

Trend Analysis of GHG Emissions of KARNATAKA

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

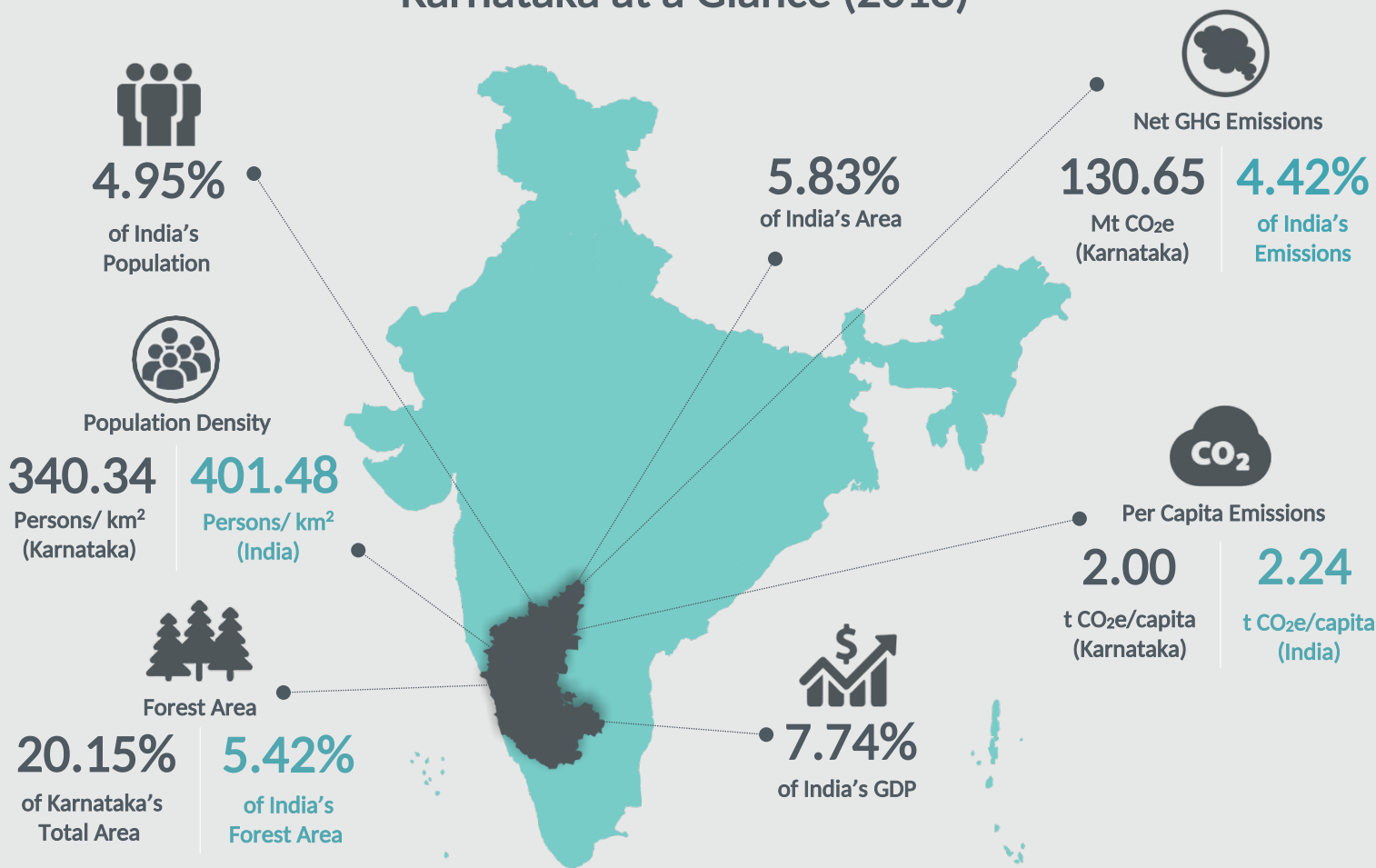
The Platform seeks to add value to the various ongoing GHG emissions estimation efforts by helping address existing data gaps and data accessibility issues, extending beyond the scope of national inventories to state inventories, and by increasing the volume of analytics and policy dialogue on India's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

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



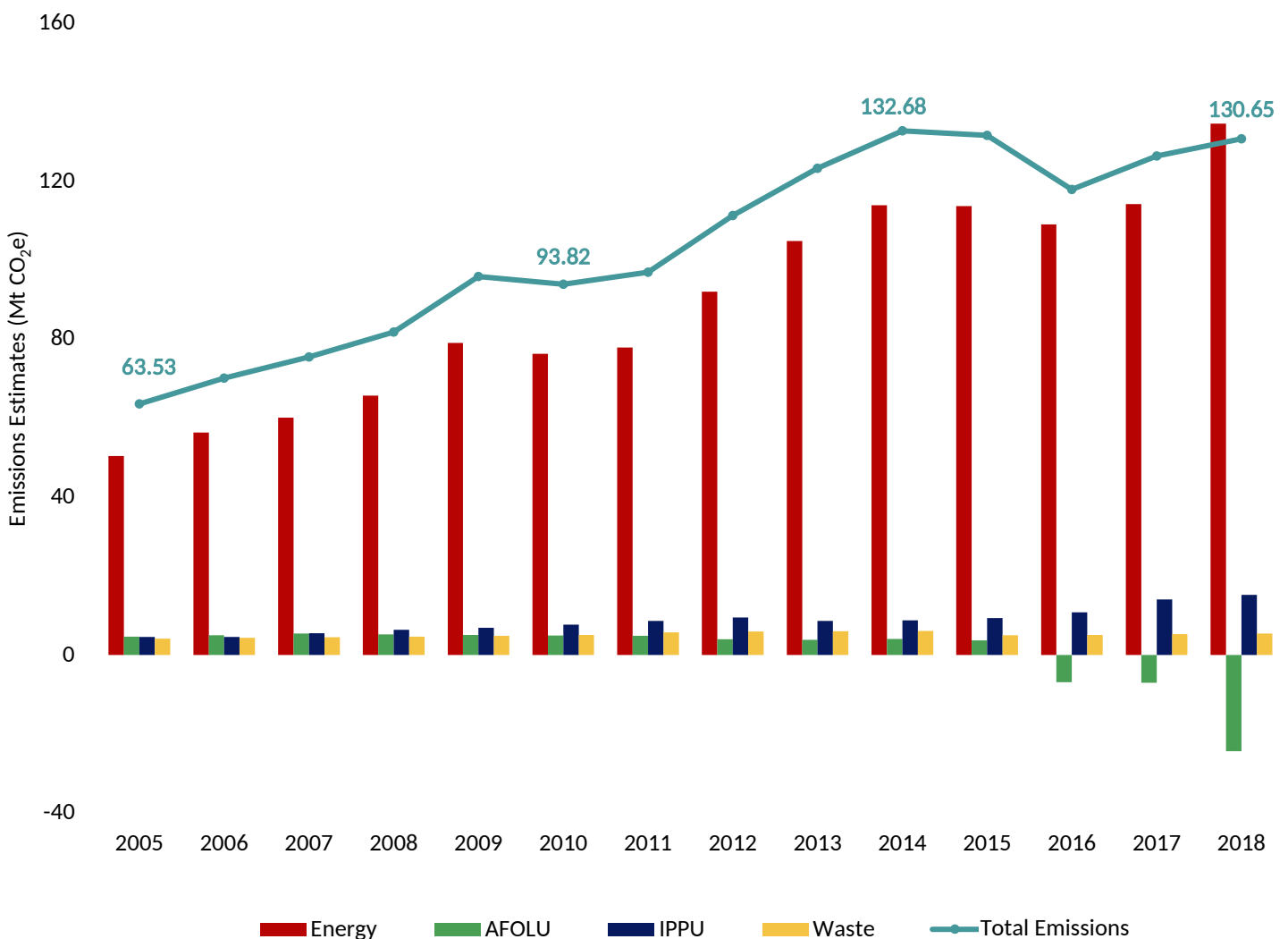
*Fuel combusted for captive electricity generation (auto-producers) and direct fuel combustion (industrial energy) has been reported under energy sector.

Karnataka at a Glance (2018)



Economy-wide Emissions Estimates

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



Emissions of Karnataka increased at an estimated CAGR of 5.70% from 63.53 Mt CO₂e in 2005 to 130.65 Mt CO₂e in 2018. As illustrated in Figure 1, the Energy sector was the major contributor to Karnataka's economy-wide GHG emissions, throughout the reference period. Notably, the total economy-wide emissions peaked in 2014 at 132.68 Mt CO₂e. This was followed by a dip in total GHG emissions in 2016 due to decline in emissions from the Energy sector, coupled with an increase in removals from the Agriculture, Forestry and Other Land-Use (AFOLU) sector. In 2017 and 2018, emissions from the Energy sector increased significantly, but their effect was dampened by the decline in emissions due to enhancement of sinks from Land sub-sector.

It is important to note that the entire AFOLU sector was a net emitter till 2015 and became a net sink from 2016 onwards.

In 2005, the share of Energy sector in gross economy-wide emissions (excluding Land Sub-sector in AFOLU) was ~68%. This was followed by Agriculture (~21%), Industrial Processes and Product Use Sector (IPPU) (~6%) and Waste sector (~5%). In 2018, the share of Energy sector emissions increased to ~80% of the gross economy-wide emissions (excluding Land Sub-sector in AFOLU). The share of IPPU sector increased to ~9%, whereas, Agriculture and Waste sectors declined to ~8% and ~3% respectively in 2018 (see Figure 2).

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

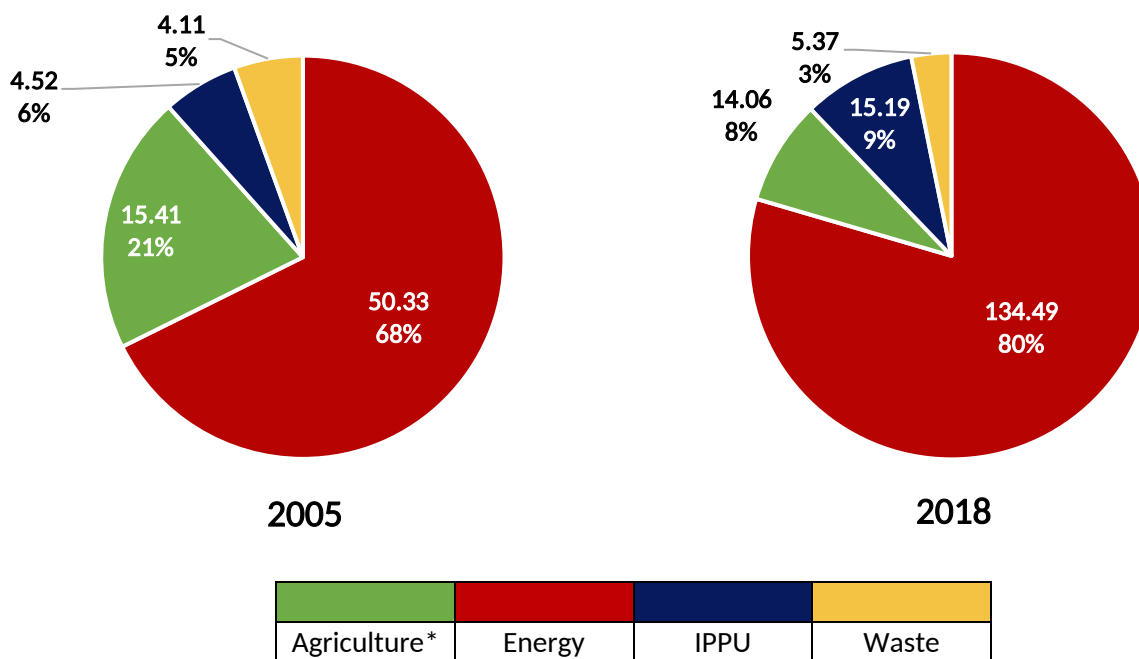
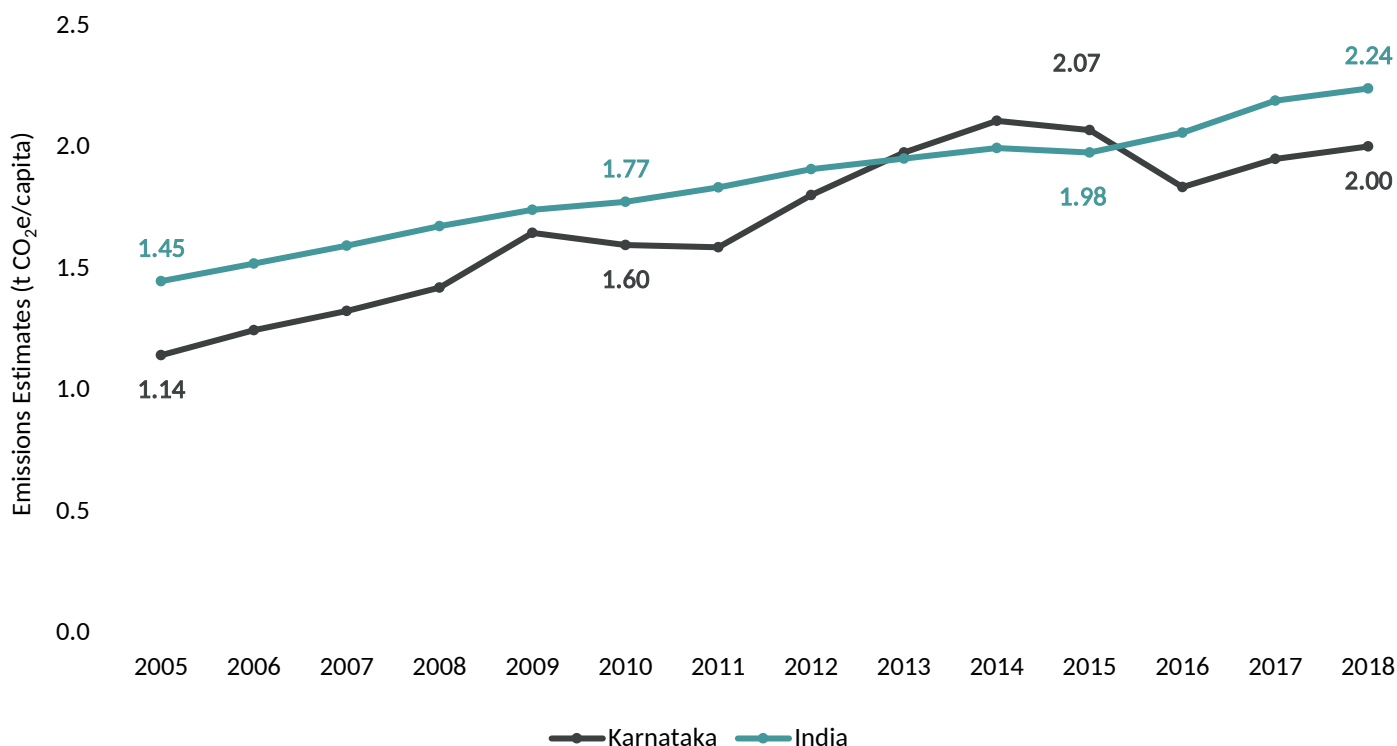


Figure 3: Per Capita Net GHG Emissions of Karnataka and India (2005 to 2018)



The per capita emissions of Karnataka were slightly lower as compared to India's per capita emissions, across the reference years, except for 2014 and 2015 (see Figure 3). The per capita emissions of Karnataka increased at a CAGR of 4.41% from 1.14 t CO₂e/capita in 2005 to 2.00 t CO₂e/capita in 2018, which was higher than India's CAGR (~3.41%).

* 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.

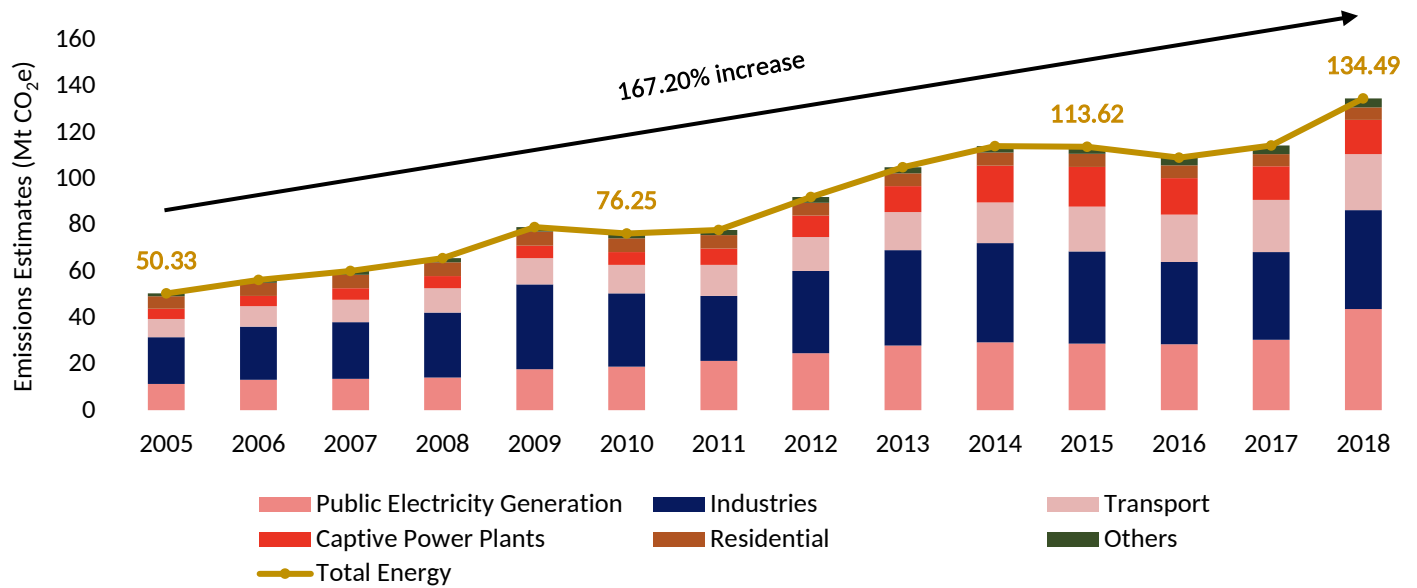


Energy Sector

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 Karnataka, Energy sector represented ~80% of the gross economy-wide emissions (excluding Land sub-sector within AFOLU) in 2018. Emissions from the Energy sector increased at a CAGR of 7.85% from 50.33 Mt CO₂e in 2005 to 134.49 Mt CO₂e in 2018. A noticeable increase in overall Energy emissions was observed in 2018 as a result of higher emissions from the Public Electricity Generation and Industrial Energy categories (see Figure 4).

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



Within the Energy sector, Public Electricity Generation and Industrial Energy categories were the leading contributors to GHG emissions, both with share of ~32%, each, in the total Energy emissions in 2018. This was followed by Transport category with a share of ~18% and Captive Power Plants category with a share of ~11% in 2018 (see Figure 5).

Within the Fuel-Combustion sub-sector, emissions from Coal were the major contributor, with the average share being ~66%, across the reference period. This was followed by emissions from combustion of Liquid Petroleum Fuels, with an average share of ~27% between 2005 and 2018. Gaseous Petroleum Fuels had an average share of ~6%, while Other Fuels contributed ~2% to the Fuel Combustion emissions throughout the reference period (see Figure 6).

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

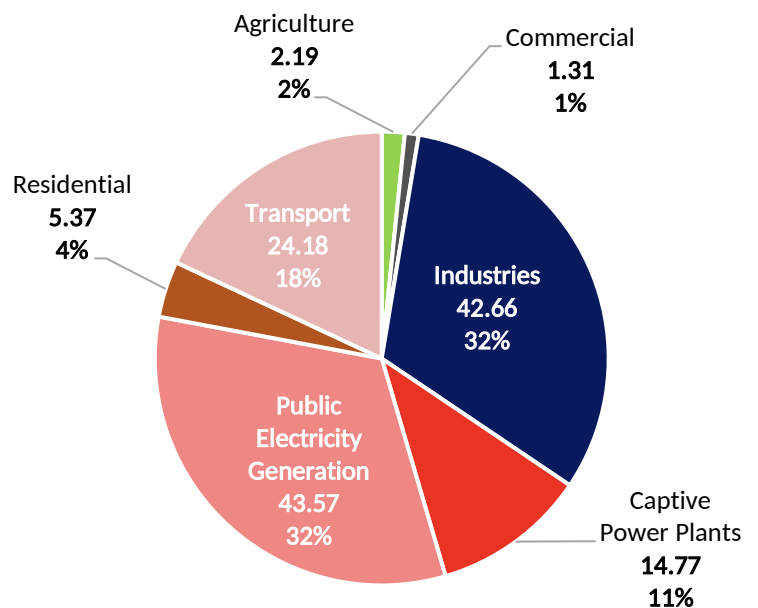
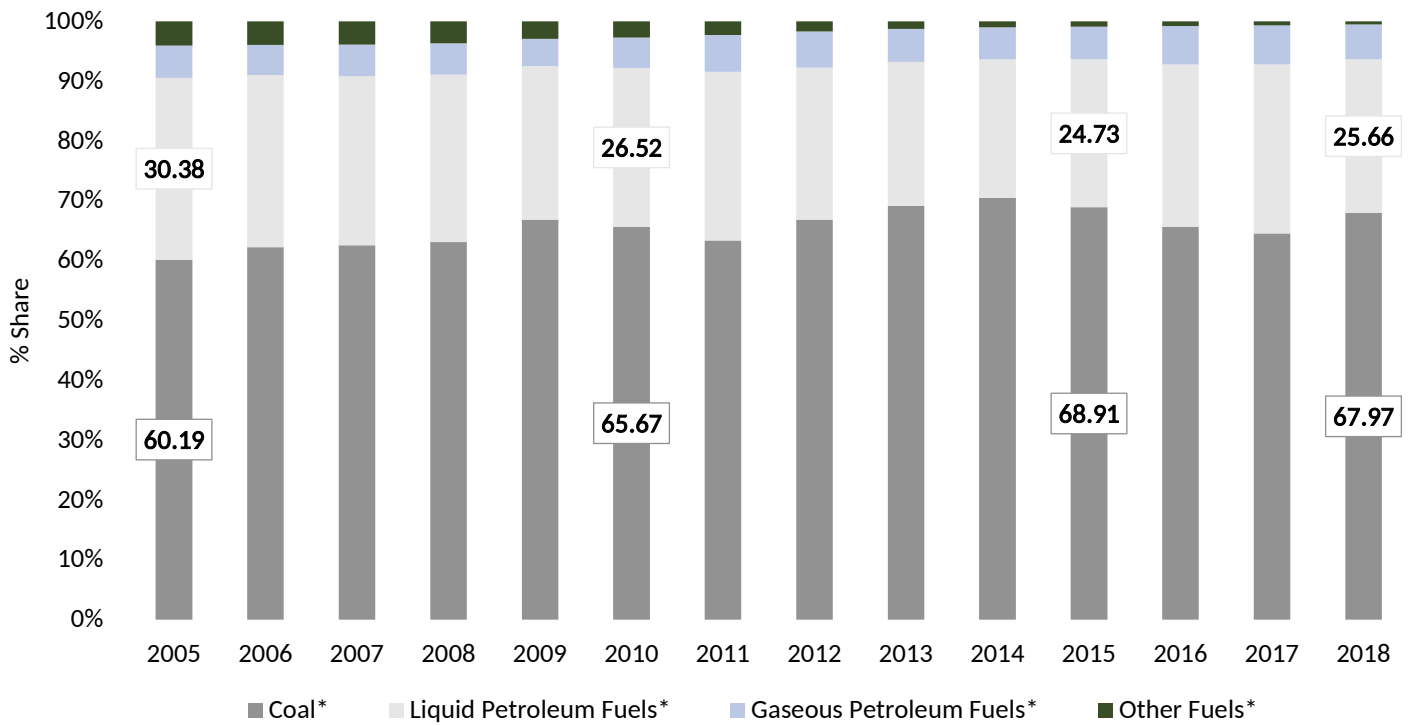


Figure 6: Percentage Share of GHG Emissions by Fuel Type due to Fuel Combustion in Energy Sector (2005 to 2018)



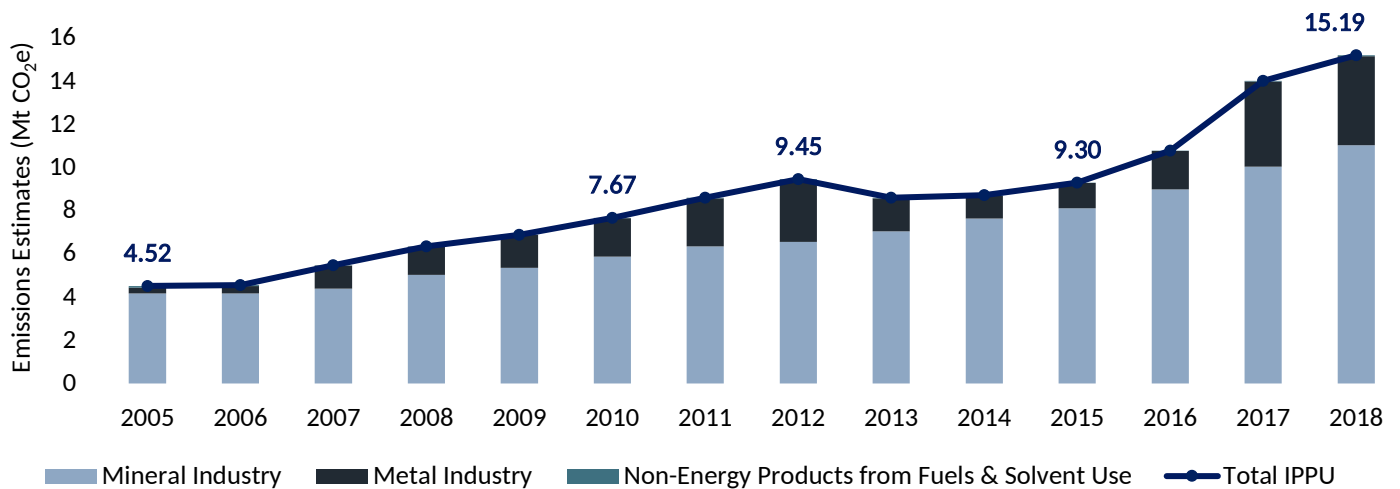
***Notes:**

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



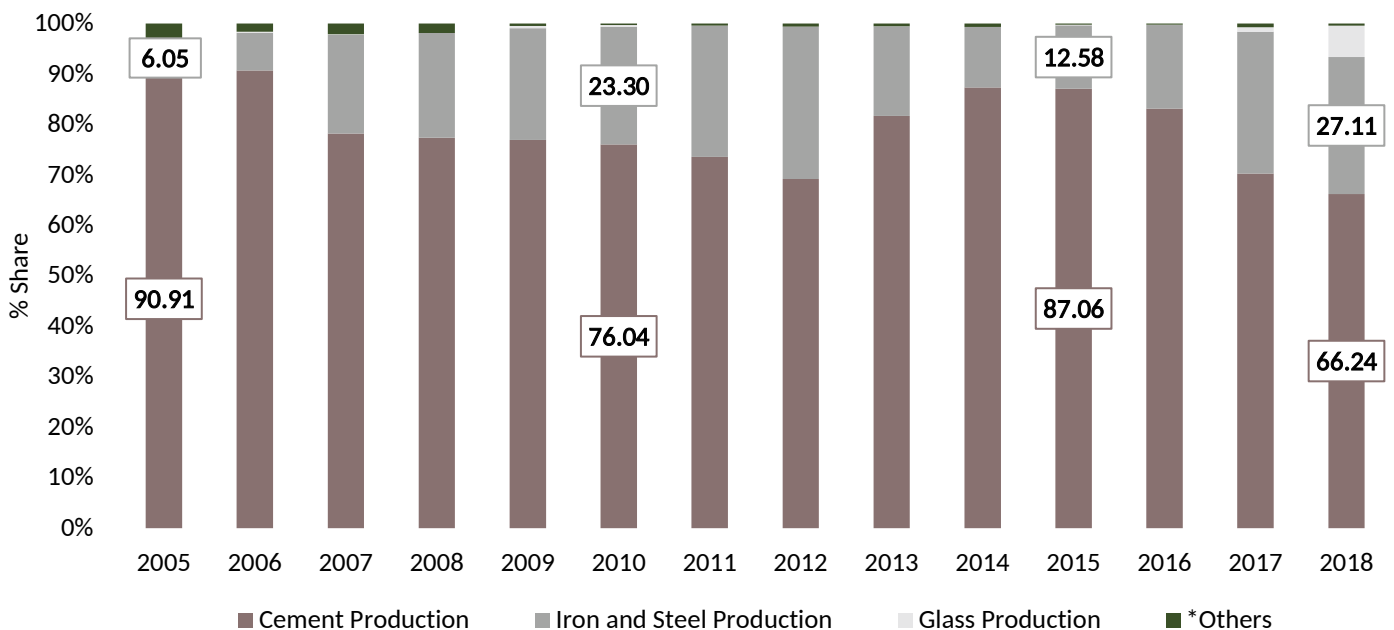
Emissions from the Industrial Processes and Product Use (IPPU) sector are largely driven by Chemical, Metal, Mineral Industries and Non-Energy Products from Fuels and Solvent Use. In Karnataka, the IPPU sector represented ~9% of the gross economy-wide emissions (excluding Land sub-sector within AFOLU) in 2018. Between 2005 and 2018, the overall IPPU emissions increased at a compounded rate of 9.78% from 4.52 Mt CO₂e in 2005 to 15.19 Mt CO₂e in 2018, owing to the increase in emissions from both Iron and Steel Production in the Metal Industry sub-sector and Cement Production in the Mineral Industry sub-sector. The overall IPPU emissions declined in 2013 due to the reduction in the emissions from the Metal Industry sub-sector, however, they began to rise again after 2014 (see Figure 7).

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



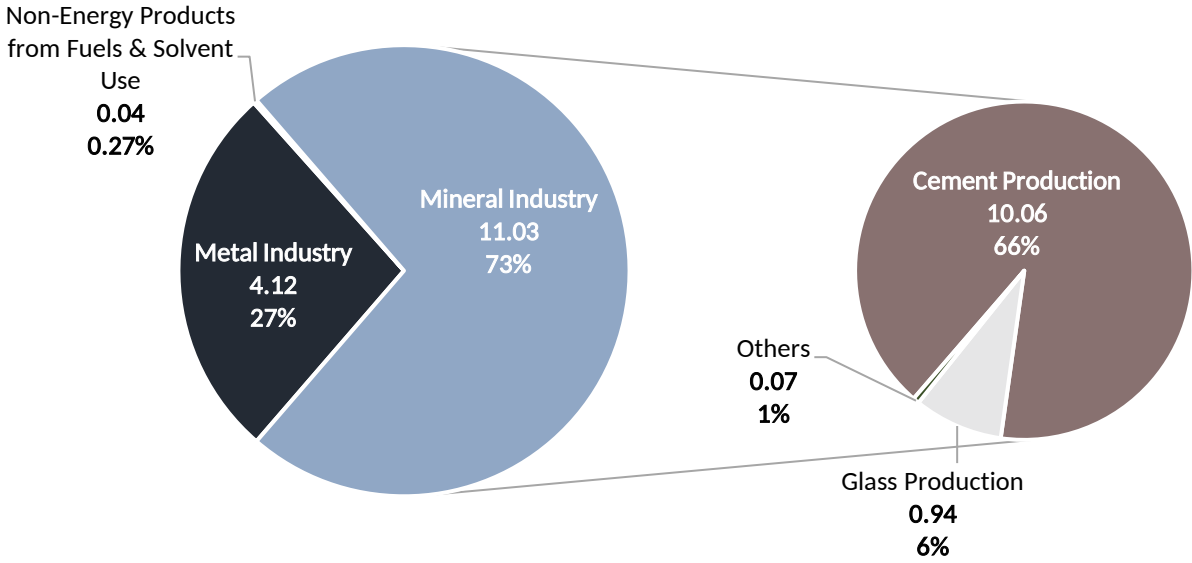
In 2018, Cement Production accounted for ~66% of the overall IPPU sector emissions, followed by Iron and Steel Production and Glass Production with shares of ~27% and ~6%, respectively. The share of emissions from Cement Production decreased from ~91% in 2005 to ~66% in 2018. Whereas, share of Iron and Steel Production emissions increased from ~6% in 2005 to ~27% in 2018 (see Figures 8 and Figure 9).

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



* Others include: Other Uses of Soda Ash, Lime Production, Ceramics, Lubricant Use, Paraffin Wax Use

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

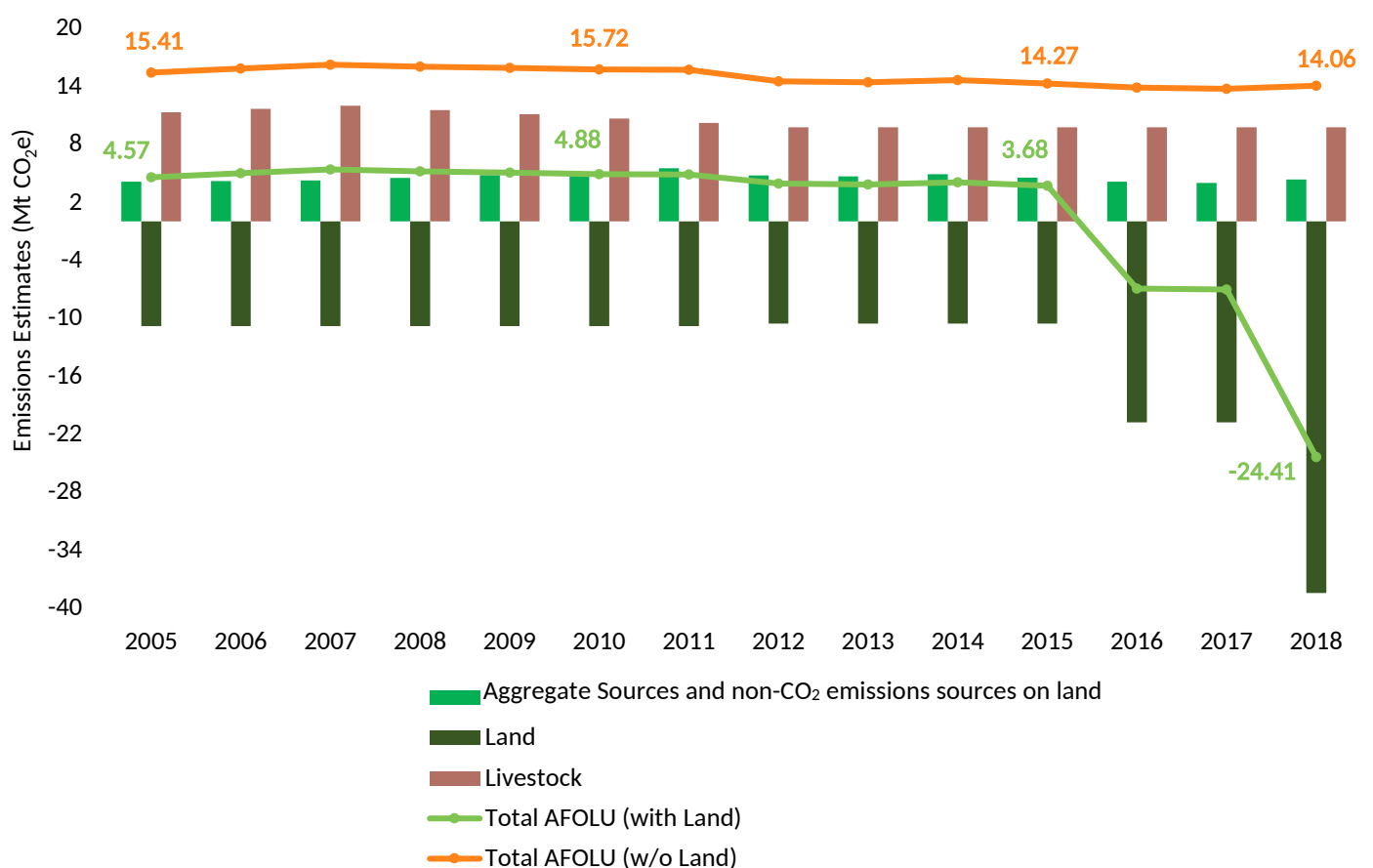




Emissions from the Agriculture, Forestry and Other Land Use (AFOLU) sector arise from three main sub-sectors, namely Livestock, Land and Aggregate Sources and Non-CO₂ Emissions Sources on Land*. In Karnataka, while the Livestock and Aggregate Sources and Non-CO₂ Emissions Sources on Land sub-sectors were net GHG emitters, the Land sub-sector was a sink throughout the reference period (see Figure 10).

The AFOLU sector overall became a net sink of emissions from 2016 onwards. This was because removals from Forest Land increased significantly in 2016 owing to a considerable increase in forest area. The average annual removals from the Land sub-sector in Karnataka during the reference period were 14.16 Mt CO₂e, around ~94% of the average annual gross AFOLU emissions (excluding Land sub-sector).

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



In 2018, the Livestock sub-sector had the maximum share of ~69% of the positive AFOLU emissions (excluding Land sub-sector) in Karnataka. Within the Livestock sub-sector, Enteric Fermentation was the major contributor to positive AFOLU emissions across the reference period with an average share of ~63%. However, the emissions from this category declined at a rate of 1.13% (compounded annually) from 10.30 Mt CO₂e in 2005 to 8.88 Mt CO₂e in 2018.

The categories of Agriculture Soils and Rice Cultivation were the major contributor to positive AFOLU emission, with average shares of ~18% and ~9% respectively, during the reference period. The share of positive AFOLU emissions from Agriculture Soils increased from ~15% in 2005 to ~20% in 2018. Whereas, the share of Rice Cultivation reduced from ~10% in 2005 to ~8% in 2018 (see Figures 11 and 12).

* The sub-sector called 'Aggregate Sources and Non-CO₂ Emission Sources on Land' includes emissions from Rice Cultivation, Agriculture Soils and Biomass Burning in Cropland and Forestland.

Figure 11: Category-wise Emissions (Mt CO₂e) and Percentage Share in Positive AFOLU Emissions (excluding Land Sub-sector) (2018)

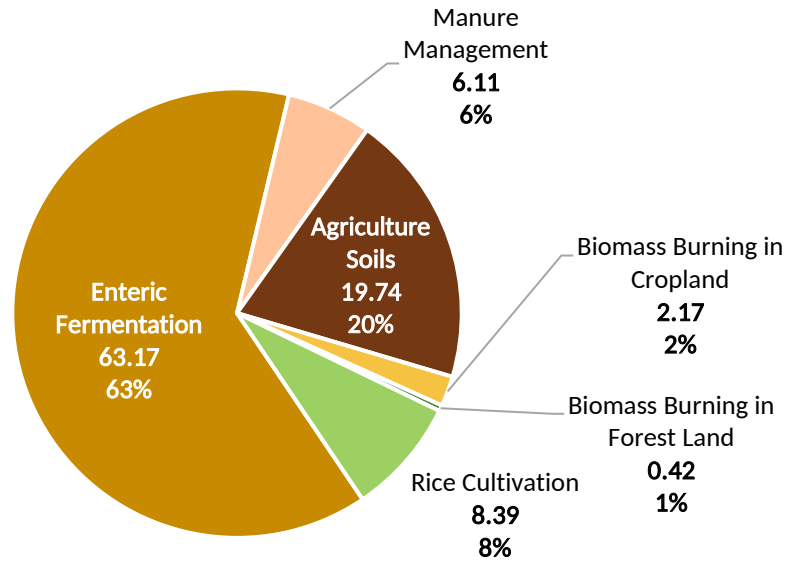
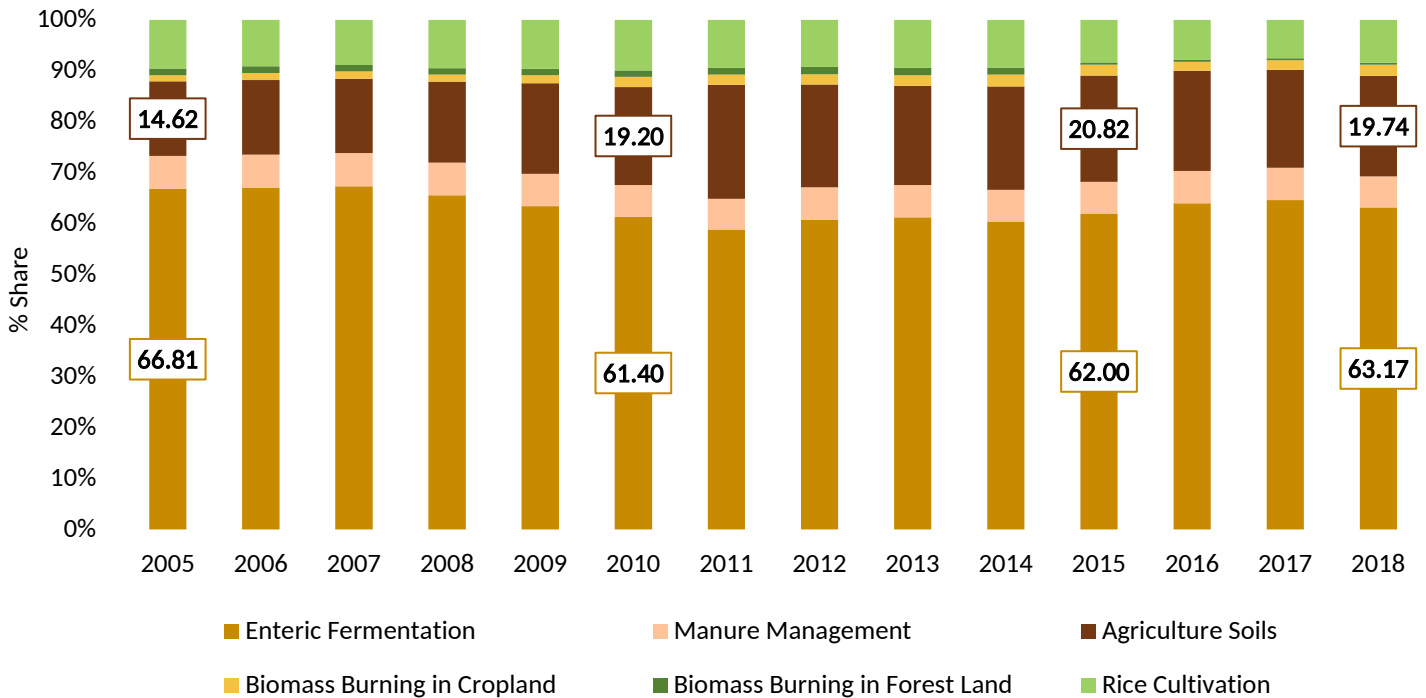


Figure 12: Category-wise Share in Positive AFOLU Emissions (excluding Land Sub-sector) (2005 to 2018)





Waste Sector

Solid Waste Disposal, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. In Karnataka, Waste sector contributed to almost 3% of gross economy-wide emissions (excluding Land sub-sector within AFOLU) in 2018. GHG emissions from the Waste sector of Karnataka increased at a CAGR of 2.08% from 4.11 Mt CO₂e in 2005 to 5.37 Mt CO₂e in 2018. Waste emissions were reduced significantly in 2015, due to a decline in emissions from the Industrial Wastewater sub-sector (see Figure 13).

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

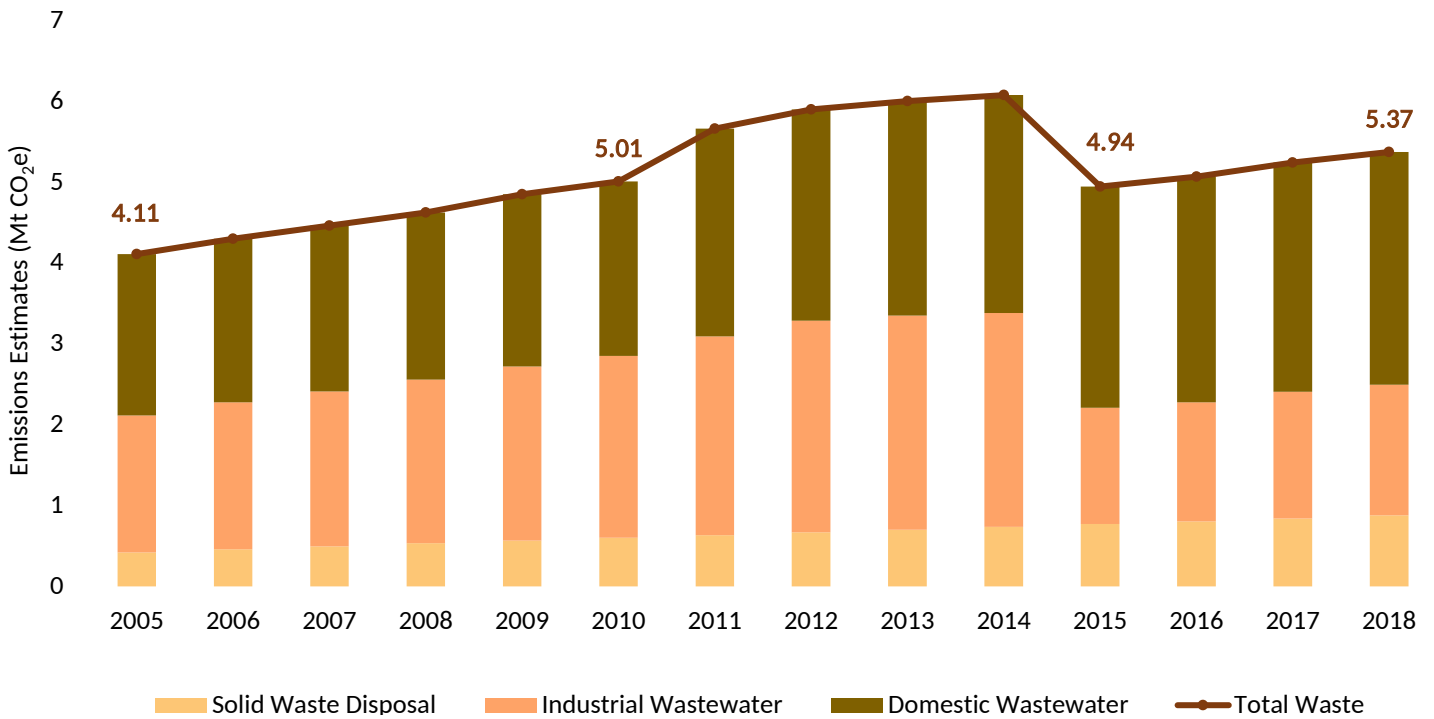
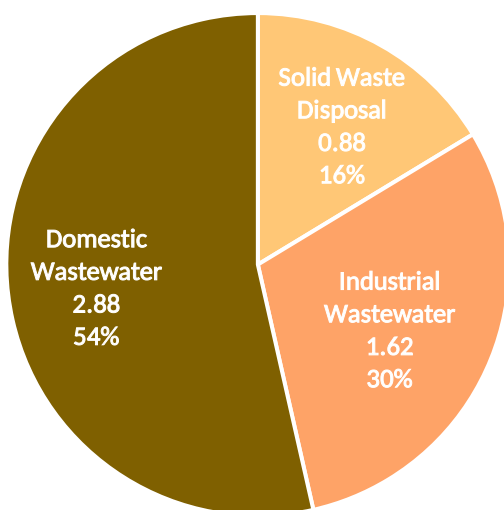


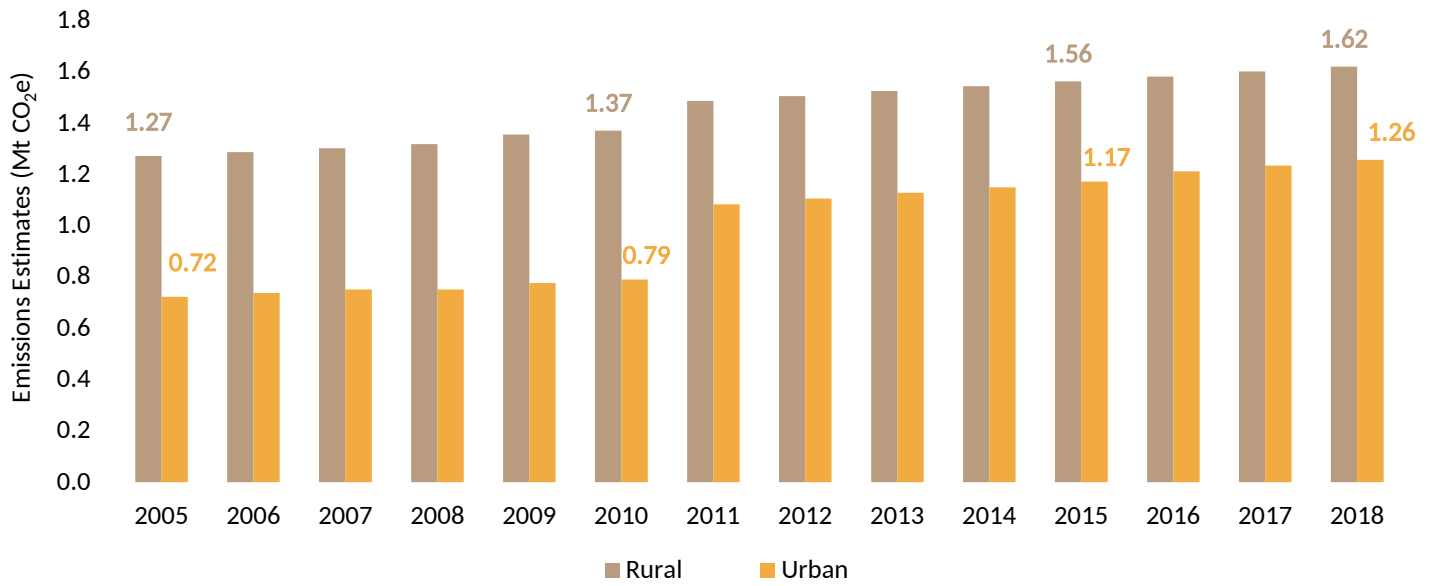
Figure 14: Sub-sector Emissions (Mt CO₂e) and Percentage Share in Total Waste Sector Emissions (2018)



Discharge of untreated wastewater and use of septic tanks are the key drivers of emissions due to Domestic Wastewater sub-sector. In 2018, Domestic Wastewater had a share of ~54% in the total Waste sector emissions of Karnataka. Approximately 16% of the Waste sector emissions were from Solid Waste Disposal, which increased at an estimated CAGR of 5.86% during the reference period; from 0.42 Mt CO₂e in 2005, to 0.88 Mt CO₂e in 2018. Industrial Wastewater accounted for nearly 30% of Waste sector emissions in 2018. Emissions from this sub-sector declined at rate of 0.36% (compounded annually) from 1.70 Mt CO₂e in 2005 to 1.62 Mt CO₂e in 2018 (see figure 14).

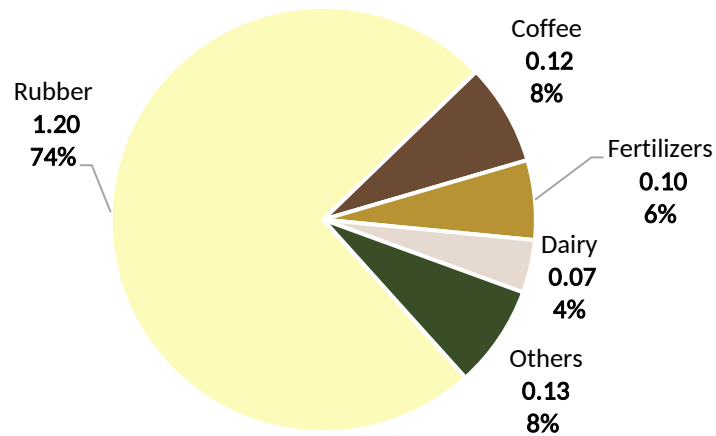
Emissions from Domestic Wastewater of both rural and urban areas grew at a CAGR of 2.86% from 1.99 Mt CO₂e in 2005 to 2.88 Mt CO₂e in 2018. Almost 56% of Domestic Wastewater emissions emanated from rural areas of Karnataka in 2018 (see Figure 15).

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



The Rubber Industry was the major contributor to Industrial Wastewater emissions, with a share of ~74%, in 2018. This was followed by Coffee Industry (~8%), Fertilisers Industry (~6%), Dairy Industry (~4%), whereas Other Industries contributed ~8% (see Figure 16).

Figure 16: Category-wise Emissions (Mt CO₂e) and Percentage Share in Total 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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