

Trend Analysis of GHG Emissions of ANDHRA 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.

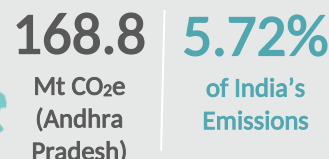
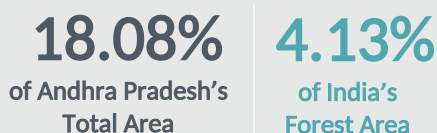
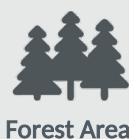
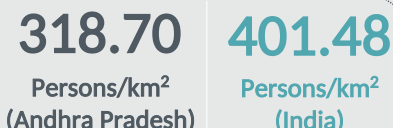
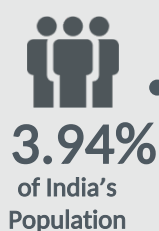
The Platform aims to add value to the various ongoing GHG emissions estimation efforts by addressing existing data gaps and data accessibility issues, broadening the scope of national inventories to include state inventories, and increasing the volume of analytics and policy dialogue on India's GHG emissions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

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



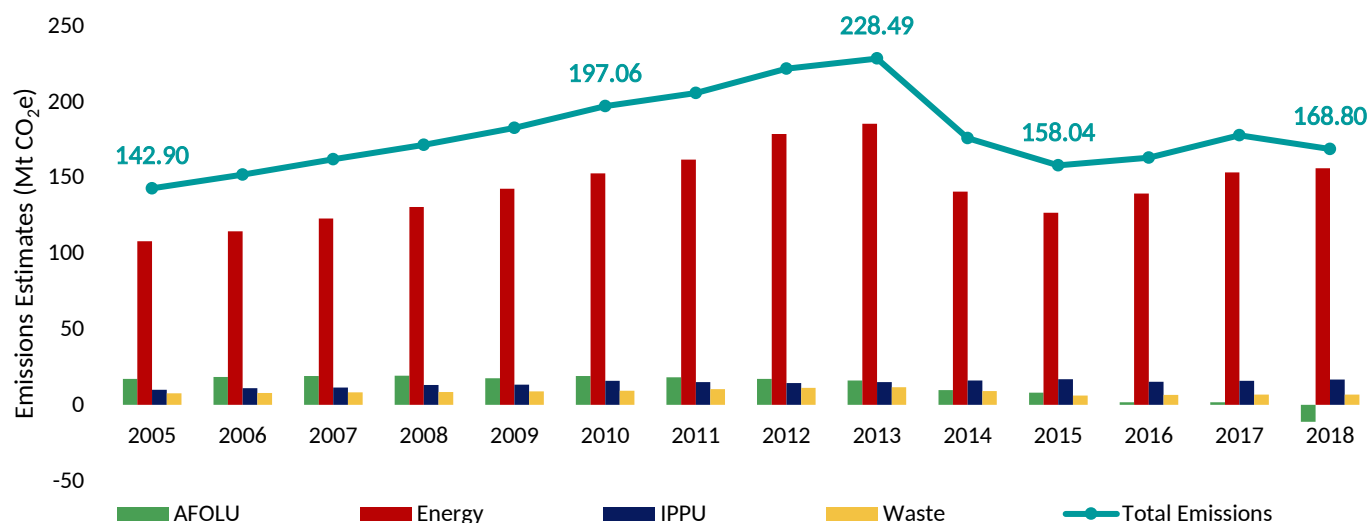
* Fuel combusted for captive electricity generation (auto-producers) and direct fuel combustion (industrial energy) has been reported under Energy sector.

Andhra Pradesh at a Glance (2018)



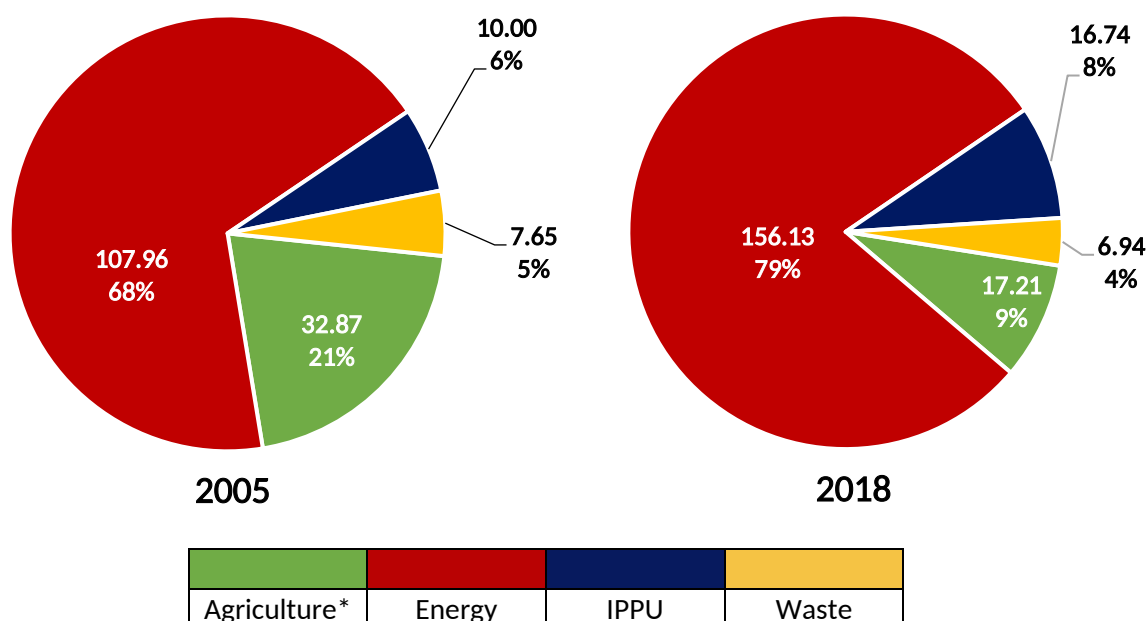
Economy-wide Emissions Estimates

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



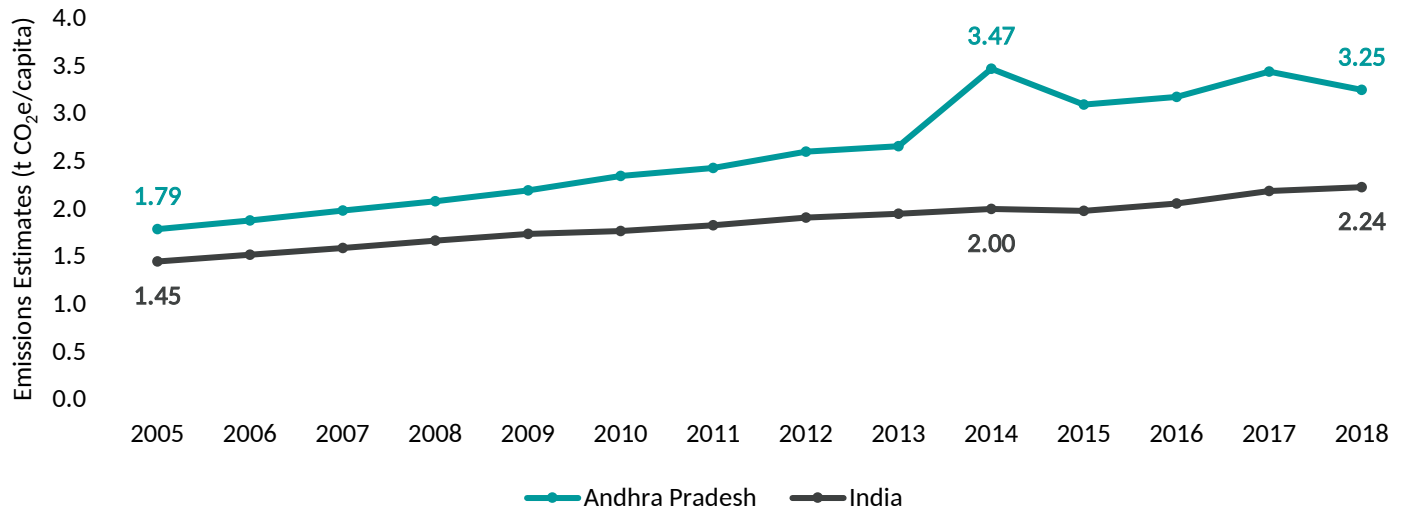
Emissions of Andhra Pradesh increased at a rate of 1.29% (compounded annually), from 142.9 Mt CO₂e in 2005, to 168.8 Mt CO₂e in 2018 (see Figure 1). Energy sector remained the major contributor to Andhra Pradesh’s GHG emissions, throughout the reference years. Net emissions in the State declined post 2013 due to the State’s bifurcation in 2014. In 2015, decrease in emissions from Energy sector led to a further decline in overall emissions. The net economy-wide emissions declined in 2018, because of enhancement of AFOLU sinks. It is important to note that the entire AFOLU sector was a net emitter till 2017 and became a net sink in 2018. The share of Energy sector in gross economy-wide emissions (without Land sub-sector within AFOLU) increased from ~68% in 2005 to ~79% in 2018. The share of Industrial Processes and Product Use (IPPU) sector increased from ~6% in 2005 to ~8% in 2018. Whereas, the contribution of Agriculture sub-sector to the gross economy-wide emissions reduced from ~21% in 2005 to ~9% in 2018. The share of Waste sector reduced from 5% in 2005 to ~4% in 2018 (see Figure 2).

Figure 2: Sector-wise Contribution (Mt CO₂e) and Percentage Share in Gross Economy-wide GHG Emissions (without Land sub-sector within AFOLU) of Andhra Pradesh



* 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

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



The per capita emissions of Andhra Pradesh were higher than the per capita emissions of India across the reference years, as seen in Figure 3. They increased from 1.79 t CO₂e/capita in 2005 to 3.25 t CO₂e/capita in 2018, at a rate of 4.69% (compounded annually), which was higher than India's CAGR of 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 emissions represented 79% of the gross economy wide emissions (excluding Land sub-sector within AFOLU) in Andhra Pradesh. Energy emissions increased almost 1.5-fold, from 107.96 Mt CO₂e in 2005 to 156.13 Mt CO₂e in 2018, as depicted in Figure 4. Emissions from this sector declined post 2013, due to the State's bifurcation. Further, decrease in emissions between 2014-2015 can be attributed to reduction in emissions from the Industrial Energy category during the reference period but they began to rise again from 2016.

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

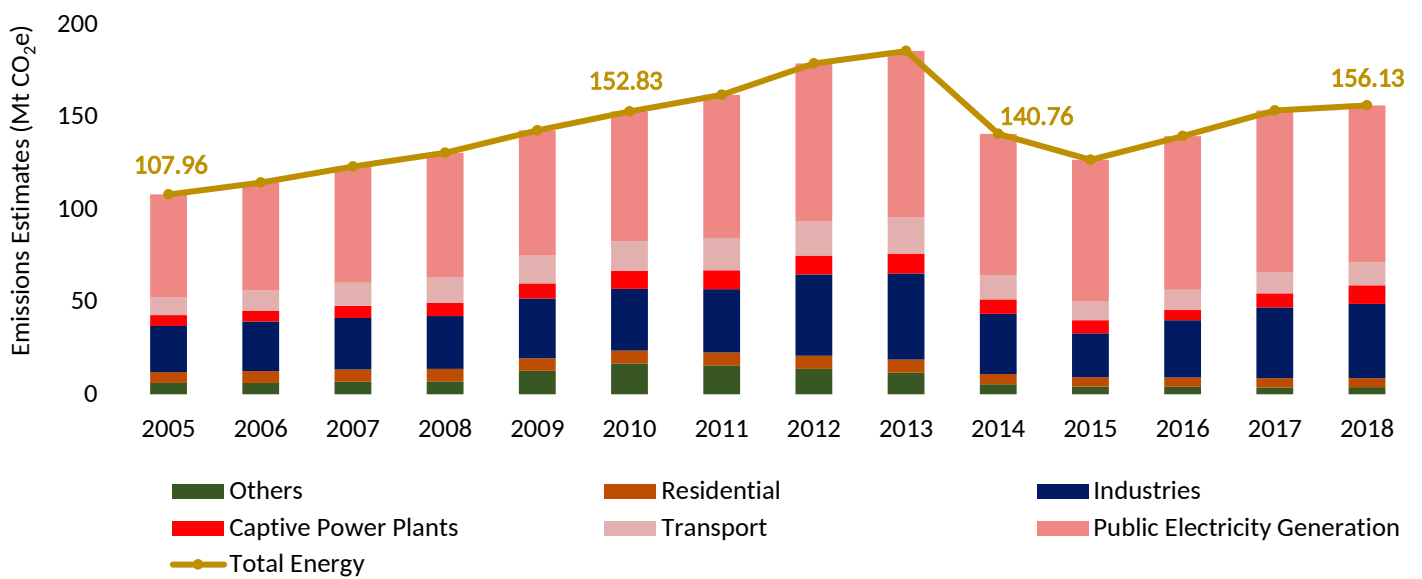


Figure 5: Category-wise Emissions (Mt CO₂e) and Percentage Share in Total Energy Sector Emissions (2018)

Within the Energy sector, Public Electricity Generation (PEG) category had the highest share of ~54% of the Energy sector emissions of Andhra Pradesh in 2018. This was followed by Industrial Energy and Transport categories with shares of ~26% and ~8%, respectively (see Figure 5).

Within the Fuel Combustion sub-sector, emissions from combustion of Coal were a major contributor to emissions, with an average share of ~77% during the reference period (see Figure 6). This was followed by Liquid Petroleum Fuels with their average share at ~15% between 2005 and 2018. Gaseous Petroleum Fuels had an average share of ~6% of the Fuel Combustion emissions throughout the reference period.

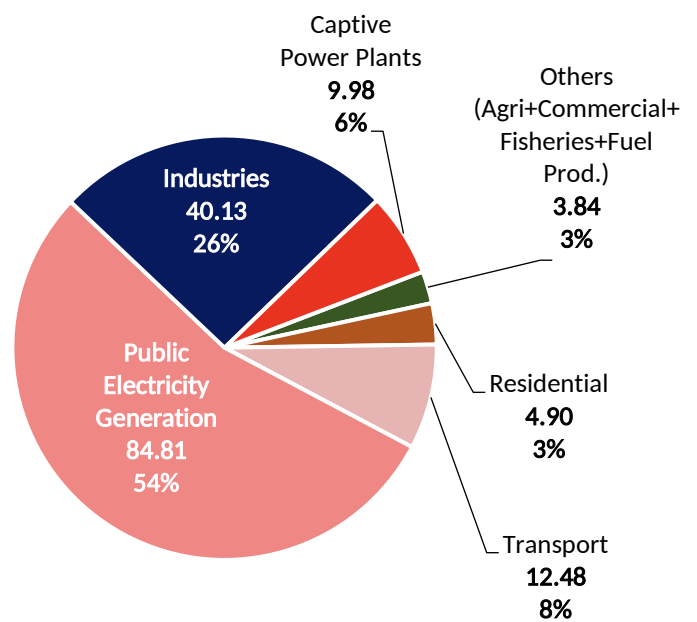
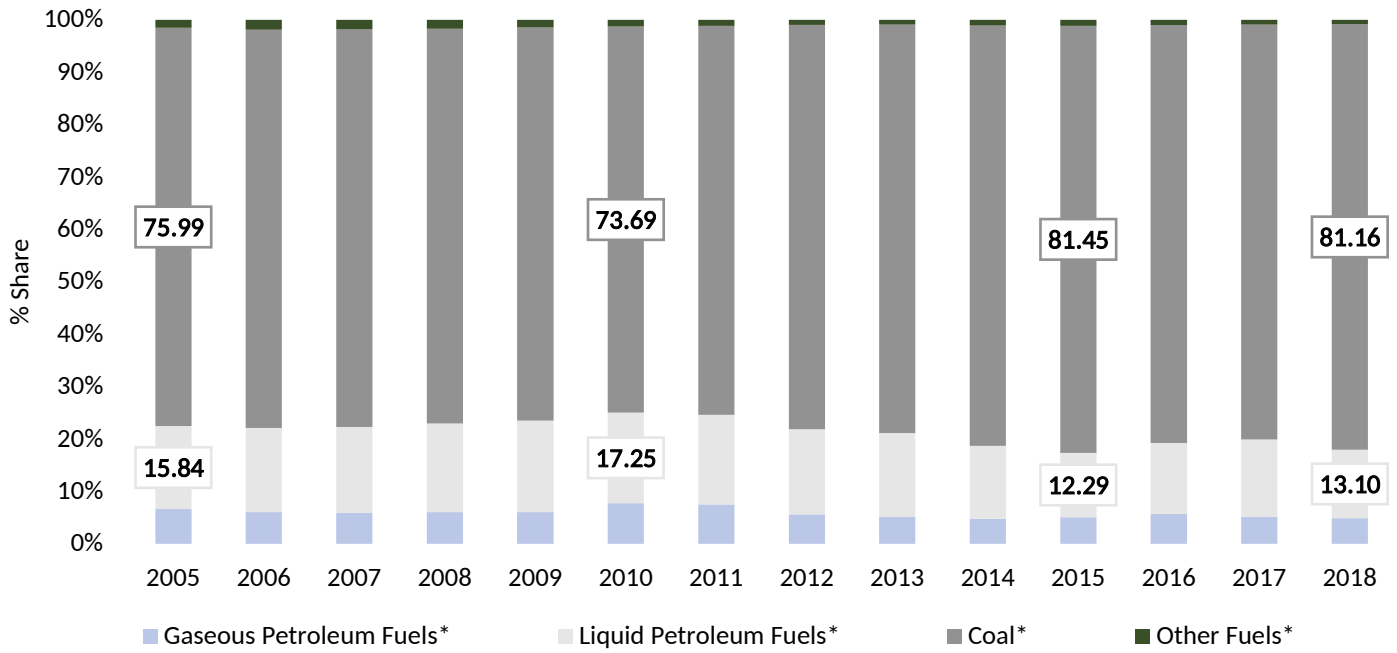


Figure 6: Percentage Share of GHG Emissions by Fuel Type due to Fuel Combustion in Energy Sector (2005 to 2018)



***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 Andhra Pradesh, the IPPU sector represented ~8% of the gross GHG emissions (excluding Land sub-sector within AFOLU) in Andhra Pradesh, in 2018. Between 2005 and 2018, emissions from this sector increased from ~10.00 Mt CO₂e to 16.74 Mt CO₂e, at a CAGR of 4.04%. As seen in Figure 7, emissions from the IPPU sector in Andhra Pradesh were primarily driven by the Mineral Industry, largely due to emissions from Cement Production category. The share of emissions from the Mineral, Metal and Chemical industry were ~84%, ~11% and ~5%, respectively, in 2018 (see Figure 8).

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

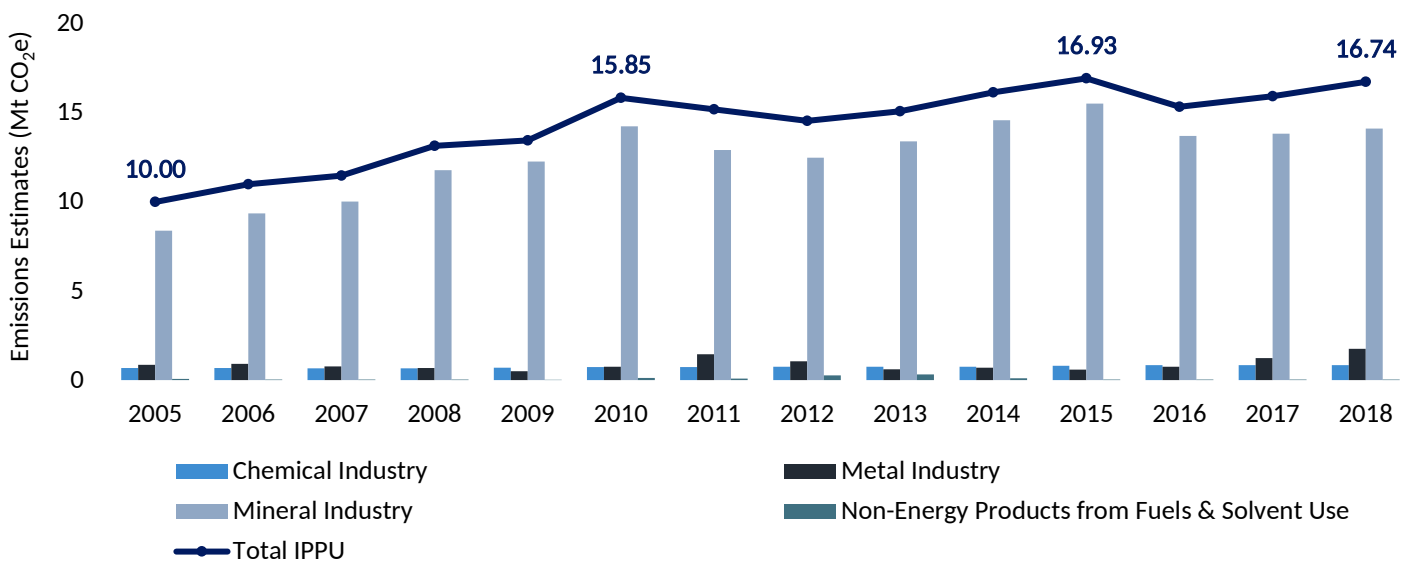
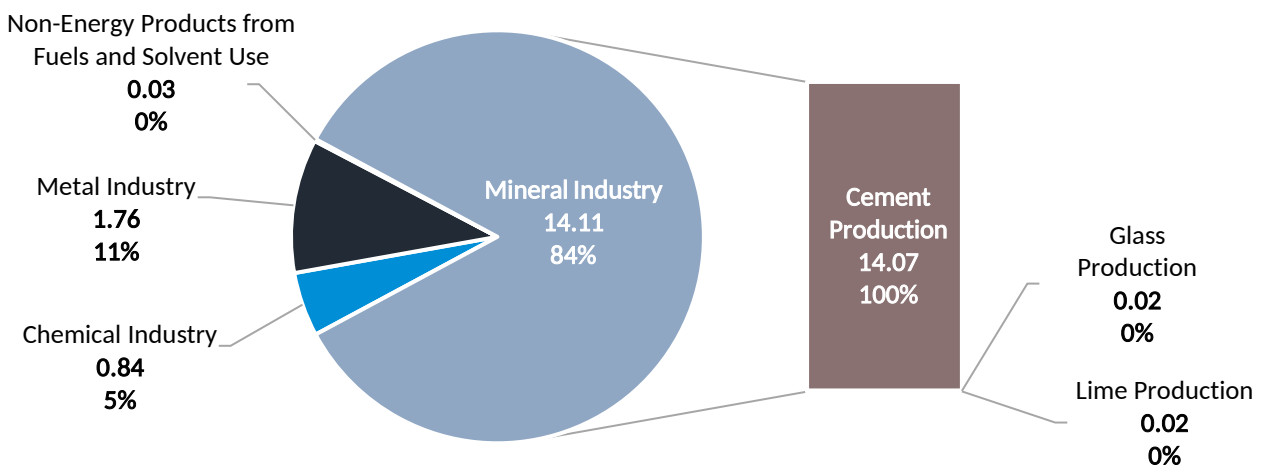
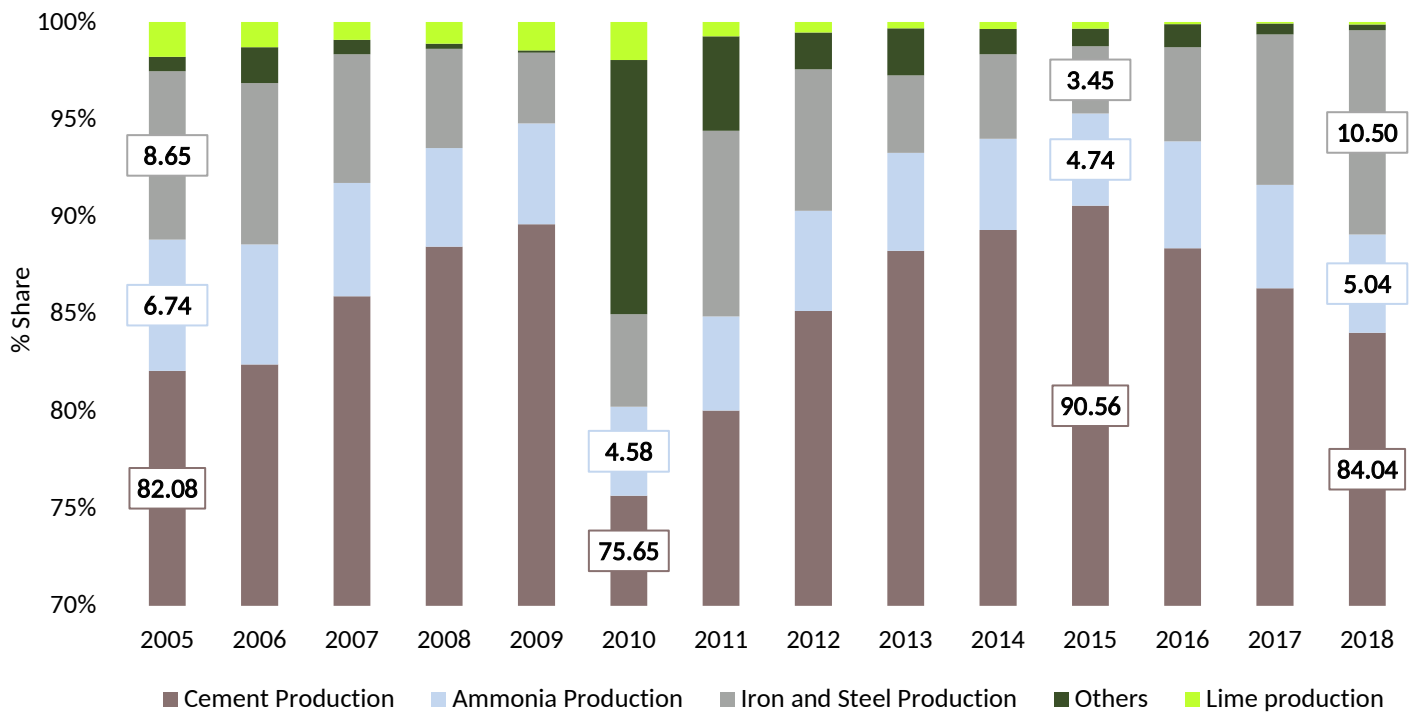


Figure 8: Sub-Sector Emissions (Mt CO₂e) and Percentage Contribution in Total IPPU Emissions (2018)



A detailed trend of GHG emissions by various IPPU categories is depicted in Figure 9. Cement Production was the key driver of GHG emissions in the IPPU sector, however, its share reduced from ~82% in 2005 to ~75% in 2010 before peaking in 2015, contributing 90% share of the total IPPU emissions. The decrease in the share of emissions from Cement Production can be attributed to the increase in emissions from Glass Production in the year 2010. The share of emissions from Ammonia Production decreased from 6.74% in 2005 to 5.04% in 2018, whereas, emissions from Iron and Steel Production increased from 8.65% in 2005 to 10.50% in 2018.

Figure 9: Percentage Share of GHG Emissions from IPPU Categories (2005 to 2018)

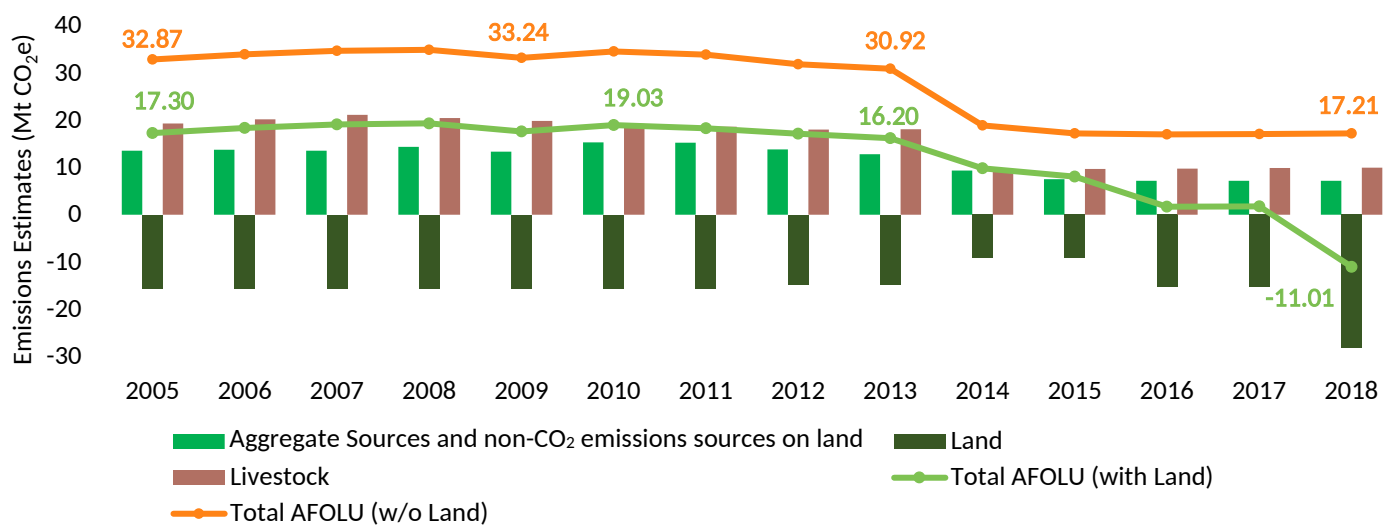




AFOLU Sector

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*. In Andhra Pradesh, 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. Emissions from AFOLU sector declined post 2013, due to the State's bifurcation resulting in reapportionment of its resources. However, in 2018, the overall AFOLU sector became a net sink, owing to the increase in removals from the Land sub-sector. This can be attributed to increase in the forest area as well as enhanced carbon stock density of forests, as reported in Forest Survey of India (2021)**. The average annual removals from the Land Sub-Sector in Andhra Pradesh during the reference period were 15.41 Mt CO₂e, around ~88% of the average annual gross AFOLU emissions (see Figure 10).

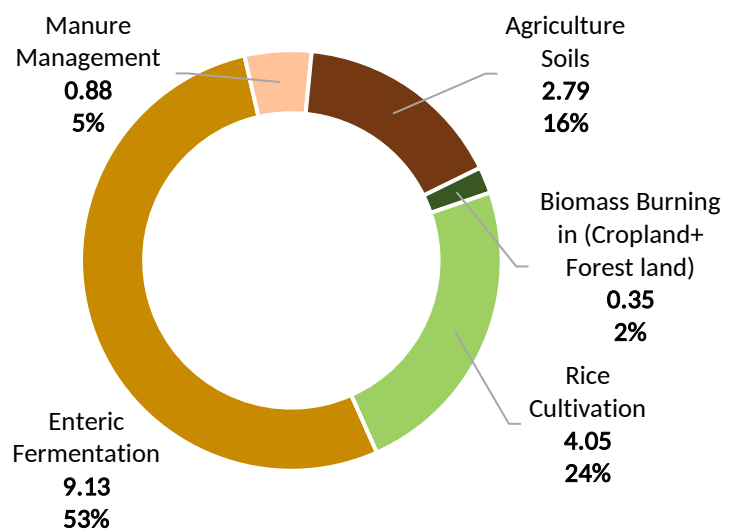
Figure 10: GHG Emissions Estimates of AFOLU Sector - Andhra Pradesh (2005 to 2018)



In 2018, the Livestock sub-sector had the maximum share of ~58% of positive AFOLU emissions (excluding Land sub-sector) in Andhra Pradesh. Within the Livestock sub-sector, Enteric Fermentation category was the major contributor to positive AFOLU emissions across the reference period with an average share of ~52%.

Within the Aggregate Sources sub-sector, categories of Rice Cultivation and Agriculture Soils contributed ~16% and ~22% respectively, to positive AFOLU emissions, across the reference period. The share of emissions from Rice Cultivation increased slightly from ~21% in 2005 to ~24% in 2018, and that of emissions from Agriculture Soils remained nearly constant throughout the reference period (see Figures 11 and 12).

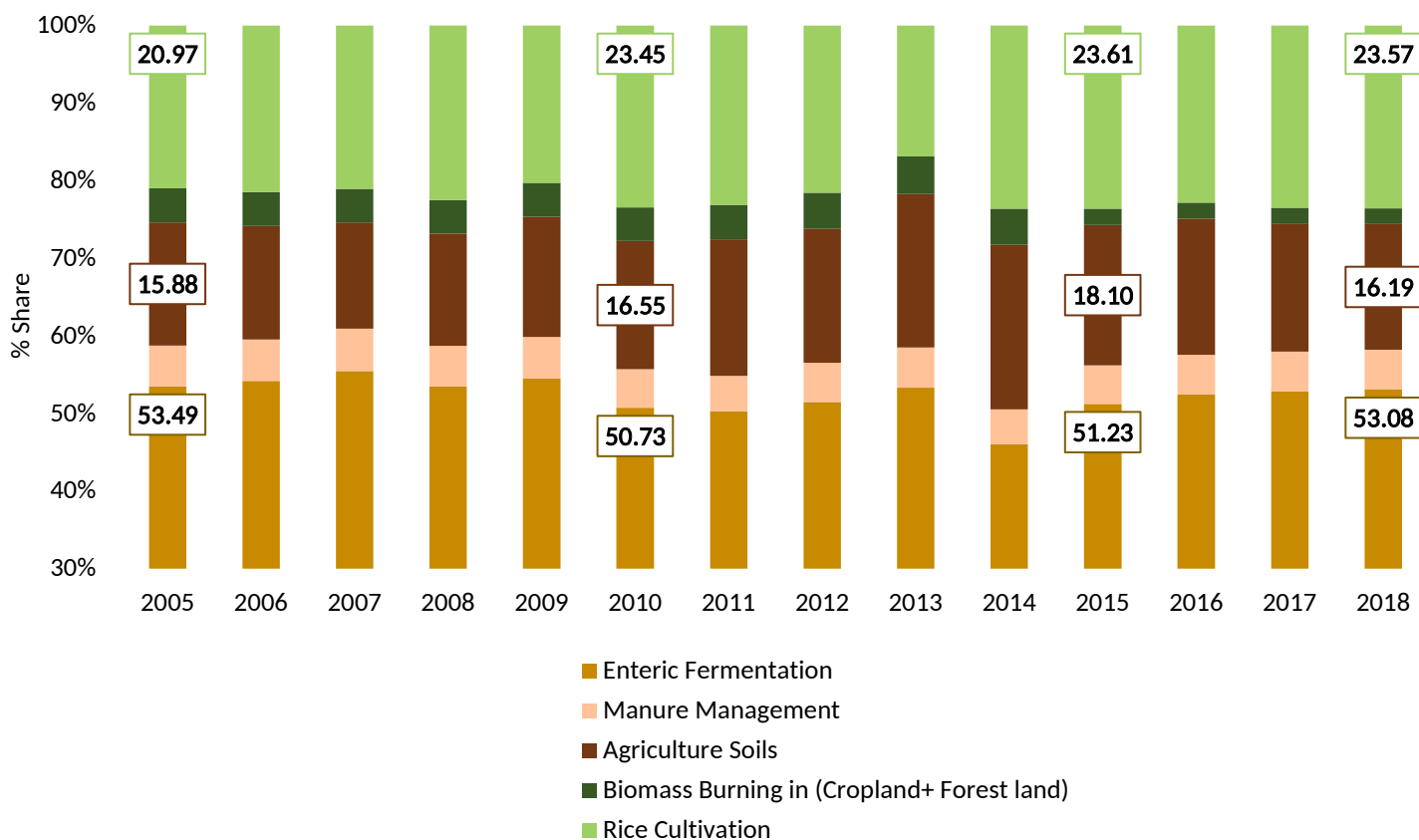
Figure 11: Category-wise Emissions (Mt CO₂e) and Percentage Share in Positive AFOLU Emissions (excluding Land sub-sector) (2018)



*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.

** FSI Report 2021 reports data for 2019

Figure 12: Category-wise Percentage 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 Andhra Pradesh, Waste sector contributed to almost 4% of gross GHG emissions (excluding Land sub-sector within AFOLU) in 2018. Waste emissions declined at a CAGR of ~1%, from 7.65 Mt CO₂e in 2005, to 6.94 Mt CO₂e in 2018. As seen in Figure 13, the overall Waste sector emissions declined in 2014, which can be attributed to the State's bifurcation.

Figure 13: GHG Emissions Estimates of Waste Sector – Andhra Pradesh (2005 to 2018)

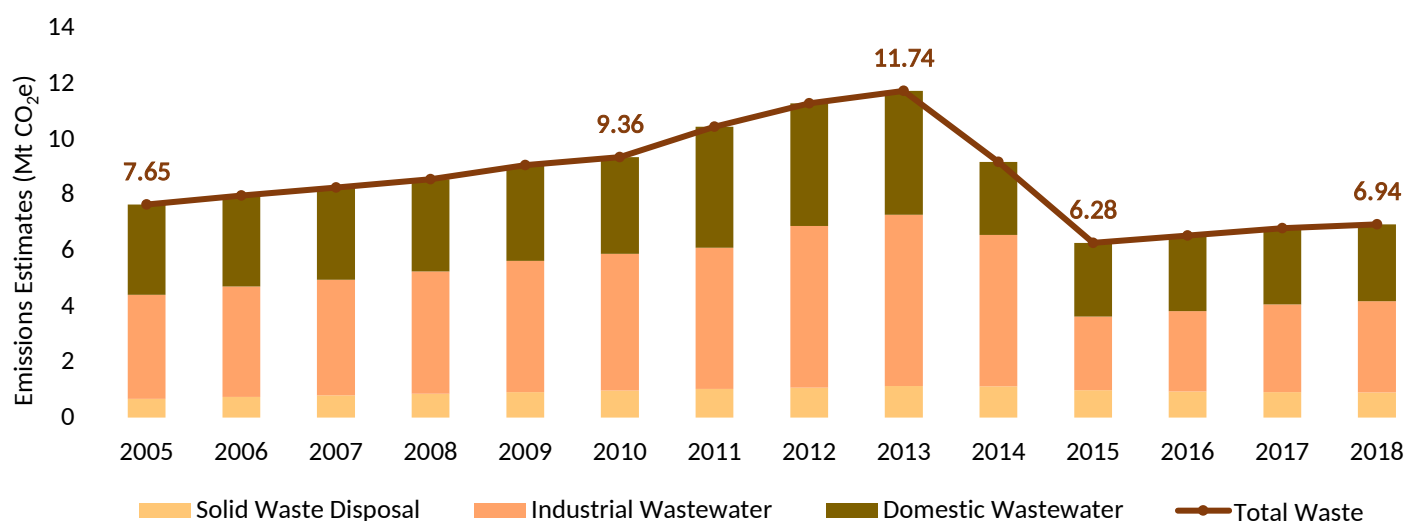
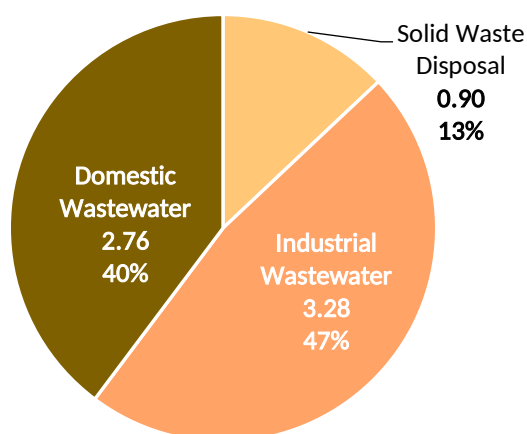


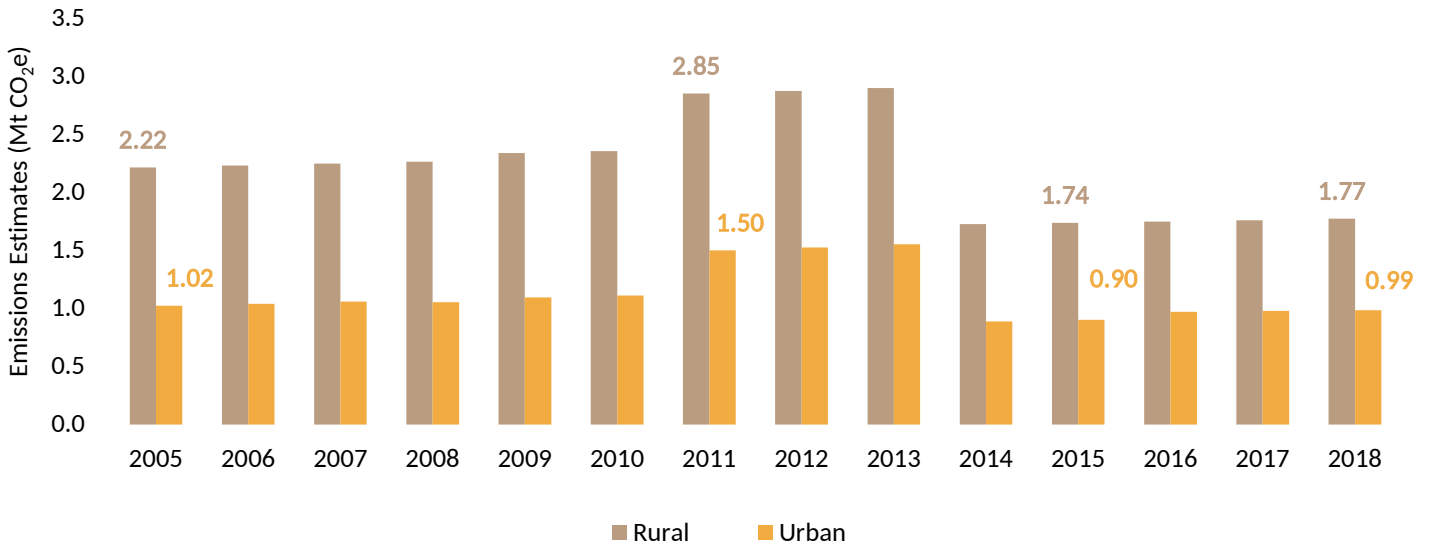
Figure 14: Sub-sector Emissions (Mt CO₂e) and Percentage Share in Total Waste Sector Emissions (2018)



Discharge of untreated wastewater and use of septic tanks are the key drivers of emissions due to Domestic Wastewater sub-sector. Domestic Wastewater had a share of 40% in the total Waste sector emissions of Andhra Pradesh in 2018. Approximately 13% of the Waste sector emissions were from Solid Waste Disposal, which grew at an estimated CAGR of 2.2% from 0.68 Mt CO₂e in 2005 to 0.90 Mt CO₂e in 2018. Industrial Wastewater accounted for nearly 47% of Waste sector emissions in 2018 and declined at a CAGR of ~1% from 3.73 Mt CO₂e in 2005 to 3.28 Mt CO₂e in 2018 (see Figure 14).

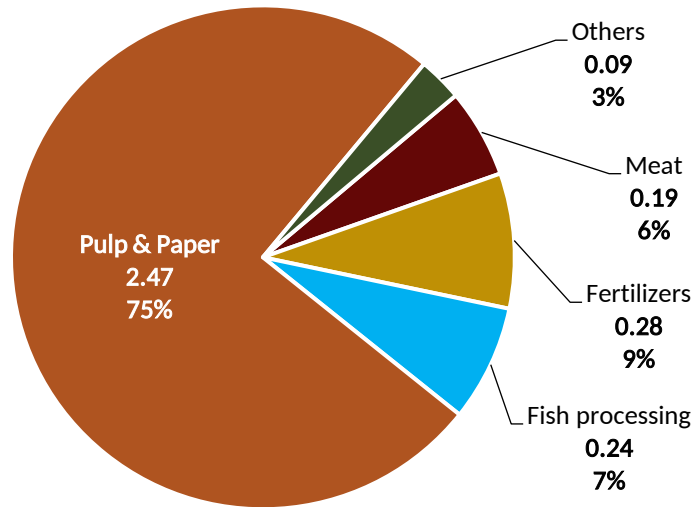
Emissions from Domestic Wastewater of both rural and urban areas decreased at a CAGR of ~1.2% from 3.24 Mt CO₂e in 2005 to 2.76 Mt CO₂e in 2018. Almost 64% of Domestic Wastewater emissions were from the rural areas of Andhra Pradesh in 2018 as shown in Figure 15 below.

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



The Pulp and Paper Industry was the major contributor to Industrial Wastewater emissions with a share of ~75% in 2018. This was followed by Fertilizers Industries (~9%), Fish Processing (7%), and Meat (6%) as illustrated in Figure 16 below.

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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