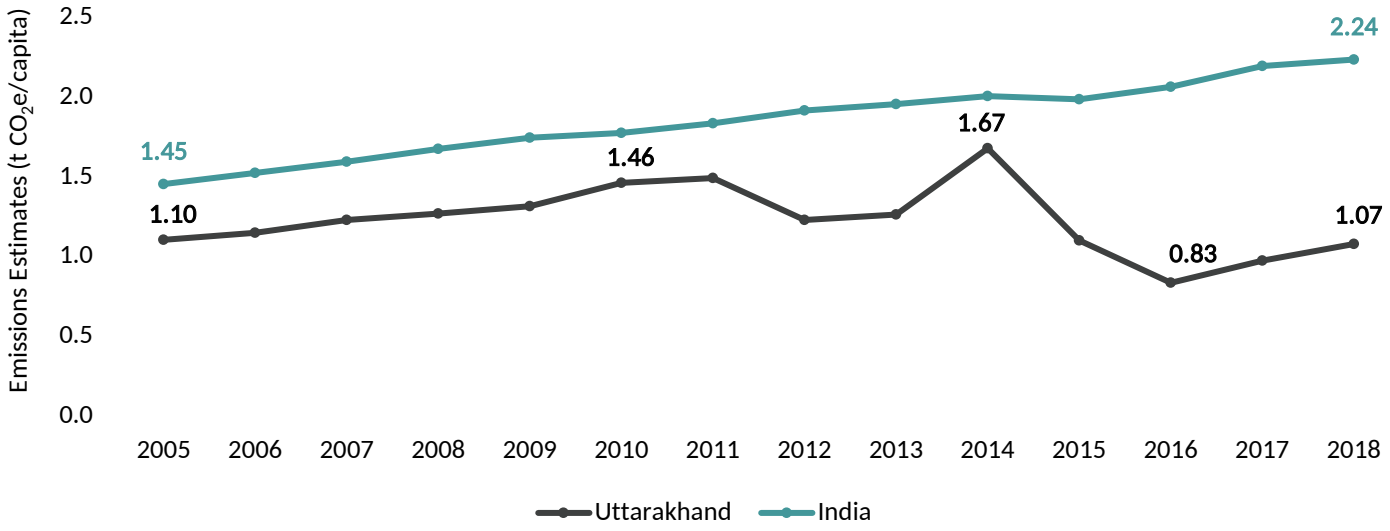


Figure 3: Per Capita Net GHG Emissions of Uttarakhand and India (2005 to 2018)



The per capita emissions of Uttarakhand were lower than India's per capita emissions, across the reference years, as illustrated in Figure 3. While they peaked in 2014, the per capita emissions of Uttarakhand decreased at a CAGR of 0.20% from 1.10 t CO_2e/capita in 2005 to 1.07 t CO_2e/capita in 2018. This trend was the opposite of the per capita emissions trend of India. The national per capita emissions grew at a CAGR of ~3.41% between 2005 and 2018.

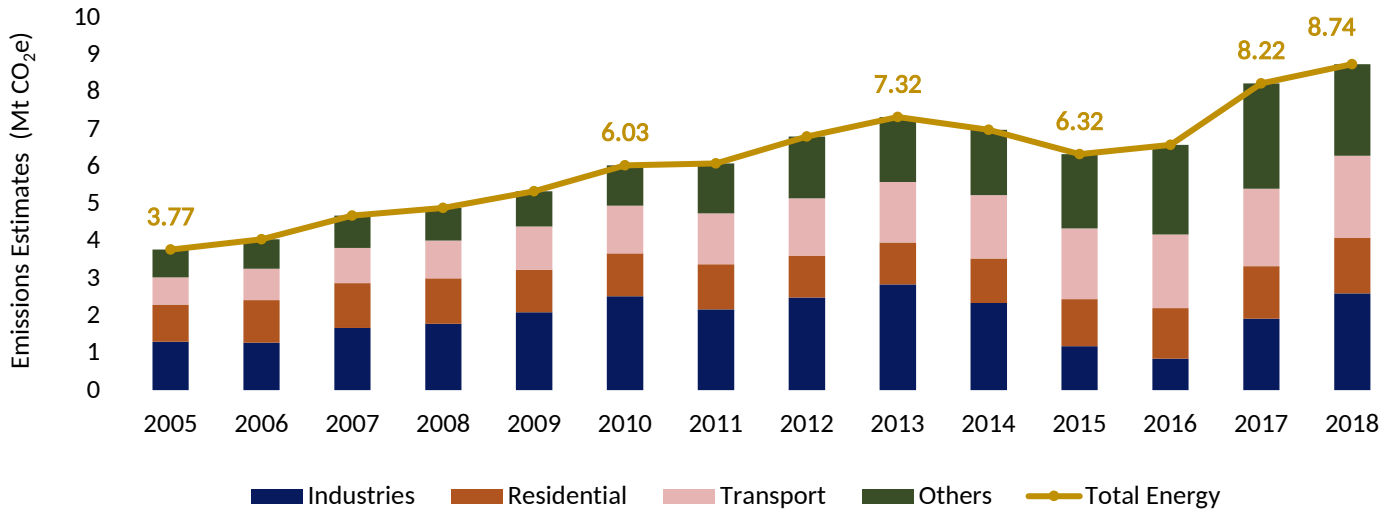
**For the purpose of this comparison, agriculture emissions do not include removals from lands and forests. For further details, please see the section on AFOLU emissions below*

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.

In Uttarakhand, the Energy sector represented ~57% of the gross economy-wide emissions (excluding Land sub-sector within AFOLU) in 2018. Notably, almost all the Energy emissions in Uttarakhand were due to Fuel Combustion sub-sector and negligible emissions were registered from the Fugitive Emissions sub-sector. Emissions from the Energy sector increased at a CAGR of 6.69% from 3.77 Mt CO_2e in 2005 to 8.74 Mt CO_2e in 2018 as shown in Figure 4.

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



Within the Energy sector, Industrial Energy and Transport categories were the leading contributors to GHG emissions, having shares of ~30% and ~25%, respectively, in 2018. This was followed by Residential category with a share of ~17% and Captive Power Plants category with a share of ~14% in 2018 (see Figure 5).

Within the Fuel-Combustion sub-sector, emissions from Liquid Petroleum Fuels were the leading contributor, with an average share of ~50% across the reference period (see Figure 6). This was followed by emissions from combustion of Coal, with an average share of ~30% between 2005 and 2018. Gaseous Petroleum Fuels had an average share of ~12%, while Other Fuels contributed ~8% 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)

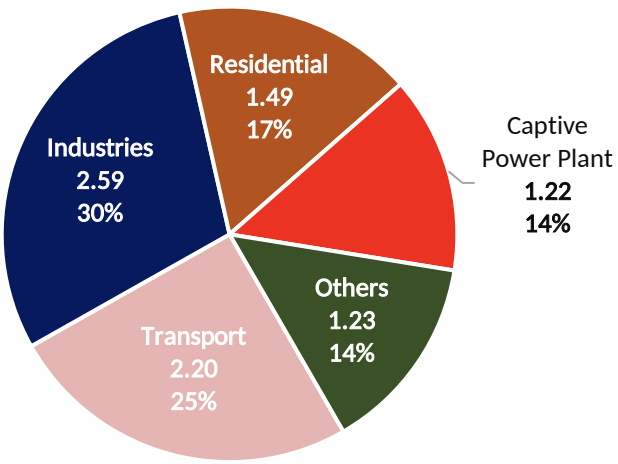
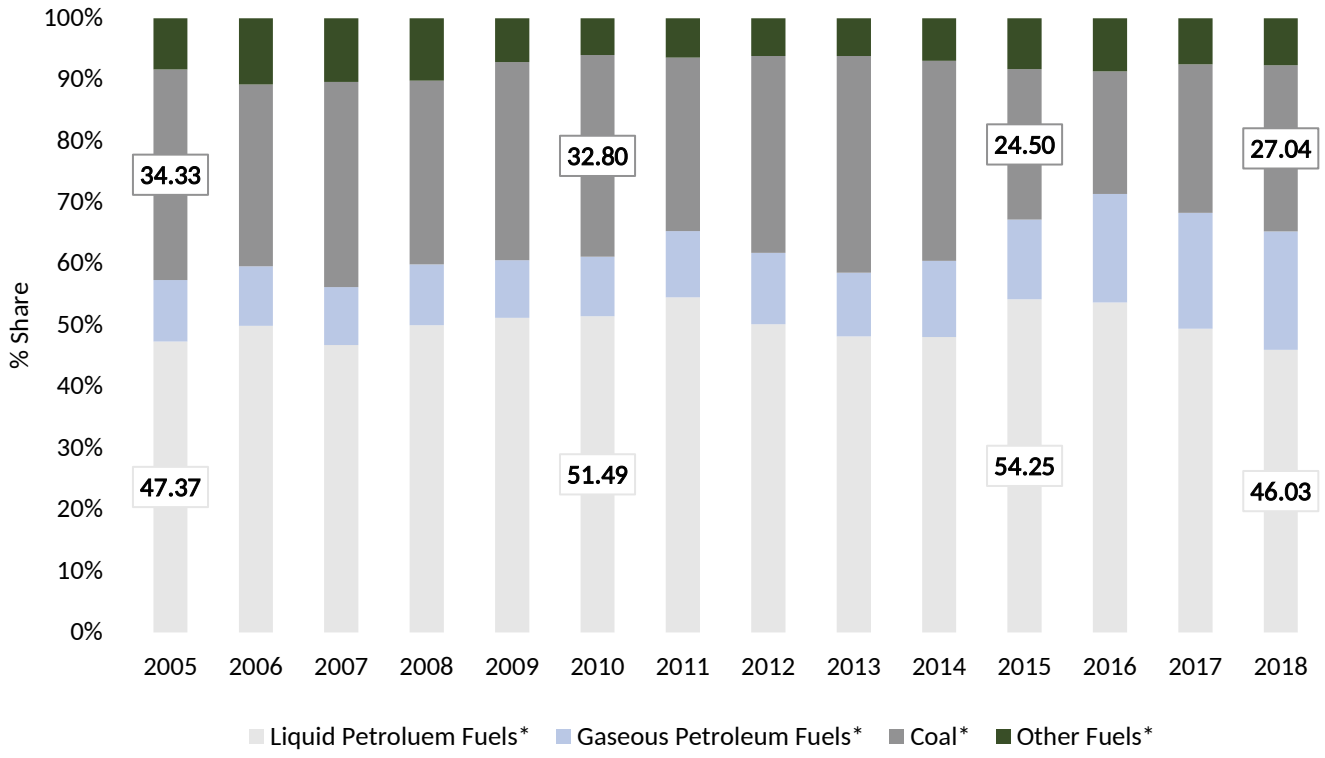


Figure 6: Percentage Share of GHG Emissions by Fuel Type due to Fuel Combustion in Energy Sector (2005 to 2018)



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

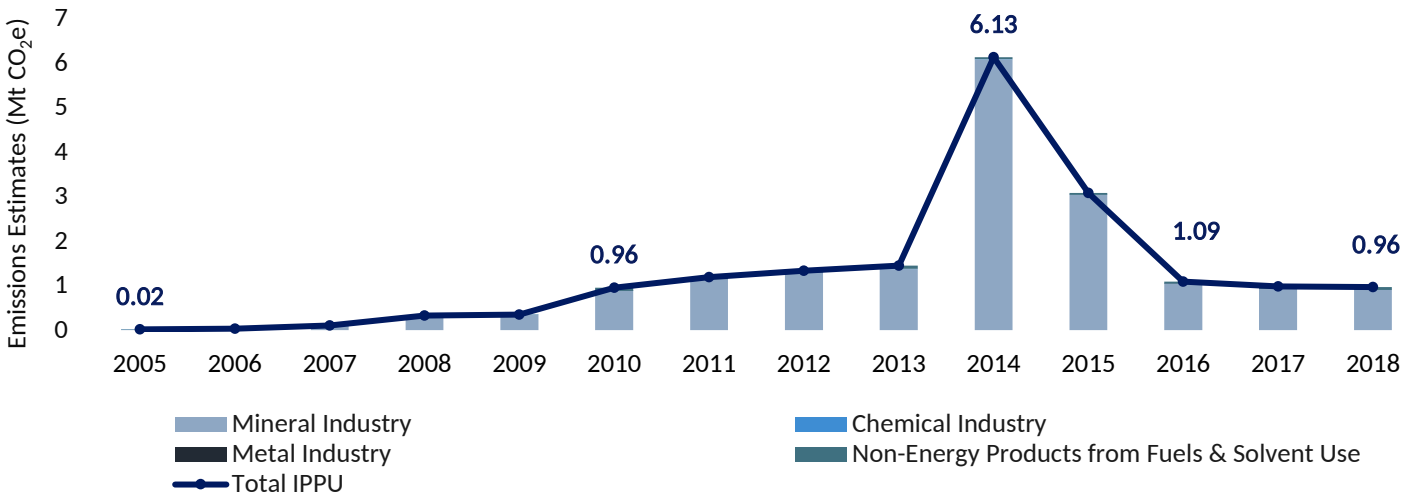
3. Liquid Petroleum Fuels - ATF, diesel, kerosene, motor spirit and other liquid fuels

4. Other Fuels comprises of firewood and charcoal

IPPU Sector

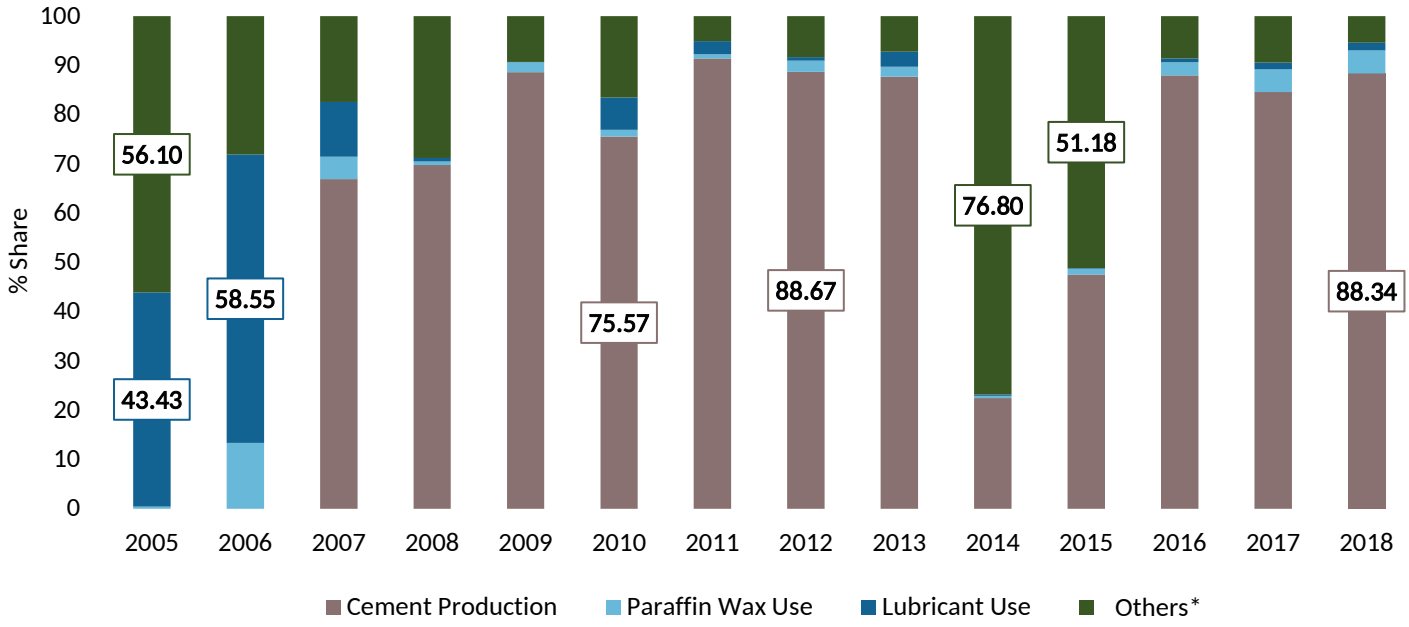
Emissions from the Industrial Processes and Product Use (IPPU) sector are largely driven by Chemical, Metal, Mineral Industries and Non-Energy Products from Fuels and Solvent Use. In Uttarakhand, the IPPU sector represented ~6% of the gross economy-wide emissions (excluding Land sub-sector within AFOLU) in 2018. Between 2005 and 2018, the overall IPPU emissions increased at a compounded rate of 36.33% from 0.02 Mt CO_2e in 2005 to 0.96 Mt CO_2e in 2018, owing to the increase in emissions from Mineral Industry sub-sector (mainly from Cement Production and Glass Production). However, a peak in the overall IPPU emissions was observed in 2014 due to the increase in the emissions from Other Uses of Soda Ash (see Figure 7).

Figure 7: GHG Emission Estimates of IPPU Sector - Uttarakhand (2005 to 2018)



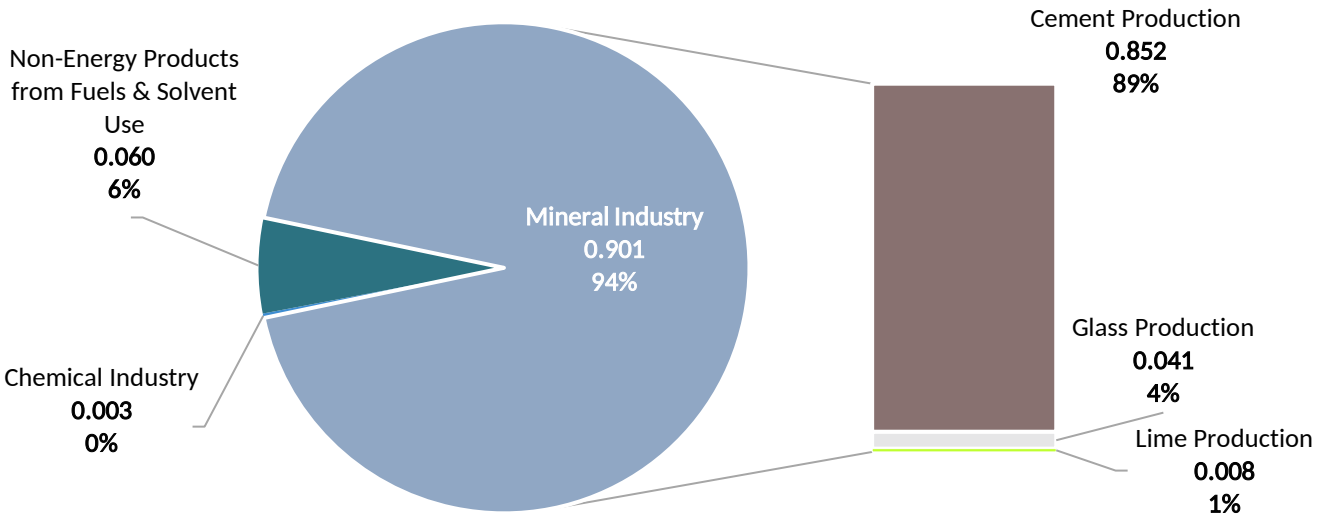
A detailed trend of GHG emissions by various IPPU categories across the reference period is depicted in Figure 8. Cement Production, was a key contributor to Mineral Industry sub-sector in the IPPU emissions and had a share of ~89% in the overall IPPU sector emissions in 2018. This was followed by Paraffin Wax Use and Others with shares of ~4% and ~5%, respectively in 2018 (see Figure 9).

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



**'Others' includes: Other Uses of Soda Ash, Ethylene oxide and Lime Production*

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

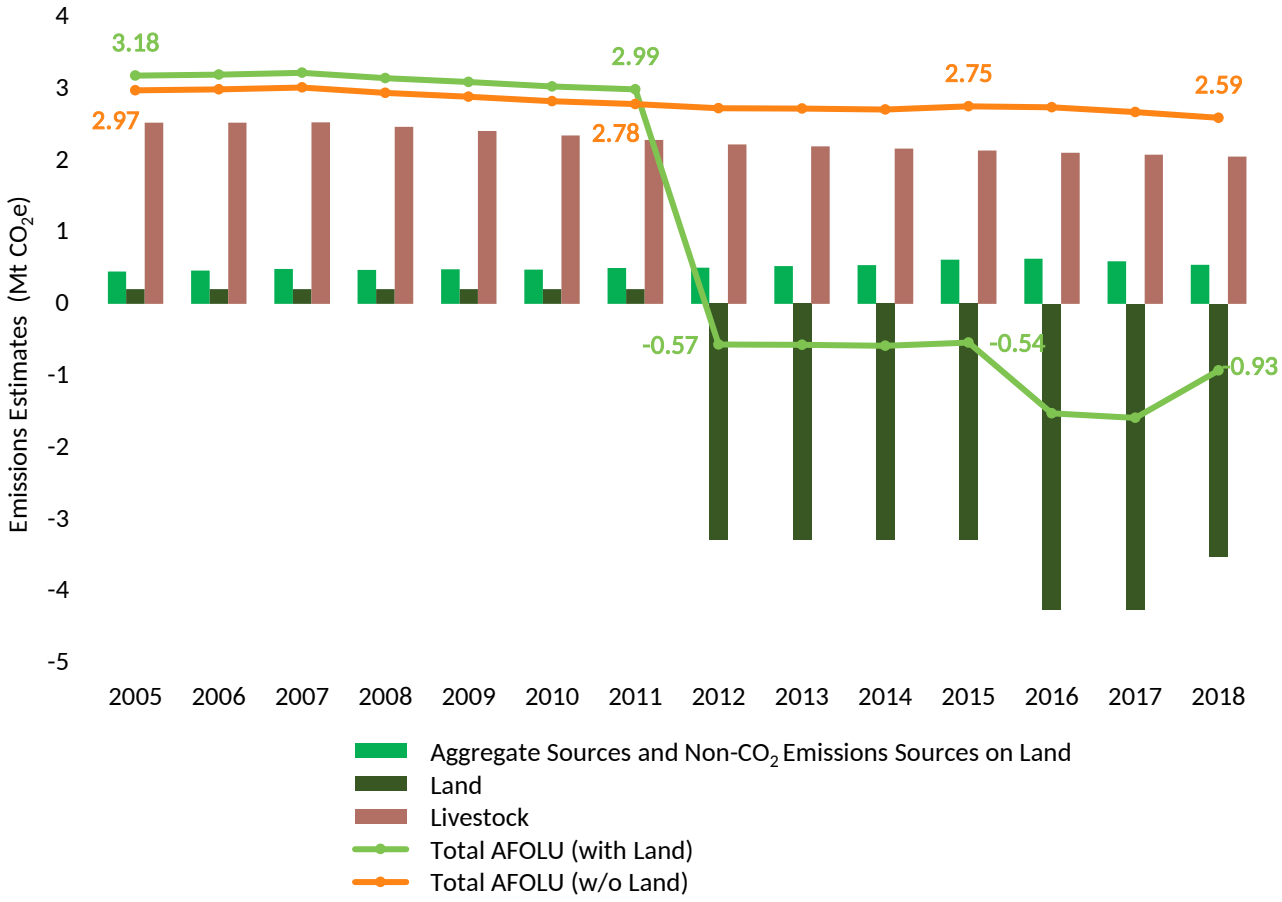


AFOLU Sector

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-CO_2 Emissions Sources on Land*. In Uttarakhand, while the Livestock and Aggregate Sources and Non-CO_2 Emissions Sources on Land sub-sectors were net GHG emitters throughout the reference period, the Land sub-sector was a sink post 2011. Consequently, the AFOLU sector, overall, became a net sink of emissions from 2012 onwards. This was because removals from Forest Land and Other Land categories increased significantly from 2012 onwards. This in turn was largely due to Land Use and Land-Use Change practices combined with a significant increase in carbon stock density.

Overall, the average annual emissions from Livestock and Aggregate Sources sub-sectors were 2.81 Mt CO_2e that were neutralised by CO_2 removals from the Land sub-sector which was, on an average, removing 1.70 Mt CO_2e during the reference period. Additionally, emissions from the highest contributing sub-sector, i.e., Livestock declined at a CAGR of 1.59% over the reference period (see Figure 10).

Figure 10: GHG Emission Estimates of AFOLU Sector - Uttarakhand (2005 to 2018)



The Livestock sub-sector had the maximum share of ~79% in positive AFOLU emissions (excluding Land sub-sector) of Uttarakhand 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 ~72%. However, emissions from this category declined at the rate of 1.58% (compounded annually) from 2.29 Mt CO_2e in 2005 to 1.86 Mt CO_2e in 2018 (see Figures 11 and 12).

Within the Aggregate Sources sub-sector, Agriculture Soils and Rice Cultivation categories were major contributors to positive AFOLU emissions throughout the reference period. In the positive AFOLU emissions, the share of emissions from Agriculture Soils increased from ~10% in 2005 to ~16% in 2018, whereas, the share of emissions from Rice Cultivation remained constant throughout the reference period (see Figures 11 and 12).

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

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

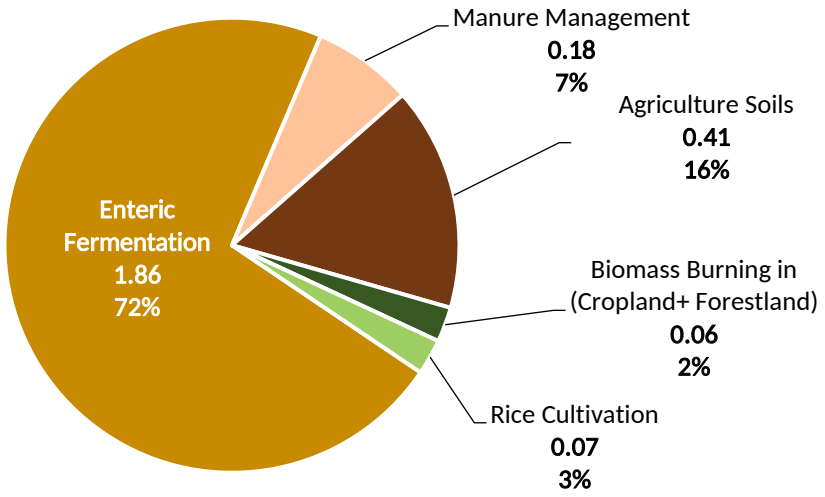
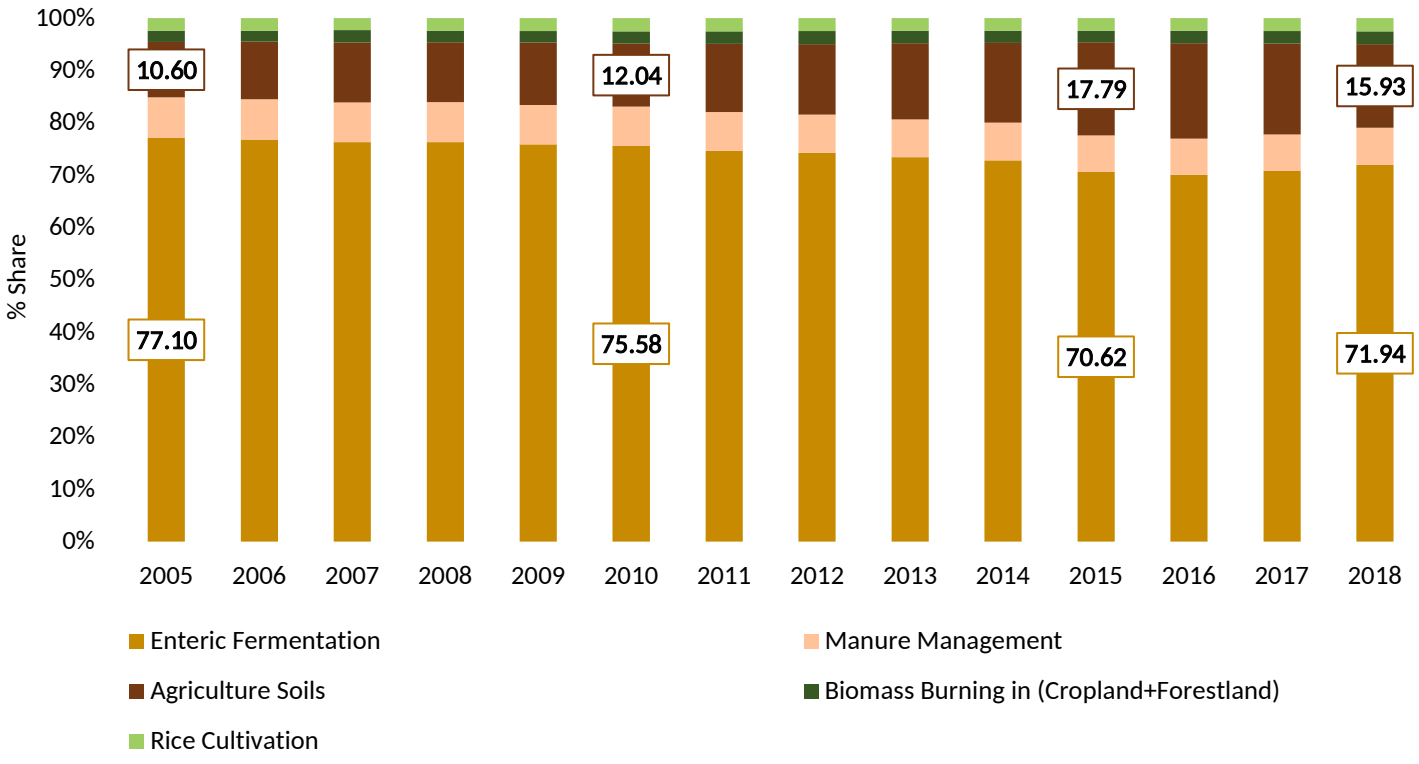


Figure 12: Category-wise Share in Positive AFOLU Emissions (excluding Land sub-sector) (2005 to 2018)



Waste Sector

Solid Waste Disposal, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. In Uttarakhand, Waste sector contributed to almost 20% of gross economy-wide emissions (excluding Land sub-sector within AFOLU) in 2018. GHG emissions from the Waste sector of Uttarakhand grew at a CAGR of 0.05% from 3.03 Mt CO_2e in 2005 to 3.05 Mt CO_2e in 2018. There was a dip in emissions after 2014 which can be attributed to decline in emissions from Industrial Wastewater sub-sector (see Figure 13).

Figure 13: GHG Emission Estimates of Waste Sector - Uttarakhand (2005 to 2018)

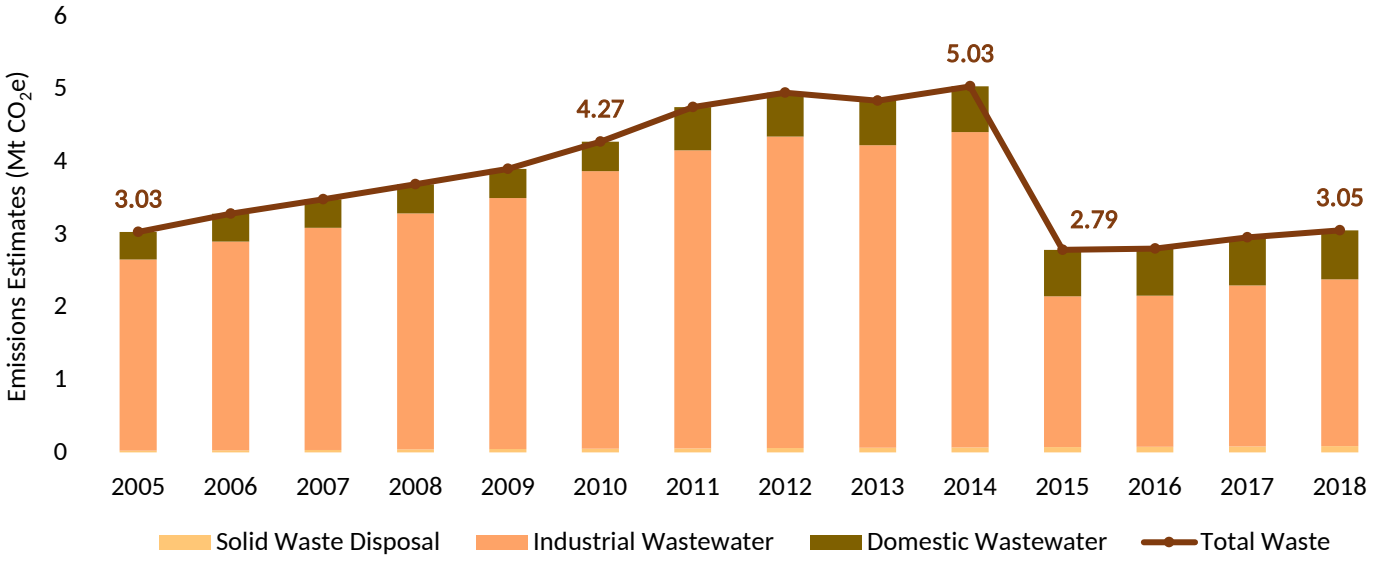
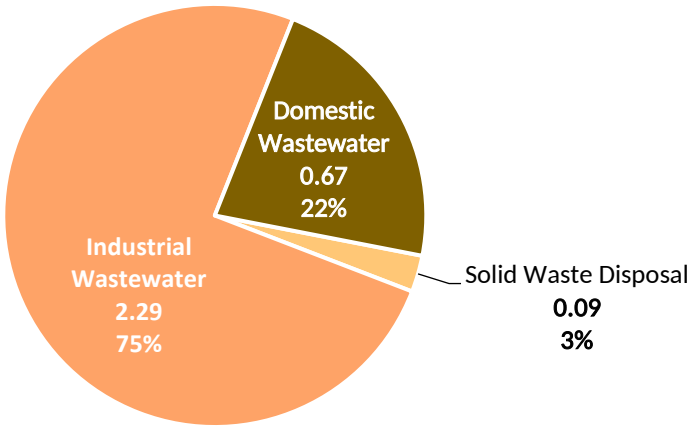


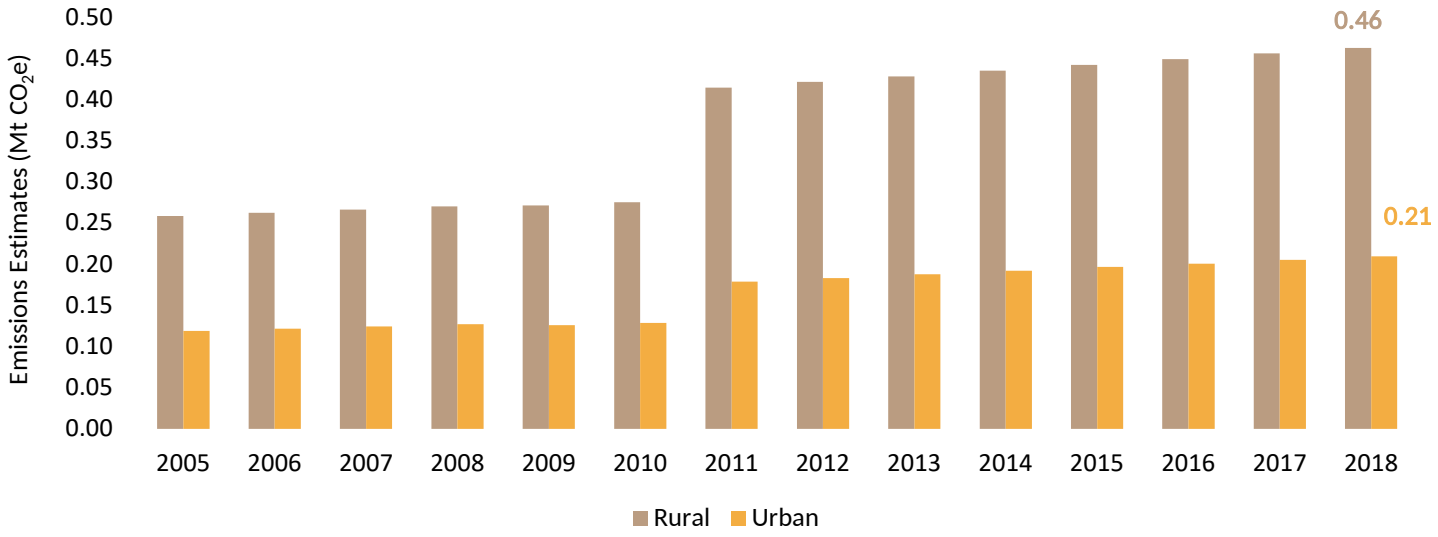
Figure 14: Sub-sector Emissions (Mt CO_2e) and Percentage Share in Total Waste Sector Emissions (2018)



Discharge of untreated wastewater and use of septic tanks are the key drivers of emissions due to Domestic Wastewater sub-sector. Domestic Wastewater had a share of ~22% in the total Waste sector emissions of Uttarakhand in 2018. Approximately, 3% of the Waste sector emissions were from Solid Waste Disposal, which grew at an estimates CAGR of 10.49% from 0.02 Mt CO_2e in 2005 to 0.09 Mt CO_2e in 2018. Industrial Wastewater had the major share of Waste sector emissions in Uttarakhand across the reference years, contributing ~75% to the total Waste sector emissions in 2018. However, emissions from this sub-sector declined at a CAGR of 1.05% from 2.63 Mt CO_2e in 2005 to 2.29 Mt CO_2e in 2018 (see Figure 14).

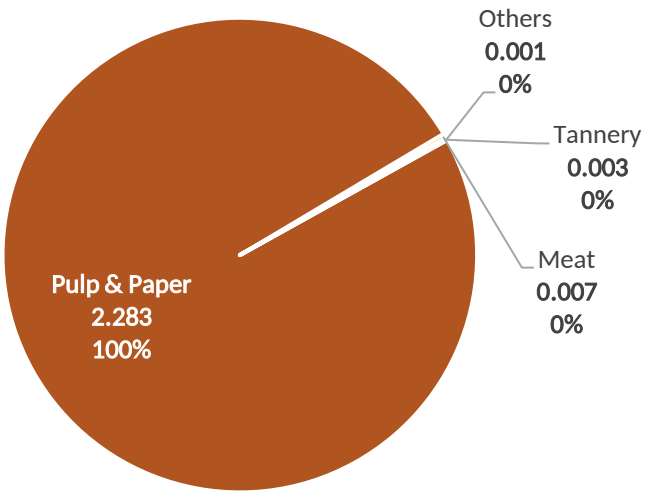
The emissions from Domestic Wastewater of both rural and urban areas grew at a CAGR of 4.55% from 0.38 Mt CO_2e in 2005 to 0.67 Mt CO_2e in 2018. Almost ~69% of the Domestic Wastewater emissions were from the rural areas of Uttarakhand in 2018 as shown in Figure 15.

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



As illustrated in Figure 16, Pulp & Paper Industry was the major contributor to Industrial Wastewater emissions with a share of ~100% in 2018. Other categories had negligible contributions to the total Industrial Wastewater Emissions in 2018.

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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