GHG Platform INDIA

Trend Analysis of GHG Emissions of GUJARAT

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

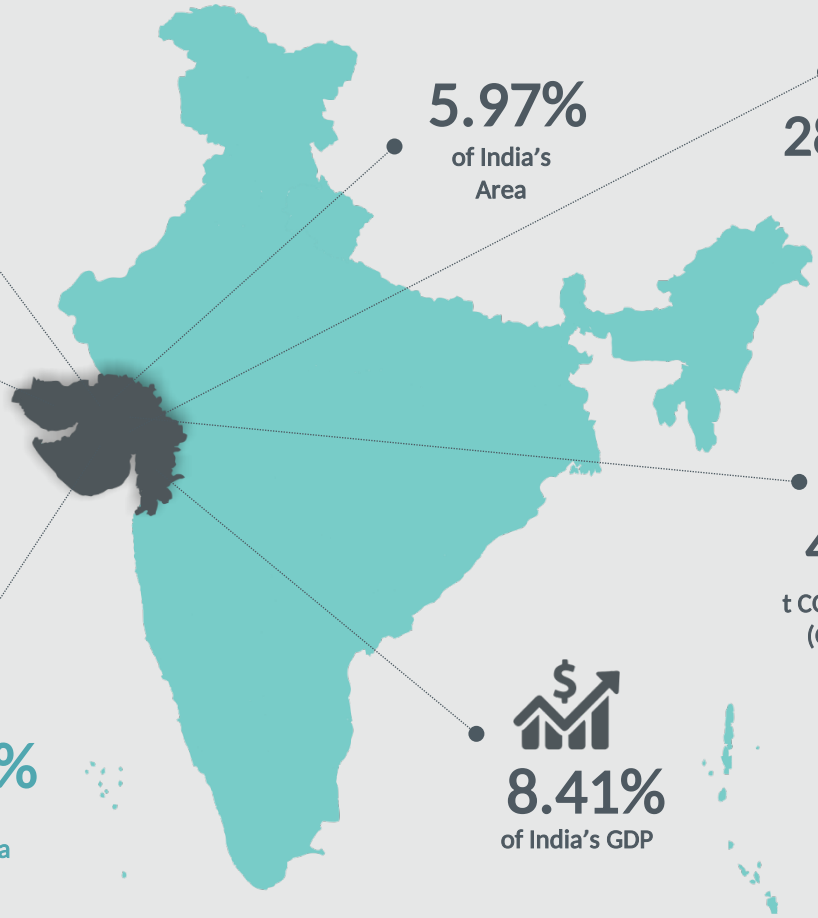
The Platform aims to add value to the various ongoing GHG emissions estimation efforts by addressing existing data gaps and data accessibility issues, broadening the scope of national inventories to include state inventories, and increasing the volume of analytics and policy dialogue on India's GHG emissions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

Gujarat at a Glance (2018)



5.08% of India's Population

5.97% of India's Area

Net GHG Emissions
286.98 Mt CO_2e (Gujarat)
9.72% of India's emissions

Population Density
341.46 Persons/km² (Gujarat)
401.48 Persons/km² (India)

Per Capita Emissions
4.28 t CO_2e/capita (Gujarat)
2.24 t CO_2e/capita (India)

Forest Area
7.59% of Gujarat's Total Area
2.09% of India's Forest Area

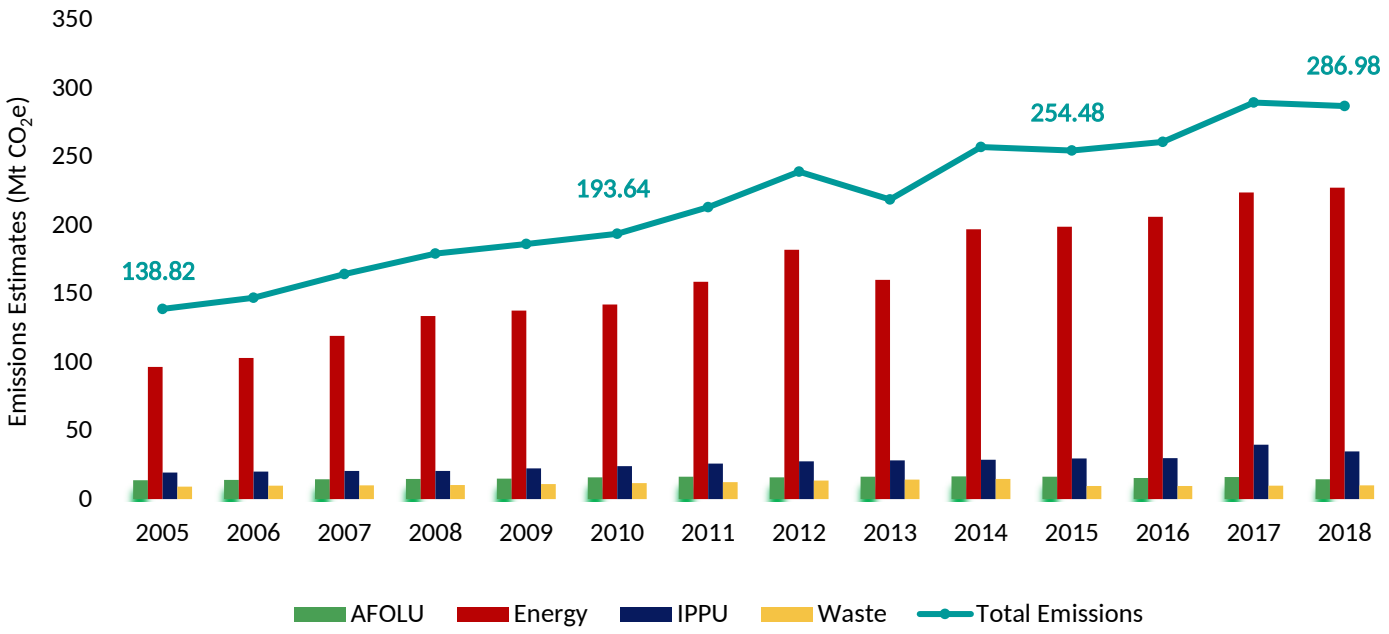
8.41% of India's GDP

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 Gujarat (2005 to 2018)



Emissions in Gujarat increased at a CAGR of 5.75% from 138.82 Mt CO_2e in 2005 to 286.98 Mt CO_2e in 2018 (see Figure 1). The Energy sector was the major contributor to Gujarat's total emissions across the reference period. In 2013, a drop in the overall emissions was observed owing to a decline in the Energy sectors emissions. In 2005, the share of Energy sector in Gujarat's economy-wide emissions was ~69%, while Industrial Processes and Product Use (IPPU) accounted for ~14%. These were followed by Agriculture, Forestry and Other Land Use (AFOLU) and Waste sectors with contributions of 10% and 7%, respectively. In 2018, the share of emissions from the Energy sector increased to 79%, while the share of the IPPU, AFOLU, and Waste sectors decreased to 12%, 5% and 4%, respectively (see Figure 2).

Figure 2: Sector-wise Contribution (Mt CO_2e) and Percentage Share in Economy-wide GHG Emissions of Gujarat

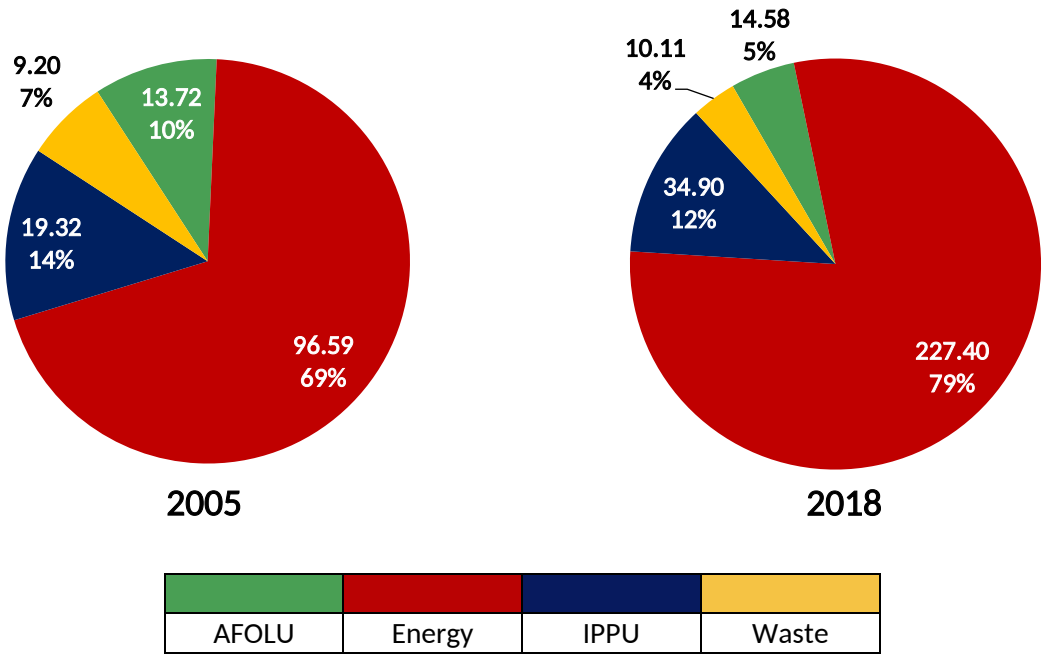
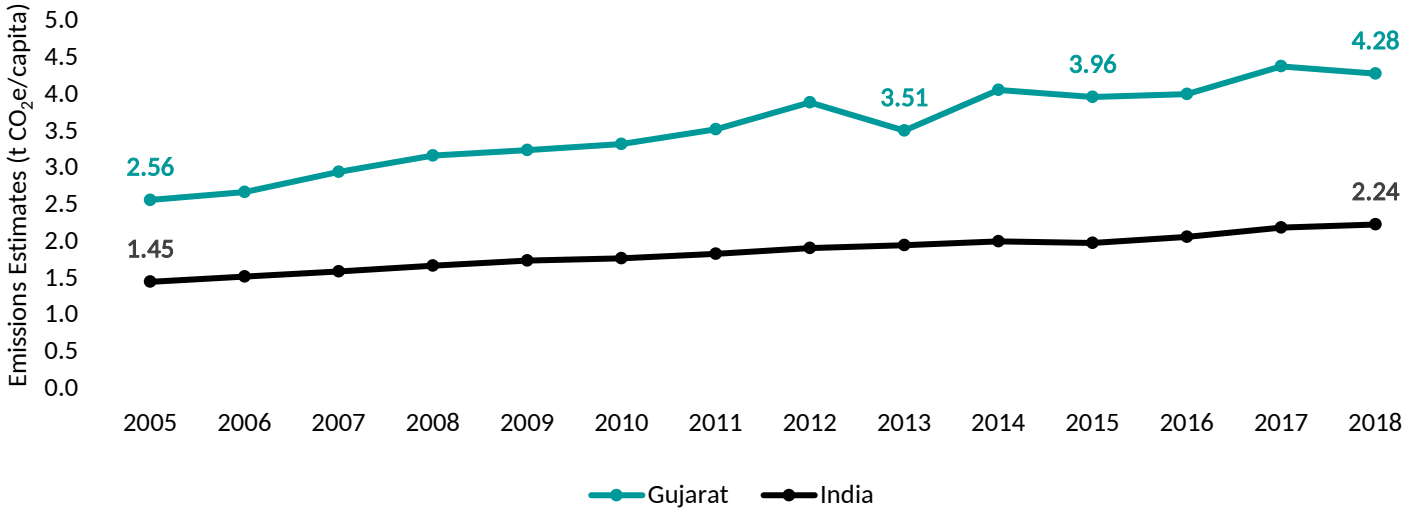


Figure 3: Per Capita GHG Emissions of Gujarat and India (2005 to 2018)



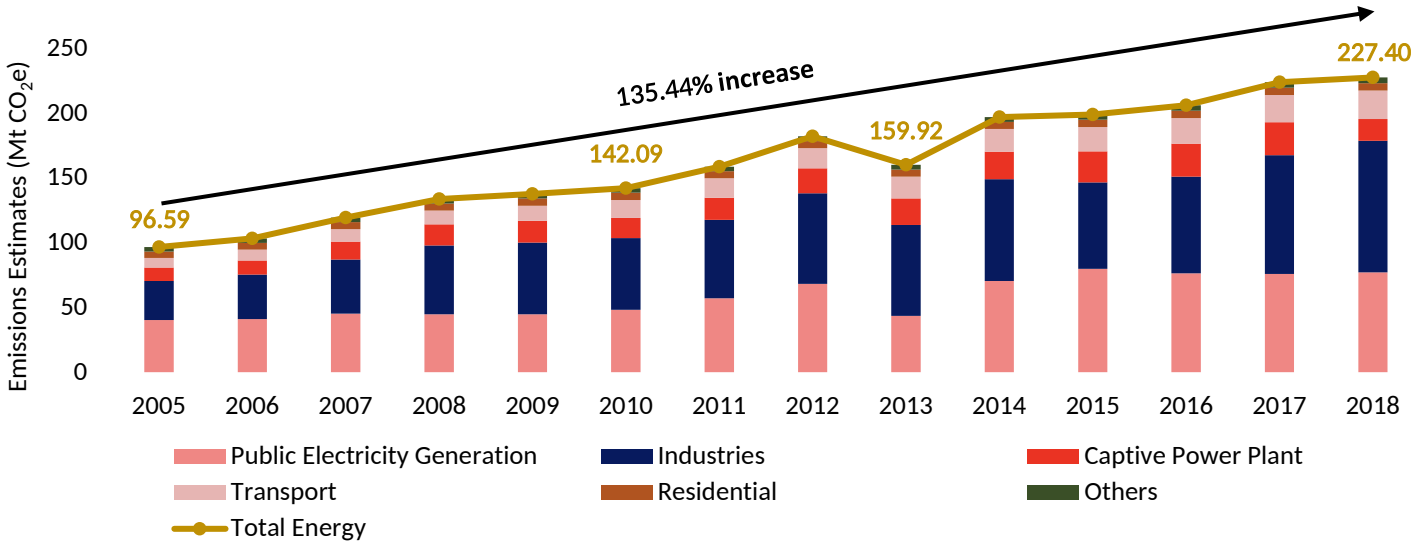
The per capita emissions of Gujarat were significantly higher than that of India throughout the reference period (see Figure 3). The per capita emissions of Gujarat increased from 2.56 t CO_2e/capita in 2005 to 4.28 t CO_2e/capita in 2018 at a CAGR of 4.02%, which was higher than India's CAGR (~3.41%).

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.

The Energy sector of Gujarat accounted for ~79% of the total economy-wide emissions in 2018. Emissions from Energy sector increased at a CAGR of 6.81% from 96.59 Mt CO_2e in 2005 to 227.40 Mt CO_2e in 2018. Further, ~99% of the Energy emissions of Gujarat were due to Fuel Combustion activities. A decrease was observed in total Energy emissions in 2013. This was due to decline in the Public Electricity Generation category emissions (see Figure 4).

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



Within the Energy sector, Industrial Energy category was the major contributor of GHG emissions with a share of ~45% of the total Energy emissions in 2018. This was followed by Public Electricity Generation and Transportation categories with shares of ~34% and 10%, respectively (see Figure 5).

Within the Fuel Combustion sub-sector, Coal use continued to be the major source of emissions in the state, with an average share of ~59% between 2005 and 2018. This was followed by emissions from combustion of Liquid Petroleum Fuels and Gaseous Petroleum Fuels, with average shares of ~22% and 19%, respectively, over the reference period (see Figure 6).

Figure 5: Category-wise Emissions (Mt CO_2e) and Percentage Share in Total Energy Sector Emissions (2018)

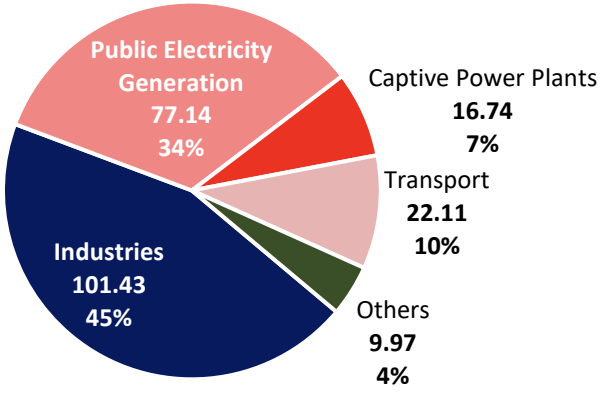
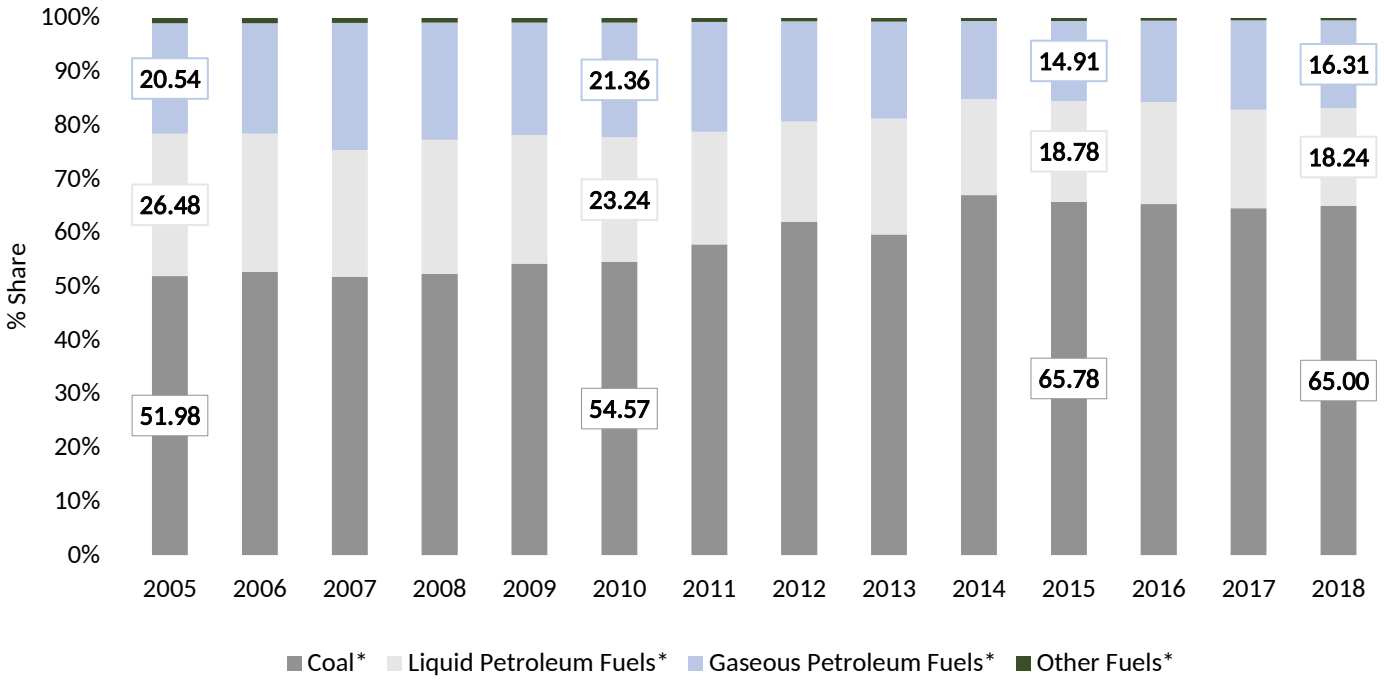


Figure 6: Percentage Share of GHG Emissions by Fuel Type due to Fuel Combustion in Energy Sector (2005 to 2018)



**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

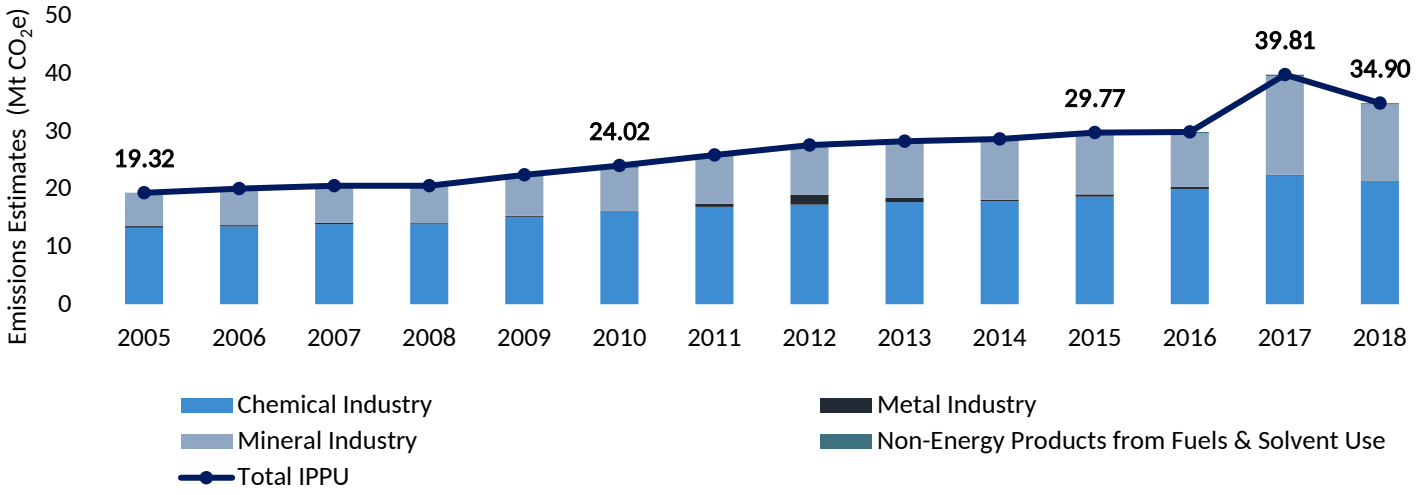
4. Other Fuels comprises of firewood and charcoal

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 Gujarat, the IPPU sector represented ~12% of the total economy-wide emissions in 2018. The overall IPPU emissions increased at a CAGR of 4.65% from 19.32 Mt CO_2e in 2005 to 34.90 Mt CO_2e in 2018 (see Figure 7). Chemical Industry and Mineral Industry sub-sectors were the key drivers of Gujarat's IPPU emissions, with shares of 62% and 38%, respectively. A spike in emissions was observed in 2017, which can be attributed to increase in emissions from Glass Production category.

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



Cement Production and Ammonia Production were the key drivers of emissions of IPPU sector, with average shares of ~30% and ~ 28%, respectively, across the reference period. However, the share of emissions from Cement Production declined from ~29% in 2005 to ~26% in 2018 and the share of emissions from the Ammonia Production decreased from ~34 % in 2005 to ~24% in 2018. Meanwhile, the share of Ethylene Oxide increased from ~14% in 2005 to ~22% in 2018 (see Figures 8 and 9).

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

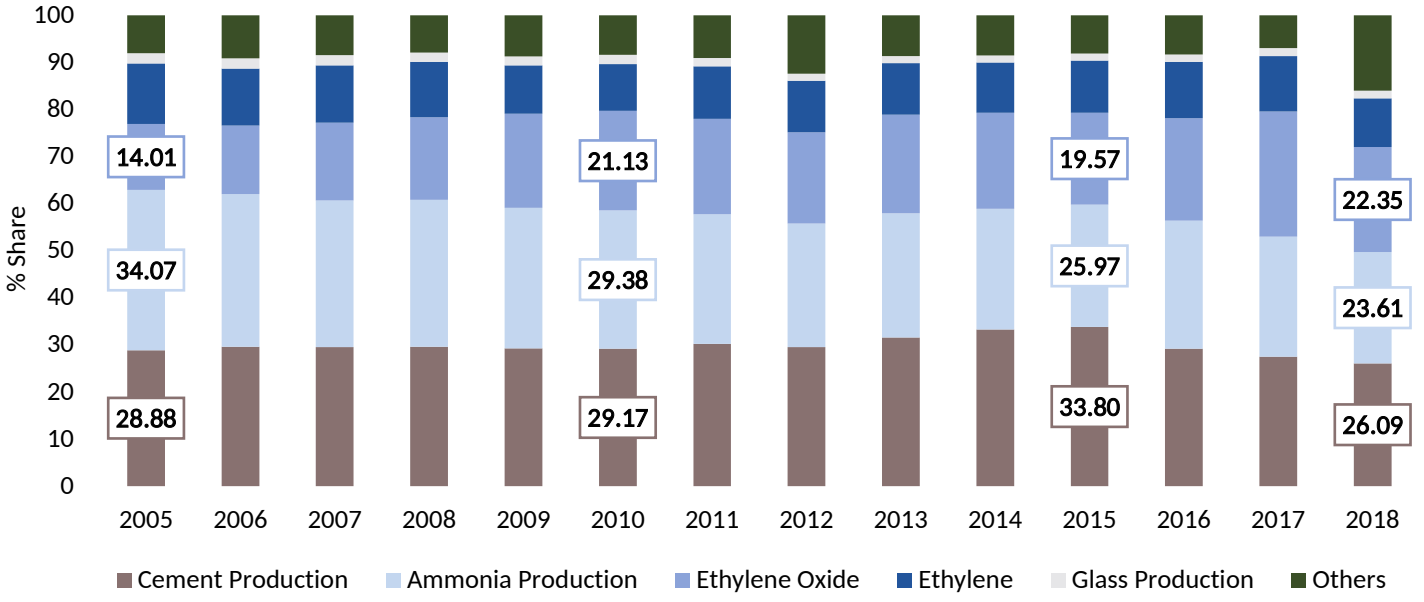
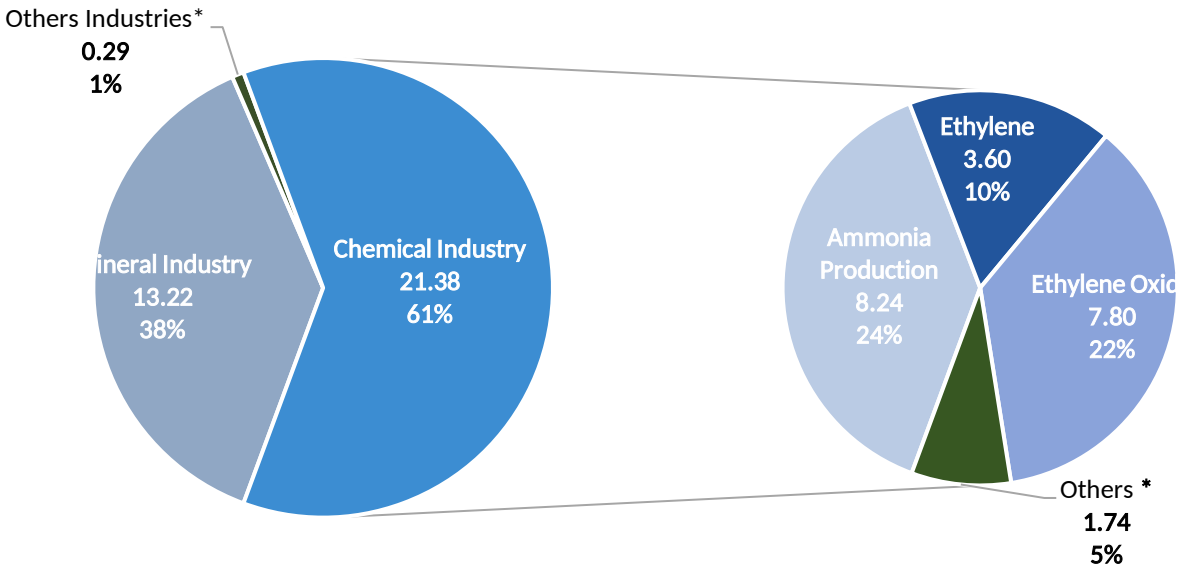


Figure 9: Sub-sector Emissions (Mt CO_2e) and Percentage Contribution in Total IPPU Emissions (2018)



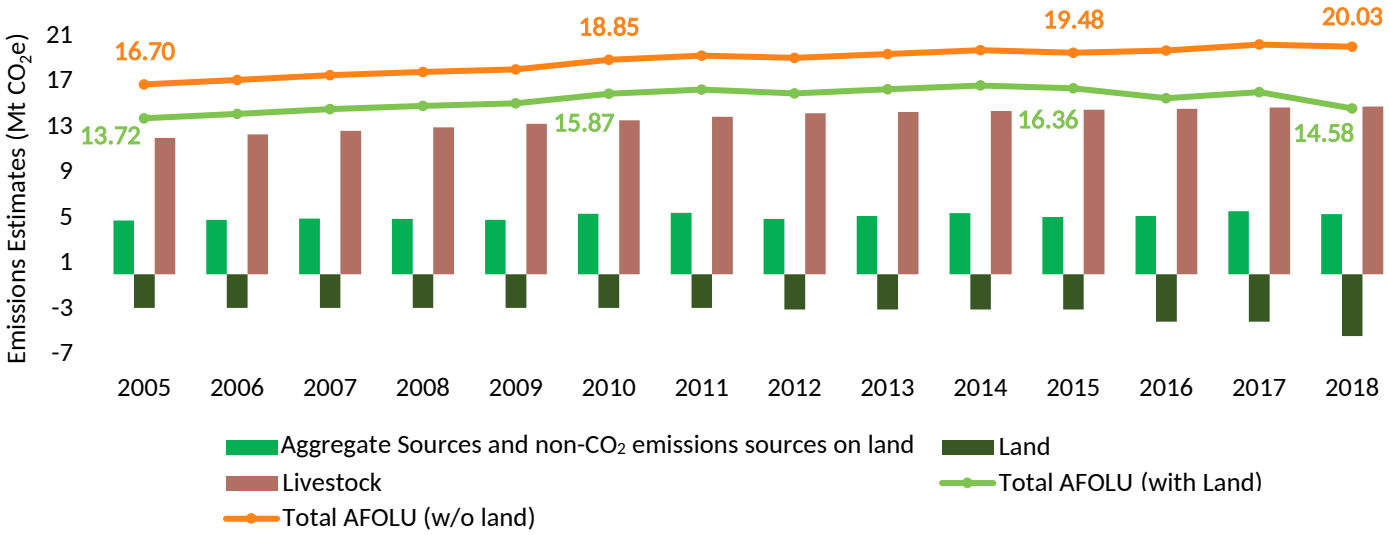
Other Industries in the first pie includes Metal and Non-energy Products category; while others in the second pie include chemicals like methanol, acrylonitrile, nitric acid, soda ash etc.

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-CO_2 Emissions Sources on Land*. In 2018, the AFOLU sector contributed ~5% to the total economy-wide emissions of Gujarat. The net emissions from the AFOLU sector grew at a CAGR of 0.47% from 13.72 Mt CO_2e in 2005 to 14.58 Mt CO_2e in 2018.

In Gujarat, while the Livestock and Aggregate Sources and Non-CO_2 Emissions Sources on Land sub-sectors were net GHG emitters, the Land sub-sector was a sink across all the reference years. Between 2016 and 2018, the increase in sink in the Land sub-sector can be attributed to the increase in quantum of forest area as reported in Forest Survey of India (2021)**. The average annual removals from the Land Sub-Sector in Gujarat during the reference period were 3.37 Mt CO_2e, around ~18% of the average annual gross AFOLU emissions (excluding Land sub-sector) (see Figure 10).

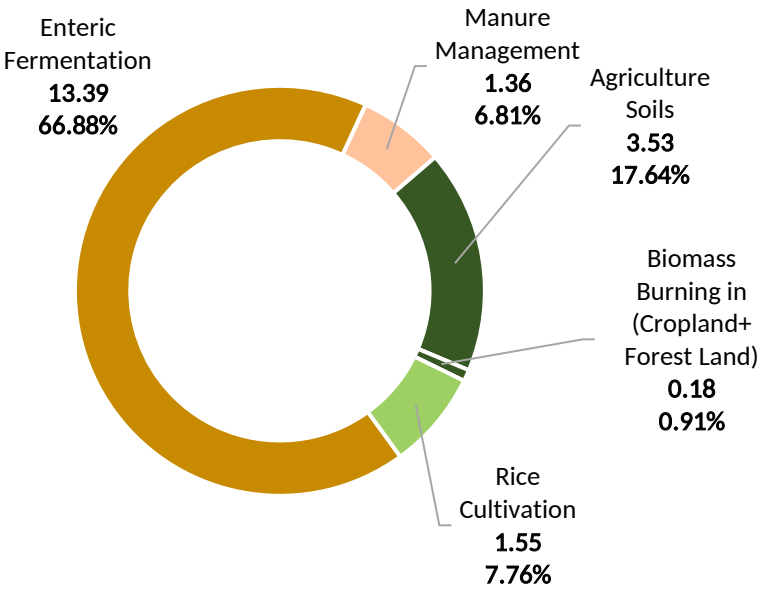
Figure 10: GHG Emissions Estimates of AFOLU Sector - Gujarat (2005 to 2018)



The Livestock sub-sector was the major contributor to the gross AFOLU emissions (excluding Land sub-sector) in Gujarat, with a share of 74% in 2018 (see Figure 11). 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 ~67%.

Within the Aggregate Sources sub-sector, the categories of Agriculture Soils and Rice Cultivation were major contributors to gross AFOLU emissions with average shares of ~18% and ~8%, respectively, during the reference period. The contribution of emissions from Agriculture Soils to gross AFOLU emissions decreased from ~19% in 2005 to ~17% in 2018 while that of Rice Cultivation remained constant across all the years, at around 8% (see Figures 11 and 12).

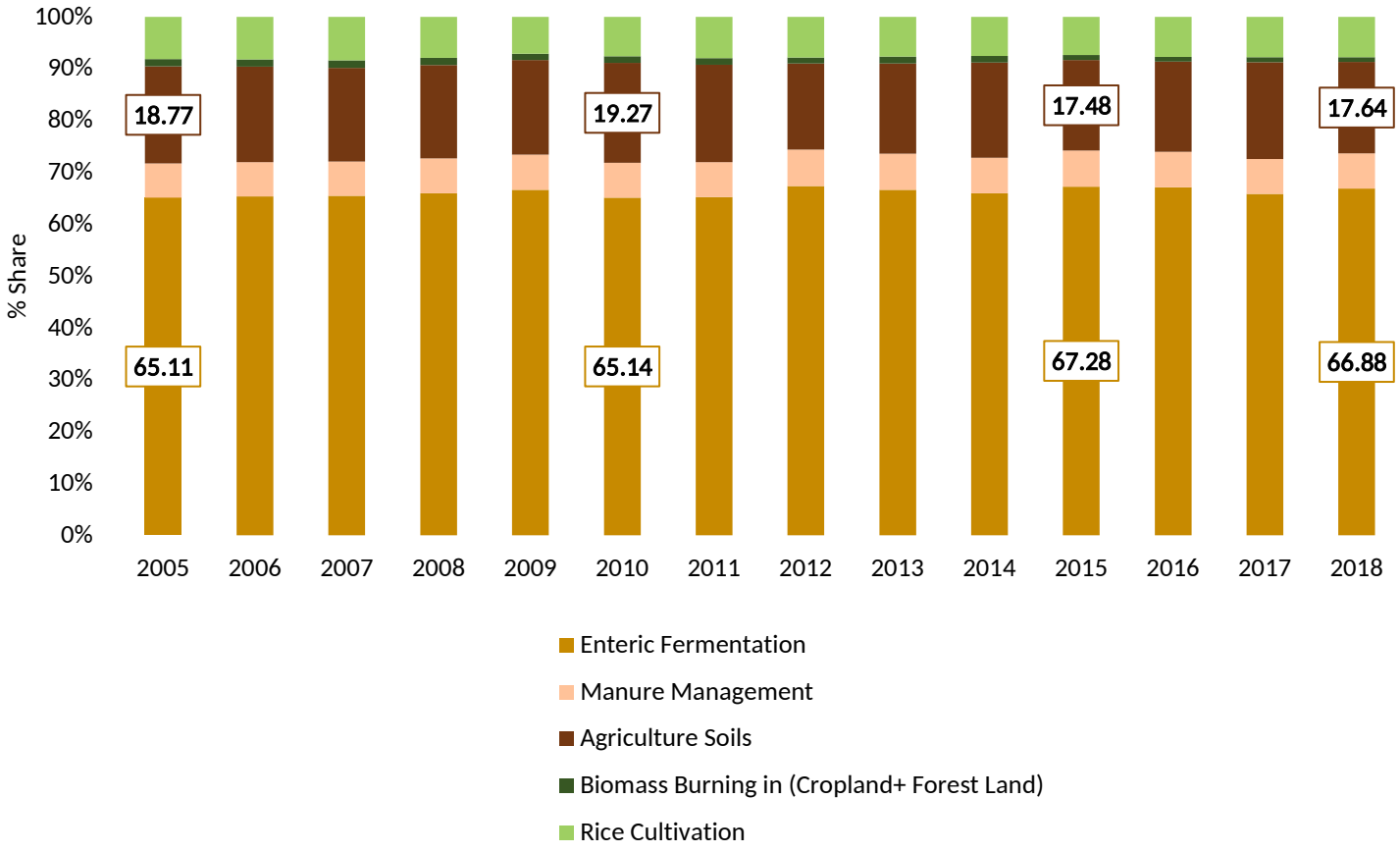
Figure 11: Category-wise Emissions (Mt CO_2e) and Percentage Share in Gross AFOLU Sector Emissions (excluding Land sub-sector) (2018)



** 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.*

*** FSI Report 2021 reports data for 2019*

Figure 12: Category-wise Share of Gross AFOLU GHG 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. Waste sector contributed to nearly 4% of the total economy-wide emissions of Gujarat in 2018. GHG emissions from the Waste sector grew at a CAGR of 0.73% from 9.20 Mt CO_2e in 2005 to 10.11 Mt CO_2e in 2018 as depicted in Figure 13. Post 2014, a decrease in overall Waste emissions was observed, which can be attributed to decline in Industrial Wastewater (primarily from Pulp and Paper Industry).

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

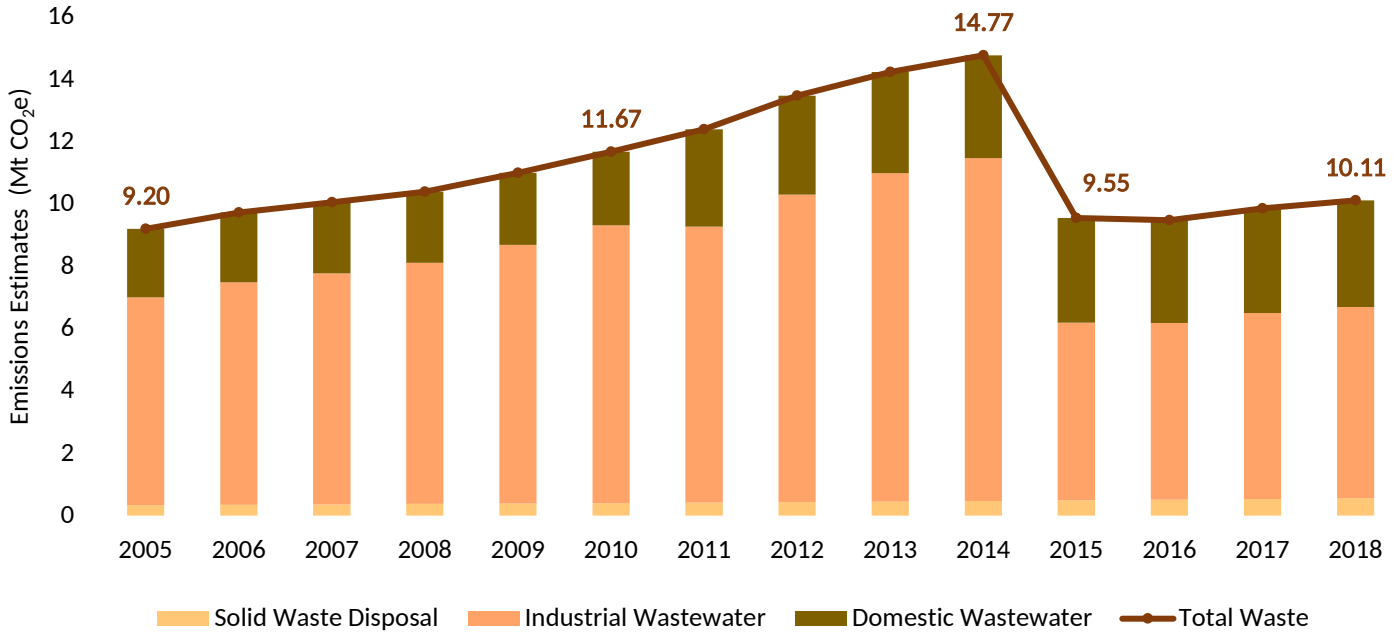
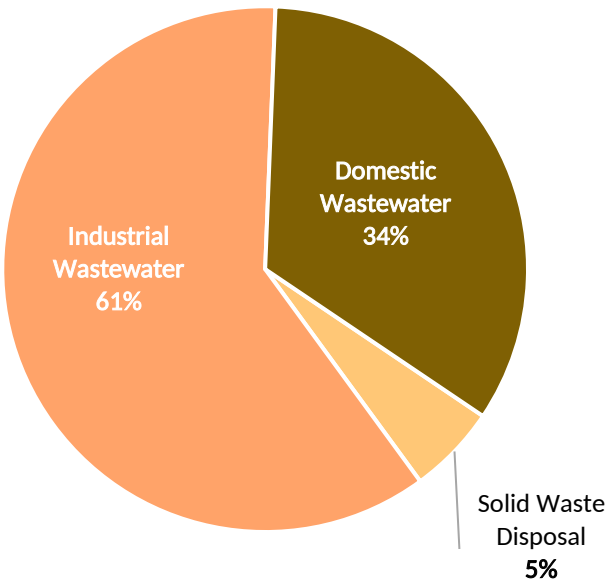


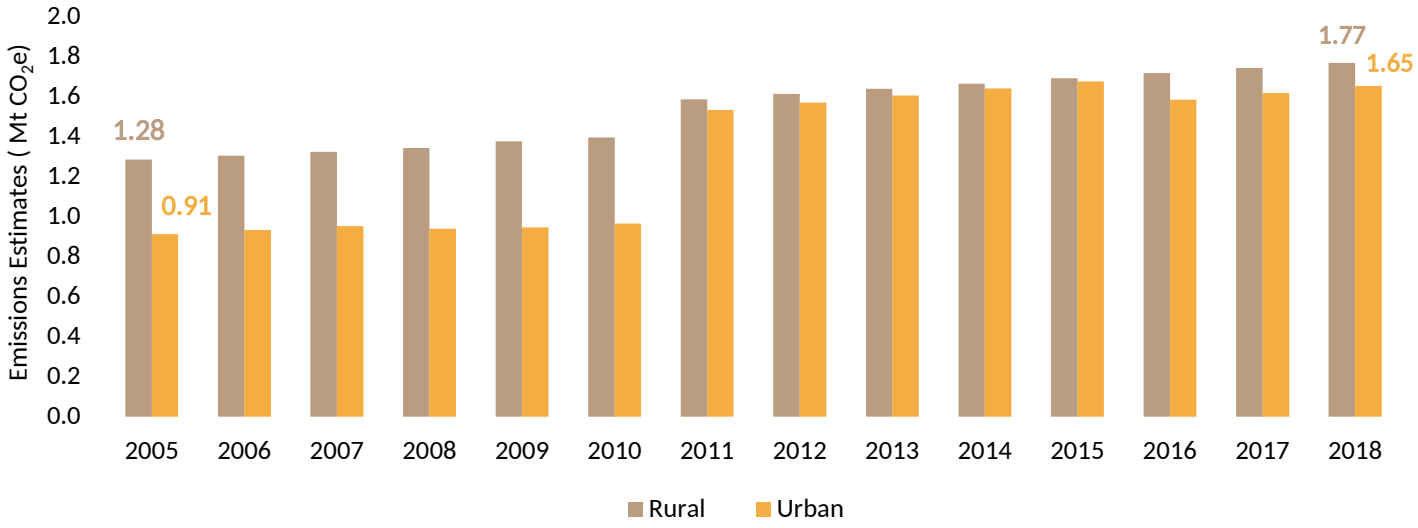
Figure 14: Sub-sector Emissions (Mt CO_2e) and Percentage Share in Total Waste Sector emissions (2018)



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 34% in the total Waste sector emissions of Gujarat in 2018. Approximately 5% of the Waste sector emissions were from Solid Waste Disposal, which grew at an estimated CAGR of 4% from 0.33 Mt CO_2e in 2005 to 0.56 Mt CO_2e in 2018. Industrial Wastewater accounted for nearly 61% of Waste sector emissions in 2018 and declined at a CAGR of ~0.64% (6.67 Mt CO_2e in 2005 to 6.13 Mt CO_2e in 2018) (see Figure 14).

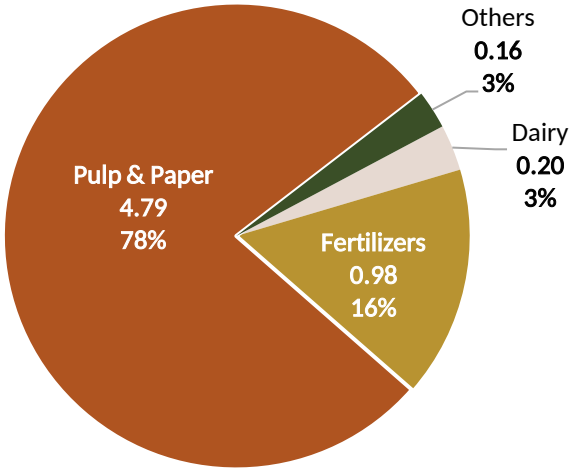
Emissions from Domestic Wastewater of both rural and urban areas decreased at a CAGR of ~3.47% from 2.19 Mt CO_2e in 2005 to 3.42 Mt CO_2e in 2018. Almost 52% of Domestic wastewater emissions were from the rural areas of Gujarat in 2018 (see Figure 15).

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



In 2018, Pulp and Paper Industry had a major share of ~78% of the emissions in Industrial Wastewater emissions, followed by Fertilizers Industry (16%) and Dairy Industry (~3%), while emissions from other Industries had a combined share of ~3% (see Figure 16).

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

This document has been compiled and analysed by Vasudha Foundation. All information mentioned in this document is sourced from GHG Platform India.
To download this document and to know more about the Platform, please visit www.ghgplatform-india.org or write to info@ghgplatform-india.org