

# Trend Analysis of GHG Emissions of CHHATTISGARH

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

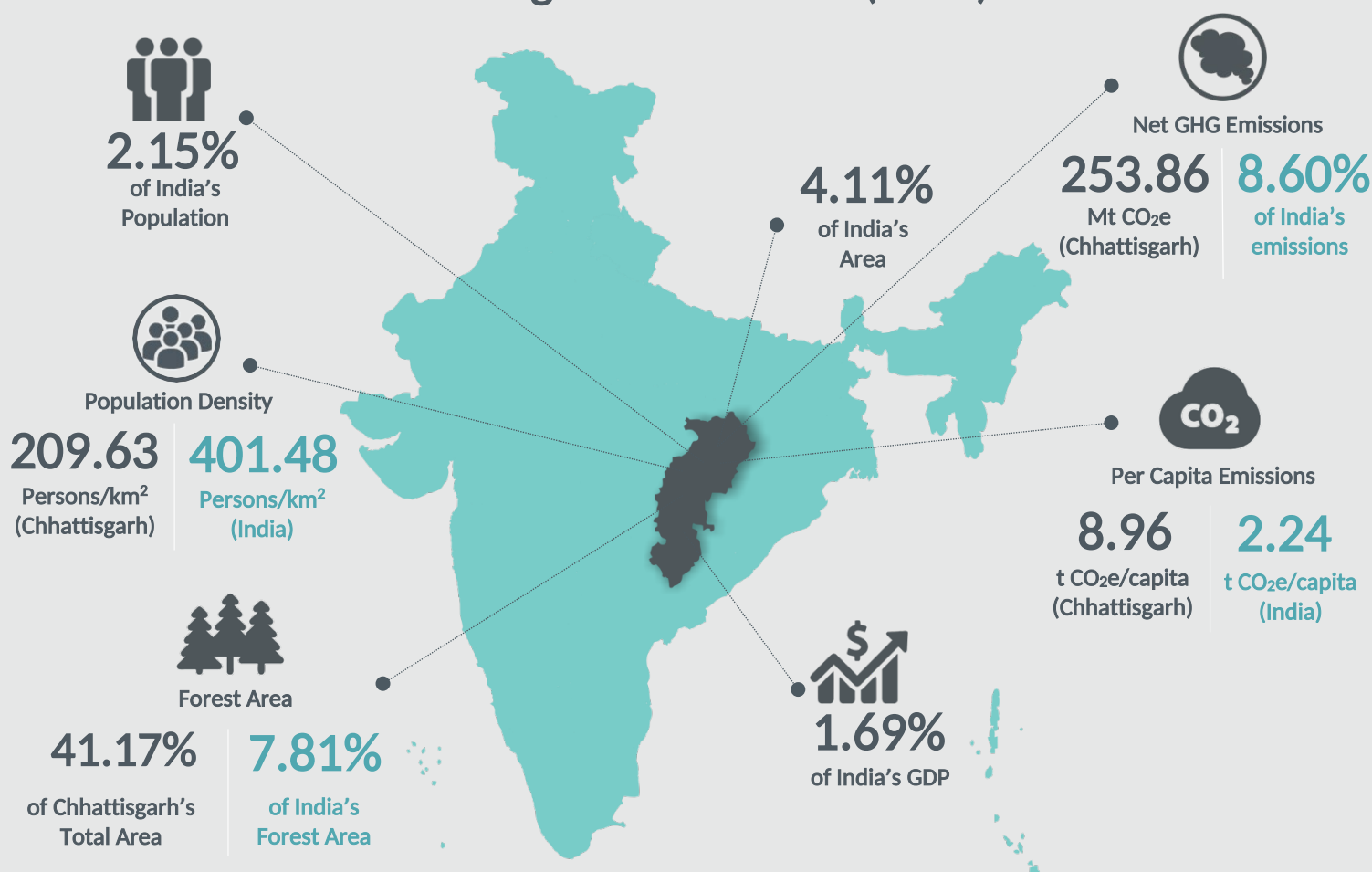
The Platform aims to add value to the various ongoing GHG emissions estimation efforts by addressing existing data gaps and data accessibility issues, broadening the scope of national inventories to include state inventories, and increasing the volume of analytics and policy dialogue on India's GHG emissions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

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



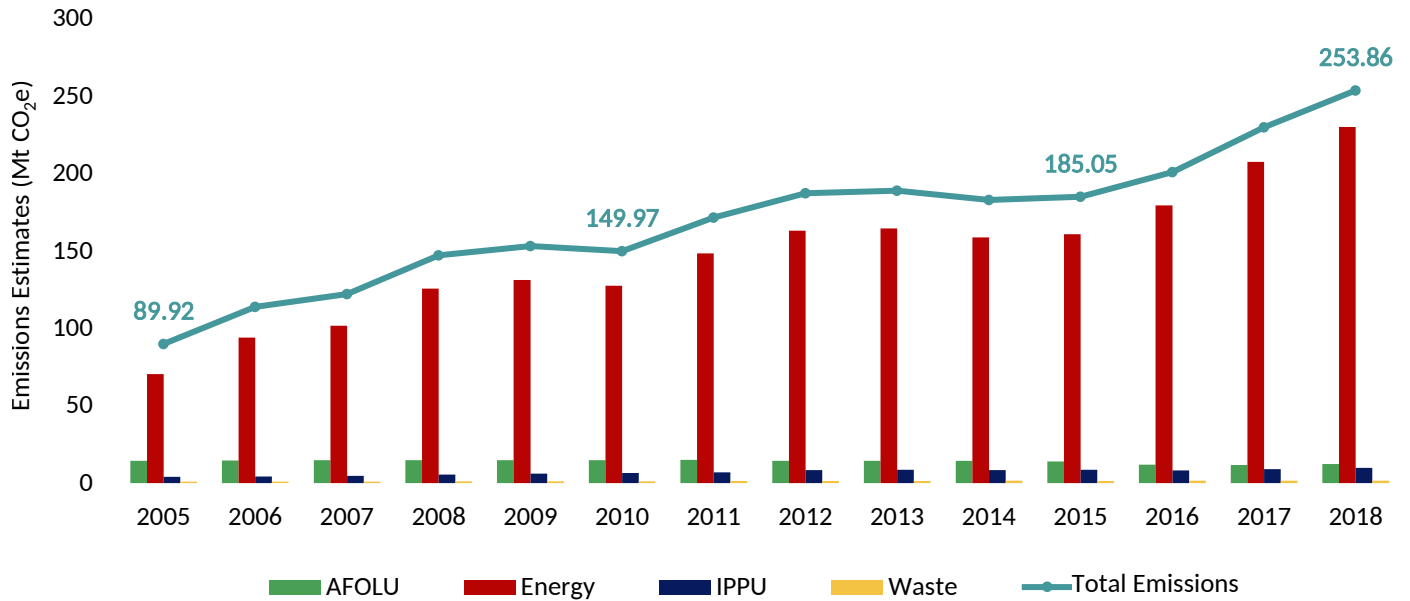
\* Fuel combusted for captive electricity generation (auto-producers) and direct fuel combustion (industrial energy) has been reported under energy sector.

## Chhattisgarh at a Glance (2018)



# Economy-wide Emissions Estimates

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



Emissions in Chhattisgarh increased at a rate of 8.31% (compounded annually) from 89.92 Mt CO<sub>2</sub>e in 2005 to 253.86 Mt CO<sub>2</sub>e in 2018 (Figure 1). Chhattisgarh’s rapid growth of emissions was due to increase in emissions from the Energy sector. In 2005, the share of Energy sector in the total economy-wide emissions of Chhattisgarh was ~78%. Agriculture, Forestry and Other Land Use (AFOLU), Industrial Processes and Product Use (IPPU) and Waste sectors accounted for ~16%, 5% and ~1%, respectively. As can be seen in Figure 2, in 2018, the share of emissions from Energy sector increased to ~91%, while the share of AFOLU sector emissions decreased to ~5%. Further, the share of IPPU and Waste sectors also decreased slightly as compared to 2005 levels.

Figure 2: Sector-wise Contribution (Mt CO<sub>2</sub>e) and Percentage Share to Economy-wide GHG Emissions of Chhattisgarh

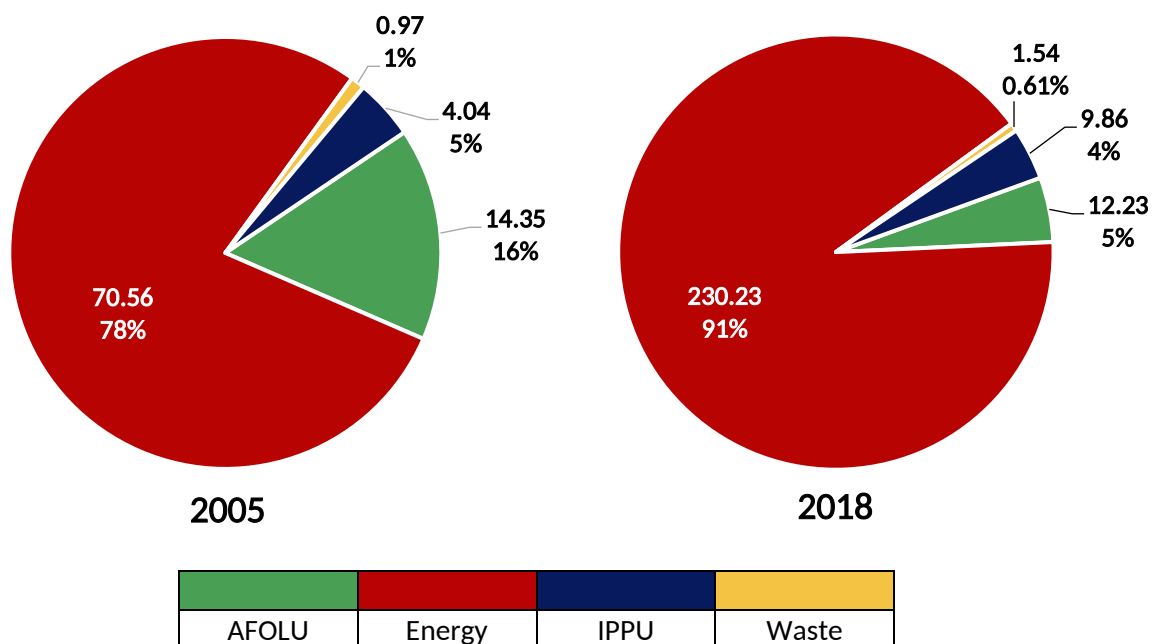
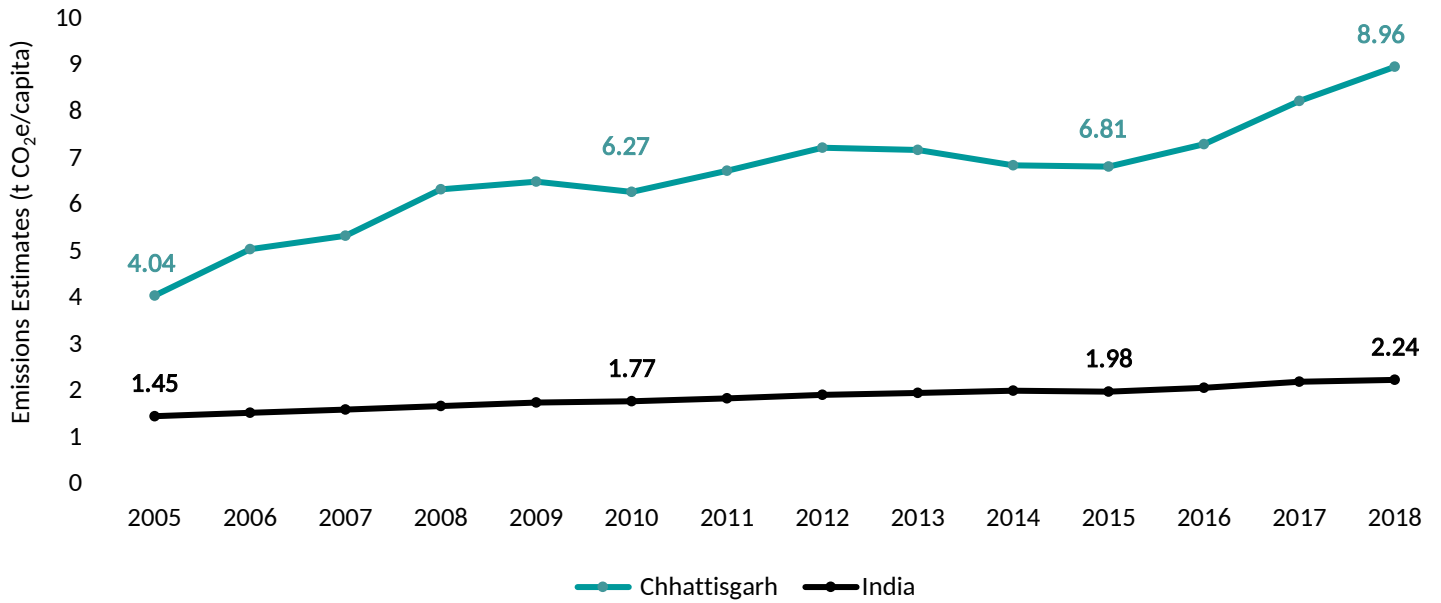


Figure 3: Per Capita GHG Emissions of Chhattisgarh and India (2005 to 2018)



Chhattisgarh's per-capita emissions were significantly higher than those of India, coming in at almost four times the amount (see Figure 3). The per capita emissions of Chhattisgarh increased from 4.04 t CO<sub>2</sub>e/capita in 2005 to 8.96 t CO<sub>2</sub>e/capita in 2018 at a CAGR of 6.35%, which was nearly double of India's CAGR (~3.41%).

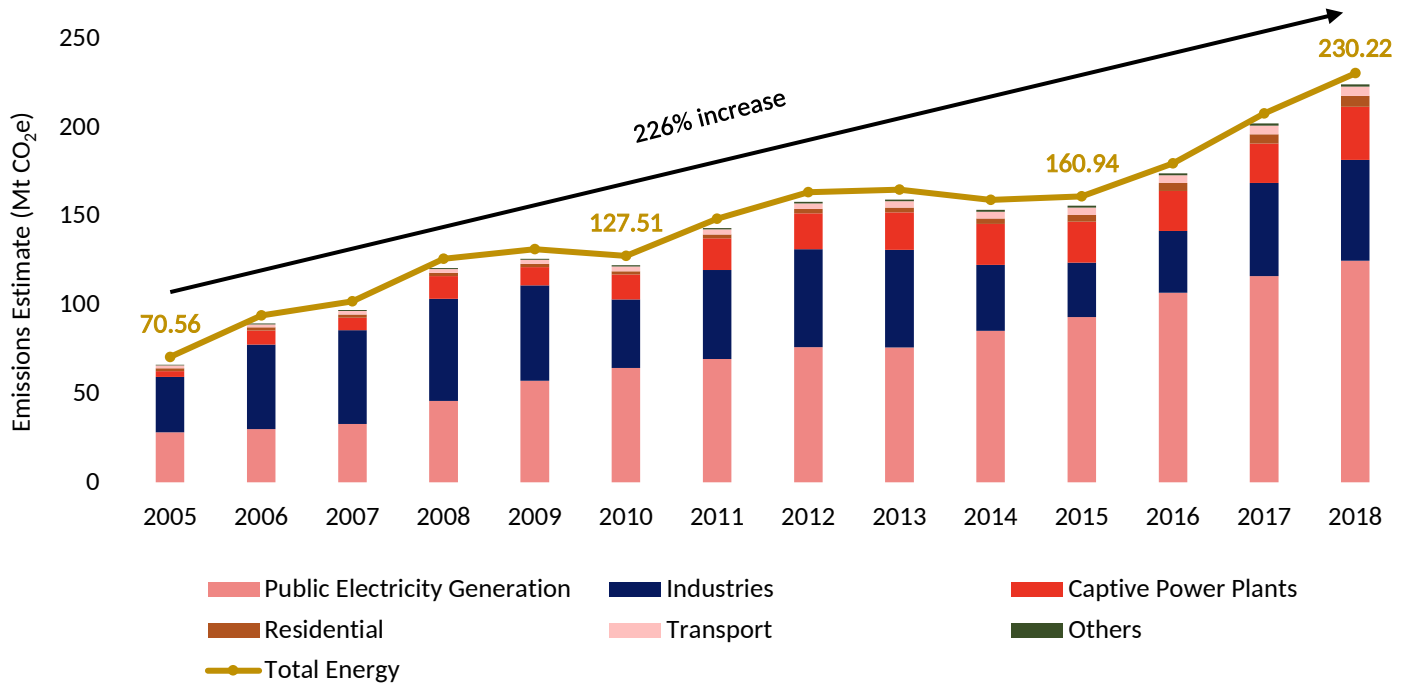
# Energy Sector



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.

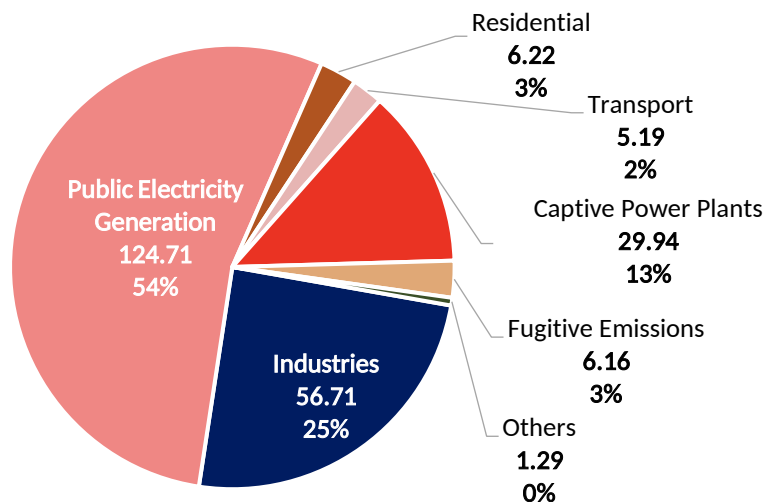
In Chhattisgarh, Energy sector accounted for ~91% of the total economy-wide emissions in 2018. Emissions from the Energy sector increased at a CAGR of 9.52% from 70.56 Mt CO<sub>2</sub>e in 2005 to 230.22 Mt CO<sub>2</sub>e in 2018 (see Figure 4).

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



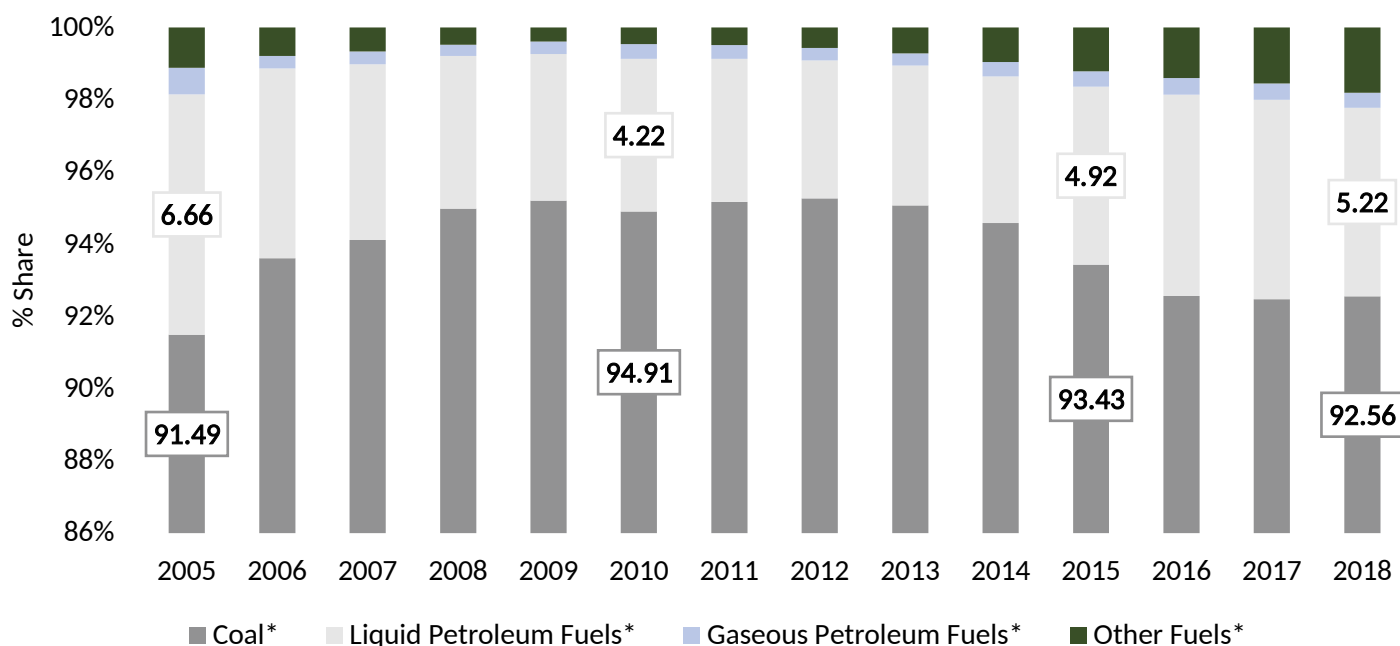
Within the Energy sector, Public Electricity Generation category was the major contributor to GHG emissions, with a share of ~54% of the total Energy emissions of the state in 2018. This was followed by Industries and Captive Power Plants categories with shares of ~25% and 13%, respectively, in 2018 (see Figure 5).

**Figure 5: Category-wise emissions (Mt CO<sub>2</sub>e) and Percentage Share in Total Energy Sector Emissions (2018)**



Within the Fuel-Combustion sub-sector, emissions from combustion of Coal were the major contributor to Energy sector emissions in the state, with an average share of ~94% across the reference period (see Figure 6). This was followed by emissions from combustion of Liquid Petroleum Fuels, with an average share of ~5% between 2005 and 2018. Gaseous Petroleum Fuels and Other Fuels, both had marginal average shares of <1% of the total Fuel Combustion emissions in Chhattisgarh during 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 Chhattisgarh, the IPPU sector represented ~4% of the total economy-wide emissions in 2018. Between 2005 and 2018, the overall IPPU emissions grew at a CAGR of 7.11%, from 4.04 Mt CO<sub>2</sub>e in 2005 to 9.86 Mt CO<sub>2</sub>e in 2018 (see Figure 7). Majority of Chhattisgarh's IPPU emissions were driven by Mineral Industry (~62%), followed by Metal Industry (~38%), with marginal contribution from Non-Energy Products sub-sector in 2018 as illustrated in Figure 8.

Figure 7: GHG Emissions Estimates for IPPU Sector - Chhattisgarh (2005 to 2018)

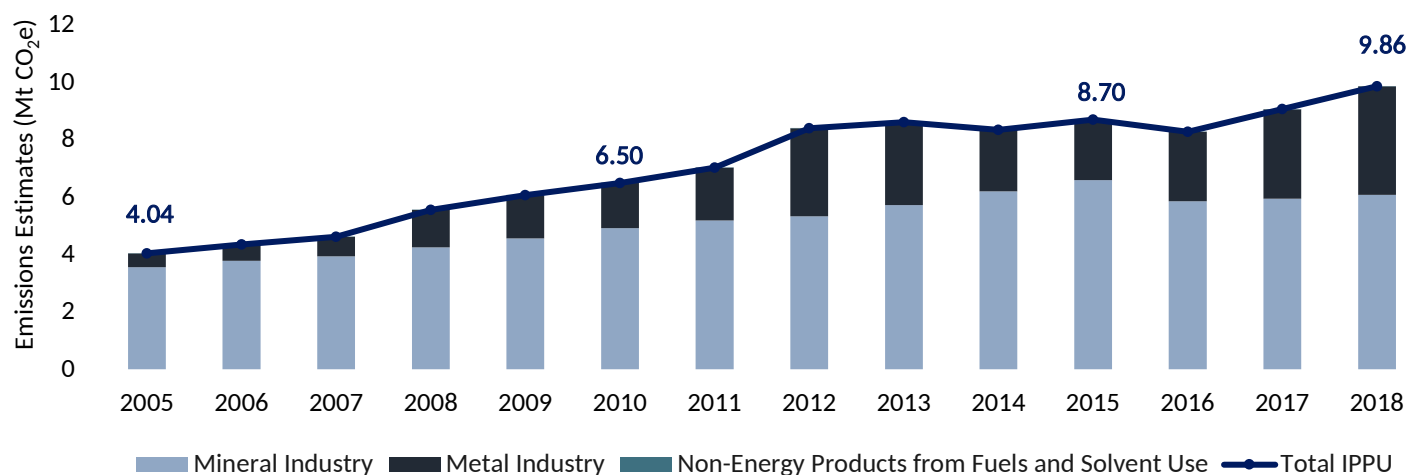
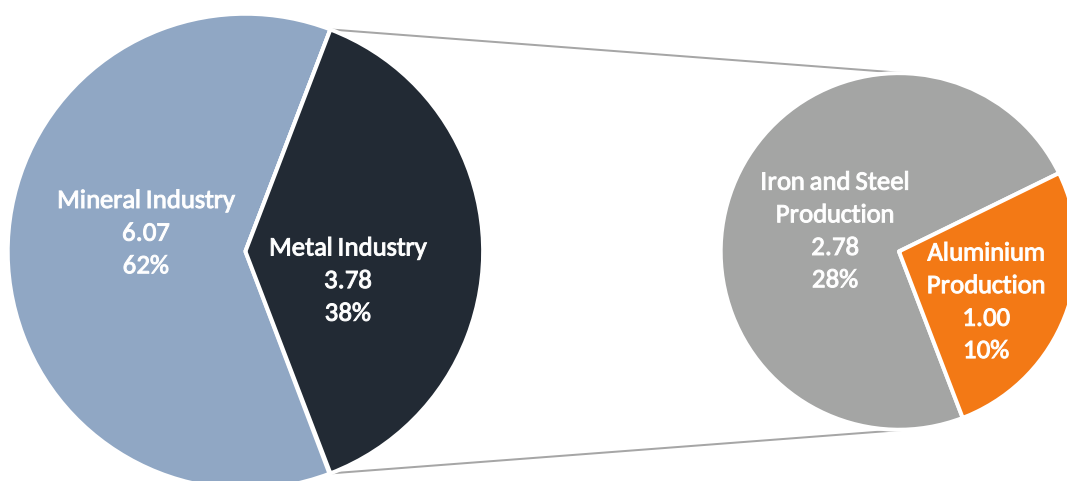
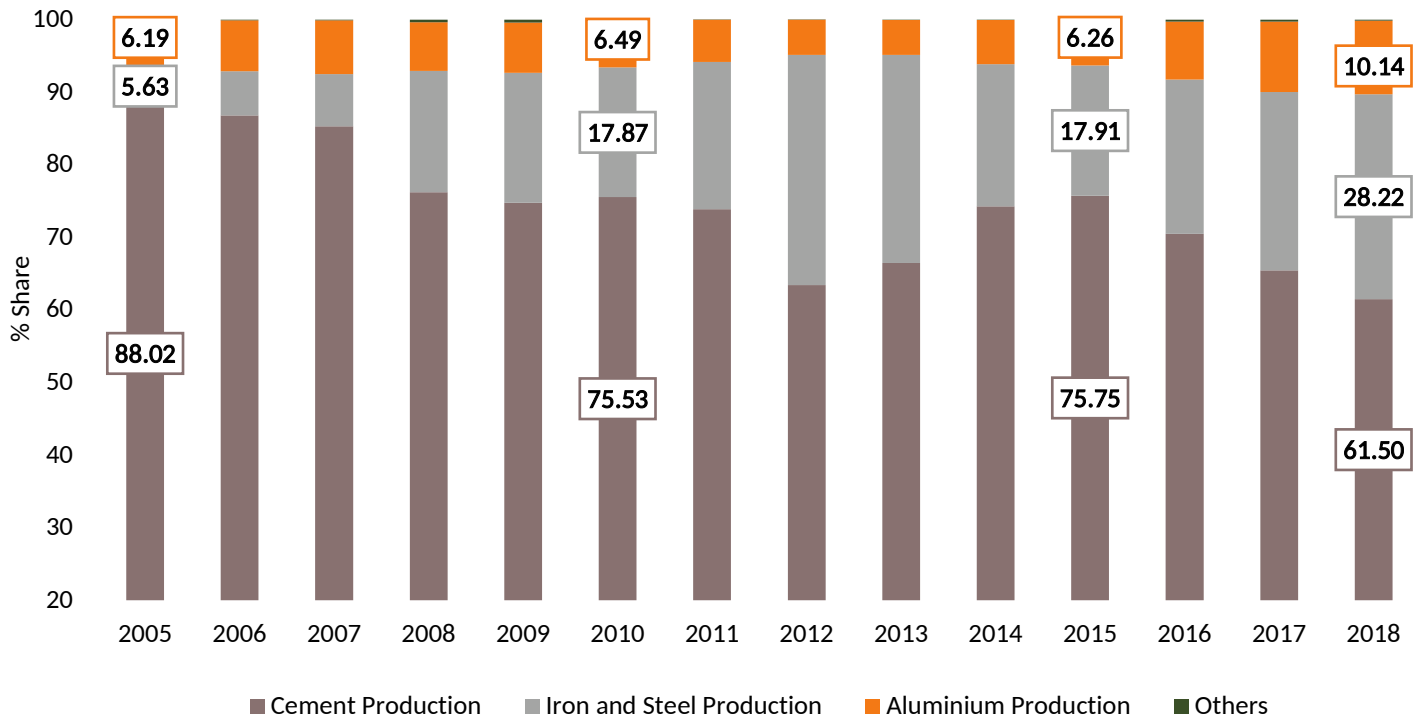


Figure 8: Sub-Sector Emissions (Mt CO<sub>2</sub>e) and Percentage Contribution in Total IPPU Emissions (2018)



A detailed trend of GHG emissions by various IPPU categories is illustrated in Figure 9. Cement Production (Mineral Industry) was the key driver of emissions in this sector across all the reference years. However, its share in the total IPPU emissions declined from ~88% in 2005 to ~61% in 2018. Meanwhile, the share of emissions from the Iron and Steel Industries (Metal Industry) increased from ~5.63 % in 2005 to ~28% in 2018. Similarly, the share of Aluminium Industry also increased over the years, from ~6% in 2005 to ~10% in 2018.

Figure 9: Percentage Share of GHG Emissions from IPPU Categories (2005 to 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-CO<sub>2</sub> Emissions Sources on Land\*. The AFOLU sector represented ~5% of the total economy-wide emissions of Chhattisgarh in 2018. The net AFOLU emissions decreased from 14.35 Mt CO<sub>2</sub>e in 2005 to 12.23 Mt CO<sub>2</sub>e in 2018, at a rate of 1.22% (compound annually).

The Livestock and Aggregate Sources, and Non-CO<sub>2</sub> Emissions Sources on Land sub-sectors were net GHG emitters throughout the reference period, while Land sub-sector was a net emitter till 2011. Post 2011, the sub-sector turned into a sink as a result of increased removals from Agricultural Land, Settlements and Other Land Categories. According to the Forest Survey of India (2021)\*\* , there was an increase in the forest area as well as carbon stock density between 2016 and 2018, which contributed to an increase in the removals of the Land sub-sector during those years. The average annual removals from the Land Sub-Sector in Chhattisgarh during the reference period were 0.17 Mt CO<sub>2</sub>e, around 1.24% of the average annual gross AFOLU emissions.

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

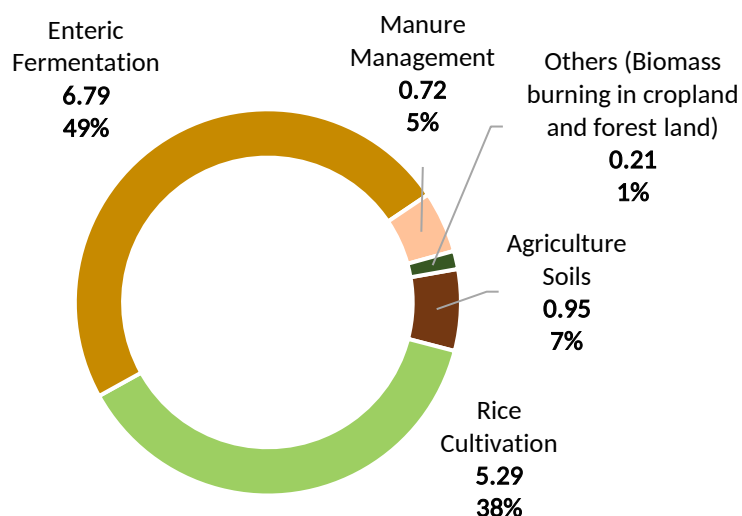




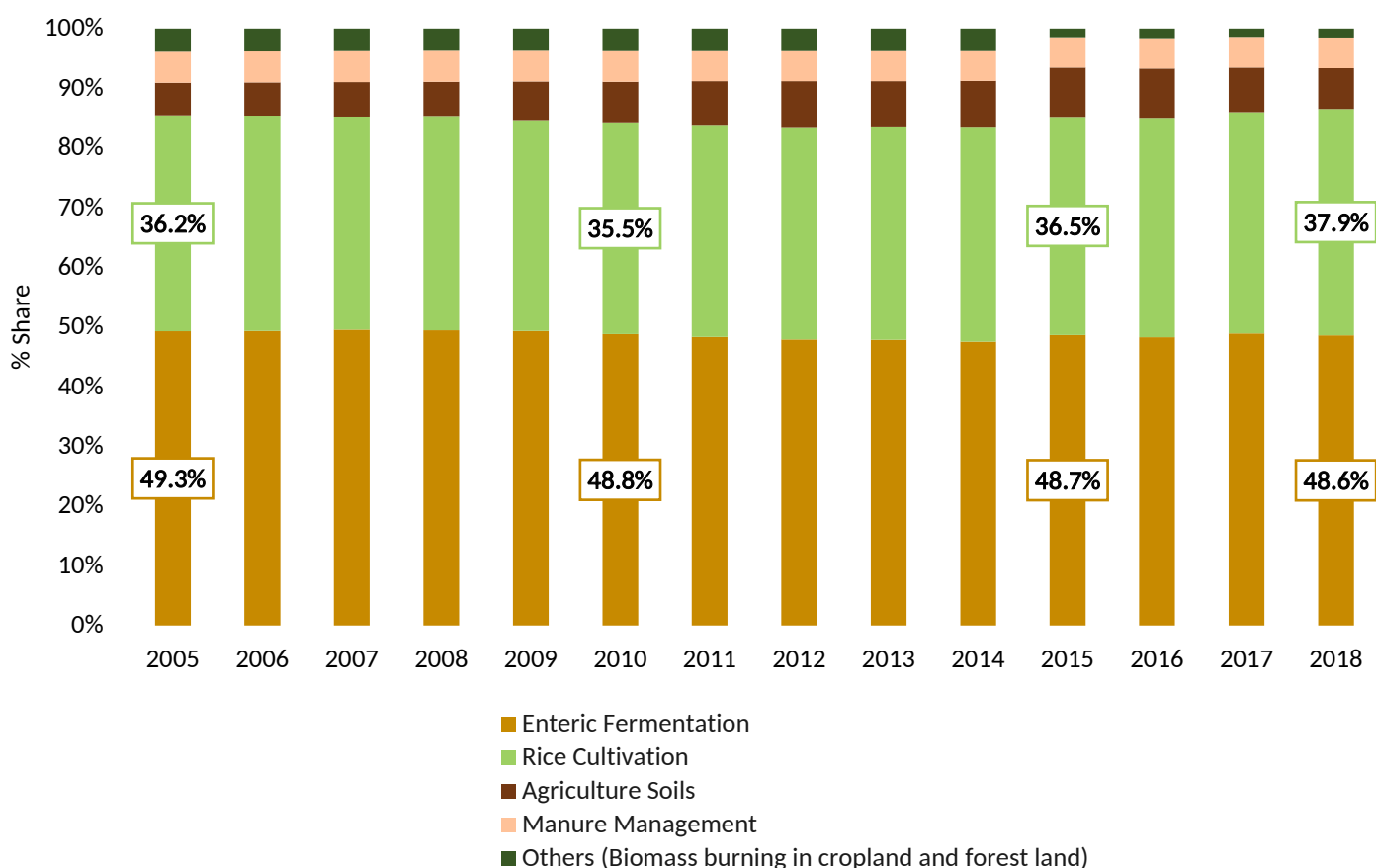
In 2018, the Livestock sub-sector had the maximum share of ~54% of gross AFOLU emissions (excluding Land sub-sector) in Chhattisgarh. Within the Livestock sub-sector, Enteric Fermentation category was the major contributor to gross AFOLU emissions with a share of ~49% in 2018. The emissions from this category remained mostly steady during this period (see Figure 11).

From the Aggregate Sources sub-sector, the categories of Rice Cultivation and Agriculture Soils were the leading contributors to gross AFOLU emissions. The share of emissions from Rice Cultivation increased slightly from ~36% in 2005 to ~38% in 2018, and that of emissions from Agriculture Soils increased from ~5% in 2005 to ~7% in 2018 (see Figures 11 and 12).

**Figure 11: Category-wise Emissions (Mt CO<sub>2</sub>e) and Percentage Share in Gross AFOLU Emissions (excluding Land sub-sector) (2018)**



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



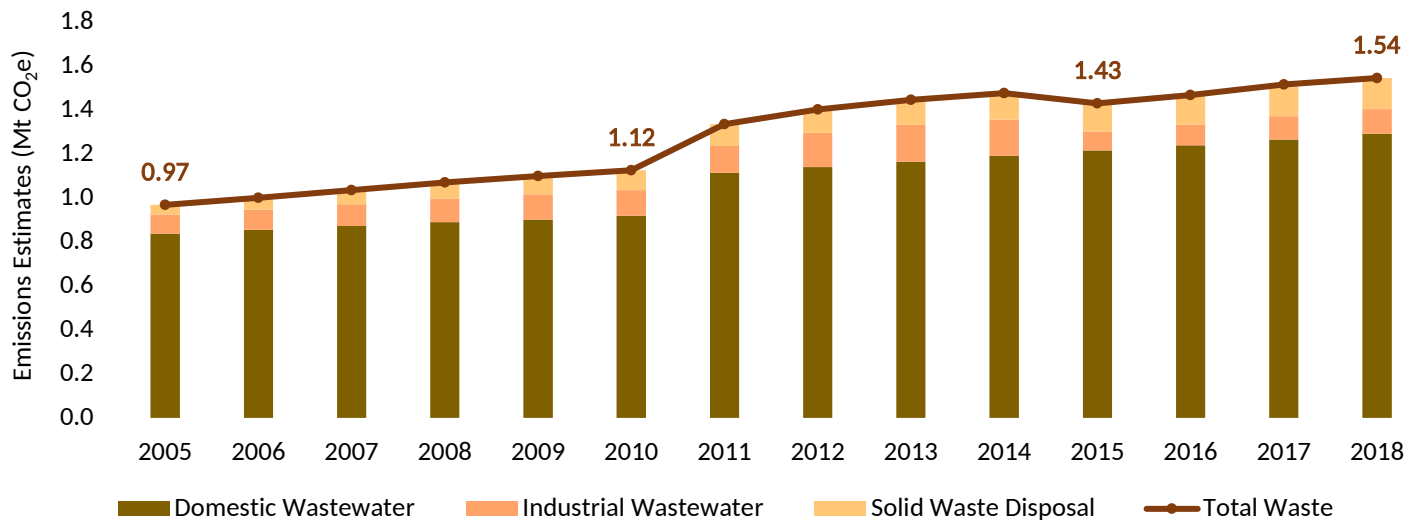
\* The sub-sector called 'Aggregate Sources and Non-CO<sub>2</sub> Emissions Sources on Land' includes emissions from Rice Cultivation, Agriculture Soils, and Biomass Burning in Cropland and Forestland.

\*\* FSI Report 2021 reports data for 2019



Solid Waste Disposal, Domestic Wastewater and Industrial Wastewater are the key sources of GHG emissions in the Waste sector. In Chhattisgarh, the Waste sector contributed to less than 1% of total economy-wide emissions in 2018. GHG emissions from the Waste sector grew from 0.97 Mt CO<sub>2</sub>e in 2005, to 1.54 Mt CO<sub>2</sub>e in 2018, at a CAGR of 3.7% (see Figure 13). In 2011, a rise in the total Waste sector emissions was observed owing to the significant rise in emissions from Domestic Wastewater.

**Figure 13: GHG Emissions Estimates of Waste Sector - Chhattisgarh (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% of the total Waste sector emissions of Chhattisgarh in 2018. Approximately 9% of the Waste sector emissions were from Solid Waste Disposal, which grew at an estimated CAGR of 9.44% from 0.04 Mt CO<sub>2</sub>e in 2005 to 0.14 Mt CO<sub>2</sub>e in 2018. Industrial Wastewater accounted for nearly 7% of Waste sector emissions in 2018 and grew at a CAGR of 0.37% from 0.10 Mt CO<sub>2</sub>e in 2005 to 0.11 Mt CO<sub>2</sub>e in 2018 (see Figure 14).

Emissions from Domestic Wastewater of both rural and urban areas grew at a CAGR of 3.40% from 0.84 Mt CO<sub>2</sub>e in 2005 to 1.29 Mt CO<sub>2</sub>e in 2018. Almost 64% of Domestic Wastewater emissions were from the urban areas of Chhattisgarh in 2018 as shown in Figure 15.

**Figure 14: Sub-sector Emissions (Mt CO<sub>2</sub>e) and their Percentage Share in Total Waste Sector Emissions (2018)**

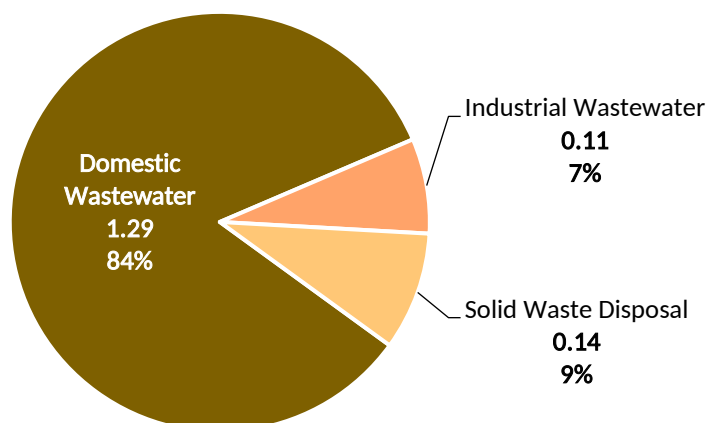
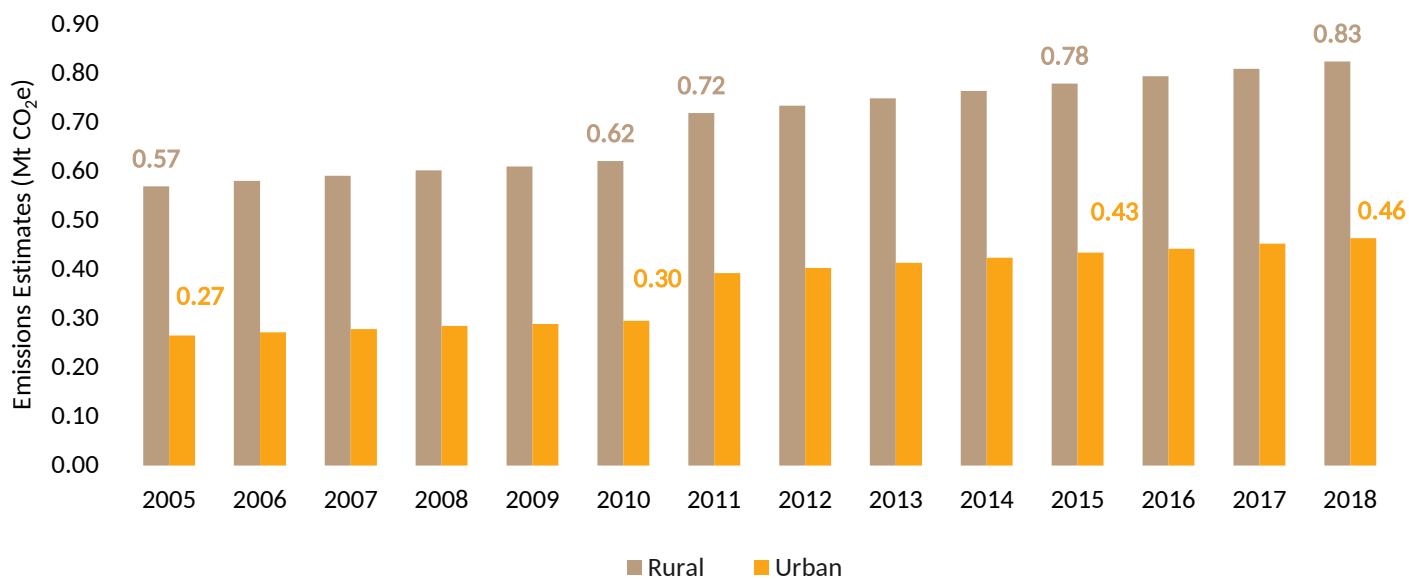
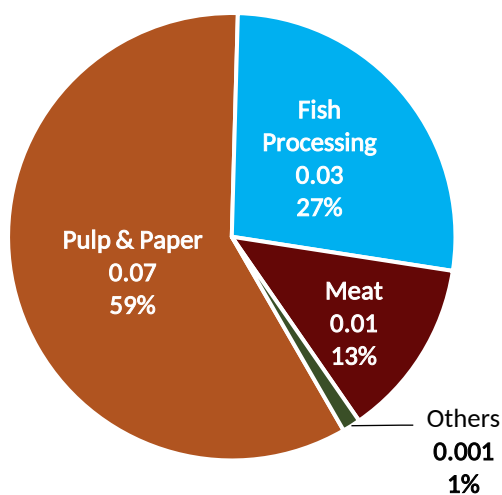


Figure 15: Area-wise GHG Emissions Estimates of Domestic Wastewater (2005 to 2018)



In 2018, Pulp and Paper Industry had a major share of ~59% in the total Industrial Wastewater emissions, while Fish Processing and Meat categories accounted for ~27% and ~13%, respectively. Other industries including tannery, dairy and sugar contributed to the remaining emissions of this sub-sector (see Figure 16).

Figure 16: Category-wise Emissions (Mt CO<sub>2</sub>e) 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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