

Trend Analysis of GHG Emissions of SIKKIM

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

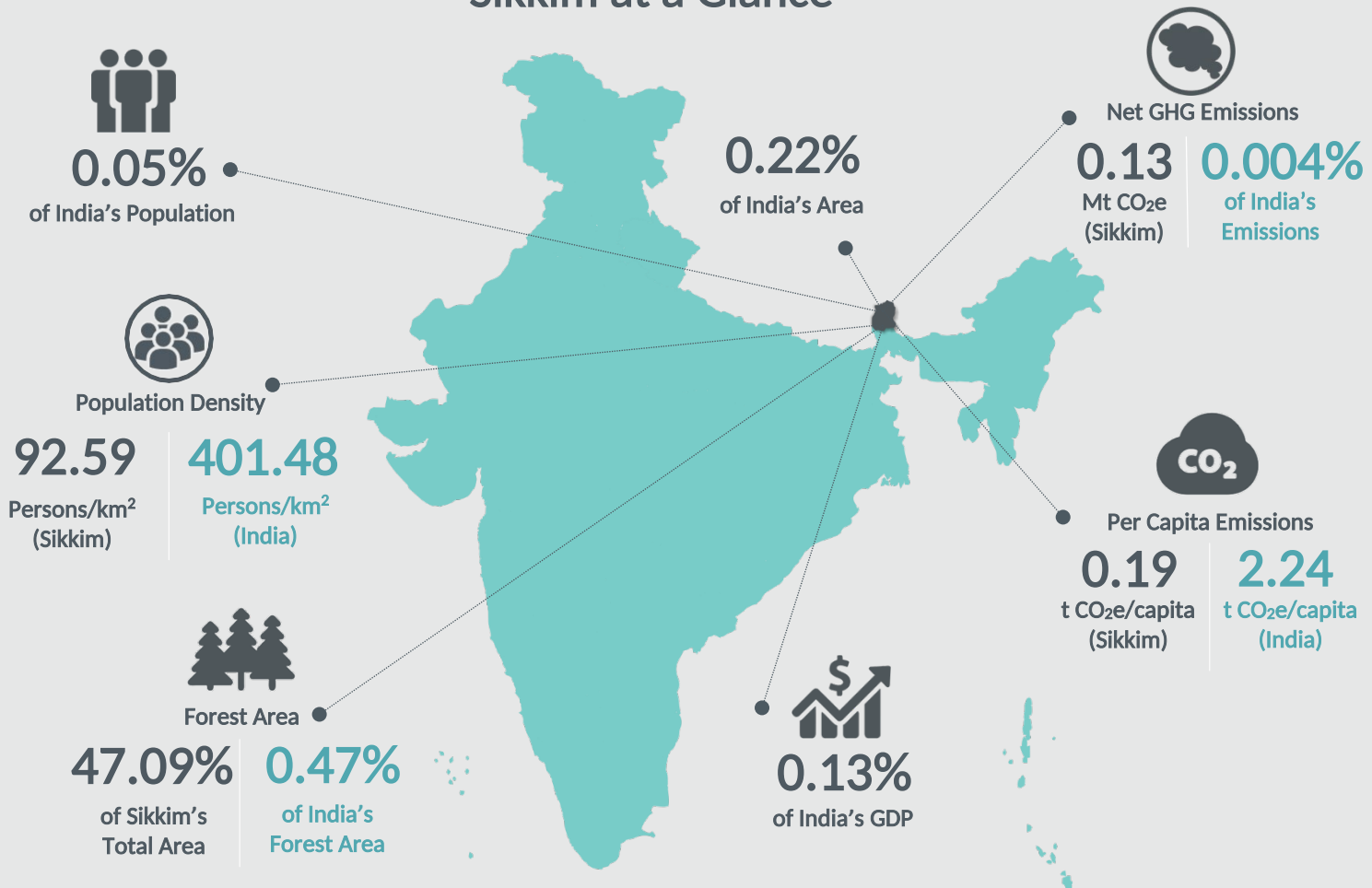
The Platform aims to add value to the various ongoing GHG emissions estimation efforts by addressing existing data gaps and data accessibility issues, broadening the scope of national inventories to include state inventories, and increasing the volume of analytics and policy dialogue on India's GHG emissions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

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



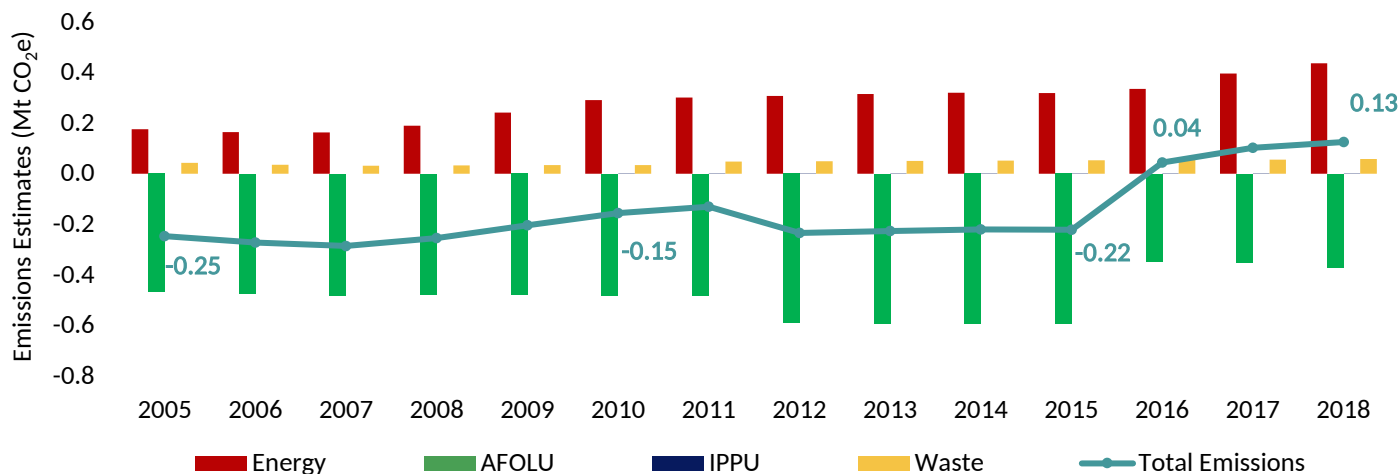
*Fuel combusted for Captive Electricity Generation (Auto-Producers) and direct fuel combustion (industrial energy) has been reported under Energy sector.

Sikkim at a Glance



Economy-wide Emissions Estimates

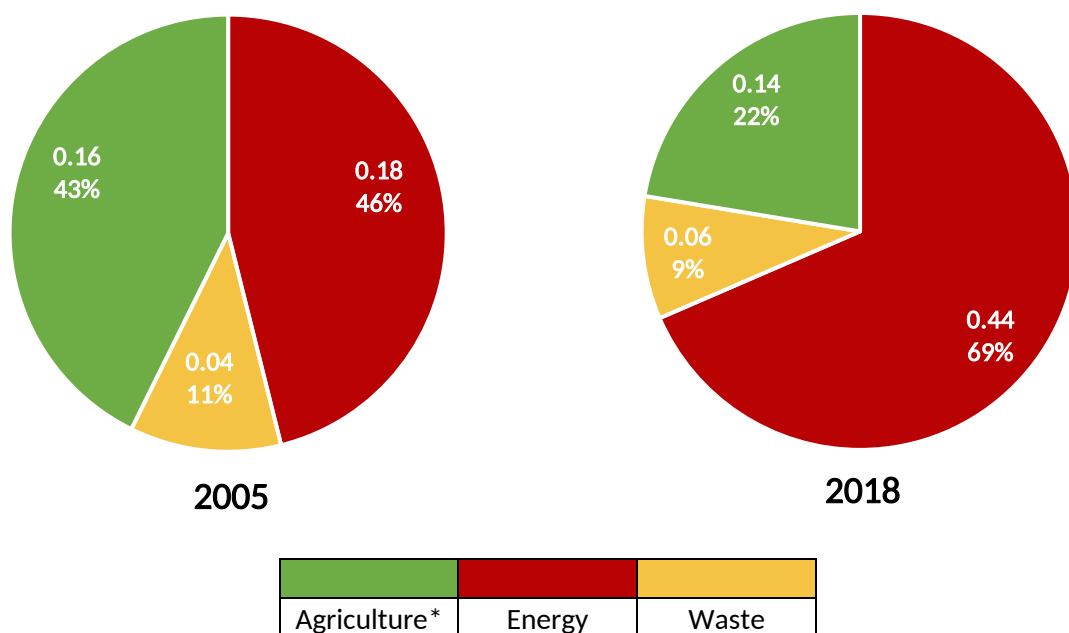
Figure 1: GHG Emissions Estimates of Sikkim (2005 to 2018)



Sikkim’s removal of emissions declined at a CAGR of 1.27% from 0.25 Mt CO₂e in 2005 to 0.22 Mt CO₂e in 2015. 2016 onwards, the total economy-wide emissions grew at a CAGR of 68.75% from 0.04 Mt CO₂e to 0.13 Mt CO₂e. Sikkim’s rapid growth of emissions during the reference period was due to increase in emissions from the Energy sector and reduction in sinks from the Agriculture, Forest, and Other Land Use (AFOLU) sector. During the reference period, Sikkim was a net sink, until 2016, after which it became a net emitter (see Figure 1).

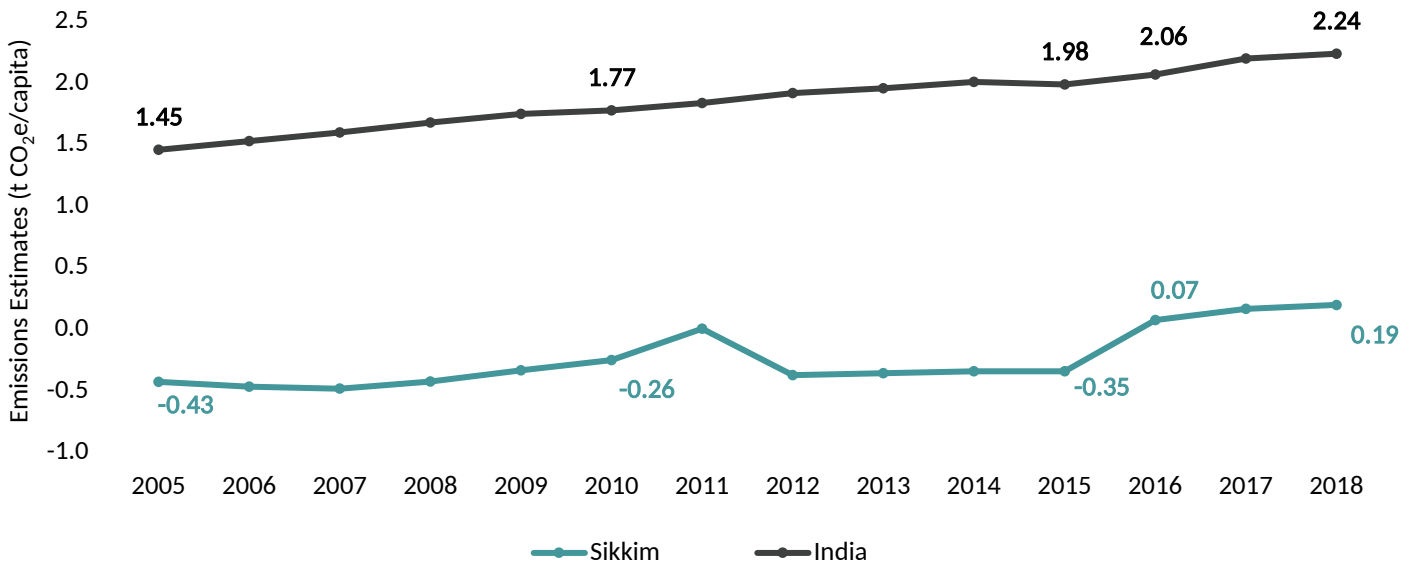
In 2005, the share of Energy sector in gross economy-wide emissions (excluding Land sub-sector within AFOLU) was ~46%. This was followed by Agriculture (~43%) and Waste (~11%) sectors. In 2018, the share of Energy sector emissions increased to ~69% of the gross economy-wide emissions, while the contribution of Agriculture and Waste sectors declined to ~22% and ~9%, respectively (see Figure 2). IPPU emissions of Sikkim were negligible throughout the reference period.

Figure 2: Sector-wise Contribution (Mt CO₂e) and Percentage Share in Gross Economy-wide GHG Emissions (excluding Land sub-sector within AFOLU) of Sikkim



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

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



The per capita emissions of Sikkim were negative till 2015. They became positive from 2016 onwards due to decline in GHG removals from the state. However, Sikkim's per capita emissions were much lower than those of India, throughout the reference period. It may be noted that Sikkim's per capita emissions increased at a compounded rate of 67.08% from 0.07 t CO₂e/capita in 2016 to 0.19 t CO₂e/capita in 2018, which was much higher than that of India between 2016 and 2018 (4.28%).

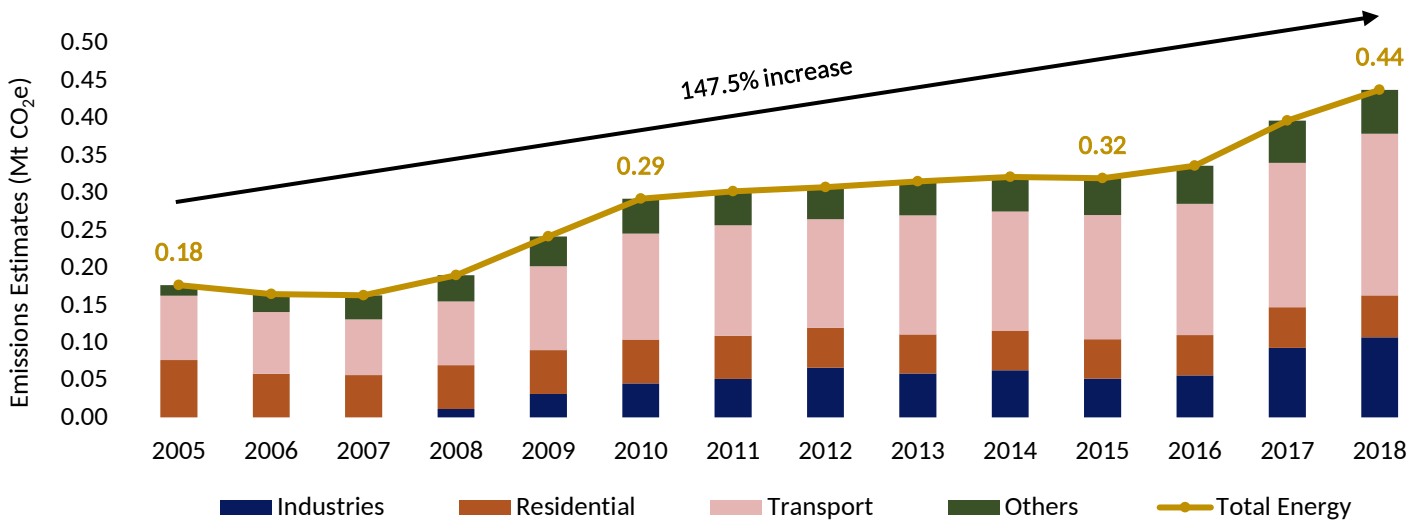
Energy Sector



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 Sikkim accounted for ~69% of the gross economy-wide emissions (excluding Land sub-sector within AFOLU) in 2018. Emissions from the Energy sector increased at a CAGR of 7.22% from 0.18 Mt CO₂e in 2005 to 0.44 Mt CO₂e in 2018 as shown in Figure 4.

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



Within the Energy sector, Transport category was the major contributor to GHG emissions with a share of ~49% of the total Energy sector emissions in 2018. This was followed by Industrial Energy and Residential categories with shares of 24% and 13%, respectively (see Figure 5).

Within the Fuel Combustion sub-sector, emissions from Liquid Petroleum Fuels were the major contributor, with an average share of ~81% across the reference period (see Figure 6). This was followed by emissions from combustion of Gaseous Petroleum Fuels with an average share of ~14% between 2005 and 2018.

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

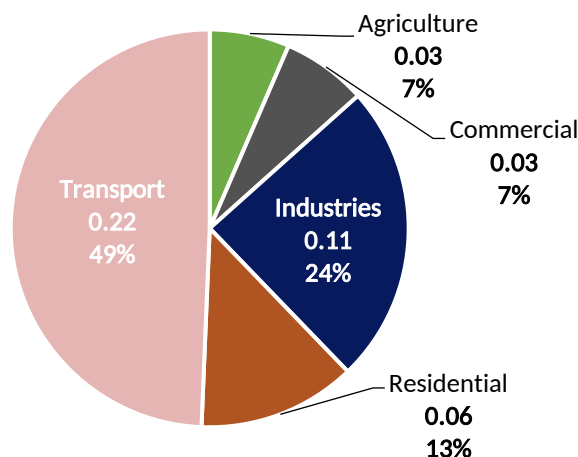
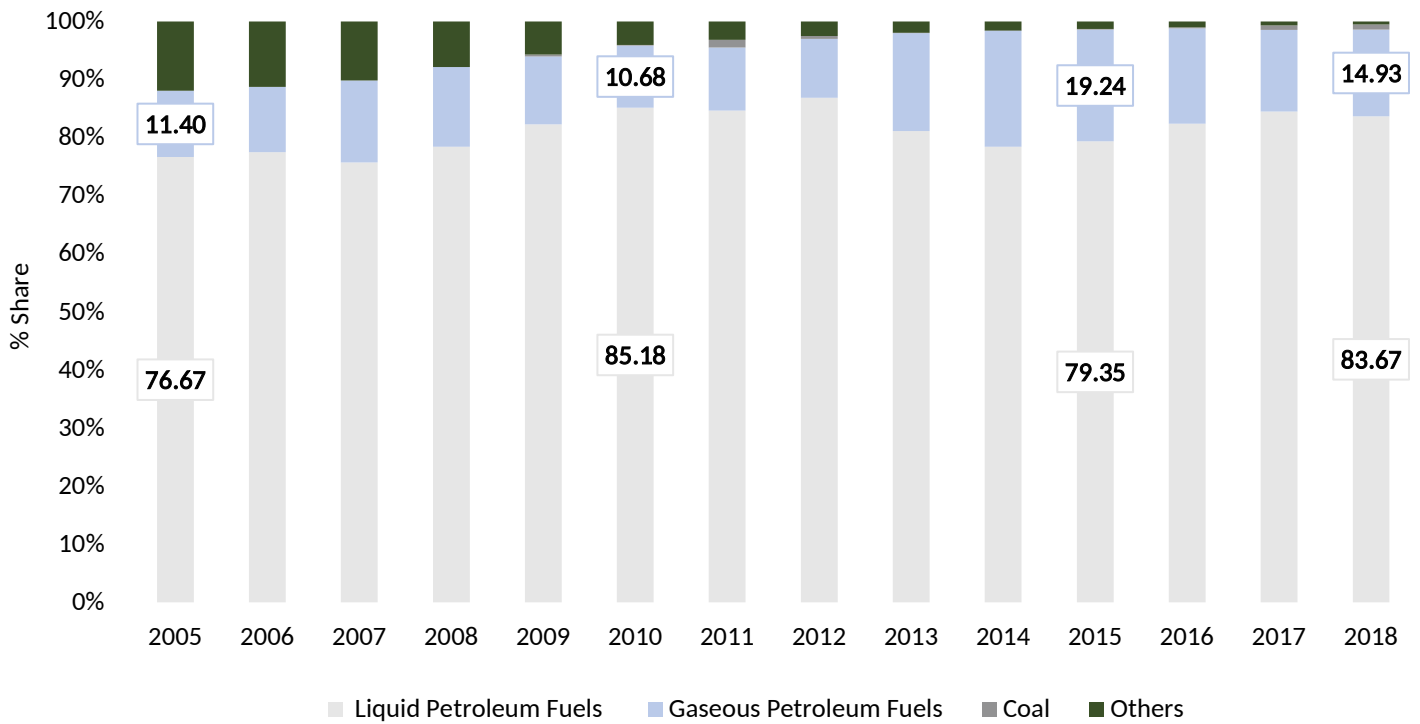


Figure 6: Percentage Share of GHG Emissions by Fuel Type due to Fuel Combustion in Energy Sector (2005 to 2018) *



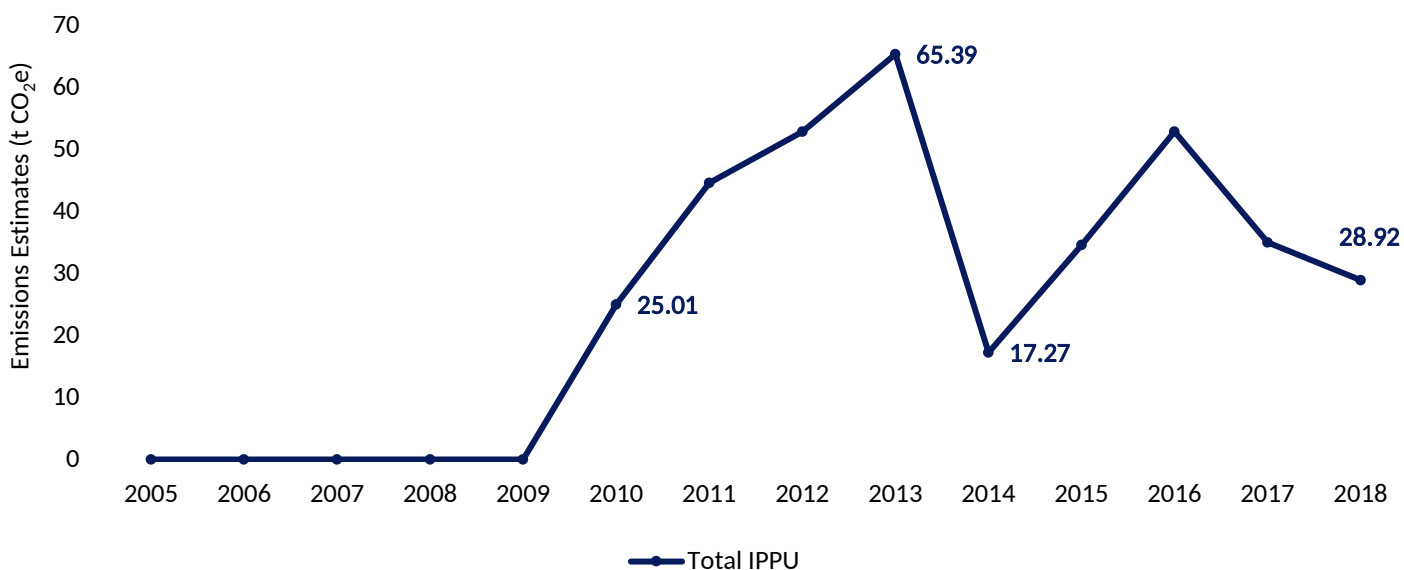
***Notes**

1. Coke is considered in coal because the bifurcation of pet-coke and coke was not available.
2. Gaseous Petroleum Fuels- Natural Gas, LPG and other gaseous fuels
3. Liquid Petroleum Fuels- ATF, Diesel, Kerosene, Motor spirit and other liquid fuels
4. Other Fuels comprise 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. There were negligible emissions from the Industrial Processes and Product Use (IPPU) sector in Sikkim. Emissions emanated only from the sub-sector of Non-Energy Products from Fuels and Solvent Use. Within this sub-sector, Paraffin Wax Use was the only emitter. Emissions from this category of Paraffin Wax Use increased at a CAGR of 1.83% from 25.01 t CO₂e in 2010 to 28.92 t CO₂e in 2018, with several ups and downs across the reference period (see Figure 7).

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

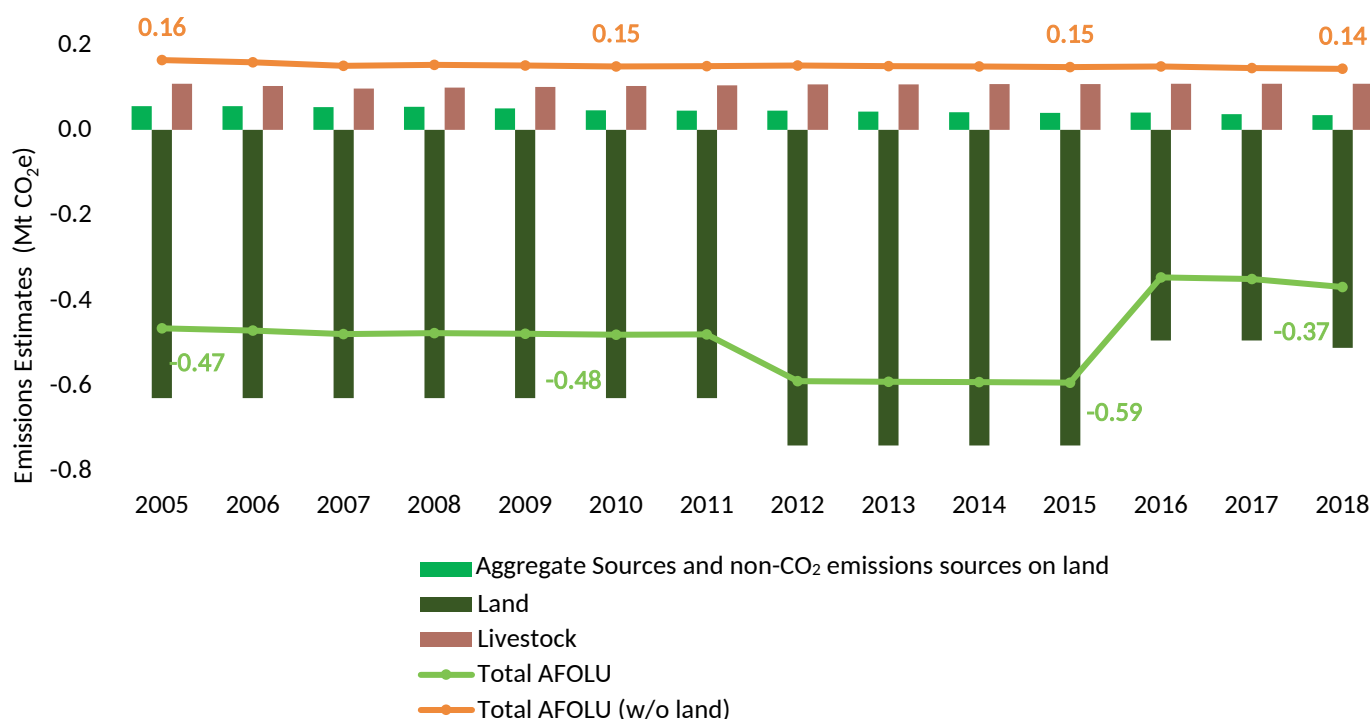


AFOLU Sector



Emissions from the Agriculture, Forestry and Other Land Use (AFOLU) sector arise from three main sub-sectors: Livestock, Land and Aggregate Sources and Non-CO₂ Emissions Sources on Land*. The AFOLU sector was a net sink throughout the reference period. In Sikkim, the AFOLU removals decreased from 0.47 Mt CO₂e in 2005 to 0.37 Mt CO₂e in 2018 at a CAGR of 1.77% as depicted in Figure 8. The reduction in the sink in the recent years can be attributed to the decrease in the forest area of the state. The average annual emissions from Livestock and Aggregate Sources were 0.15 Mt CO₂e that were neutralized by CO₂ removals from the Land sector which was, on an average, annually removing 0.48 Mt CO₂e during the reference period (see Figure 8).

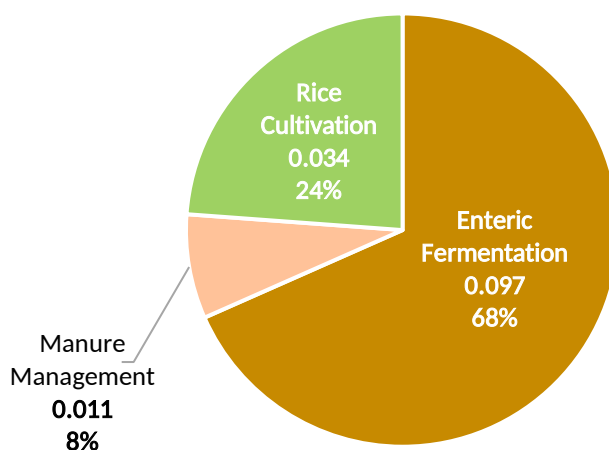
Figure 8: GHG Emissions Estimates of AFOLU Sector - Sikkim (2005 to 2018)



The Livestock sub-sector had the maximum share of ~70% of the positive AFOLU emissions (excluding Land sub-sector) in Sikkim during the reference period. Within the Livestock sub-sector, Enteric Fermentation was the major contributor to positive AFOLU emissions with a share of ~68% in 2018 (see Figure 9). The emissions from this category increased at a nominal rate of 0.06% (compounded annually) from 0.096 Mt CO₂e in 2005 to 0.097 Mt CO₂e in 2018.

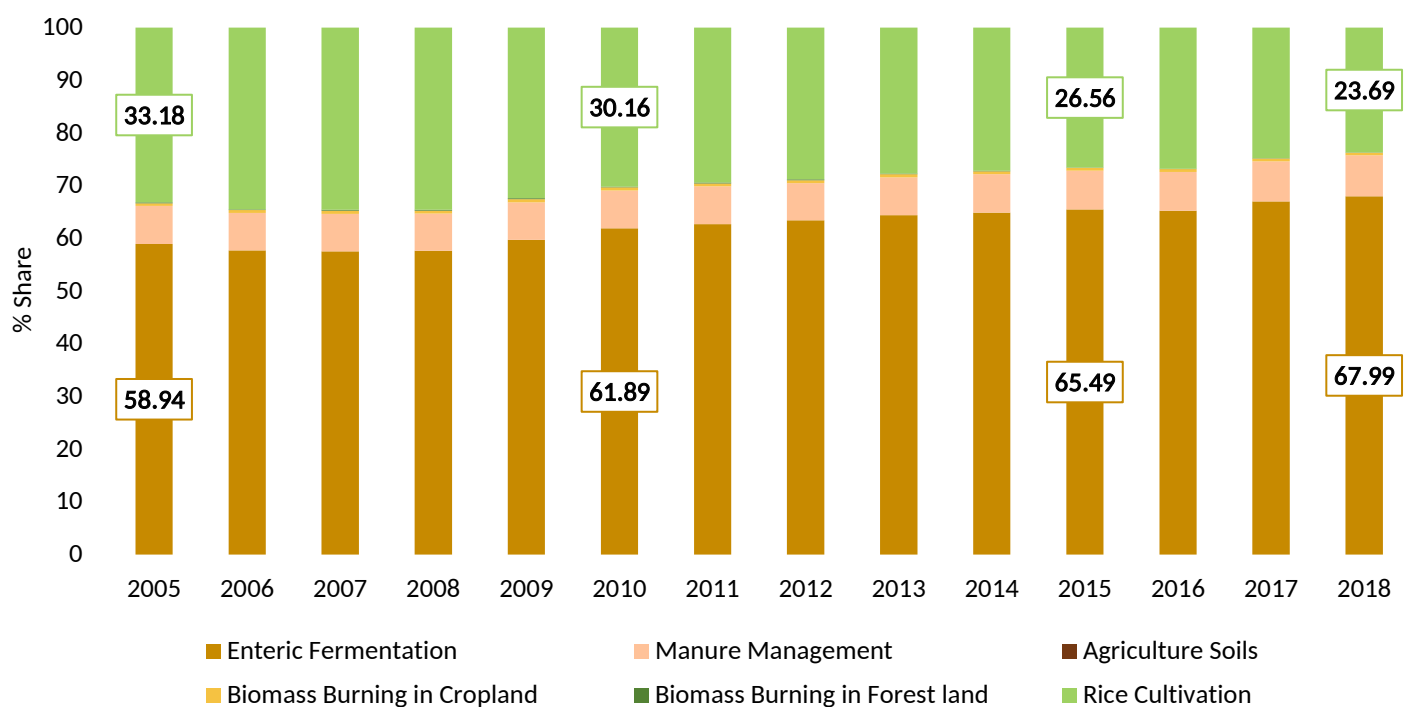
Within the Aggregate Sources sub-sector, the category of Rice Cultivation was the highest contributor to positive AFOLU emissions with an average share of ~30% during the reference period. The share of emissions from Rice Cultivation reduced from ~33% in 2005 to ~24% in 2018 (see Figure 10).

Figure 9: Category-wise Emissions (Mt CO₂e) and Percentage in Positive AFOLU Emissions (excluding Land sub-sector) (2018)



* 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.

Figure 10: Category-wise Share of Positive AFOLU Emissions (excluding Land sub-sector) (2005 to 2018)

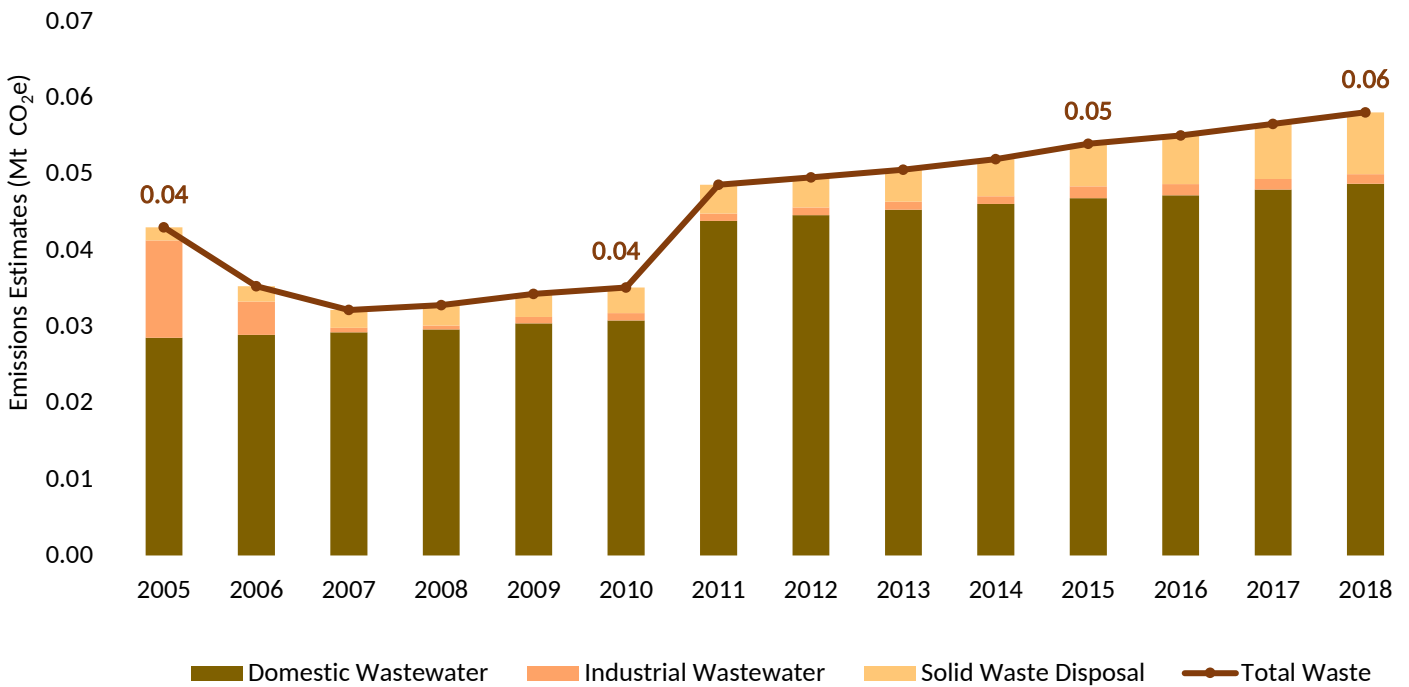




Waste Sector

Solid Waste Disposal, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. In Sikkim, emissions of the Waste sector contributed to ~12% of the gross economy-wide emissions (excluding Land sub-sector within AFOLU) in 2018. The Waste sector emitted 0.058 Mt CO₂e in the year 2018 up from 0.043 Mt CO₂e in 2005, indicating a CAGR of 2.34%, as illustrated in Figure 11. A significant increase in the overall Waste sector emissions was observed from 2011 onwards, which can be attributed to higher emissions from the Domestic Wastewater sub-sector.

Figure 11: GHG Emissions Estimates of Waste Sector - Sikkim (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 84% in the total Waste sector emissions of Sikkim in 2018. Approximately 14% of the Waste sector emissions were from Solid Waste Disposal, which grew at an estimated CAGR of 12.65% from 0.002 Mt CO₂e in 2005 to 0.008 Mt CO₂e in 2018. Industrial Wastewater accounted for nearly 2% of the Waste sector emissions in 2018 and declined at a CAGR of 16.11% from 0.013 Mt CO₂e in 2005 to 0.001 Mt CO₂e in 2018 (see Figure 12).

Emissions from Domestic Wastewater of both rural and urban areas grew at a CAGR of 4.19% from 0.029 Mt CO₂e in 2005 to 0.049 Mt CO₂e in 2018. Almost 80% of Domestic Wastewater emissions were from the rural areas of Sikkim in 2018, as shown in Figure 13.

Figure 12: Sub-sector Emissions (Mt CO₂e) and Percentage Share in Total Waste Sector Emissions (2018)

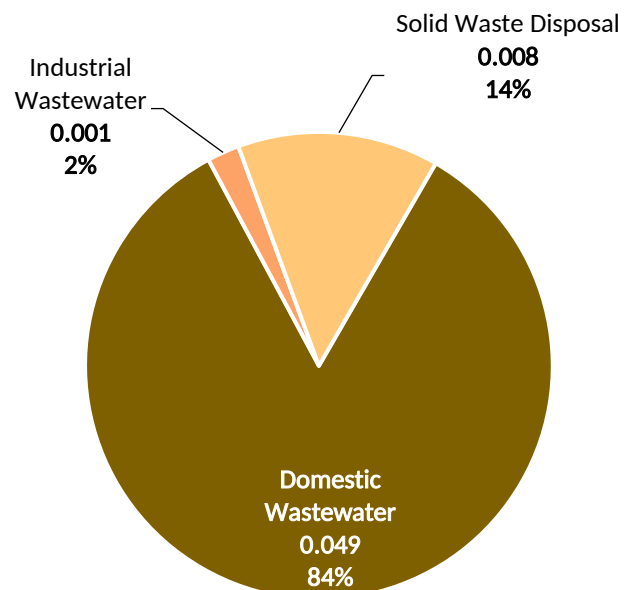
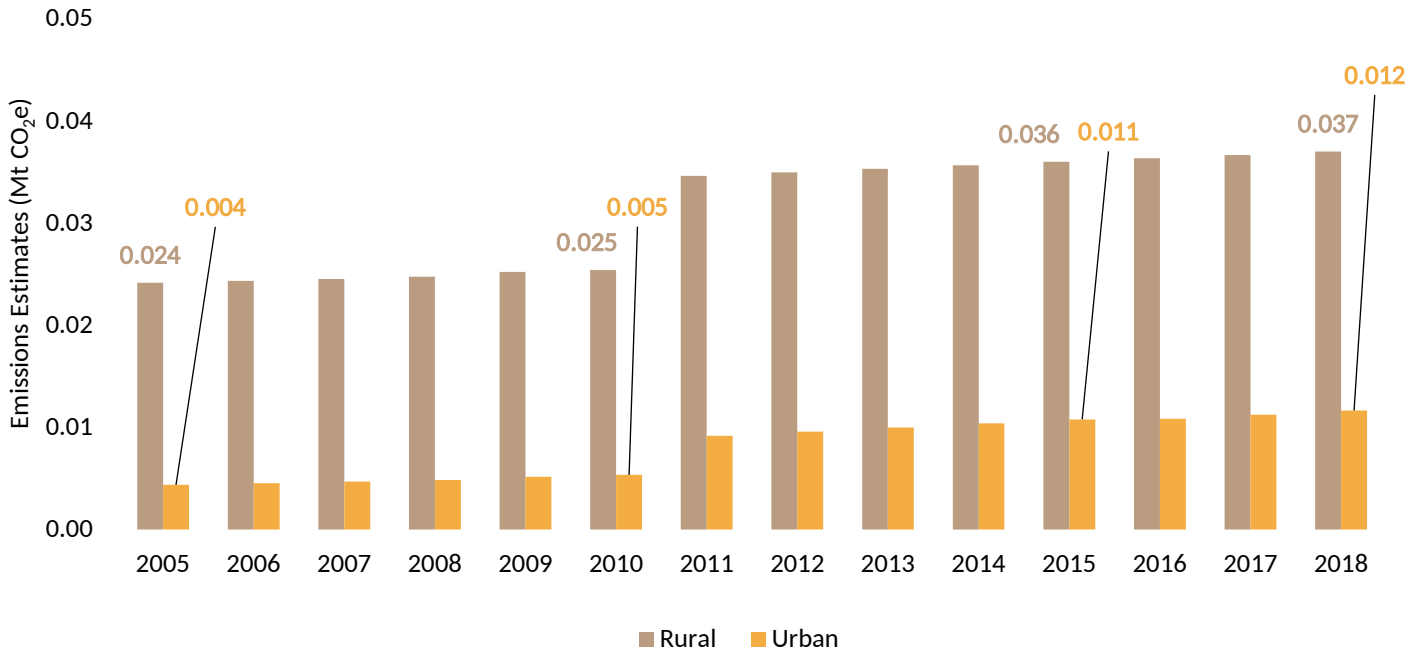
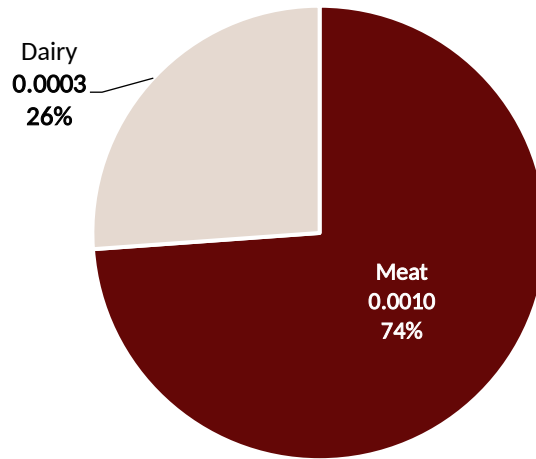


Figure 13: Area-wise GHG Emissions Estimates of Domestic Wastewater (2005 to 2018)



The Meat Industry was the major contributor to Industrial Wastewater emissions with a share of ~74% in 2018. This was followed by Dairy Industry (~26%) as illustrated in Figure 14.

Figure 14: 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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